Tess Square, Marnhull Village Centre

FLOOD RISK ASSESSMENT

P & D CROCKER

MAY 2023

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EXECUTIVE SUMMARY

I. This Flood Risk Assessment has been prepared on behalf of P & D Crocker in connection with proposals for a development comprising a commercial centre with 2 dwellings on land to the West of Church Hill in Marnhull.

II. The site is currently in mainly arable agricultural use and is surrounded by hedgerows and a ditch running along the northern boundary. There is an existing Doctors Surgery with associated parking located in the north eastern corner of the site.

III. With reference to the Environment Agency's Flood Map for Planning, the site falls within Flood Zone 1, which means that the site has less than 1 in 1,000 annual probability of river flooding (<0.1% Annual Exceedance Probability (AEP). There are areas of slightly elevated surface water flood risk running along the northern boundary associated with the drainage ditch and a low risk surface water overland flow path to the north east running offsite.

IV. The site falls within Flood Zone 1 and on this basis the sequential test is passed in terms of river flooding. Therefore there is no need to apply the Exceptions test.

V. An outline drainage strategy, involving the implementation of SuDS, is proposed for managing the disposal of surface water runoff from the proposed development on the site. Flow balancing methods are proposed, in order to attenuate surface water runoff to greenfield runoff rates with discharges to the local ditch systems to the north of the site. The proposed surface water drainage measures incorporate Strategic SuDS Features, to attenuate and store surface water runoff, comprising a series of detention basins, swales, and pervious paving. The proposed drainage strategy would ensure that surface water arising from the developed site would be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

VI. This Flood Risk Assessment demonstrates that the proposed development is compliant with the NPPF, DEFRA/Environment Agency guidance, and Local Plan Policies.

VII. The overall conclusions drawn from this Flood Risk Assessment are that the development would be appropriately safe for its lifetime taking account of the vulnerability of its users, the development would not increase flood risk elsewhere when the proposed mitigation measures are taken into account, and would reduce flood risk overall.

1. INTRODUCTION

1.1. This Flood Risk Assessment (FRA) has been prepared on behalf of P & D Crocker in connection with proposals for a development comprising a commercial centre with 2 dwellings on land to the West of Church Hill in Marnhull.

1.2. The overall site comprises around 5.2 hectares, and is located approximately 7.4km to the south west of Gillingham, and lies in the district of North Dorset. The nearest post code is DT10 1PU, and the approximate grid reference for the site is ST 78045 18960. The location of the site is shown edged red on **Figure 1** below.

Figure 1: Site Location Plan

1.3. The main purpose of this site-specific Flood Risk Assessment is to provide sufficient flood risk information to support a planning application for the development proposals in order to demonstrate that the development would be appropriately safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, would reduce flood risk overall.

2. SCOPE OF THE ASSESSMENT

National Planning Policy

2.1. The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these should be applied. Policy on planning and flood risk in the NPPF is dealt with at paragraphs 159-169 in chapter 14 'Meeting the challenge of climate change, flooding and coastal change'. Chapter 14 was first published on 27 March 2012 and last updated on 20 July 2021.

2.2. The national planning practice guidance to the NPPF was launched as a web-based resource in March 2014. The category dealing with flooding is contained in Flood Risk and Coastal Change (Reference ID: 7) and last updated on 25 August 2022.

2.3. Paragraph 159 of the NPPF states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future), but where development is necessary, the development should be made safe for its lifetime without increasing flood risk elsewhere.

2.4. Paragraph 160 states that strategic policies should be informed by a strategic flood risk assessment (SFRA), and should manage flood risk from all sources.

2.5. A Level 1 SFRA was prepared by JBA Consulting on behalf of North Dorset District Council, in February 2018, to support the development of their Local Plan. The SFRA provides an overview of flood risk from all sources including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

2.6. As set out in paragraph 161 of the NPPF, all plans should apply a sequential, risk-based approach to the location of development - taking into account the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, applying the sequential test and then, if necessary, the exception test.

2.7. Paragraph 162 states that the aim of the sequential test is to steer new development to areas with the lowest probability of flooding from any source. The strategic flood risk assessment will provide the basis for applying the test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.

2.8. Paragraph 166 identifies that where appropriate; applications should be supported by a site-specific flood-risk assessment. Footnote 55 of the NPPF states a site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

2.9. A copy of the Environment Agency's Flood Map for Planning, obtained from the GOV.UK website, which shows the Flood Zones in the vicinity of the site, is reproduced as **Figure 2** below.

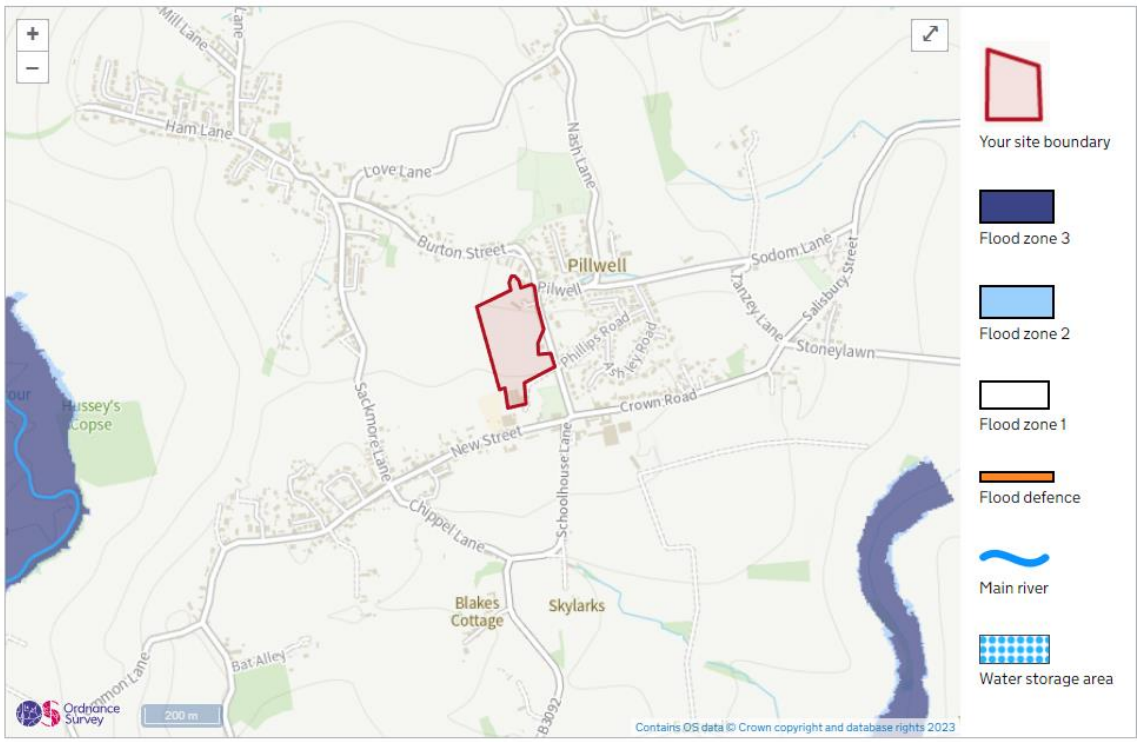


Figure 2: Environment Agency's Flood Map for Planning

2.10. The Environment Agency's Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences, and show the extent of the natural floodplain and the additional extent of an extreme flood. The Environment Agency's Flood Map for Planning shows the area that could be affected by flooding, either from rivers or the sea, coloured dark blue corresponding to Flood Zone 3. The light blue area is Flood Zone 2 and shows the additional extent of an extreme flood from rivers or the sea. These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Where there is no blue shading, this shows the area where flooding from rivers and the sea is very unlikely corresponding to Flood Zone 1.

2.11. The red line site boundary has been added to the Environment Agency's Flood Map for Planning on Figure 2. From an inspection of the Flood Map it can be seen that the site falls within Flood Zone 1.

2.12. Areas of Flood Zone 1 have a less than 1 in 1,000 annual probability of river flooding (<0.1% Annual Exceedance Probability (AEP)).

2.13. Paragraph 167 of the NPPF states:

> **'When determining any planning applications, local planning authorities should ensure flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:**
>
> **a. within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;**
>
> **b. the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;**

c. it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;

d. any residual risk can be safely managed; and

e. safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

Flood Risk Assessment Planning Practice Guidance

2.14. For the purposes of applying the NPPF, paragraph 20 in the Flood Risk and Coastal Change Planning Practice Guidance advices that a site-specific flood risk assessment is carried out to assess the flood risk to and from a development site. The objectives of a site-specific flood risk assessment are to establish:

- whether a proposed development is likely to be affected by current or future flooding from any source;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;
- the evidence for the local planning authority to apply (if necessary) the Sequential Test, and;
- whether the development will be safe and pass the Exception Test, if applicable.

2.15. Paragraph 1 of the Guidance states "flood risk" is a combination of the probability and the potential consequences of flooding. Areas at risk of flooding are those at risk of flooding from any source, now or in the future. Sources of flood risk include rivers and the sea, direct rainfall on the ground surface, rising groundwater, overwhelmed sewers and drainage systems, reservoirs, canals and lakes and other artificial sources. Flood risk also accounts for the interactions between these different sources.

2.16. Paragraph 21 in the Guidance advises that the information provided in the flood risk assessment should be credible and fit for purpose. Site-specific flood risk assessments should be proportionate to the degree of flood risk and make optimum use of information already available, including information in a SFRA for the area, and the interactive flood risk maps. A flood risk assessment should also be appropriate to the scale, nature and location of development.

2.17. The Guidance provides a model checklist for a site-specific flood risk assessment.

2.18. With regard to what further advice is available on the preparation of a site-specific flood risk assessment, Guidance from the Department for Environment, Food & Rural Affairs (DEFRA) and the Environment Agency, published on the Government's GOV.UK website, includes guidance on how to carry out a flood risk assessment entitled: 'Flood risk assessment in flood zone 1 and critical drainage areas'. This guidance provides information on the range of factors that need to be considered when assessing flood risk.

Local Planning Policy

2.19. The North Dorset Local Plan Part 1 was formally adopted in January 2016 and provides a planning policy framework for the district for the period up to 2031

2.20. Relevant policies from the Core Strategy include: Core Policy 3 and Core Policy 13.

2.21. Core Policy 3: 'Climate Change' states:

'Development should seek to minimise the impacts of climate change overall through:

d) incorporation of measures to reduce water consumption; and

e) avoidance of areas at risk of flooding of all sources and incorporation of measures to reduce flood risk overall; '

2.22. Relevant 'saved' policies from the District Wide Local Plan (2003) include: Policy 1.16.

2.23. Policy 1.16 'Groundwater Source Protection'.

> **'Development which would have an unacceptable risk upon the water quality, quantity or natural flow patterns of a groundwater resource will not be permitted. This is especially important within the Groundwater Source Protection Areas defined on the Proposals Map and also where land may have been subject to previous contamination.'**

Summary of Scope

2.24. The scope of this Flood Risk Assessment is to provide sufficient information to satisfy the requirements of the NPPF and its associated guidance, Local Plan Policies, guidance published by DEFRA/Environment Agency, and the Government's 'Non-statutory technical standards for sustainable drainage systems'.

3. DEVELOPMENT SITE CONTEXT

Development Site Description

3.1. The site is located to the west of Church Hill in Marnhull. The site is currently in agricultural use, mainly arable with some grassland.

3.2. The Site Location Plan and the Environment Agency's Flood Map for Planning are based on the Ordnance Survey map of the area, and show geographical features and identify watercourses and other bodies of water in the vicinity of the site.

Onsite Watercourses and Existing Drainage Arrangements

3.3. The nearest main river is the River Stour, which runs from east to west approximately 1.3km to the north of the site. The River Stour is designated as a 'main river'.

3.4. Currently the site naturally drains by a combination of overland flow towards the drainage ditch which runs along the northern boundary, towards the low points and infiltration into the underlying ground.

3.5. The existing surface water management arrangements at the site are indicated on Drawing No. C798/13, a copy of which is contained in **Appendix 1**.

Site Levels

3.6. A Topographical Survey was undertaken by Total Survey Solutions in September 2022. The survey is shown on Drawing Number 120922-3230-1, a copy of which is reproduced in **Appendix 2.**

3.7. The Topographical Survey indicates that the site falls downhill south to north from around 80.5 AOD, in the south-western corner of the site, to around 67.5 AOD to the north eastern corner of the site. A typical gradient at the top of the site is approximately 1 in 30, which steepens to 1 in 15 towards the northern part of the site.

Ground Conditions

3.8. The British Geological Survey (BGS) geological mapping of the area shows the majority of the site is underlain by multiple superficial and bedrock deposits. Head (Clay, silt, sand and gravel) superficial deposits run along the northern boundary. In terms of bedrock deposits, the northern section of the site is underlain by Hazelbury Bryan Formation (Sandstone), continuing in bands towards the south of the site are Woodrow Clay Member (Mudstone), Cucklington Oolite Member (Limestone, ooidal), Sturminster Pisolite Member (Limestone, ooidal) and Newton Clay Member (Mudstone, sandy).

3.9. Based on the Flood Studies Report Winter Rainfall Acceptance Potential (WRAP) Map, as shown reproduced on Drawing No. C798/18 in **Appendix 3**, the site is located in a 'Soil Index Class 1' area. Soil Index Class 1 has a high winter rainfall acceptance potential and low standard percentage runoff, and so suggests the underlying soil has good permeability.

3.10. The Cranfield Soil and AgriFood Institute (CSAI), incorporating the National Soil Resources Institute (NSRI,) at Cranfield University maintains soil reports and maps for England and Wales. The Soilscapes dataset map indicates that soils in the area are 'Shallow lime-rich soils over chalk or limestone'. These soils are identified as being 'Freely Draining'.

Groundwater Source Protection

3.11. From an inspection of the Environment Agency's Aquifer Designation Map dataset held on Natural England's MAGIC website. The majority of the site's bedrock deposits are classified as unproductive

with the northern and southern boundary lying in Secondary A Aquifers. A 'Secondary A' Aquifer which is classified as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. A Secondary Undifferentiated superficial drift aquifer is located along the northern boundary associated with the Head (Clay, silt, sand and gravel) superficial deposits.

3.12. A copy of the Aquifer Designation (Superficial Drift) Map is reproduced in **Figure 3** below.

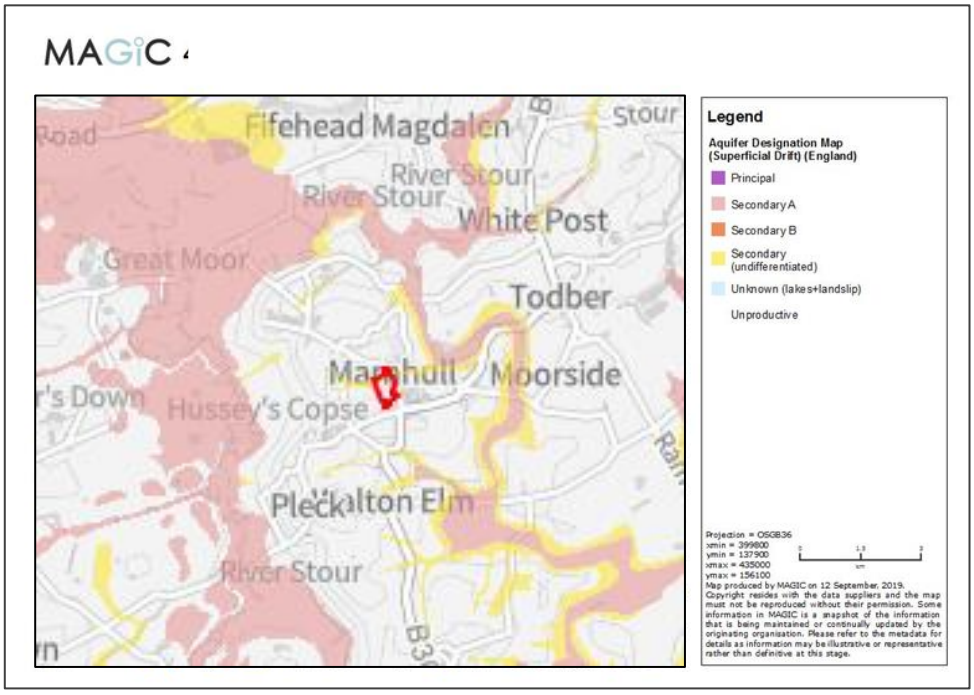


Figure 3: Environment Agency's Aquifer Designation Map (Superficial Drift)

3.13. A copy of the Aquifer Designation (Bedrock) Map is reproduced in Figure 4 below.

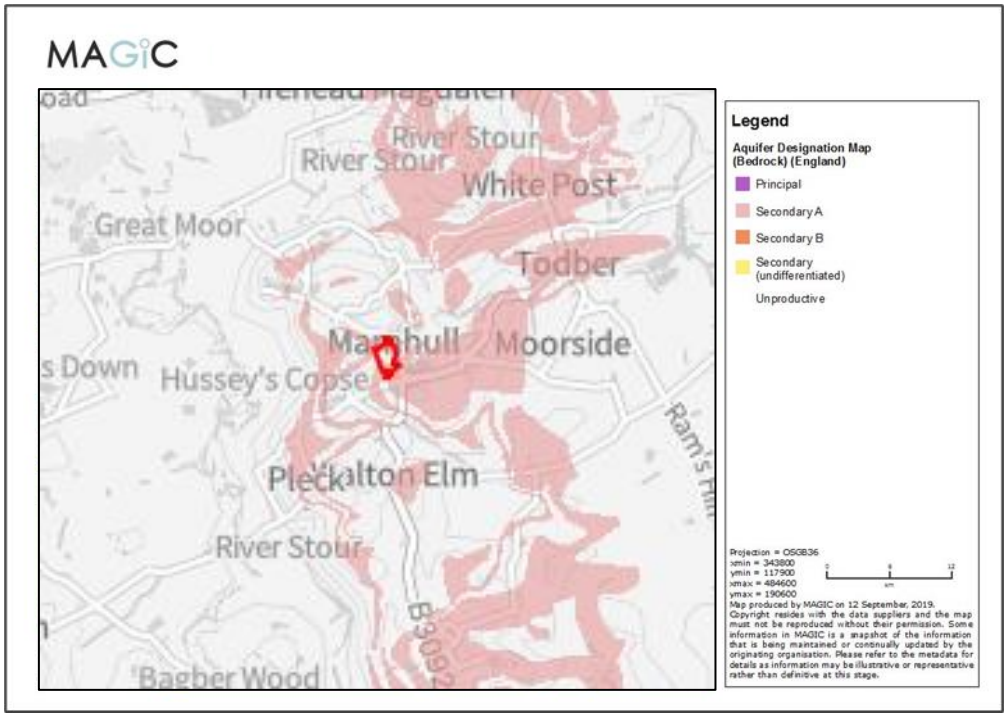


Figure 4: Environment Agency's Aquifer Designation Map (Bedrock)

Ground Investigation

3.14. An intrusive ground investigation was undertaken across the site west of Church Hill by Omnia in January 2023. Due to waterlogged conditions across the site, soakage test were only taken at the site entrance to prevent equipment becoming stuck. An extract from the Exploratory Ground Investigation report including trial pit, borehole logs and infiltration test results are located in **Appendix 4**.

3.15. As part of the site investigation, infiltration tests were carried out across the site in accordance with BRE Digest 365 methodology. Due to poor ground conditions an effective storage rate was not reach in all three trail pits and therefore no infiltration rates were calculated.

3.16. Based on the foregoing it is considered that the use of infiltration devices would not provide a suitable means of draining surface water runoff from development on the majority of the site due to unsuitable ground conditions.

3.17. Groundwater was not encountered within SA101 and SA103, however groundwater seepage occurred at 1.40m bgl within SA102 located to the east of the site. Winter Groundwater monitoring was undertaken by Omnia in November 2022 and March 2023. A copy of the Omnia report is reproduced in **Appendix 5.**

Summary of Ground Conditions

3.18. On the basis of the site investigation and infiltration tests, and with reference to the WRAP Map, the soils underlying the site more closely relate to Soil Index Class 4 with a relatively low winter rainfall acceptance potential and higher standard percentage runoff. Therefore the site can be classed as being 'impermeable'.

Development Proposals

3.19. The development proposals comprise a number of commercial buildings, these include a food store, offices, a Café and business units as well as two 2 bedroom flats. There are a number of parking areas associated with this development.

3.20. A copy of the Site Layout Plan, Drawing No. 22039 101 Tess Square Site Layout P1, prepared by Bright Space, showing the development proposals, is reproduced in **Appendix 6**.

Climate Change Allowances

3.21. The NPPF and its guidance requires development to take account of the impacts of climate change. The allowances to be made for climate change effects when assessing flood risk are related to the lifetime of the development.

3.22. Guidance on the lifetime of development is provided at paragraph 6 in the Flood Risk and Coastal Change Planning Practice Guidance. There are two residential dwellings associated with the commercial development and therefore the lifetime of the development can be assumed to be at least 100 years, unless there is specific justification for considering a different period.

3.23. Paragraph 20 of the Guidance states site-specific flood risk assessments should demonstrate to the decision-maker how flood risk will be managed now and over the development's lifetime, taking climate change into account and links to Environment Agency Guidance entitled 'Flood risk assessments: climate change allowances' last updated on 27 May 2022. This sets out the climate change allowances to be used for peak rainfall intensity.

3.24. There are a range of climate change allowances for each river basin district and are based on percentiles. A percentile describes the proportion of possible scenarios that fall below an allowance level. The higher central allowance is based on the 70th percentile (only 30% of projections would exceed this allowance) whereas the upper end allowance is based on the 95th percentile (only 5% of projections would exceed this allowance).

Peak Rainfall Intensity Allowance

3.25. With respect to the peak rainfall intensity allowance, the site lies in the Dorset Management Catchment. The Guidance advises for development with a lifetime beyond 2100 assess the upper end allowance for the 2070s epoch (2061 to 2125) and design your development so that for the upper end allowance in the 1% annual exceedance probability event there is no increase in flood risk elsewhere and your development will be safe from surface water flooding. The total potential change anticipated for 2070s epoch (2061 to 2125) is +45% for the central allowance in the 1% AEP rainfall event.

Standard of Protection

3.26. In terms of providing an acceptable standard of protection against flooding for new development, where development is necessary in flood risk areas the development should be made safe for its lifetime without increasing flood risk elsewhere. The Site-specific flood risk assessment checklist makes reference to the assessment of the 'design flood'.

3.27. Paragraph 2 in the Flood Risk and Coastal Change Planning Practice Guidance defines a "design flood" as follows:

'This is a flood event of a given annual probability, which is generally taken as:

- **river flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year); or**
- **tidal flooding with a 0.5% annual probability (1 in 200 chance each year); or**
- **surface water flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year),**

plus an appropriate allowance for climate change.

3.28. Therefore, in terms of providing an acceptable standard of protection against flooding for new development, the development should be appropriately safe without increasing flood risk elsewhere in the 'design flood'.

3.29. The Government published its 'Non-statutory technical standards for sustainable drainage systems' in March 2015. They should be used in conjunction with the NPPF and planning practice guidance. Standard S7 states that the drainage system must be designed so that flooding does not occur on any part of the site for a 1 in 30 year rainfall event. Standard S8 goes on to state that the drainage system must be designed so that flooding does not occur during a 1 in 100 year rainfall event in any part of a building (including a basement); or in any utility plant susceptible to water within the development.

4. FLOOD RISK ASSESSMENT

4.1. In addition to flooding from rivers and the sea it is also necessary to consider the potential consequences of flooding from all other sources, which include directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

Sources of Information

4.2. This assessment makes reference to the SFRA detailed in paragraph 2.5 above.

4.3. Dorset Council have a surface water planning page on their website which sets out the surface water flood risk requirements across the county and Dorset Councils responsibilities as the lead local flood authority.

4.4. The Government's GOV.UK website contains 'Long Term Flood Risk Information' which includes interactive maps showing 'Flood risk from rivers or the sea' and 'Flood risk from surface water'. These maps show the chance of flooding in one of four risk categories: High risk means that each year this area has a chance of flooding of greater than 3.3% (1 in 30); Medium risk between 1% and 3.3% (1 in 100 and 1 in 30); Low risk between 0.1% and 1% (1 in 1000 and 1 in 100); and Very low risk less than 0.1% (1 in 1000). The 'Flood risk from surface water' map indicates the extent, depth and velocity of water for High, Medium and Low risk scenarios. The Long Term Flood Risk Information also includes a 'Flood risk from reservoirs' map.

Site Specific Flood Risk

Flooding from Watercourses

4.5. Flooding from watercourses is caused by high flows in rivers or streams exceeding the capacity of the river channel and spilling onto the floodplain, usually after periods of heavy rainfall across the catchment.

4.6. The nearest main river in the vicinity of the site is the River Stour located 1.3km to the north of the site. There is an unnamed ordinary watercourse running along the northern boundary.

Flood Zones

4.7. A definition of each Flood Zone and probability of river flooding is provided in Table 1 of the Flood Risk and Coastal Change Planning Practice Guidance.

4.8. As identified in 2.12 above, the site lies entirely within Flood Zone 1, which is defined as the zone with the lowest probability of flooding from rivers and is defined as land having a less than a 1 in 1000 (0.1%) annual probability of river flooding.

Summary of Pre Development Flooding from Watercourses

4.9. In summary, the risk of flooding from watercourses is assessed as 'Very Low'

Flooding from Surface Water

4.10. The GOV.UK's Flood risk from surface water map indicates where surface water may be expected to flood or pond. Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead. The GOV.UK website advises that flooding from surface water is difficult to predict as rainfall location and volumes are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding. The information shown is a general indicator of an area's flood risk. A copy of the GOV.UK's Flood risk from surface water map is reproduced in **Figure 5** below.

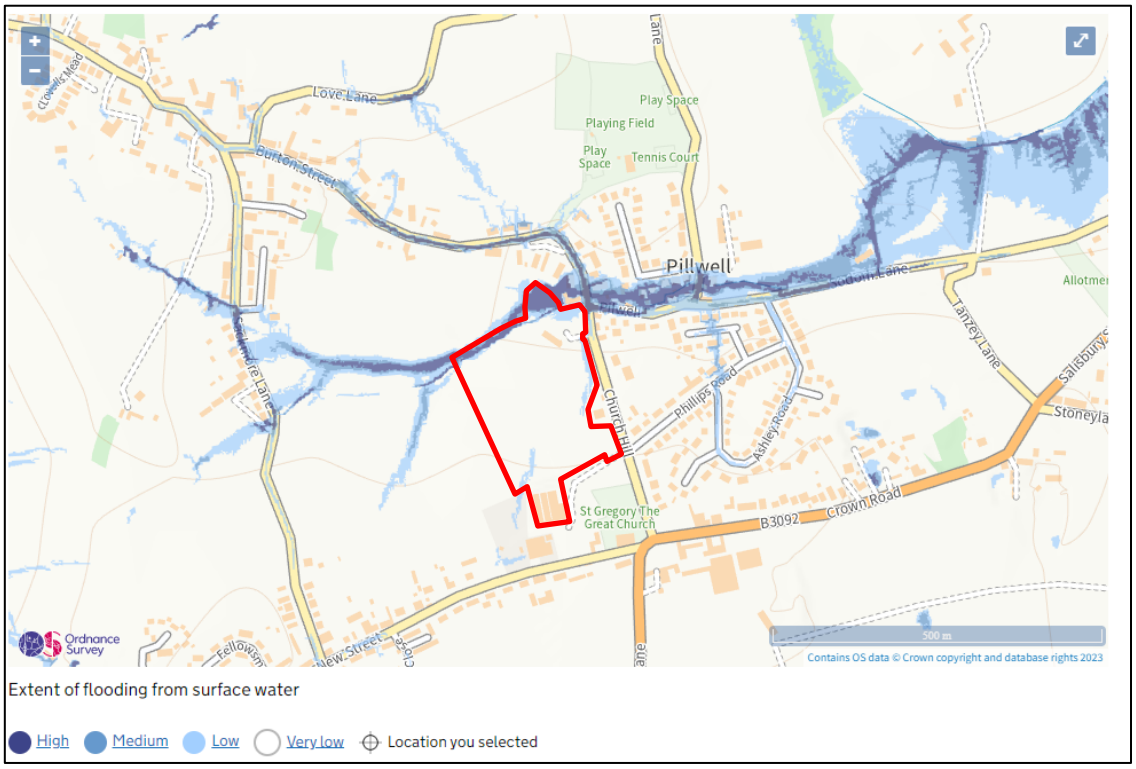


Figure 5: Flood risk from surface water map

4.11. The GOV.UK's Flood risk from surface water map shows that the site contains areas of Very Low risk (less than 0.1%), Low risk (between 0.1% and 1%), Medium risk (between 1% and 3.3%) and High risk (greater than 3.3%).

4.12. The areas of elevated surface water flooding are associated with low points on the site where surface water runoff could collect and are related to localised low points and routes of drainage ditches. Development is not proposed in these locations.

4.13. The extent of the Low risk surface water flood event is shown on Drawing No. C798/13 contained in Appendix 2. Depths ranging from 300m to +900mm are restricted the channel of the onsite drainage ditch, with a small area of depths below 300mm in the north and western boundary. The modelled velocities in the low risk event are over 0.25 m/s indicating the surface water flooding is associated with overland flow routes through the site.

4.14. In terms of historic flooding, the SFRA does not identify any historical surface water flood events across the site.

4.15. The risk of flooding from surface water is assessed as 'Very Low'.

Flooding from Groundwater

4.16. Groundwater flooding is most likely to occur in low-lying areas underlain by water-bearing permeable rocks termed aquifers. These may be extensive regional aquifers in chalk or sandstone, or localised sands or river gravels in valley bottoms underlain by less permeable rock. Groundwater flooding occurs as a result of water rising from the underlying rocks or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. In low-lying areas the water table is usually at shallower depths, so during very wet periods, all the additional groundwater flowing towards these areas can cause the water table to rise to the surface causing groundwater flooding which may follow overland flow paths or pond at local

topographic depressions. The rate of groundwater emergence depends upon the pressure head on the groundwater body, and the permeability of soils and near surface geology which can be locally variable.

4.17. In relation to groundwater flooding, the SFRA indicates the site falls within an area with a 'low' likelihood of groundwater flooding.

4.18. The Level 1 SFRA uses the BGS Susceptibility to Groundwater Flooding which indicates where groundwater may emerge due to geological and hydrogeological conditions. This information is shown as a proportion of 50m grid squares where there is potential for groundwater emergence. The mapping shows that the application site falls predominately within areas that have no chance of susceptibility of groundwater flooding with small areas of limited potential for groundwater flooding associated with the Secondary A Aquifers located on the site.

4.19. The SFRA does not identify any incidents of groundwater flooding in the vicinity of the site.

4.20. In summary, the risk of flooding from groundwater is assessed as 'Very Low' for the site based on the available information and underlying geological deposits which are not a significant source of groundwater.

Flooding from Overwhelmed Sewers and Drainage Systems

4.21. Flooding from sewers and drainage systems occurs when the sewer or drainage system is overwhelmed as a result of a blockage or excessive flow exceeding its capacity and/or when sewers cannot discharge properly to watercourses due to high water levels.

4.22. There is an existing sewer network located within the existing Surgery car park which drains to the west along Pillwell. An existing sewer crosses over the northern section of the site however, the SFRA does not identify any incident of flooding from overwhelmed sewers and drainage systems affecting the site.

4.23. Due to the absence of sewers crossing the site the flood risk posed by overwhelmed sewers to the site is therefore 'Low'.

Flooding from Artificial Sources

4.24. Flooding form reservoirs may occur as a result of partial or complete failure of the control structure designed to retain water in the artificial storage area.

4.25. The GOV.UK's Flood risk from reservoirs map indicates the site is unaffected by flooding from any reservoirs.

4.26. The GOV.UK website advises that while there is a risk in this area, flooding from reservoirs is extremely unlikely. Also, since this is a worst case scenario, it is unlikely that any actual flood would be this large. Current reservoir regulation has been further enhanced by the Flood and Water Management Act 2010, which amends the Reservoirs Act 1975, and aims to make sure that all reservoirs are properly maintained and monitored in order to detect and repair any problem.

4.27. The SFRA does not identify any incident of flooding from Artificial Sources on the site.

4.28. No significant waterbodies are identified upstream of the site which are considered to pose a risk to the site.

4.29. In summary, the risk of flooding from artificial sources is assessed as 'Very Low' due to the absence of any reservoirs in the vicinity of the site.

Summary of Pre Development Flood Risk

4.30. A summary of the potential flood risk from all sources of flooding associated with existing pre-development conditions is shown in **Table A** below.

Table A: Pre-development Potential Flood Risk from All Sources of Flooding

Flood Source	Potential Risk	Description
Watercourses	Very Low	The site is located in Flood Zone 1, which indicates less than 1 in 1,000 annual probability of river flooding (<0.1%).
Surface Water	Very Low	The risk of flooding from surface water on the majority of the site is 'very low' with areas of elevated risk around the low lying areas adjacent to ordinary watercourse which crosses the site where development is not proposed.
Groundwater	Low	The underlying ground conditions suggest the risk of significant groundwater being present in the underlying geological deposits is low. If groundwater were to emerge it would behave like surface water flooding and collect at low spots of the site associated with ordinary watercourses.
Overwhelmed Sewers	Low	The SFRA indicates that there are no historic records of sewer flooding in the postcode area within the vicinity of the site. The risk of the site being affected by flooding from overwhelmed sewers and drainage systems is assessed as 'low'.
Artificial Sources	Very Low	None identified.

4.31. The pre-development potential flood risk to the site from majority of sources of flooding is considered to be 'Very Low' to 'Low'. There are areas of high risk associated with surface water flooding.

Overland Flood Flow Paths

4.32. Standard S9 in the Government's 'Non-statutory technical standards for sustainable drainage systems' states that the design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of 1 in 100 year rainfall event are managed in exceedance routes that minimise the risk to people or property.

4.33. In event of the drainage system being overwhelmed by a rainfall event greater than the design standard or as a result of blockage or failure overland flood flow paths would follow the natural topography of the land towards the onsite watercourses which are located at the low point of the development site. The design of the internal road network would broadly respect the natural topography and continue to fall towards the onsite watercourses and Strategic SuDS Features. These exceedance flow routes would minimise the risk to people and property on and off site.

Off Site Impacts

4.34. The provision of a surface water drainage system with outflow rates restricted to the Q_{BAR} greenfield runoff rate for each development sub catchment would reduce the rate of runoff into the onsite watercourse compared with the pre-development scenario (as per Tables C and D). The provision of a surface water drainage system would also intercept and manage uncontrolled

overland flows. These measures would contribute to reducing flood risk overall for the development site compared with the pre-development situation.

4.35. The proposed development would result in flood risk betterment on and off site.

Additional Consents

4.36. Additional consents would potentially be required for any works to watercourses in addition to securing planning permission.

NPPF Planning Policy Flood Risk Tests

Flood Risk Vulnerability and Flood Zone 'Compatibility'

4.37. Annex 3 of the NPPF sets out the Flood Risk Vulnerability Classification of development and categorises different types of development according to their vulnerability to flood risk. Paragraphs 77-78 of the Flood Risk and Coastal Change Planning Practice Guidance refer to two Flood Zone and Flood Risk Tables. Table 1: Flood Zones provides a definition of each Flood Zone. Table 2: Flood risk vulnerability and flood zone 'compatibility' maps the vulnerability classes against the flood zones to indicate where development is appropriate and where development should not be permitted.

4.38. With reference to Annex 3 of the NPPF. The proposed employment development falls into the 'Less Vulnerable' flood risk vulnerability classification, which includes buildings used for offices, general industry. However due to the two dwellings located within the development the vulnerability is increased to 'More Vulnerable'.

4.39. The Environment Agency's Flood Map for Planning indicates that the site falls within Flood Zone 1.

4.40. With reference to Table 2, all uses of land are appropriate in Flood Zone 1.

4.41. Notes to Table 2 states that the table does not show the application of the Sequential Test which should be applied first to guide development to the lowest flood risk areas.

Sequential Test

4.42. Paragraph 161 of the NPPF states:

> **'All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by:**
>
> **(a) applying the sequential test and then, if necessary, the exception test as set out below;'**

4.43. Paragraph 162 of the NPPF goes onto state:

> **'The aim of the sequential test is to steer new development to areas with the lowest probability 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 the test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.'**

4.44. The site falls within Flood Zone 1 and on this basis the sequential test is passed in terms of river flooding. Therefore there is no need to apply the Exceptions test.

5. DRAINAGE STRATEGY

Sustainable Drainage Systems Guidance

5.1. Paragraph 169 of the NPPF states:

> **'Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:**
>
> **a) take account of advice from the lead local flood authority;**
>
> **b) have appropriate proposed minimum operational standards;**
>
> **c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and**
>
> **d) where possible, provide multifunctional benefits.'**

5.2. 'Major development' is defined in the NPPF Annex 2: Glossary as:

> **'For non-residential development it means additional floorspace of 1,000m^2 or more, or a site of 1 hectare or more, or as otherwise provided in the Town and Country Planning (Development Management procedure) (England) Order 2015.'**

5.3. Paragraph 55 in the Flood Risk and Coastal Change planning practice guidance advises that sustainable drainage systems are designed to control surface water runoff close to where it falls and mimic natural drainage as closely as possible. Sustainable drainage systems can contribute to the causes and impacts of flooding and deliver a wider range of additional biodiversity and environmental net gains.

5.4. In terms of what sort of sustainable drainage system should be considered, paragraph 56 in the Guidance advises Where possible, preference should be given to multi-functional sustainable drainage systems, and to solutions that allow surface water to be discharged according to the following hierarchy of drainage options:

1. into the ground (infiltration);
2. to a surface water body;
3. to a surface water sewer, highway drain, or another drainage system;
4. to a combined sewer.

5.5. The drainage hierarchy is also set out in Section 3.2 of Approved Document H of the Building Regulations.

5.6. The Government's 'Non-statutory technical standards for sustainable drainage systems' relate to the design, construction, operation and maintenance of sustainable drainage systems and have been published as guidance. The Government expect these standards to apply to all developments of 10 homes or more and to major commercial development. The Government's 'Non-statutory technical standards for sustainable drainage systems' set out peak flow control standards (S2 and S3) and volume control technical standards (S4, S5 and S6).

5.7. Guidance on the design and construction of SuDS is provided in Ciria C753 'The SuDS Manual' as well as in the Design and Construction Guidance (DCG) published by Water UK.

5.8. There are a number of potential SuDS techniques that might be used on any particular site. These include rainwater harvesting systems, pervious pavements, infiltration devices such as soakaways and infiltration trenches, bioretention systems, as well as flow balancing methods including swales, detention basins, and underground storage facilities.

5.9. The use of soakaways, pervious pavements and infiltration devices to discharge surface water runoff to ground depends upon the underlying strata having a suitable permeability. In addition, the Environment Agency will seek to control discharges into underground strata from areas subject to contamination or where groundwater is judged to be at risk from pollution caused by possible contamination.

5.10. The SuDS Manual promote the use of a SuDS 'management train', which seeks to address the quality and quantity of runoff at all stages of a drainage system. It uses a hierarchy of techniques, namely: i) prevention, ii) source control, iii) site control and iv) regional control. The drainage strategy for the proposed development seeks to follow the concept of a SuDS management train.

Design Criteria

Greenfield Runoff Assessment

5.11. Chapter 24 of the SuDS Manual (C753) provides a summary of runoff estimation methods and references the DEFRA/Environment Agency R&D Technical Report – SC030219 'Rainfall runoff management for developments'. This guide gives advice on designing drainage for stormwater for new building developments and was last revised in October 2013.

5.12. Table 1 in the 'Rainfall Runoff Management for Developments – Interim National Procedure Principles' set out in Report – SC030219 states that for developments between 0-50 hectares one of two approaches can be used:

> **'1. The Institute of Hydrology (IH) Report 124 Flood Estimation for Small Catchments (1994) method can be used to estimate the greenfield site flow rate, Q_{BAR} (the Mean Annual Flood).**
>
> **2. The Index Flood, Q_{MED} (the median of the set of annual maximum flood peaks) regression equation that forms part of the FEH statistical method can also be used where the appropriate parameters are known or can be derived/estimated.**
>
> **Where developments are smaller than 50 ha, the analysis for determining the greenfield index flood flow rate should use 50 ha in the formula and linearly interpolate the flow rate value based on the ratio of the development area.'**

5.13. FSSR 2 and 14 regional growth curve factors can be used to calculate the greenfield peak flow rates for other return periods.

5.14. Discharge rate criteria are set out in Point 8 of the 'Rainfall Runoff Management for Developments – Interim National Procedure Principles' in the Environment Agency's Report – SC030219. It states:

> **'The Environment Agency will normally require that, for the range of annual flow rate probabilities, up to and including the 1% annual probability (1 in 100 year) event, the developed rate of runoff into a watercourse should be no greater than the undeveloped rate of runoff for the same event based on the calculation of Q_{BAR} or Q_{MED} and the use of FSSR growth curves. Exceptions only apply where it is not practical to achieve this due to either constraints on the size of the hydraulic control unit (see point 17), or excessive storage volumes. The purpose of this is to retain a natural flow regime in the receiving watercourse and not increase peak rates of flow for events of an annual probability greater than 1%.**

Three annual probabilities are used to define discharge compliance limits though the critical criteria are for the lowest and highest frequency events; 100% (1 year), 3.33% (30 year) and 1% (100 year).'

5.15. Volumetric criteria are set out in Point 10 of the 'Rainfall Runoff Management for Developments – Interim National Procedure Principles' in the Environment Agency's Report – SC030219, which states:

'Theoretically the stormwater runoff volume from a site should be limited to the greenfield runoff volume for all event frequencies. However this is technically extremely difficult to achieve and therefore compliance to two criteria on runoff volume is required.'

5.16. The two criteria are set out in Points 10.1 and 10.2 as 'Interception' and 'Additional runoff due to development'. Point 10.1 states:

'Interception. Where possible, infiltration or other techniques are to be used to try and achieve zero discharge to receiving waters for rainfall depths up to 5mm.'

5.17. Point 10.2 states:

'Additional runoff due to development. The difference in runoff volume pre- and post-development for the 100 year 6 hour event should be disposed of by way of infiltration, or where this is not feasible due to soil type, discharged from the site at flow rates below 2 l/s/ha.'

5.18. Point 10.3, of the 'Rainfall Runoff Management for Developments – Interim National Procedure Principles' in the Environment Agency's Report – SC030219, states:

'Where compliance to 100 year volumetric criterion is not provided, the limiting discharge for any return period up to the 100 year event shall not be greater than the mean annual peak rate of runoff for the greenfield site (Referred to as Q_{BAR} in IH Report 124) or 2 l/s/ha, whichever is greater.'

5.19. The practicable minimum limit on the discharge rate from a flow attenuation device is dependent on the size of the hydraulic control unit while keeping the risk of blockage to an acceptable level. At this time vortex flow control devices area available which can achieve rates of 1 l/s with a shallow head design and still provide more than a 50mm orifice diameter. The practicable minimum limit on the discharge rate is therefore approximately 1 l/s.

5.20. When a flow control device forms part of a drainage system to be adopted by a Water Company, flow controls should have a minimum opening size of 100mm where the upstream system is open and debris can enter the system, and a minimum opening size of 50mm where the design of the upstream system will prevent debris entering the system. Variable controls may have a smaller opening provided they have a self-cleansing mechanism.

5.21. As the additional runoff generated cannot be disposed of by infiltration it is proposed that the outflow from the drainage system is constrained to Q_{BAR}, which approximates to a return period of 2.3 years, and hence a reduced rate of runoff for higher return periods.

Surface Water Management

5.22. A sustainable drainage strategy, involving the implementation of SuDS, is proposed for managing the disposal of surface water runoff from the proposed development on the site.

5.23. A preliminary ground investigation, undertaken by Omnia in January 2023, indicates that the site is underlain by Superficial Head Deposits (clay, silt, sand and gravel) with bands of Limestone and Mudstone bedrock deposits. Infiltration tests, carried out in accordance with BRE Digest 365 methodology, demonstrate that infiltration drainage would not be suitable. The relevant extract from the Site Investigation Report is reproduced in Appendix 4.

5.24. As the use of infiltration devices is not feasible it is necessary to use flow balancing methods in order to store and attenuate surface water runoff to greenfield runoff rates with discharges to the local watercourse, ditch system, or sewer network. The required storage may be provided using swales, detention basins, pervious pavements, oversized pipes, and underground cellular storage facilities.

5.25. A preliminary surface water drainage strategy is shown on the Preliminary Surface Water Drainage Strategy Plan, Drawing No. C798/22B, a copy of which is contained in **Appendix 7**.

5.26. Winter Groundwater monitoring was undertaken by Omnia in November 2022 and March 2023. The Omnia report, reproduced in Appendix 5, indicates that the base of the proposed SuDS features shown on the Preliminary Surface Water Drainage Strategy Plan, Drawing No. C798/22B would be above the maximum winter groundwater level.

5.27. The proposed surface water drainage measures incorporate Strategic SuDS Features, to attenuate and store surface water runoff, comprising a series of detention basins, swales and lined pervious paving. Outflow from the Strategic SuDS Features is controlled by means of suitable flow control devices and ultimately discharged to the onsite drainage ditch.

5.28. The proposed drainage strategy would ensure that surface water arising from the developed site would be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

SuDS Management Train

5.29. In terms of the SuDS 'management train', the drainage strategy for the proposed development seeks to address the quality and quantity of runoff as follows:-

Prevention

5.30. Prevention is the use of good site design and housekeeping measures to prevent pollution. Good site design and housekeeping measures that should be considered include:

- Minimising the impermeable areas created on the site by providing soft landscaping and planting wherever possible.
- Good site wide housekeeping and maintenance to minimise blockages and prevent pollution arising.
- Installation of separators and other proprietary pollution control systems where land use requires or specific risks necessitate their use.
- Silt traps and trapped gullies to retain sediment.
- Planting within landscaped areas to encourage nutrient / pollutant uptake and evapotranspiration.
- The implementation of a SuDS Maintenance Strategy. Advice on what should be included within a maintenance strategy for the Strategic SuDS Features is included with this report. The SuDS Maintenance Strategy should become a living document that is continuously reviewed.

Source Control

5.31. Source control is defined in The SuDS Manual 2015 (CIRIA C753) as the control of runoff at or near its source, so that it does not enter the drainage system or is delayed and attenuated before it enters the drainage system. Source Control techniques that should be used within development parcels include the following:

- **Pervious Paving**: Pervious paving intercepts rainfall that lands on its surface before it can run overland into the downstream drainage system. This provides a degree of interception, particularly in the most polluted first-flush events, as well as filtration through the various layers of construction and through the stone sub-base. Pervious paving would typically be used for parking areas such as driveways, parking courts and car parks. Through the inclusion of a suitable flow control device, the stone sub-base in the pervious paving structure can be utilised to provide additional attenuation storage. It is recommended that any pervious pavement areas are lined on the site when used for collection of rainfall to ensure shallow groundwater does not compromise the functioning of the structure.

5.32. Delivery of Source Control techniques dependent on detailed design and subject to requirements of adopting authority. Adoption of Source Control SuDS features can be a barrier to delivery and detailed proposals should be assessed as part of future reserved matters applications.

Site Control

5.33. Site control is the management of water from several sub-catchments within a site. The proposed surface water drainage system amalgamates the runoff from the roofs, roads, and paved areas, for each area of development on the site, and deals with it in a combination of swales and detention basins, to attenuate flows and reduce the rate of runoff from the site.

5.34. The detention basins would provide attenuation, and would also contribute to the pollutant and sediment removal capability of the SuDS management train, as well as enhance the site's amenity value and provide biodiversity betterment.

5.35. The detention basins would incorporate a sediment forebay, designed in accordance with the guidance given in The SuDS Manual, to enhance water quality.

5.36. The Strategic SuDS Features should be designed to incorporate specific design features to maximise their ability to enhance quality of runoff, deliver biodiversity net gain and their general amenity value. These design features include:

- The Strategic SuDS Features will be 'online' and receive runoff during all storm events (where levels permit).
- Low flow channels will be incorporated into the SuDS features to create wetter areas of habitat and encourage drier areas across other parts of the basin creating a diverse mosaic of habitats within the feature. Low flow channels will be locally widened to create wetland areas in the base.
- Micro pools will create areas of standing water at the outlet of the Strategic SuDS Features to prevent the resuspension of fine sediment.
- Sediment forebays will be provided at the inlet to promote sedimentation and allow fine sediments to collect in an area for periodic removal.
- Planting throughout the Strategic SuDS Features will enhance the rate of evapotranspiration, provide interception and increase rates of sedimentation. Biological uptake of nutrients from vegetation growth will also contribute to the surface water quality enhancement of the Strategic SuDS Features.

- Areas of permanent water will be incorporated in accordance with the Landscape Masterplan and will include the appropriate safety benching as per the recommendations of the SuDS Manual.
- The Strategic SuDS Features identified should incorporate variable side slopes to enhance the amenity value of the feature and integrate it into the surrounding landscape. Detailed design of the Strategic SuDS Features can continue to soften and enhance landscape integration.

5.37. Outfall routes connecting Strategic SuDS to the on-site drainage ditch (downstream of the flow control) should utilise swales where possible. This measure increases the entrapment of sediments within the grass and minimises the risk of erosion around the outfall.

5.38. The proposed Strategic SuDS Features are located outside of Root Protection Zones areas, at least 3m from the onsite drainage ditch and at least 5m from hedgerows.

Regional Control

5.39. Regional control is the management of runoff from more than one site and so in this case is covered by the site control techniques.

Greenfield Runoff Rate - IH Report 124 Method

5.40. The ICP SuDS module in the Micro Drainage design software enables the calculation of greenfield runoff rates based on the IH Report 124 estimation method with pro-rata values for sites smaller than 50ha.

5.41. Greenfield runoff rates have been determined using Micro Drainage design software based on the method set out in IH Report 124. Catchment descriptors have been obtained from the Flood Estimation Handbook (FEH), published by the Institute of Hydrology. Rainfall and soil parameters have been obtained from maps in Volume V of the Flood Studies Report (FSR) within the MicroDrainage design software. FSSR 2 and 14 regional growth curve factors are used to calculate the greenfield peak flow rates for 1, 30 and 100 year return periods.

5.42. The FSR WRAP Map, shown in Appendix 3, indicates the site is located in 'Soil Index Class 1', which has the lowest standard percentage runoff and suggests the underlying soil has good permeability. However, the site investigation shows the overlying superficial deposits are relatively impermeable.

5.43. Due to the observed relatively impermeable nature of the site, using a Soil Index Class 1 in IH 124 would underestimate Q_{BAR}. On the basis of the site investigation and soakaway tests, and with reference to the WRAP Map, the soils underlying the site more closely relate to Soil Index Class 4 with a relatively higher standard percentage runoff. A Soil Index value of 0.45, which more closely represents the site specific soil value, has there been used to calculate Q_{BAR} in IH Report 124.

5.44. Copies of the MicroDrainage greenfield runoff calculations for the site are included in **Appendix 8**. A summary of the greenfield runoff rates for the various return period events is shown in **Table B**. The mean annual peak rate of runoff, referred to as Q_{BAR} in IH Report 124, is 5/s.

Table B: Greenfield Runoff Rates

Return Period (Years)	1	Q_{BAR}	30	100
Greenfield Runoff Rates (l/s)	4.2	5.0	11.3	15.9

5.45. As the additional runoff generated cannot be disposed of by infiltration it is proposed that the outflow from the drainage system is constrained to Q_{BAR} or the practicable minimum limit on the discharge rate (1 l/s) for all rainfall events up to the 100 year return period event, including a 45%

allowance for climate change, the proposed development would reduce flood risk overall when compared to existing greenfield runoff rates.

Surface Water Flow Balancing

5.46. The detention basins and pervious paving shown on the Preliminary Surface Water Drainage Strategy Plan, Drawing No. C798/22B in Appendix 7, indicate the location and sizes of the required storage facilities to serve the various development areas and are subject to detailed design.

5.47. It is proposed to use flow balancing methods, comprising detention basins and pervious pavements, in order to attenuate surface water runoff to greenfield runoff rates with discharge to the local watercourse and ditch system.

5.48. Preliminary storage calculations have been undertaken to establish the required storage for the development catchment areas on the site using the Source Control module in the Micro Drainage design software for 1 in 100 year events plus a 45% increase in peak rainfall intensity to take account of climate change. Copies of the Micro Drainage Source Control and cascade results output for the development catchment areas are reproduced in **Appendix 9 and 10**.

5.49. The results for Outfall 1 are summarised in **Table C** and the results for Outfall 2 are summarised in **Table D** below.

Table C: Outfall 1

SuDS Feature	Impermeable Area (Ha)	Allowable Discharge (l/s)	1 in 100 yr +45% Storage Vol. (m^3)	Resulting Discharge (l/s)
Detention Basin 1	0.339	-	231.1	-
Detention Basin 2	0.122	2.3	93.2	2.2
PP10	0.120	0.6	85.1	0.7
Total	**0.581**	**2.9**	**409.4**	**2.9**

5.50. Outfall 1, referred to in Table C above receives flows from Detention Basins 1&2 and Pervious Paving 10 (PP10). The roof area from a number of the business units, the food store and courtyard (0.339 ha) are piped to attenuation basin 1, which stores and directs flows into attenuation basin 2. Attenuation basin 2 also receives flows from the café and business units (0.121 ha). Cascade summaries for these storage facilities are contained in Appendix 9. Pervious Paving 10 drains the area of parking which flows into outfall 1, a copy of the Micro Drainage Source Control summary is contained in Appendix 9.

Table D: Outfall 2

SuDS Feature	Impermeable Area (Ha)	Allowable Discharge (l/s)	1 in 100 yr +45% Storage Vol. (m3)	Resulting Discharge (l/s)
PP1	0.050	-	28.6	-
PP2	0.054	-	49.2	-
PP3	0.055	-	60.0	-
PP4	0.054	-	63.5	-
PP5	0.054	-	63.6	-
PP6	0.087	-	89.3	-
PP7	0.064	-	86.5	-
PP8	0.007	1.9	3.3	0.8
PP9	0.009	0.1	2.7	0.7
Total	**0.434**	**2.0**	**446.7**	**1.5**

5.51. Outfall 2, referred to in Table D above, receives surface water runoff form the parking areas; Cascade summaries PP1 to PP8 are contained in appendix 9. Outfall 2 also receives flows from PP9 which is the additional parking provided to the pre-existing surgery carpark; the Micro Drainage results are contained in Appendix 10

5.52. The Strategic SuDS Features shown on the Preliminary Surface Water Drainage Strategy Plan, Drawing No. C798/22B in Appendix 7, indicate the location and sizes of the required storage facilities to serve the various development areas and are subject to detailed design.

Additional Consents

5.53. Consent would need to be obtained for the construction of the various outfalls to the ditch system under Section 23 of the Land Drainage Act 1991.

Water Quality Assessment

5.54. The proposed Outline Surface Water Drainage Strategy incorporating Strategic SuDS Features provides treatment of surface water runoff which in turn delivers water quality benefits.

5.55. The proper implementation of a SuDS management / treatment train using a combination of upstream Source Control and Strategic SuDS Features will create greater resilience and allow the system to collect silt at various points which can then be removed as part of periodic maintenance. Creating a diverse SuDS scheme encourages sedimentation, filtration and biological uptake throughout the site.

5.56. Ensuring that the principles of the Outline Surface Water Drainage Strategy are taken forward into the future detailed design of the individual development parcels and ensuring that effective maintenance and management procedures are followed will be the key to ensuring the overall effectiveness of the SuDS scheme.

5.57. With reference to Chapter 26 of the CIRIA SuDS Manual 2015 a water quality assessment of the proposed Outline Surface Water Drainage Strategy has been undertaken using the simple index approach.

5.58. To deliver adequate treatment the SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type):

Total SuDS mitigation index > pollution hazard index

5.59. Where the mitigation index of an individual component is insufficient, two components (or more) in series will be required, where:

Total SuDS mitigation Index = mitigation index$_1$ + 0.5(mitigation index$_2$) + etc

5.60. From Table 26.2 in the CIRIA SuDS Manual 2015 the pollution hazard indices for each contaminant type for the proposed land use comprising commercial roofs non-residential car parks, and low traffic roads are shown in **Table E** below.

Table E: Pollution hazard indices

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Other roofs (typically commercial/industrial roofs)	Low	0.3	0.2	0.05
Individual property driveways, residential carparks, low traffic roads and non-residential car parking with infrequent change (e.g. schools, offices) i.e. < 300 traffic movements/day	Low	0.5	0.4	0.4

5.61. From Table 26.3 in the CIRIA SuDS Manual 2015 the indicative SuDS mitigation indices for discharges to surface waters for different SuDS features which could be utilised on the development site are shown in **Table F** below.

Table F: Indicative SuDS mitigation indices for discharges to surface waters

Type of SuDS component	TSS	Metals	Hydrocarbons
Swale	0.5	0.6	0.6
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6

5.62. **Table G** below summarises the catchment areas on the development site, the associated pollution hazard indices and the appropriateness of the proposed SuDS feature to deliver adequate treatment.

Table G: Total Mitigation Index

Catchment	Pollution hazard level	SuDS Feature (minimum proposed[1])	SuDS mitigation index					
			Total suspended solids (TSS)		Metals		Hydrocarbons	
			SuDS Mitigation Index *[Target]*	Pass / Fail	SuDS Mitigation Index [*Target*]	Pass / Fail	SuDS Mitigation Index [*Target*]	Pass / Fail
Commercial Roofs	Low	Detention Basin	0.5 *[0.3]*	P	0.5 *[0.2]*	P	0.6 *[0.05]*	P
Individual property driveways and residential car parks	Low	Lined Pervious Paving	0.7 *[0.5]*	P	0.6 *[0.4]*	P	0.7 *[0.4]*	P

Notes:
[1] Opportunities for Source Control features should be considered when detailed layouts are developed.

5.63. With reference to Table H above it can be seen that the total pollution mitigation equals or exceeds the pollution hazard index (for each contaminant type) for the majority of the proposed land uses and so the proposed surface water drainage scheme delivers adequate water quality treatment.

Non-statutory technical standards for sustainable drainage systems

5.64. The Government published its 'Non-statutory technical standards for sustainable drainage systems' in March 2015. The technical standards relate to the design, construction, operation and maintenance of sustainable drainage systems and have been published as guidance. The Government expect these standards to apply to all developments of 10 homes or more and to major commercial development.

5.65. The 'Non-statutory technical standards for sustainable drainage systems' set out peak flow control standards (S2) and volume control technical standards (S4 and S6).

5.66. Standard S2 states:

> **'S2 For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.'**

5.67. In terms of volume control, standard S4 states:

> **'S4 Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.'**

5.68. Standard S6 states:

> **'S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.'**

5.69. In accordance with Points 8 and 10 of the 'Rainfall Runoff Management for Developments – Interim National Procedure Principles' in the Environment Agency's Report – SC030219, the limiting discharge rate that does not adversely affect flood risk, for any return period up to the 100 year

event, is the mean annual peak rate of runoff for the greenfield site referred to as Q_{BAR} or 2 l/s/ha, whichever is greater.

5.70. **Table H** demonstrates how the proposed development complies with the relevant standards of the Government's 'Non-statutory technical standards for sustainable drainage systems'

Table H: Compliance with Non-statutory technical standards for sustainable drainage systems

Standard	Justification for compliance
Flood risk outside the development	
S1	N/A – It is proposed to discharge to onsite watercourses.
Peak flow control	
S2	From inspection of Table C and Table D it can be seen that the peak runoff rates from the proposed drainage system for the 1 in 100 year rainfall event never exceed the peak greenfield runoff rate for the same event (taking into account the practical minimum discharge limit of 1.0 l/s) and there is a net reduction across the site when all sub catchments are taken into account.
S3	N/A. Greenfield development so S2 applies.
Volume control	
S4 & S6	As a result of the proposed development the amount of impermeable area increases which has implications for runoff volume. Based on the available evidence it is considered infiltration drainage will not be viable means to dispose of this additional volume. Consequently, the runoff volume has been discharged at a rate that does not adversely affect flood risk which equates to Q_{BAR} into the onsite watercourses (Table B).
S5	N/A. Greenfield development so S4 and S6 applies.
Flood Risk within the development	
S7	The surface water drainage system will be designed so that flooding does not occur on any part of the site for a 1 in 1 year rainfall event. The Strategic SuDS Features are sized to accommodate the 1 in 100 year rainfall event (including a 45% allowance for climate change) with no flooding. S7 is satisfied based on the calculations contained in Appendices 8 and 9
S8	The surface water drainage system will be designed so that flooding does not occur during a 1 in 100 year rainfall event within the development. The Strategic SuDS Features are sized to accommodate the 1 in 100 year rainfall event (including a 45% allowance for climate change) with no flooding. S8 is satisfied based on the calculations contained in Appendix 9 and 10

S9	For extreme events (greater than 1 in 100 year storm) the proposed development will intercept any uncontrolled overland flow and direct it into the proposed drainage system. The site levels will be designed to direct exceedance flows along their pre development routes to minimise the risks to people and property on the proposed development.
Structural integrity	
S10	Components would be designed to ensure structural integrity of the drainage system under anticipated loading conditions over the design life of the development.
S11	The materials specified by the designer at the detailed design stage would be of a suitable nature and quality for their intended use.
Designing for maintenance considerations	
S12	N/A - Pumping is not proposed.
Construction	
S13	The mode of construction of the connection with the existing sewer or drainage system would comply with the appropriate standards and be inspected by the relevant authority so would not be prejudicial to the structural integrity and functionally of the drainage system.
S14	Any damage to the drainage system would be rectified before the drainage system is completed to the satisfaction of the relevant authority.

Foul Water Drainage

5.71. Wessex Water's online asset map reproduced in **Figure 6** below provides the location of the existing public sewers in the vicinity of the site. A copy of the Public Sewer map is reproduced in **Figure 6** below.

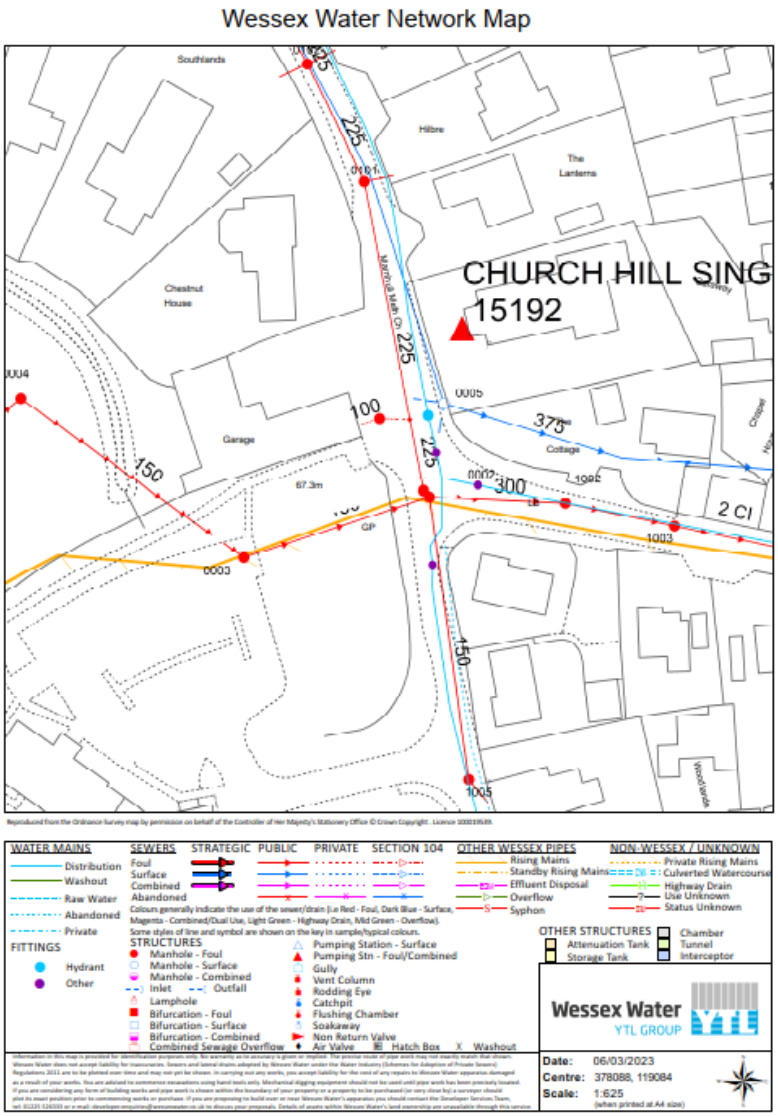


Figure 6: Public Sewer Map

5.72. The public sewer map indicates there are existing public foul water sewers located to the east of the site at manhole 0003.

5.73. Under the provisions of Section 143 of the Water Industry Act 1991 (as amended), with effect from 1 April 2018 changes have been made to the charging arrangements for services provided by sewerage undertakers to those developing land and laying new water and sewerage infrastructure. In terms of wastewater connections, the developer is entitled to make a connection to the nearest practical point on the network where the existing sewer is at least the same diameter as the new sewer required to provide capacity for the development.

5.74. The proposed development would require a 150mm diameter connection. In terms of the adequate point of connection for foul flows from the proposed development to the public foul water sewer system, a connection is proposed to the existing public foul sewer at Manhole 0003 in the existing car park of the onsite surgery.

5.75. In terms of foul water drainage, it has been demonstrated that a suitable means of drainage can be provided to serve the proposed development.

Maintenance Strategy

5.76. Paragraph 169 of the NPPF states that for major developments the sustainable drainage systems used should have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development.

5.77. In terms of the maintenance strategy for the proposed drainage measures, the main surface and foul water drainage systems would be adopted by Wessex Water, in its role as sewerage undertaker, under a Section 104 Agreement of the Water Industry Act 1991. Wessex Water would therefore be responsible for the future maintenance of the adopted drainage systems

5.78. It is proposed that the SuDS system, comprising swales and detention basins, would be be maintained by a Management Company.

5.79. Pervious pavements located onsite would be the responsibility of the management company.

5.80. Guidance on the operation and maintenance requirements of sustainable drainage systems is contained in The SuDS Manual 2015 (CIRIA C753). There are three categories of maintenance: regular, occasional and remedial. The Management Company would be responsible for putting in place a suitable maintenance plan in accordance with the recommendations in CIRIA C753 'The SuDS Manual'. Outline maintenance procedures for the SuDS features are set out in Table I below.

Table I: Maintenance Procedures

Maintenance Schedule	Required Action	Frequency
Swale		
Regular Maintenance	Litter and debris removal.	As required.
	Grass cutting or animal grazing – to retain grass height to site owner's specification.	As required.
	Manage other vegetation and remove nuisance plants..	Monthly (as stated, then as required)
Occasional Maintenance	Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter, and cut back adjacent vegetation where possible.	Annually
	Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, if required.	Annually, 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 reseeding.	As required.
	Re-level 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.
Monitoring	Inspect infiltration surfaces for ponding, compaction, and silt accumulation. Record areas where water is ponding for > 48 hours.	Monthly, or when required.
	Inspect surface for silt accumulation. Establish appropriate silt removal frequencies.	Half yearly.
Detention Basin		
Regular Maintenance	Remove litter and debris	Monthly

Maintenance Schedule	Required Action	Frequency
	Cut grass – for spillways and access routes	Monthly (during growing seasons) or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn
	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 banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chpater 23)
Occasional Maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial Actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required
Pervious Pavements		
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations - pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment

Maintenance Schedule	Required Action	Frequency
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth - if required, take remedial action	Three-monthly, 48h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

6. CONCLUSIONS

6.1. This Flood Risk Assessment has been prepared in connection with proposals for a development comprising a commercial centre with 2 dwellings on land to the West of Church Hill in Marnhull.

6.2. The overall site comprises around 5.2 hectares and is currently in mainly arable agricultural use and is surrounded by hedgerows and a ditch running along the northern boundary. There is an existing Doctors Surgery with associated parking located in the north eastern corner of the site.

6.3. With reference to the Environment Agency's Flood Map for Planning, the site falls within Flood Zone 1, which has the lowest probability of flooding.

6.4. In relation to Flood Risk Vulnerability and Flood Zone 'Compatibility', the planning practice guidance to the NPPF advises that all uses of land are appropriate in Flood Zone 1. On this basis the sequential test is passed.

6.5. In addition to flooding from rivers, this Flood Risk Assessment has considered the potential consequences of flooding from all other sources, which include directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

6.6. An assessment has been made of the potential risk from all sources of flooding to and from the development site, with reference to available flood risk information, for existing conditions pre-development, and post-development with the various development mitigation measures incorporated.

6.7. The available flood risk information includes: The Environment Agency's Flood Map for Planning; modelled flood levels for the watercourse in the vicinity of the site; flood defence locations; details of historic flood events; local flood history data from all sources of flooding; the GOV.UK 'Long Term Flood Risk Information' interactive maps; and flooding information in the SFRA.

6.8. The SFRA, and historic flood information, provides an assessment of the impact of all other sources of potential flooding. Based on the SFRA and available information, there are no historic flood incidents recorded on the site from all sources of potential flooding.

6.9. The pre-development potential flood risk to the site from all sources of flooding is considered to be 'Very Low' to 'Low'.

6.10. Through the sequential approach to site design and incorporation of flood mitigation measures the proposed development would reduce any risk from watercourses, surface water, and groundwater flooding to the proposed development.

6.11. Through the sequential approach to site design and incorporation of flood mitigation measures the proposed development would reduce the risk of flooding from watercourses, surface water, and groundwater flooding to the proposed development. By reducing the rate of runoff from developed areas, intercepting overland flows, and incorporating watercourse diversions and flood alleviation, the proposed development would reduce flood risk of the surrounding area.

6.12. The British Geological Survey (BGS) geological mapping of the area shows the majority of the site is underlain by multiple superficial and bedrock deposits. Head (Clay, silt, sand and gravel) superficial deposits run along the northern boundary. In terms of bedrock deposits, the northern section of the site is underlain by Hazelbury Bryan Formation (Sandstone), continuing in bands towards the south of the site are Woodrow Clay Member (Mudstone), Cucklington Oolite Member (Limestone,

ooidal), Sturminster Pisolite Member (Limestone, ooidal) and Newton Clay Member (Mudstone, sandy).

6.13. A site investigation was undertaken by Omnia in January 2023. As part of the site investigation, soakaway tests were carried out across the site in accordance with BRE Digest 365. Due to poor ground conditions an effective storage rate was not reach in all three trail pits and therefore no infiltration rates were calculated.

6.14. Based on the site investigation it is considered that the use of soakaways would not provide a suitable means of draining surface water runoff from development on the site.

6.15. A sustainable drainage strategy, involving the implementation of SuDS, is proposed for managing the disposal of surface water runoff from the proposed development on the site.

6.16. As the use of infiltration devices is not appropriate flow balancing methods are proposed, comprising a system of detention basins and pervious paving, in order to attenuate surface water runoff to greenfield runoff rates with discharges to the local watercourse and ditch system.

6.17. Winter Groundwater monitoring undertaken by Omnia in November 2022 and March 2023 indicates that the base of the proposed SuDS features would be above the maximum winter groundwater level.

6.18. The proposed drainage strategy would ensure that surface water arising from the developed site would be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

6.19. By limiting the development rate of runoff to the mean annual peak rate of runoff, Q_{BAR}, for all rainfall events up to the 1 in 100 year return period event, including an allowance for climate change, the proposed development would reduce flood risk overall when compared to existing greenfield rates.

6.20. The proposed drainage measures would ensure that there is little or no residual risk of property flooding occurring during events well in excess of the minimum acceptable standard of protection for new property, which requires that no flooding of property should occur as a result of a one in 100 year storm event taking account of climate change.

6.21. For extreme events it is considered that the proposed development would intercept any uncontrolled overland flow and direct it into the proposed drainage system. The proposed drainage measures would therefore ensure the proposed development would have adequate flood protection for extreme events over the lifetime of the development.

6.22. The Micro Drainage calculations contained in this Flood Risk Assessment demonstrate that a suitable means of drainage can be provided to drain the developed site in terms of surface water runoff in accordance with the guidance and standards laid down.

6.23. The proposed development complies with the relevant standards of the Government's 'Non-statutory technical standards for sustainable drainage systems'.

6.24. The proposed surface water drainage measures would ensure the proposed development satisfies the peak flow control standards and volume control technical standards in the Government's 'Non-statutory technical standards for sustainable drainage systems'.

6.25. The proposed drainage measures would ensure that there would be little or no residual risk of property flooding occurring during events well in excess of the minimum acceptable standard of protection for new property, which requires that no flooding of property should occur as a result of a 1 in 100 year storm event.

6.26. In terms of foul water drainage, it has been demonstrated that a suitable means of drainage can be provided to serve the proposed development.

6.27. The proposed foul and surface water drainage arrangements can be covered by a suitably worded condition requiring the submission of details to be submitted to and approved by the Local Planning Authority.

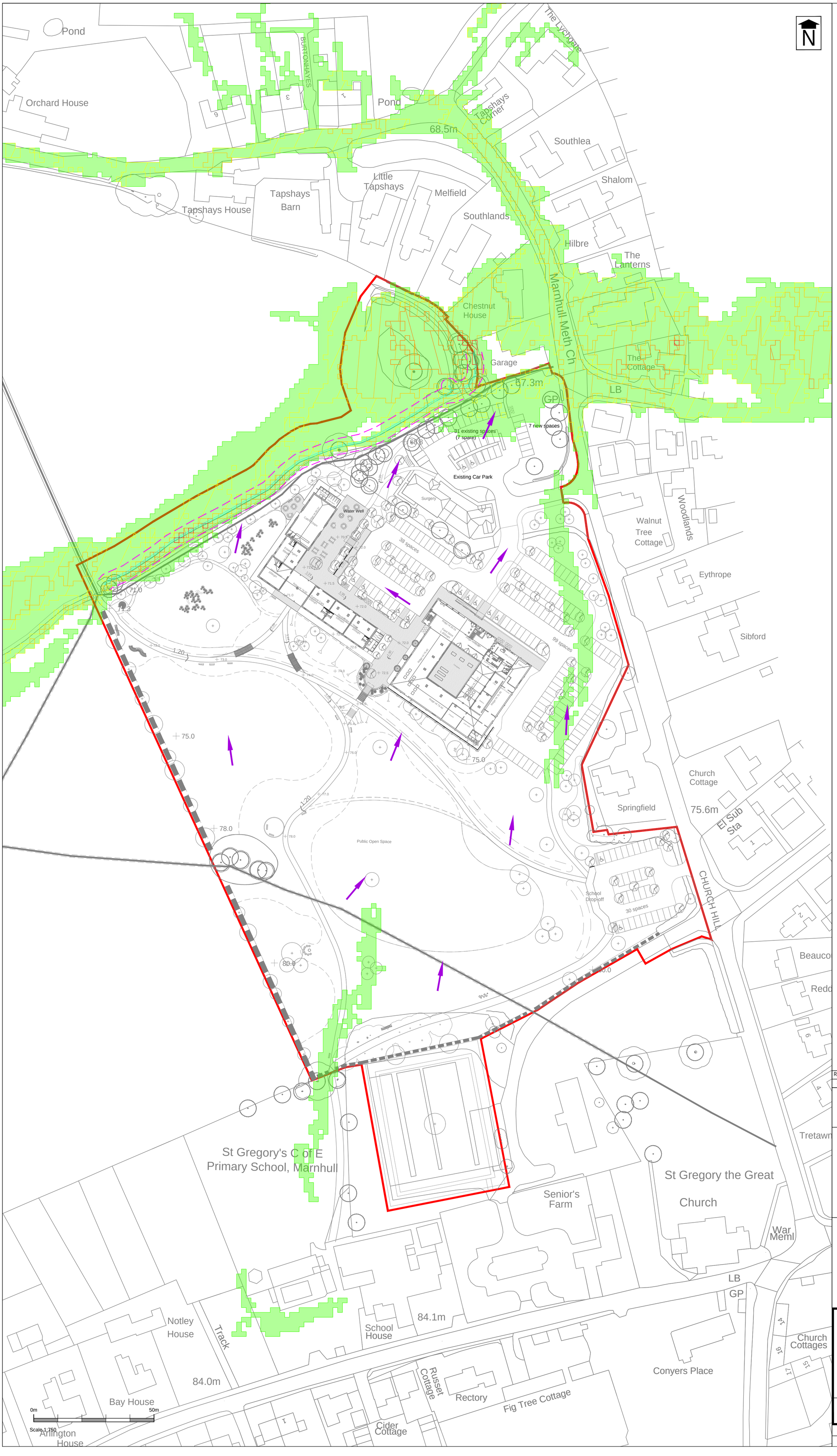
6.28. A maintenance strategy for the proposed foul and surface water drainage measures to serve the development has been set out in this document.

6.29. This Flood Risk Assessment has demonstrated that the proposed development complies with the relevant requirements of the NPPF, the planning practice guidance checklist, Local Plan Policies, guidance published by DEFRA/Environment Agency, the Government's 'Non-statutory technical standards for sustainable drainage systems'.

6.30. The overall conclusions drawn from this Flood Risk Assessment are that the development would be appropriately safe for its lifetime taking account of the vulnerability of its users, the development would not increase flood risk elsewhere, and would reduce flood risk overall.

Appendices

Appendix 1



N

PFA consulting

Stratton Park House, Wanborough Road
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Telephone
01793 828000

Website
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KEY

- Site Boundary
- Overland Flow Routes
- 3 Meter Ordinary Watercourse Maintenance Buffer
- Watercourse (Top of Bank)

Flood Risk Constraints

- Low Risk of Surface Water Flooding (Between 1 in 1000 (1%) and 1 in 1000 (0.1%)

Low Risk of Surface Water Flooding Depths

- Depth 0.3m – 0.6m
- Depth 0.6m – 0.9m
- Depths 0.9m – 1.2m
- Depths >1.2m

NOTES

1. Drawing based on Tess Square Site Layout 05, produced by Bright Space Architects (Dated: 25.04.2023,)
2. Surface water flood risk zones based on the extract from Environmental Agency website (RoFSW–ST71, Dated September 2022)
3. Drawing based on Topographical Survey, produced by Total Survey Solutions, Drawing No. 120922–3230–1 (Dated: September 2022)
4. Contains public sector information licensed under the Open Government Licence V3.0.

Rev	Date	Description	Drawn	Check
#		First Issue.	IS	xx

Status

FOR INFORMATION

Client

P & D Crocker

Project

Tess Square, Marnhull

Drawing Title

Flood Constraints Plan

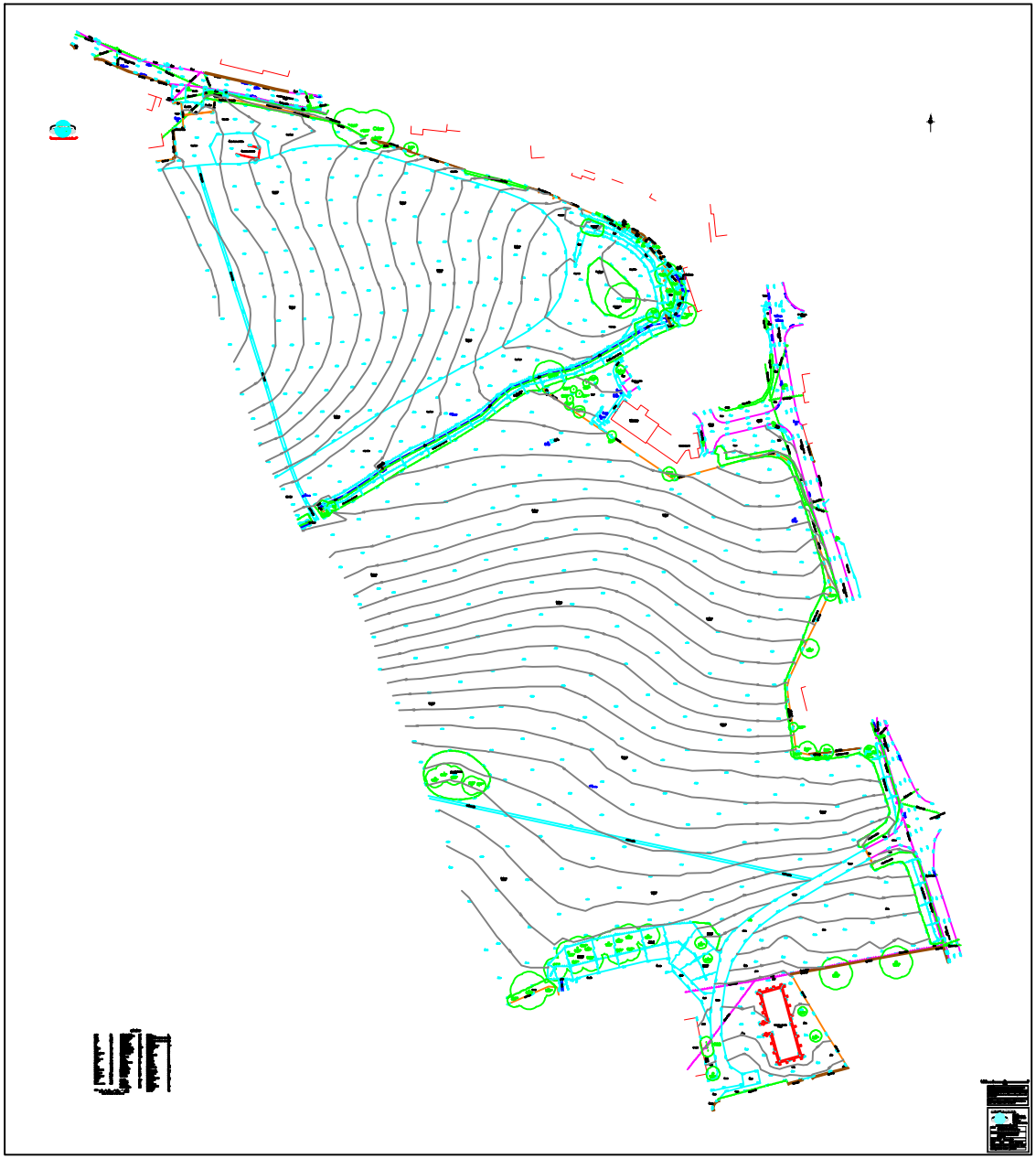
Drawing No.

C798/13

Date: April 2023 | Scale: 1:750 @ A1

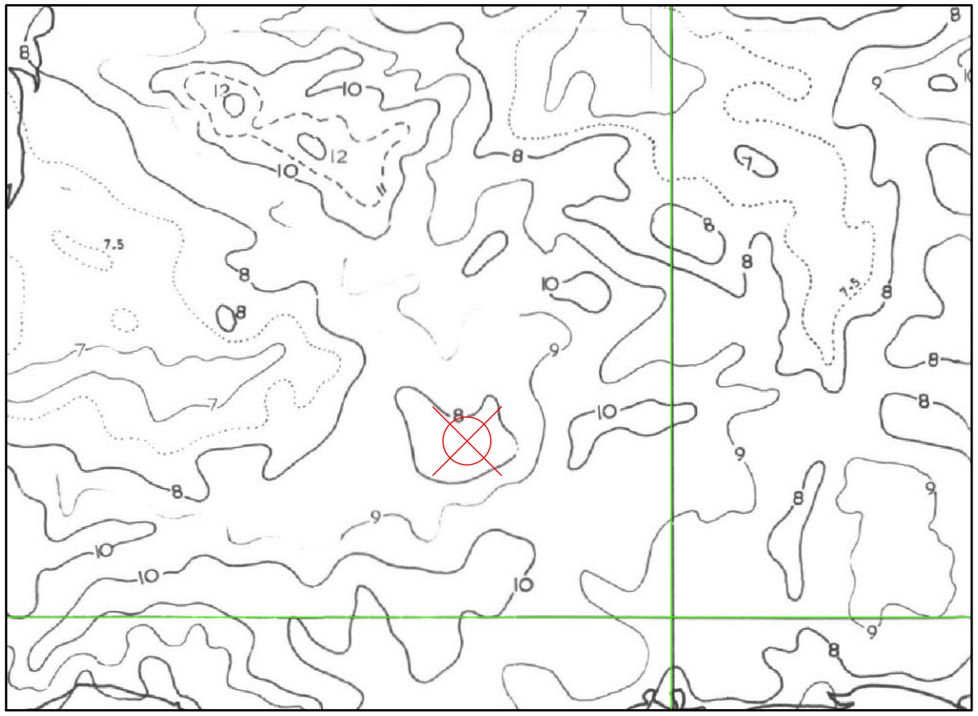
E-Mail: istevenson@pfaplc.com

Appendix 2

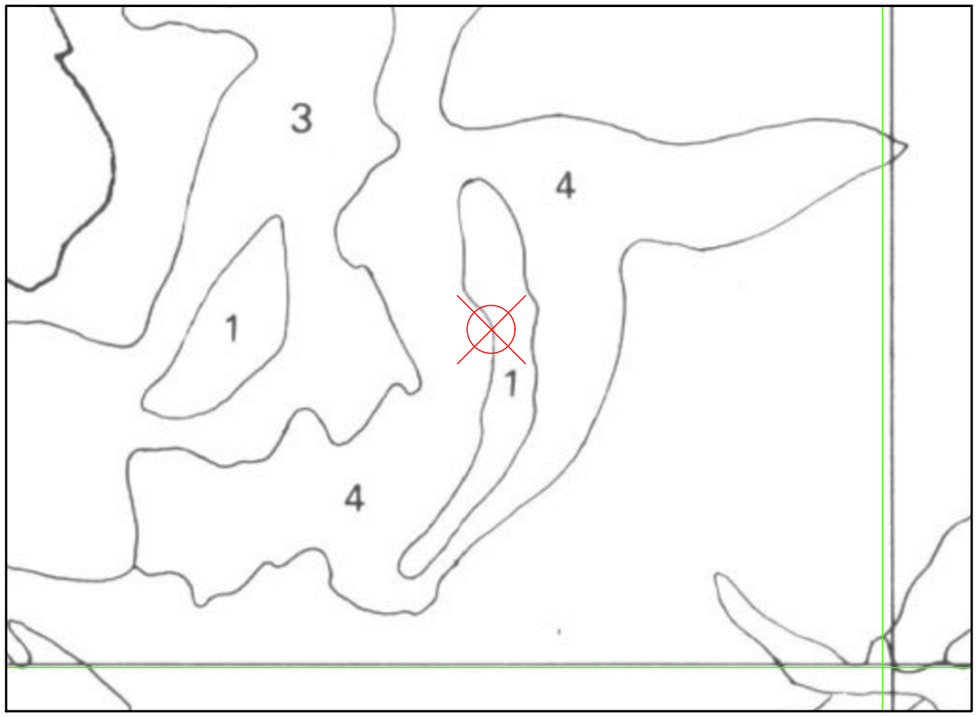


Appendix 3

Location Plan



Standard Average Annual Rainfall (SAAR) (in hundreds of mm)



Winter Rain Acceptance Potential (WRAP)

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NOTES

1. Standard Average Annual Rainfall (SAAR) and Winter Rain Acceptance Potential (WRAP) map extracts shown on this drawing are reproduced from the maps contained in Volume V of the Flood Studies Report – NERC:1975.

Soil Classification			
Soil Class (WRAP)	Soil Index (IoH)	SPR (FEH)	St (ADAS)
1	0.15	10	0.1
2	0.30	30	0.5
3	0.40	37	0.8
4	0.45	47	1.0
5	0.50	53	1.3

Rev	Date	Description	Drawn	Check
#	13/03/23	First Issue	IS	XX

Status
FOR INFORMATION

Client
Chapman Lily Planning Ltd

Project
Tess Square

Drawing Title
SAAR and WRAP Maps

Drawing No.
C798/18

Date: March 2023 | Scale: NTS @ A3

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Appendix 4

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30th January 2023 Ref: A11909/230123/L2

Prepared for:

Steven Bainbridge
Chapman Lily Planning Limited
Unit 5 Designer House
Sandford Lane
Wareham
BH20 4DY

By Email: steven.bainbridge@clplanning.co.uk

Dear Steven,

RE: Site 1 Central Site – Hybrid Application, Marnhull - Infiltration Testing

Omnia were commissioned by Chapman Lily Planning Limited, to undertake infiltration testing in general accordance with *BRE Digest 365 – Soakaway Design* at the above referenced site. Three (3no.) infiltration tests within locations SA101-SA103 were unable to be completed on 31st October to 1st of November 2022. Please find set out below a summary of on-site observations from site works undertaken on Tuesday 17th January, including presentation of infiltration rates within SA101-SA103.

Yours sincerely,

[redacted]

Abbie Dodds
Graduate Geo-Environmental Consultant

[redacted]

Hannah Spurling
Geo-Environmental Consultant

Appendix I – Limitations
Appendix II – Drawings
Appendix III – Exploratory Hole Logs
Appendix IV – In-situ Soakaway Certificates

Quality Assurance

Project Number: A11909 January 2023						
Geotechnical	**Infiltration Testing Letter Report**					
	Prepared by:	A. Dodds	**Date:**	23.01.23	**Signature:**	[redacted]
	Reviewed by:	H. Spurling	**Date:**	25/01/23	**Signature:**	
	Authorised by:	O. Maxwell	**Date:**	27/01/23	**Signature:**	

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Site Address	(Northern parcel of land) - Land off Church Hill, Marnhull, DT10 1PU
National Grid Reference	(Northern parcel of land) - 378050, 118960
Site Area	(Northern parcel of land) – Approximately 6.1 ha

1.0 Background

The site comprises two (2no.) separate fields off Church Hill Lane within the village of Marnhull, Dorset. Reference to the 'northern parcel' of land references the field accessed from Church Hill, while reference to the 'southern parcel' of land references the field accessed from Butts Lane.

The northern parcel of land was situated off Church Hill, Marnhull, DT10 1PU. The area of investigation comprised an irregularly shaped agricultural field that had recently been cultivated. The ground was noted to be very wet and boggy on foot, and the topography sloped in a slight downward gradient from the south to the north. Access was via Church Hill to the south.

The southern parcel of land was situated off Chippel Lane, Marnhull, DT10 1NL. The area of investigation comprised an irregularly shaped agricultural field, which had also been recently cultivated. The topography sloped in a slight downward gradient from the north towards the south. Access was via a metal gate off Butts Lane to the northwest.

It is understood that Chapman Lily Planning Limited's client propose to develop both parcels of land under the same planning application. The proposed development will comprise a mixture of residential (retirement living) and commercial buildings, with associated soft landscaping and roadways.

Proposed development plans are detailed as Figures 2.1 and 2.2 within Appendix II. In order to progress with the application stage and assist with the drainage design, winter groundwater monitoring and soakaway testing are required.

Site works were completed from 31/10/22 to 01/11/22 to fulfil the scope of infiltration testing however on the northern parcel of land soakage testing was unable to be completed due to wet ground conditions on site restricting access.

Soakaway testing within the southern parcel of land is summarised within the previous letter referenced A11909/221112/L1. The scope to complete three (3no.) infiltration tests within SA101- SA103 was fulfilled within one (1no.) day on Tuesday the 17th of January 2023, with the excavation of three (3no.) trial pit locations across the northern parcel. The soakaway test locations are presented as Figure 3.0 in Appendix II and were specified by the drainage engineers for the scheme; however due to the wet ground conditions on the 17/01/2023 test locations were repositioned to be as close as possible to the specified locations however access and ground conditions dictated the final position.

Please note, this report covers the infiltration testing within the northern parcel of land (Church Hill) only. A separate factual report regarding winter groundwater monitoring will be issued upon completion of this aspect.

2.0 Geology & Hydrogeology

The British Geological Survey (BGS) map for the site, Shaftesbury (Sheet 313 1:50,000 Solid and Drift, 1994) indicates that the site is underlain by the following geological sequence:

Table 2.1 Geological sequence on site (northern parcel of land)

Geological Unit	Classification	Description
Superficial Deposits (northern extent only)	Head Deposits	Clay, Silt, Sand and Gravel
Bedrock (bands listed from northwest to southeast)	Hazelbury Bryan Formation	Mudstone
	Woodrow Clay Member	Mudstone
	Cucklington Oolite Member	Limestone
	Sturminster Pisolite Member	Limestone
	Newton Clay Member	Mudstone (sandy)

3.0 Ground Conditions Encountered

As disused in Section 1.0, only soakaway locations within the northern parcel are being summarised within this report. The locations generally confirmed the published geology, encountering soils attributed to the above listed bedrock geology within Table 2.1.

Exploratory hole logs are included within Appendix III of this report.

3.1 Topsoil

Topsoil was encountered within all three (3no.) exploratory hole locations, to depths of between 0.30m bgl (SA102) and 0.55mbgl (SA103). The soils predominantly comprised firm brown slightly sandy CLAY. Sand is fine.

3.2 Bedrock

3.2.1 Hazelbury Bryan Formation/Woodrow Clay Member/Newton Clay Member (Undifferentiated).

Soils attributed to the Hazelbury Bryan Formation/Woodrow Clay Member/Newton Clay Member were encountered within all three (3no.) locations directly beneath the Topsoil. Due to the similar properties of the above listed bedrock and narrow bands depicted on the published BGS maps, the three (3no.) mudstone-based bedrock strata have been grouped together for the purpose of this investigation as differentiating between them was not possible.

This bedrock was encountered directly below the Topsoil to a maximum observed depth of 1.60m bgl (SA101) although the base of the strata was not proven in any location. Typically, this bedrock comprised firm orangish brown slightly gravelly slightly sandy CLAY. Sand is fine to medium. Gravel is fine subangular to subrounded flint (SA102-SA103) OR soft to firm greyish blue mottled orangish brown sandy CLAY. Sand is fine to medium (SA101).

3.3 Groundwater Conditions

Groundwater was not encountered within SA101 or SA103. Groundwater seepage was identified at 1.30m bgl at SA102, where the pit was terminated.

4.0 BRE DG365 Soakaway Testing

Soakaway testing was undertaken in general accordance with BRE DG365 on Tuesday 17th January 2023 within SA101-SA103.

The soakaway test certificates, including full time and depth data, are included within Appendix IV with the test results summarised in Table 4.1 below.

Table 4.1 Summary of infiltration rates

Location	Test Number	Pit Dimensions (L x W x D)	Depth to fill (m bgl)	Strata Type	Duration of Test (hrs:mins)	Infiltration Rate (m/s)
SA101	1	2.40 x 0.40 x 1.60	1.60	CLAY	02:21	N/A
SA102	1	2.20 x 0.40 x 1.30	1.30	CLAY	03:24	N/A
SA103	1	2.60 x 0.40 x 1.50	1.50	CLAY	04:08	N/A

Both the 75% and 25% effective storage depths were not reached within Test 1 for SA101 and Test 1 for SA102. Therefore, the tests are not considered to have been successful.
Although the 75% effective storage depth within SA103 was reached, the 25% effective storage depth was not reached during the test, such that an infiltration rate could not be calculated.

5.0 Discussion & Conclusions

During the duration of the soakaway tests, the 75% and 25% effective storage depths were not reached within two (2no.) soakaway test locations (SA101 & SA102) and 25% effective storage depth was not reached within one (1no.) soakaway test location (SA103). As a result, soil infiltration rates were not calculated. This is attributed to the cohesive nature of the fine-grained material that was typically encountered within the intrusive locations.

Although the 75% intercept was reached within SA103, the 25% intercept was not reached. The data obtained suggests that the test may have been successful if given more time, however given that works were limited to one day the test had to be terminated.

Although SA103 indicates testing may have been successful, given the geology was consistent across the site it is considered that the site may not be suitable for conventional soakaway design, and it is recommended that a qualified drainage engineer is provided with the results of this testing for further discussion.

The application of soakaway drainage will ultimately be dependent on the specific requirements of the development. All soakaways should be designed in accordance with BRE Special Digest 365-Soakaway Design.

END OF REPORT

APPENDIX I

Limitations

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between OE Ltd and the Client as indicated in Section 1.2.

2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information, it has been assumed it is correct. No attempt has been made to verify the information.

3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination, which are enforced, by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.

4. During the site walkover reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.

5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.

6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.

7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials this is for indicative purposes only and do not constitute or replace full and proper surveys.

8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.

9. OE cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by OE is owned by them and no such plans or documents may be reproduced, published, or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by OE in this connection without their explicit written agreement there to by OE.

10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

APPENDIX II

Figures

Key

Site Boundary

0 100 200 300 400 m

Scale	Paper Size
1:10,000	A4

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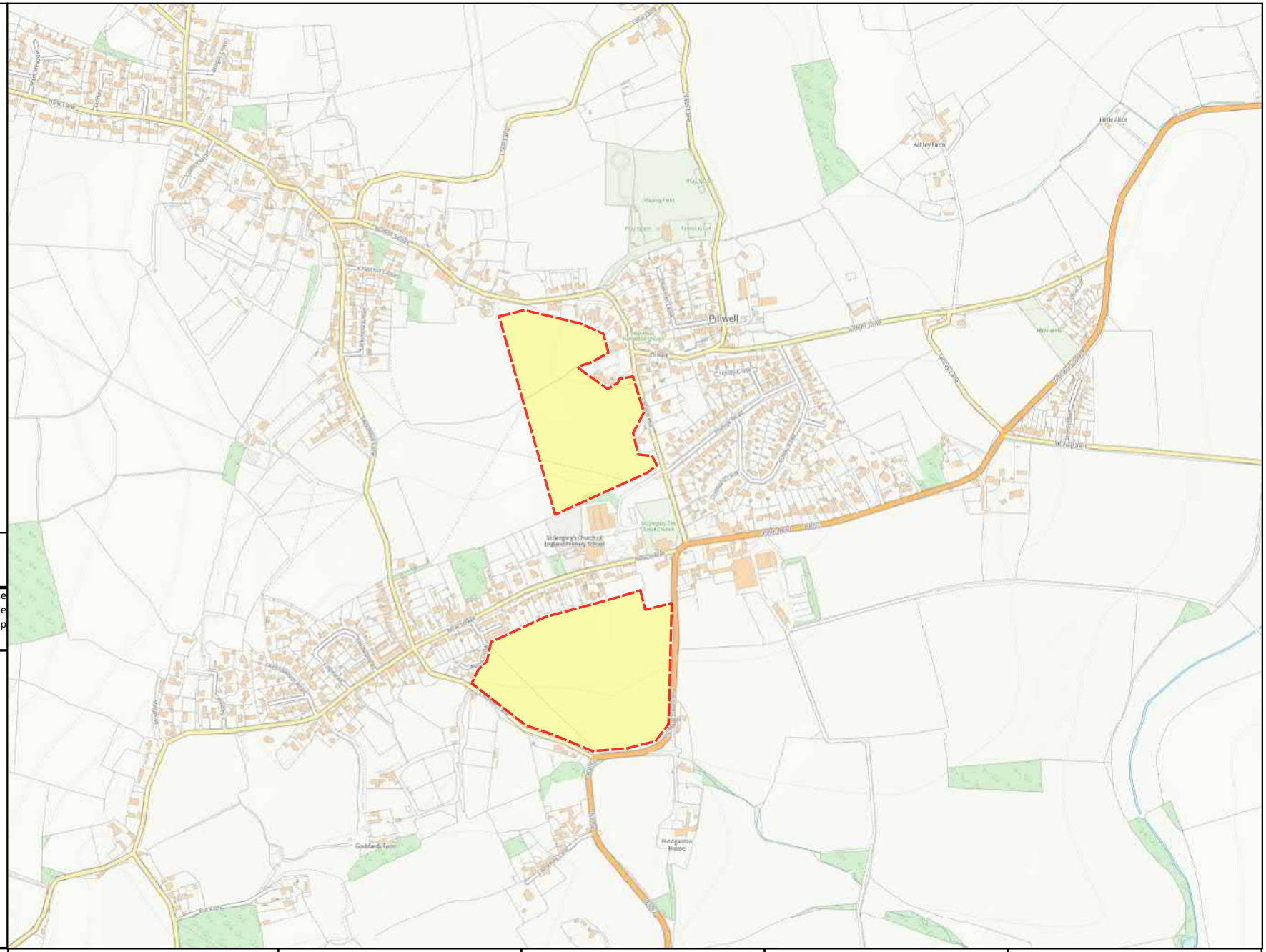

OMNIA

Job Title:	Client:	Project Number:	Date:	Drawing Title:
Site 1 Central Site - Hybrid Application	Champan Lily Planning Limited	A11909	12/11/2022	Figure 1.0 Site Location Map
		Drawn By: L. Burnett	Authorised By: O. Maxwell	

0 25 50 75 100 m

Scale	Paper Size
1:2,200	A4

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OMNIA

Job Title:	Client:	Project Number:	Date:	Drawing Title:
Site 1 Central Site - Hybrid Application	Champan Lily Planning Limited	A11909	12/11/2022	Figure 2.1 (Phillips Rd) Proposed Development Plan
		Drawn By: L. Burnett	Authorised By: O. Maxwell	

Key

return SA positions

A11909 Site Boundary

0 50 100 m

Scale	Paper Size
1:3,000	A4

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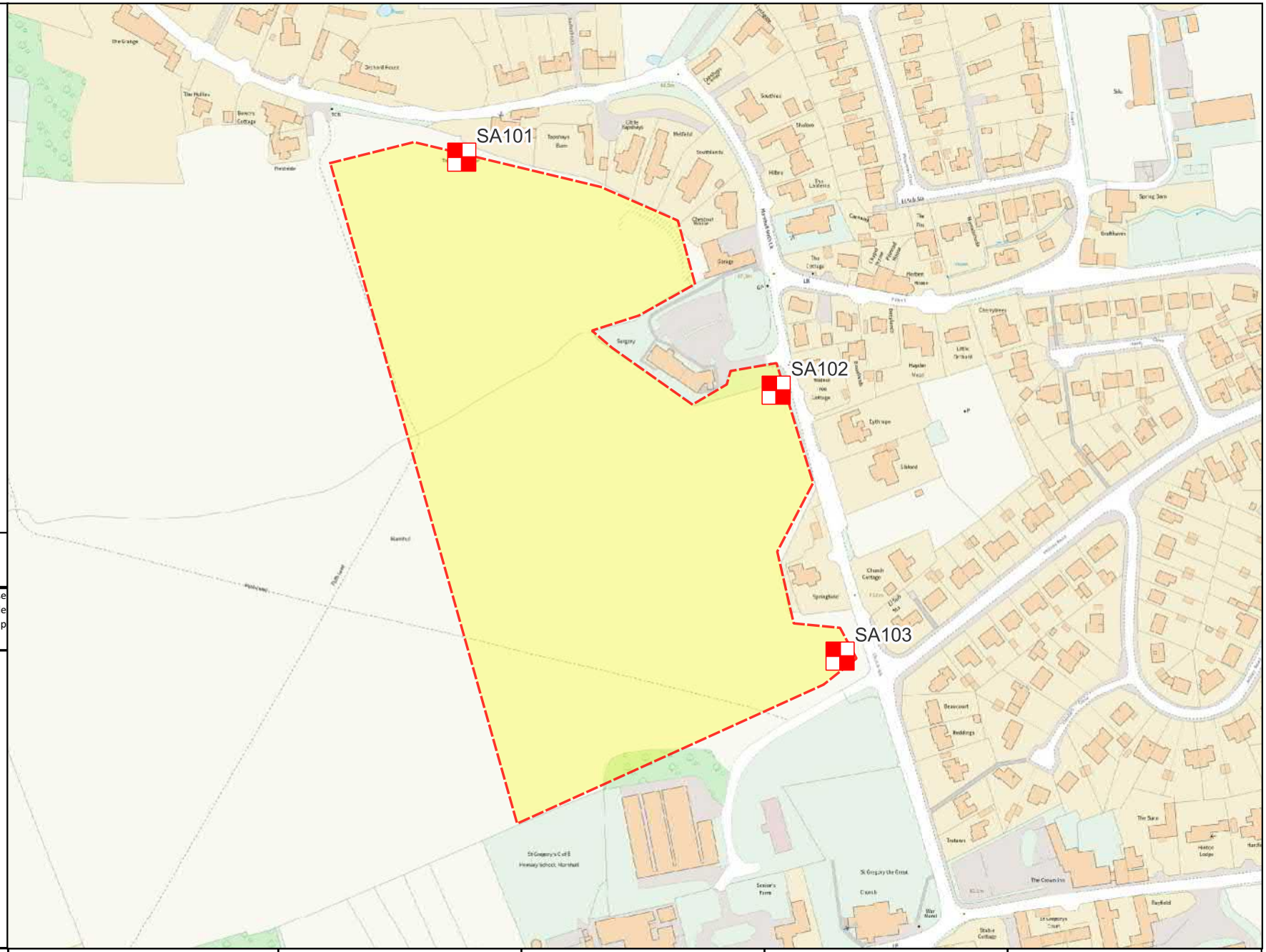
E: info@omnia-consulting.co.uk
W: www.omnia-consulting.co.uk



OMNIA	Job Title: Site 1 Central Site- Hybrid Application	Client: Champan Lily Planning Limited	Project Number: A11909	Date: 30/01/2023
			Drawn By: H. Spurling	Authorised By: O. Maxwell

Drawing Title: Figure 3.0 Intrusive Location Plan (SA101-SA103)

APPENDIX III

Trial Pit Logs

Trial Pit Log

Trialpit No **SA101** Sheet 1 of 1

Project Name:	Site 1 Central Site - Hybrid Application	Project No. A11909	Co-ords: 377917.00 - 119138.00 Level:	Date 17/01/2023
Location:	Land off Church Hill, Marnhull, DT10 1PU	Dimensions (m): Depth 1.60	2.4 / 0.4	Scale 1:20
Client:	Chapman Lily Planning Limited			Logged HS

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Firm brown slightly sandy CLAY. Sand is fine. [TOPSOIL]
				0.40			Firm orangish brown slightly sandy CLAY. Sand is fine to medium. [HAZELBURY BRYAN FORMATION/WOODROW CLAY MEMBER/NEWTON CLAY MEMBER (UNDIFFERENTIATED)]
				1.00			Soft to firm greyish blue mottled orangish brown sandy CLAY. Sand is fine to medium. [HAZELBURY BRYAN FORMATION/WOODROW CLAY MEMBER/NEWTON CLAY MEMBER (UNDIFFERENTIATED)].
				1.60			End of pit at 1.60 m

1 2 3 4

Remarks: 1. Position scanned by CAT and Genny prior to excavation. Groundwater was not encountered.

Stability: Stable

Trial Pit Log

Trialpit No **SA102**

Sheet 1 of 1

Project Name:	Site 1 Central Site - Hybrid Application	Project No. A11909	Co-ords: 378097.00 - 119008.00 Level:
Location:	Land off Church Hill, Marnhull, DT10 1PU	Dimensions (m):	2.2 × 0.4 Depth 1.30
Client:	Chapman Lily Planning Limited		

Date 17/01/2023

Scale 1:20

Logged HS

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Firm brown slightly gravelly slightly sandy CLAY. Sand is fine. [TOPSOIL]
				0.30			Firm orangish brown slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine subangular flint. [HAZELBURY BRYAN FORMATION/WOODROW CLAY MEMBER/NEWTON CLAY MEMBER (UNDIFFERENTIATED)]
							From 0.70m bgl: Becomes light grey mottled orangish brown.
							From 1.00m bgl: No gravel.
				1.30			End of pit at 1.30 m

1 2 3 4

Remarks: 1. Position scanned by CAT and Genny prior to excavation. Groundwater seepage found at 1.30m bgl.

Stability: Stable

Trial Pit Log

Trialpit No **SA103**

Sheet 1 of 1

Project Name:	Site 1 Central Site - Hybrid Application	Project No. A11909	Co-ords: 378129.00 - 119961.00 Level:
Location:	Land off Church Hill, Marnhull, DT10 1PU	Dimensions (m): Depth 1.50	1.6 × 0.4
Client:	Chapman Lily Planning Limited		

Date 17/01/2023

Scale 1:20

Logged HS

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Firm dark brown sandy CLAY. Sand is fine. [TOPSOIL]
				0.55			Firm orangish brown slightly gravelly sandy CLAY. Sand is fine. Gravel is fine to medium subangular to subrounded flint. [HAZELBURY BRYAN FORMATION/WOODROW CLAY MEMBER/NEWTON CLAY MEMBER (UNDIFFERENTIATED)]
				1.10			Firm greyish yellowish light brown sandy CLAY. Sand is fine to medium. [HAZELBURY BRYAN FORMATION/WOODROW CLAY MEMBER/NEWTON CLAY MEMBER (UNDIFFERENTIATED)]. *From 1.30m bgl: Slightly gravelly. Gravel is fine to medium, angular to subangular flint.*
				1.50			End of pit at 1.50 m

1 2 3 4

Remarks: 1. Position scanned by CAT and Genny prior to excavation. Groundwater not encountered.

Stability: Stable

AGS

APPENDIX IV

Soakaway Test Certificates

Site Name:	Site 1 - Central Site - Hybrid Application
Site Reference:	A11909
Test Date:	17/01/2023

Trial Pit Identification:	SA101
Trial Pit Length (m):	2.40
Trial Pit Width (m):	0.40
Trial Pit Depth (m):	1.60
Groundwater Level (m bgl):	Dry

SOIL INFILTRATION RATE TEST

See BRE DG365, Soakaway Design (2016).

Geology Description:

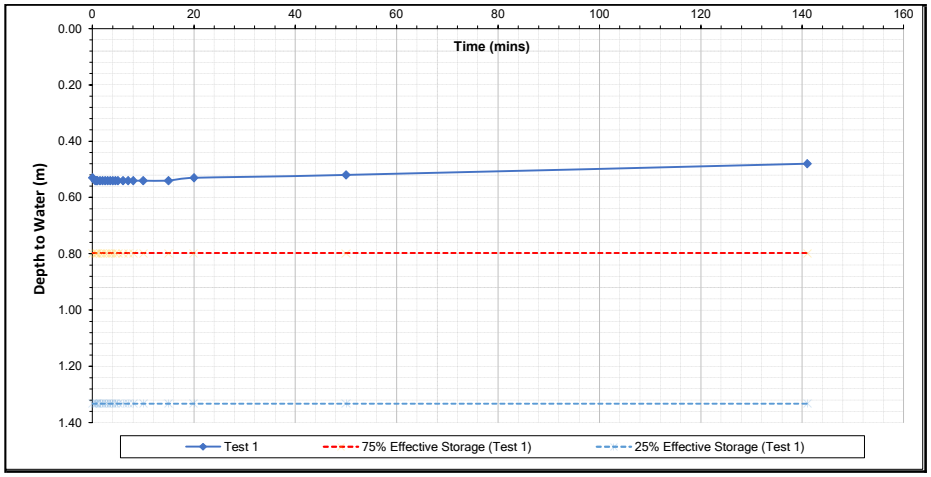
0.00 - 0.40m bgl: Firm brown slightly sandy CLAY. Sand is fine. [TOPSOIL]
0.40-1.00m bgl: Firm orangish brown slightly sandy CLAY. Sand is fine to medium. [HAZELBURY BRYAN FORMATION/WOODROW CLAY MEMBER/NEWTON CLAY MEMBER (UNDIFFERENTIATED)]
1.00-1.60m bgl: Soft to firm greyish blue mottled orangish brown sandy CLAY. Sand is fine to medium. [HAZELBURY BRYAN FORMATION/WOODROW CLAY MEMBER/NEWTON CLAY MEMBER (UNDIFFERENTIATED)]

Test Parameters	TEST 1	
	Time (min)	Depth (m)
Effective Storage Depth (m):	0.00	0.53
1.07	0.50	0.54
75% Effective Storage Depth (m):	0.75	0.54
0.80	1.00	0.54
	1.50	0.54
(i.e. Depth Below Ground Level) (m):	2.00	0.54
0.80	2.50	0.54
	3.00	0.54
25% Effective Storage Depth (m):	3.50	0.54
0.27	4.00	0.54
	4.50	0.54
(i.e. Depth Below Ground Level) (m):	5.00	0.54
1.33	6.00	0.54
	7.00	0.54
Effective Storage Depth Across 75% - 25% (m):	8.00	0.54
0.54	10.00	0.54
	15.00	0.54
Time to Fall to 75% Effective Depth (min):	20.00	0.53
N/A	50.00	0.52
	141.00	0.48
Time to Fall to 25% Effective Depth (min):		
N/A		
Vp75%-25% (m3):		
0.51		
As50% (m2):		
3.96		
Tp75%-25% (mins):		
N/A		

DESIGN SOIL INFILTRATION RATE, f (m/s):	**N/A**

Comments:

NOTE: During the duration of the test the required inercept failed to be reached. Therefore the test is considered not to have been successful. There was some pit collapse towards the end of the test.



Site Engineer:	Date:
HS	17/01/2023

Checked and Approved By:	Date:
HS	23/01/2023

Location
SA101

uired

Site Name:	Site 1 - Central Site - Hybrid Application
Site Reference:	A11909
Test Date:	17/01/2023

Trial Pit Identification:	SA102
Trial Pit Length (m):	2.20
Trial Pit Width (m):	0.40
Trial Pit Depth (m):	1.30
Groundwater Level (m bgl):	Dry

SOIL INFILTRATION RATE TEST

See BRE DG365, Soakaway Design (2016).

Geology Description:

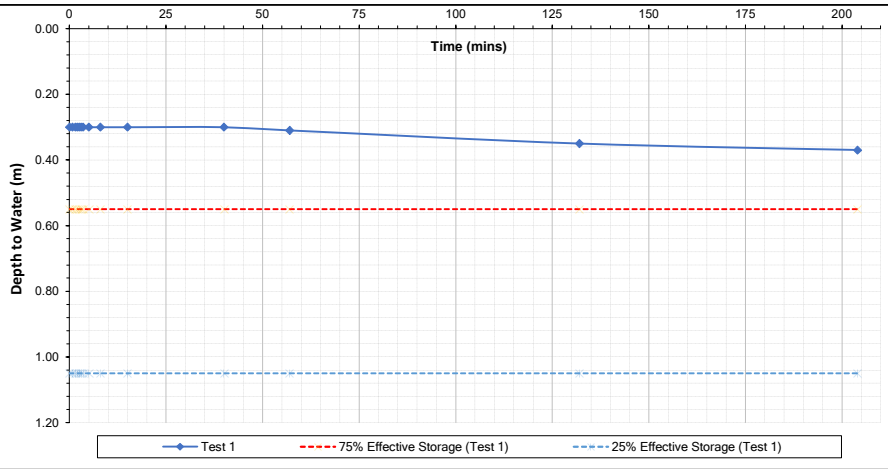
0.00 - 0.30m bgl: Firm brown slightly sandy CLAY. Sand is fine. [TOPSOIL]
0.30-1.30m bgl: Firm orangish brown slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine subangular flint. [HAZELBURY BRYAN FORMATION/WOODROW CLAY MEMBER/NEWTON CLAY MEMBER (UNDIFFERENTIATED)]

Test Parameters	TEST 1	
	Time (min)	Depth (m)
Effective Storage Depth (m):	0.00	0.30
1.00	0.75	0.30
75% Effective Storage Depth (m):	1.50	0.30
0.75	2.00	0.30
	2.50	0.30
(i.e. Depth Below Ground Level) (m):	3.00	0.30
0.55	3.50	0.30
	5.00	0.30
25% Effective Storage Depth (m):	8.00	0.30
0.25	15.00	0.30
	40.00	0.30
(i.e. Depth Below Ground Level) (m):	57.00	0.31
1.05	132.00	0.35
	204.00	0.37
Effective Storage Depth Across 75% - 25% (m):		
0.50		
Time to Fall to 75% Effective Depth (min):		
N/A		
Time to Fall to 25% Effective Depth (min):		
N/A		
Vp75%-25% (m3):		
0.44		
As50% (m2):		
3.48		
Tp75%-25% (mins):		
N/A		

DESIGN SOIL INFILTRATION RATE, f (m/s):	**N/A**

Comments:

NOTE: During the duration of the test the required inercept failed to be reached. Therefore the test is considered not to have been successful.



Site Engineer:	Date:
HS	17/01/2023

Checked and Approved By:	Date:
HS	23/01/2023

Location
SA102

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Site Name:	Site 1 - Central Site - Hybrid Application
Site Reference:	A11909
Test Date:	17/01/2023

Trial Pit Identification:	SA103
Trial Pit Length (m):	1.60
Trial Pit Width (m):	0.40
Trial Pit Depth (m):	1.50
Groundwater Level (m bgl):	Dry

SOIL INFILTRATION RATE TEST

See BRE DG365, Soakaway Design (2016).

Geology Description:

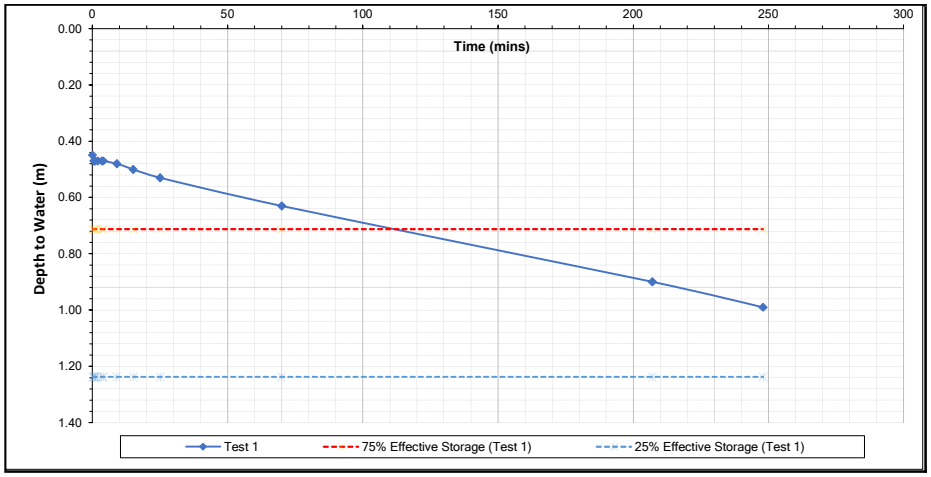
0.00 - 0.55m bgl: Firm dark brown sandy CLAY. Sand is fine. [TOPSOIL]
0.55-1.10m bgl: Firm orangish brown slightly gravelly sandy CLAY. Sand is fine. Gravel is fine to medium subangular to subrounded flint. [HAZELBURY BRYAN FORMATION/WOODROW CLAY MEMBER/NEWTON CLAY MEMBER (UNDIFFERENTIATED)]
1.10-1.55m bgl: Firm greyish yellowish light brown sandy CLAY. Sand is fine to medium. [HAZELBURY BRYAN FORMATION/WOODROW CLAY MEMBER/NEWTON CLAY MEMBER (UNDIFFERENTIATED)]
From 1.30m bgl: Slightly gravelly. Gravel is fine to medium, angular to subangular flint.

Test Parameters	**TEST 1**	
	Time (min)	**Depth (m)**
Effective Storage Depth (m):	0.00	0.45
1.05	0.50	0.47
75% Effective Storage Depth (m):	0.75	0.47
0.79	1.00	0.47
	2.00	0.47
(i.e. Depth Below Ground Level) (m):	3.50	0.47
0.71	4.00	0.47
	9.00	0.48
25% Effective Storage Depth (m):	15.00	0.50
0.26	25.00	0.53
	70.00	0.63
(i.e. Depth Below Ground Level) (m):	207.00	0.90
1.24	248.00	0.99
Effective Storage Depth Across 75% - 25% (m):		
0.53		
Time to Fall to 75% Effective Depth (min):		
110		
Time to Fall to 25% Effective Depth (min):		
207		
Vp75%-25% (m3):		
0.34		
As50% (m2):		
2.74		
Tp75%-25% (mins):		
97		

DESIGN SOIL INFILTRATION RATE, f (m/s):	**N/A**

Comments:

NOTE: During the duration of the test the required inercept failed to be reached. Therefore the test is considered not to have been successful.



Site Engineer:	**Date:**
HS	17/01/2023

Checked and Approved By:	**Date:**
HS	23/01/2023

Location
SA103

uired