Appendix A

Fews Lane, Longstanton

Drainage Review

On behalf of **Greater Cambridge Shared Planning**

GREATER CAMBRIDGE
SHARED PLANNING

Project Ref: 49304/001 | Rev: AA | Date: August 2020

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For and on behalf of Stantec UK Limited				

Revision	Date	Description	Prepared	Reviewed	Approved
A	20/08/20	Updated capability statement and typos	SK	SCD	SCD

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1 Introduction

1.1 Capability Statement

1.1.1 The Authors of this report are Simon Darch and Stephanie Knowles, on behalf of Stantec Ltd.

Simon Darch, Director, Cambridge Office, Stantec

1.1.2 Simon is a Director in Stantec which is a development and infrastructure consultancy employing more than 22,000 staff and operating from 350 offices across 6 continents. Simon has a BEng (Hons) degree in Civil Engineering, and an MSc in Irrigation Engineering. He is a Chartered Civil Engineer, a Chartered Environmentalist and a Chartered Water and Environmental Manager. Simon is fellow of the Institution of Civil Engineers and Member of the Chartered Institution of Water and Environmental Managers. He has been working in the design and implementation of drainage and infrastructure required in residential and commercial developments of varying size in the UK since 1994, with previous experience of working in irrigation and agricultural communities in Australia, Tanzania and Indonesia.

1.1.3 Simon is a Technical Advisor to the Hobson's Conduit Trust (custodians of a heritage water body through Cambridge), and represents a number of Internal Drainage Boards in both a planning control context and the delivery of their capital works drainage projects and asset management. In this capacity he has been a member on the Northstowe Technical Liaison Group for Flood Risk and Drainage for the past 12 years, a planning steering group established to ensure a sustainable and exemplar approach on drainage issues arising from the proposed new town development to the north of Cambridge, and safeguarding the protection to the villages of Oakington, Longstanton and Swavesey.

1.1.4 Simon project managed one of DEFRA's nominated Integrated Urban Drainage Pilot studies, investigating the delivery mechanisms for sustainable drainage solutions at a strategic scale.

1.1.5 Simon was on the steering committee for the delivery of the original Cambridge Northern Fringe Water Cycle Strategy, and latterly is the Project Director for the Cambridge Water Cycle Strategy currently being developed.

1.1.6 He is also the framework manager for supply chain services to the Environment Agency's Next Generation Services Agreement, Collaborative Delivery Framework and is Stantec's national lead for the non-regulated water sector

Stephanie Knowles, Associate, Cambridge Office, Stantec

1.1.7 Stephanie is an Associate based in the Stantec Cambridge office. She has a BEng (Hons) degree in Civil Engineering and is currently working towards her chartership with the Institute of Civil Engineers.

1.1.8 She has over 20 years' experience in the engineering consulting industry. She has project managed a number of multidisciplinary schemes and has provided civil engineering, water and sustainability advice to a number of clients for a variety of schemes based in the UK and abroad.

1.1.9 Stephanie has been involved in assisting and preparing Flood Risk Assessments (FRAs), undertaking Flood Risk analysis, and drainage strategies including providing sustainable drainage solutions. She is experienced in producing ES Chapters and the production of strategic flood reports such as Strategic Flood Risk Assessments (SFRAs) and Surface Water Management Plans (SWMPs).

1.1.10 Stephanie has supported clients in her role as Sustainability Champion for a variant number of schemes for BREEAM, Code for Sustainable Homes (CfSH) and CEEQUAL. She is a qualified BREEAM AP and produces Sustainability Assessments to support projects through the planning process.

1.2 Background Information

1.2.1 This drainage review has been produced by Stantec on behalf of Greater Cambridge Shared Planning.

1.2.2 In 2019, the Planning Service considered and approved details of a scheme for the foul and surface water drainage to a new dwelling located in Fews Lane, Longstanton, Cambridgeshire, application Ref S/3215/19/DC. The site formed part of the formal garden for an existing dwelling (The Retreat).

1.2.3 The application (hereafter referenced as 'the site') is for a three-bedroom bungalow, which was initially made on October 2016 and subsequently refused on 4 September 2017 (S/2937/16/L), drainage did not form part of this objection. The application went to appeal, dated 06 September 2018. The appeal was subsequently allowed, and planning permission granted for the erection of the three-bedroom bungalow with conditions relating to foul and surface water drainage supplied. The planning information supplied by the applicant is to discharge these conditions and is addressed as part of this report, application S/3215/19/DC.

1.2.4 A separate application is to be submitted in relation to the demolition of the existing dwelling, (The Retreat), and its replacement by two proposed dwellings, application Ref S/0277/19/FL (hereafter referenced as the 'southern site'). This is to be a separate application and does not form part of this review.

1.2.5 An application for the erection of another two dwellings on land to the side of The Retreat (west of the site) was submitted on 12 June 2015 and subsequently approved on 6 January 2016, application reference S/1498/15/FL and S/1059/16/DC. These dwellings have since been constructed and are now occupied.

1.2.6 The applicant for the proposed development is Landbrook Homes Ltd (Mr Gerry Caddoo),hereafter referenced as the 'Applicant'.

1.2.7 This decision has been the subject of a judicial review from an interested third party who had wanted to submit technical comments on the proposed foul and surface water drainage scheme prior to the authority's consideration. In agreeing to the consent order to quash that decision, the Planning Authority has given an undertaking to allow the third party to submit their comments to the Local Planning Authority prior to re-consideration of the submission. The final decision on the reconsidered proposals will be taken by the South Cambridgeshire District Council Planning Committee.

1.2.8 The Council had previously sought advice on the application from its retained drainage consultant and these comments have been made publicly available and are referred to within this report.

1.2.9 In anticipation of the submission of technical comments from the third party, the Planning Authority has commissioned Stantec to independently review the application and third party submissions for the purposes of providing advice to the Local Planning Authority officers and Committee on the adequacy of the proposed scheme for foul and surface water drainage, having regard to published and acknowledged approaches and best practice.

1.2.10 The conditions for drainage which were discharged by the drainage consultant were in relation to:

- Condition 4 –No construction work shall be commenced until full details of the proposed arrangements for foul water drainage have been submitted to the local planning authority and approved in writing.

- Condition 5 - No construction work shall be commenced until full details of the proposed arrangements for surface water drainage, both from the building itself and from the proposed driveway area, have been submitted to the local planning authority and approved in writing.

1.2.11 These conditions were set following the planning appeal relating to the site, APP/W0530/W/18/3197088, decided on 27 September 2018. The conditions relating to foul and surface water drainage were considered necessary by the inspector to prevent flooding and the need to take effect prior to commencement, to ensure an orderly sequence of works.

Information submitted to discharge conditions

1.2.12 The information provided on behalf of the applicant, by their appointed drainage consultant (Andrew Firebrace Partnership) in respect to application Ref S/3215/19/DC, to discharge, drainage conditions 4 and 5 are listed below. These have been reviewed to inform the production of this report.

- Site Plan dated August 2019, Reference FLL-345-Site 01 by Simon Ward Architectural Design.

- Marshalls Installation Details for Drivesett Tegula Priora Paving (superseded)

- Drainage Layout Plan, dated 13/09/19 Reference 19/0321/100 Rev P3 by Andrew Firebrace Partnership (superseded)

- Below Ground Construction Details, dated 30/08/19 Reference 19/0321/110 Rev P1 by Andrew Firebrace Partnership (superseded)

- Ditch Plan and Section 1, dated 17/10/19 Reference 19/0321/101 Rev P1 by Andrew Firebrace Partnership (superseded)

1.2.13 It should be noted the Site plan and suite of drainage drawings issued by the applicant also relate to the southern site, associated with planning application reference S/0277/19/FL. The drainage for these two properties does not form part of this application and therefore this report addresses the drainage associated with the single new dwelling (the site), application Ref S/3215/19/DC only.

1.2.14 Other documents made available on the planning portal website for Ref S/3215/19/DC are listed below:

- Sustainable Drainage Engineer Planning Consultation Response (Discharge of Conditions) dated 05/10/2019

- Sustainable Drainage Engineer Planning Consultation Response (Discharge of Conditions) dated 26/10/2019

- Neighbours Comments (Redacted), letter dated 08 October 2019

- Parish Council Comments, dated 15/10/2019

- Neighbours comments (Redacted), dated 18/10/2019

1.2.15 Further information since instruction has been provided to Stantec following our initial review these are as follows:

- Fews Lane Consortium Ltd is the third party and have provided their objections in a letter dated 02 June 2020 and 13 July 2020, 16 July 2020 and 13 August 2020.
- Parish Council objections and comments dated 11 August 2020
- Drainage Layout Plan, Reference 19/0321/100 Rev P7 (superseded), P8 (superseded) and P9 by Andrew Firebrace Partnership (illustrating an update to drainage strategy for the site)
- Ditch Plan and Section drawing reference 19/0321/101 Rev P2 (superseded) and P3
- Below Ground Construction Details, Reference 19/0321/110 Rev P2
- Micro Drainage attenuation tank calcs (superseded) and attenuation tank calcs with surcharged outfall.
- Plot 3 Greenfield Runoff Rates.
- Completed Appendix F Surface Water Drainage Pro-Forma from the Cambridgeshire Flood and Water SPD.
- Anglian Water response regarding discharge of conditions 4 and 5.
- Below Ground Drainage Operation and Maintenance Strategy Report.
- Ground Investigation Report dated January 2016, by Oakley Soils Surveys.
- Infiltration Test Report dated April 2020

1.2.16 The relevant information provided by the applicant are detailed further in this report and the appended information. It should be noted some of the information initially issued to discharge the planning conditions have been superseded. Therefore, only the latest information has been used to inform this review.

1.3 Third Party Objections

1.3.1 Neighbours objections (Fews Lane Consortium) and Parish Council were initially received on the 08 October 2019 and 18 October 2019 respectively. Further objections from The Fews Lane Consortium were received on 02 June 2020, 13 July 2020, 16 July 2020 and 13 August 2020. Updated Parish Council Objections were received on 11 August. A copy of these objections are provided in **Appendix A.** The objections all relate to the discharge of both Conditions 4 and 5.

2 Site Details and Background Information

2.1 Location

2.1.1 The site is in Longstanton village, set back from the High Street and accessed via an un-adopted access and public right of way, “Fews’ Lane”. The development abuts an existing [1]watercourse (ditch), located to the north of red line boundary, which outfalls into the Longstanton Brook.

2.1.2 The site is in Flood Zone 1, in accordance with the GOV.UK Flood Map for planning (see Figure 1) and is in an area of Low to Very Low flood risk from surface water flooding.

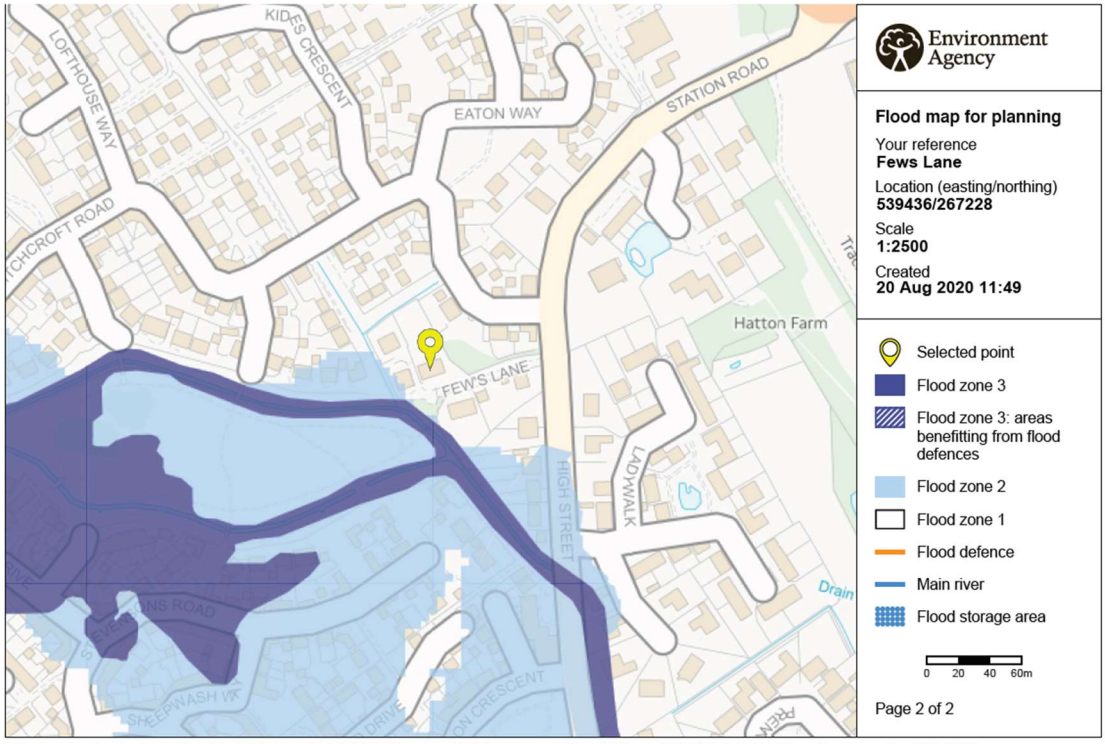

Figure 1: Flood Map for Planning

2.2 Local Hydrological Context

2.2.1 Longstanton Brook has been extensively modelled as part of the assessment for the proposed new settlement of Northstowe. As part of the Northstowe works two new storage ponds located upstream of the village along Hatton’s Road were proposed.

2.2.2 A review of the local Northstowe Planning information concludes existing flooding within the Longstanton village was primarily caused by lack of hydraulic capacity within the culverted sections of the Brook, as it flows through Longstanton Village and is compounded by the lack of maintenance. The new flood relief ponds located along Hattons Road are to work as offline flood relief mitigation to the existing Brook.

[1] A watercourse is defined as any channel through which water flows. It may range from a reasonable sized ditch with constant flow to nothing more than a depression which carries water infrequently.

2.2.3 Water levels have not been supplied for the existing watercourse, although refence on the drawings state Dry Ditch.

2.2.4 Ownership in respect to the watercourse along the redline boundary is assumed to apply to the applicant. This would be consistent with Cambridgeshire County Council, in their powers as Lead Local Flood Authority (LLFA) and the associated webpage titled Watercourse Management advice which states [2]*"If you own land adjoining a watercourse you have certain rights and responsibilities. In legal terms you are a 'riparian owner'. Your rights have been established in common law for many years. The Riparian Owner factsheet.pdf outlines your rights and responsibilities as a riparian owner."*

2.2.5 The Cambridgeshire County Council document **The rights and responsibilities of a riparian owner** states *"If you own land adjoining, above or with a watercourse running through it, you have certain rights and responsibilities. In legal terms you are a "riparian owner". If you rent the land you should agree with the owner who should manage these rights and responsibilities. Smaller watercourses, ditches and rains, known as "ordinary watercourses[2] play a crucial role in managing flood risk to people and property in Cambridgeshire. That is why it is important to ensure that they are well maintained and kept from debris, obstructions and do not become overgrown. Cambridgeshire County Council, under the Flood and Water Management Act (2010), is the Lead Local Flood Authority and responsible for regulating ordinary watercourses outside of Internal Drainage Board's rateable areas"*.

2.2.6 We have therefore assumed for the purpose of this review that the applicant has riparian responsibilities and rights associated with this watercourse. Any works to the watercourse itself (i.e outfall arrangements) is subject to ordinary watercourse consent. This does not form part of the drainage design review, but this will need to be undertaken and approval from the LLFA prior to any works.

[2] https://www.cambridgeshire.gov.uk/business/planning-and-development/flood-and-water/watercourse-management accessed on 30/07/2020

2.2.7 Cross sectional information has been issued associated with the proposed outfall arrangement for the surface water drainage into the existing watercourse (drawing 19/0321/1010 Rev P3). The cross section shows the watercourse to be at an approximate depth of 1.39m, on the bank side of the site, and 2.05m depth on the far north bank to the site. The width of the ditch has been measured as approximately 5.3m wide, at the top of bank, and 2m wide at the base of the watercourse. Refer to drawing 19/0321/1010 P3 in **Appendix B**.

2.3 Geological Information

2.3.1 The Ground Investigation Report, dated January 2016 by Oakley Soils, provides information on the underlying soils associated with the site. A borehole located in land to the west of the site, where the two occupied properties were constructed, provides an overview on the soil characteristics of the site. The borehole log shows the site to be underlined with clay and gravelly sands to a depth of 1.8m BGL and then dark, fissured clay to depths of 18.45m BGL. The clay is classified as inorganic clay of high to very high plasticity.

2.3.2 A review of the British Geological Website (BGS) also shows the site is in an area with no recorded information associated with the superficial deposits and an underlying bedrock of West Walton Formation and Ampthill Clay formation.

2.3.3 The above information would suggest limited potential for infiltration at the site where clay is present, but the superficial deposits may be able to support localised infiltration measures, subject to the results of infiltration tests in accordance with BRE365.

2.3.4 An infiltration report has been received, with soakaway tests conducted in three locations, one of which is applicable to the site (TP03) and two within the southern site (TP01 and TP02). The tests are stated within the report to have been undertaken in accordance with BRE365 and results are summarised in Table 1 below.

Trial Pit No	Depth (mbgl)	Test 1 Rate (m/s)	Test 2 Rate (m/s)	Test 3 Rate (m/s)	Design Infiltration Rate (m/s)
TP01	1.2m	1.64E-05	1.33E-05	1.13E-05	1.13E-05
TP02	1.2m	1.56E-05	1.40E-05	1.2E-05	1.2E-05
TP03	1.2m	6.97E-06	8.00E-06	8.10E-06	6.97E-06

Table 1 – Infiltration Test Results

2.3.5 The results from these reports and how these have been applied to the site drainage is further assessed in section 4 of this report.

2.3.6 Refer to Geotechnical information and infiltration test report in **Appendix C**.

2.4 Existing drainage arrangement

2.4.1 The site is an existing garden of an original dwelling (The Retreat). Existing drainage has not been confirmed within the submitted Cambridgeshire SPD [3]pro-forma (refer to **Appendix D**) but it can be reasonably concluded, from the information submitted, that the parcel of land applicable to this review would likely infiltrate but still with hydrogeological connectivity to the local watercourse, due to the impervious nature of the geology at lower depths.

[3] Pro-forma was submitted prior to discharge rate reduction to 1l/s. This is not a material change to the outcome of this review.

3 Planning Policy

3.1.1 Whilst it is acknowledged the objections received from Neighbours, the Fews Lane Consortium, are specific in relation to the failure to comply with the South Cambridgeshire adopted Local Plan (2018), a wider review specific to National and Regional policy has also been undertaken as part of this assessment. This follows the requirements of the client to undertake a peer review on all applicable drainage related policy and in response to the neighbours and the Parish Council objections.

3.1.2 Planning Policy is generated at two different levels:

i. National – these are policies set by the Government through the National Planning Policy Framework.

ii. Local – planning policies created by local planning authorities (such as LLFA, Parish, District and Local Plan, Neighbourhood Forums).

3.2 National Planning

National Planning Policy Framework (NPPF) and supporting Guidance Document

3.2.1 The **National Planning Policy Framework (NPPF)** sets out the government's planning policies for England and how these are expected to be applied. The current version was published in February 2019. Section 14 of the NPPF, 'Meeting the challenge of climate change, flooding and coastal change'; and the supporting PPG (published in March 2014), section 'Flood Risk and Coastal Change' and updated in February 2016 is applicable when assessing sites associated with flood risk. It is generally accepted that drainage will form part of the management of flood risk associated with a proposed development and therefore is also used to inform both regional and local planning policy.

3.2.2 The NPPF aims to ensure flood risk is considered at all stages in the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk. In exceptional circumstances where new development is necessary in flood risk areas the policy also aims to ensure it is safe, without increasing flood risk elsewhere, and where possible reducing flood risk overall.

3.2.3 For sites less than 1ha in size and not at risk of flooding, a Flood Risk Assessment is not required, but nevertheless, the principles of ensuring the appropriate and sustainable management of drainage, to mitigate or prevent future flooding, should still form the basis for a sustainable drainage strategy and be used in support for the promotion of sustainable development.

3.2.4 Applicable references to drainage within the NPPF are as follows:

- *Para 163: When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment[4]. Development should only be allowed in areas at risk of flooding where, in light of this assessment (and the sequential and exceptions tests, as applicable) it can be demonstrated that:*

[4] NPPF Footnote 50: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: site 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 it is development would introduce more vulnerable use.

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;*

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.*

- *Para 164. Applications for some minor development and changes of use[5] should not be subject to the sequential or exception test but should still meet the requirements for site-specific flood risk assessments set out in footnote 50.*

- *Para 165: 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.*

Sustainable Drainage Systems Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015)

3.2.5 This document sets out the non-statutory technical standards for sustainable drainage systems and promotes the use of the document in conjunction of with the [6]NPPF. This document is referenced within the neighbour's objections as evidence for reasons for refusal.

3.2.6 The then Secretary of State for Communities and Local Government made a [7]statement on the 18 December 2014 in relation to the Non-Statutory Technical Standards for Sustainable Drainage Systems, text applicable to this review and taken from this statement are as follows:

"Today we are publishing our response to the consultation explaining how we will be strengthening existing planning policy. This will make clear that the Government's expectation is that sustainable drainage systems will be provided in new developments wherever this is appropriate.

To this effect, we expect local planning policies and decisions on planning applications relating to ***major development - developments of 10 dwellings or more****; or equivalent non-*

[5] NPPF Footnote 51. This includes householder development, small non-residential extensions (with footprint of less than 250m^2) and changes of use: except for changes of use to a caravan, camping or chalet site, or a mobile home of park home site, where the sequential and exceptions tests should be applied as appropriate.
[6] https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards
[7] https://www.parliament.uk/business/publications/written-questions-answers-statements/written-statement/Commons/2014-12-18/HCWS161/

residential or mixed development (as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010) - to ensure that sustainable drainage systems for the management of run-off are put in place, unless demonstrated to be inappropriate."

Under these arrangements, in considering planning applications, local planning authorities should consult the relevant lead local flood authority on the management of surface water; satisfy themselves that the proposed minimum standards of operation are appropriate and ensure through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development. The sustainable drainage system should be designed to ensure that the maintenance and operation requirements are economically proportionate.

To protect the public whilst avoiding excessive burdens on business, ***this policy will apply to all developments of 10 homes or more and to major commercial development****. The Government will keep this under review, and consider the need to make adjustments where necessary. The current requirement in national policy that all new developments in areas at risk of flooding should give priority to the use of sustainable drainage systems will continue to apply.*

These changes will take effect from 6 April 2015. For avoidance of doubt this statement should be read in conjunction with the policies in the National Planning Policy Framework. This statement should be taken into account in the preparation of local and neighbourhood plans, and may be a material consideration in planning decisions.

3.2.7 The assessment of the site in relation to this document has been discounted, as the site is for the construction of 1 dwelling, less than the 10 dwellings or more requirement, as stated by the then Secretary of State for Communities and Local Government.

3.2.8 The NPPF Practice Guidance also reinforces this statement by stating: *Whether a sustainable drainage system should be considered* ***will depend on the proposed development and its location****, for example whether there are concerns about flooding. Sustainable drainage systems may not be practicable for some forms of development (for example, mineral extraction). New development should only be considered appropriate in areas at risk of flooding if priority has been given to the use of sustainable drainage systems. Additionally, and more widely, when considering* ***major development****, as defined in the [8]Town and Country Planning (Development Management Procedure) (England) Order 2015, sustainable drainage systems should be provided unless demonstrated to be inappropriate.*

3.3 Regional and Local Planning Policy

Cambridgeshire Flood and Water SPD

3.3.1 **The Cambridgeshire Flood and Water SPD**, adopted in November 2016, has been prepared by Cambridgeshire County Council (as the Lead Local Flood Authority) in conjunction with the other Cambridgeshire local planning authorities (including South Cambridgeshire District Council).

3.3.2 The SPD provides guidance on the approach that should be taken to design new developments to manage and mitigate flood risk and include sustainable drainage systems (SuDS). SuDS mimic natural drainage to manage surface water run-off and can also deliver wider benefits such as providing green areas for biodiversity and recreation.

[8] Town and Country Planning (Development Management Procedure) England Order 2015, classifies Major Development as the provision of dwelling houses where— (i) the number of dwelling houses to be provided is 10 or more; or (ii) the development is to be carried out on a site having an area of 0.5 hectares or more and it is not known whether the development falls within sub-paragraph (c)(i);

3.3.3 Chapter 6 of the SPD is specific to the design of the Surface Water and Sustainable Drainage Systems. Many of the general principles within this chapter is recommended to be applied to traditional surface water drainage and states "*this chapter needs to be complied with on all development sites*[9] *and the provision of SuDS maximised*".

3.3.4 The SPD promotes the use of following the Surface water drainage hierarchy as illustrated in Figure 2 below.

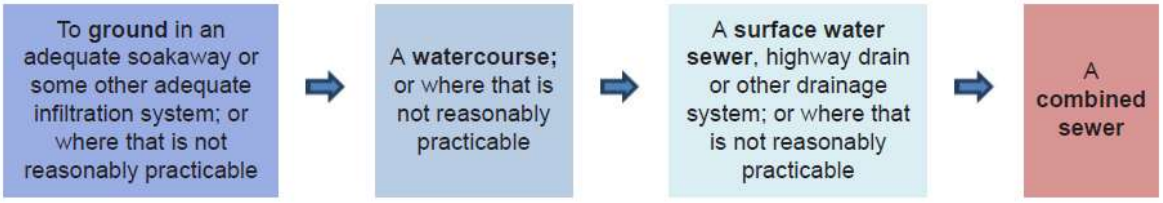

Figure 2: SuDS Hierarchy

3.3.5 Relevant Paragraph references and extracts to this assessment are as follows:

6.3.18 *"The potential for infiltration measures on a site should be considered at the outset. Careful consideration of the acceptability of infiltration drainage should be given particularly in relation to potable water sources (e.g drinking water) or land contamination issues."*

6.3.19 *The British Geological Survey can provide maps and records to support decisions with regards to the suitability of the subsurface for the installation of infiltration type SuDS type systems. The suitability for infiltration across an area should be based on:*

- *Existing constraints prior to planning infiltration SuDS;*
- *Drainage capacity and rate of infiltration into the ground;*
- *Potential for ground instability when water is infiltrated;*
- *Impact on groundwater quality as a result of infiltration;*

Development on contaminated land or Source Protection Zones (SPZ) (vulnerable aquifers).

6.3.20 *Infiltration should be assessed on-site using infiltration tests that follow the detailed SuDS design principles covered in* ***BRE365/CIRIA 156*** *procedure. SPZ's should be taken into account when considering infiltration and guidance provided by the EA should be consulted to determine infiltration constraints and requirements in these areas. Where infiltration drainage is proposed on previously developed land, contamination risk needs to be considered. This may not rule out the use of infiltrating SuDS but will require site investigations and information on remediation prospects which are outside the scope of this Supplementary Planning Document (SPD).*

6.3.21 *The maximum acceptable depth for an infiltration device is usually 2.0m below ground level, with a minimum of 1.2m clearance between the base of the feature and peak seasonal groundwater levels. In some areas of the Fens the maximum depth of infiltration (of 2.0m below ground level) is often not viable and in such areas 1.0m below ground level would be the best achievable depth. In these areas however, the possibility of incorporating shallow infiltration features such as trenches should be investigated. Deeper ('deep bore') soakaways*

[9] All Development Sites suggests there is no distinction between, minor or major development, brownfield or greenfield developments.

pose a serious pollution risk and are not acceptable, and it is expected they will become contrary to the European Union (EU) Water Framework Directive (WFD).

3.3.6 For developing a drainage strategy for the site, reference should be made to section 6.7 of the SPD which provides the following with regard to the requirements for full planning or reserved matter application.

Full planning application or reserved matter application

6.7.4 *Many developments move straight to a full planning application following pre-application discussions with the relevant WMAs. At this stage applicants will also be expected to submit a detailed surface water drainage strategy with the planning application. Whilst most topics will have been covered to some degree in the outline drainage strategy (if applicable) the applicant will be expected to provide more detail at this stage. The strategy should demonstrate that opportunities to integrate SuDS have been maximised and where obstacles to their use do persist this should be fully justified within the report. Where proposing to discharge into a third party asset (such as a watercourse or public sewer), appropriate permissions and required consents should have been discussed with the asset owner.*

6.7.5 *The key information a surface water drainage strategy must contain includes:*

- *How the proposed surface water scheme has been determined following the drainage hierarchy;*
- *Pre-development runoff rates;*
- *Post development runoff rates with associated storm water storage calculations*
- *Discharge location(s);*
- *Drainage calculations to support the design of the system;*
- *Drawings of the proposed surface water drainage scheme including sub catchment breakdown where applicable;*
- *Maintenance and management plan of surface water drainage system (for the lifetime of the development) including details of future adoption;*
- *Completed drainage proforma – the applicant must ensure that the surface water strategy contains the appropriate level of information in relation to the points covered in the proforma.*

6.7.6 *Note that the size and complexity of the site will determine how much information is included within the surface water drainage strategy however using the pre-application design checklist and drainage proforma in Appendix F will ensure the right matters are covered with the appropriate level of detail.*

3.3.7 Pro-forma is supplied within the SPD to help guide applicants on the necessary information to be submitted.

3.4 Local Plan

3.4.1 The South Cambridgeshire Local Plan sets out the planning polices and land allocations to guide the future development of the district up to 2031. It includes policies on a wide range of topics and pertinent to this report is the policies relating to flood risk drainage design.

3.4.2 Applicable references within the **South Cambridgeshire Local Plan,** and also referenced by residents as grounds for objection, are as follows:

- *Policy CC/7: Water Quality*

1. In order to protect and enhance water quality, all development proposals must demonstrate that:

a. There are adequate water supply, sewerage and land drainage systems (including water sources, water and waste water infrastructure) to serve the whole development, or an agreement with the relevant service provider to ensure the provision of the necessary infrastructure prior to the occupation of the development. Where development is being phased, each phase must demonstrate sufficient water supply and waste water conveyance, treatment and discharge capacity;

b. The quality of ground, surface or water bodies will not be harmed, and opportunities have been explored and taken for improvements to water quality, including re-naturalisation of river morphology, and ecology;

c. Appropriate consideration is given to sources of pollution, and appropriate Sustainable Drainage Systems (SuDS) measures incorporated to protect water quality from polluted surface water runoff.

2. Foul drainage to a public sewer should be provided wherever possible, but where it is demonstrated that it is not feasible, alternative facilities must not pose unacceptable risk to water quality or quantity.

- *Policy CC/8: Sustainable Drainage Systems*

Development proposals must incorporate appropriate sustainable surface water drainage systems (SuDS) appropriate to the nature of the site. Development proposals will be required to demonstrate that:

a. Surface water drainage schemes comply with the Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems and the Cambridgeshire Flood and Water Supplementary Planning Document or successor documents;

b. Opportunities have been taken to integrate sustainable drainage with the development, create amenity, enhance biodiversity, and contribute to a network of green (and blue) open space;

c. Surface water is managed close to its source and on the surface where it practicable to do so;

d. Maximum use has been made of low land take drainage measures, such as rainwater recycling, green roofs, permeable surfaces and water butts;

e. *Appropriate pollution control measures have been incorporated, including multiple component treatment trains; and*

f. *Arrangements have been established for the whole life management and maintenance of surface water drainage systems.*

- *Policy CC/9: Managing Flood Risk*

1. In order to minimise flood risk, development will only be permitted where:

a. *The sequential test and exception tests established by the National Planning Policy Framework demonstrate the development is acceptable (where required).*

b. *Floor levels are 300mm above the 1 in 100 year flood level plus an allowance for climate change where appropriate and where appropriate and practicable also 300mm above adjacent highway levels.*

c. *Suitable flood protection / mitigation measures are incorporated as appropriate to the level and nature of flood risk, which can be satisfactorily implemented to ensure safe occupation, access and egress. Management and maintenance plans will be required, including arrangements for adoption by any public authority or statutory undertaker and any other arrangements to secure the operation of the scheme throughout its lifetime;*

d. *There would be no increase to flood risk elsewhere, and opportunities to reduce flood risk elsewhere have been explored and taken (where appropriate), including limiting discharge of surface water (post development volume and peak rate) to natural greenfield rates or lower, and*

e. *The destination of the discharge obeys the following priority order:*

iii. *Firstly, to the ground via infiltration;*

iv. *Then, to a water body;*

v. *Then, to a surface water sewer;*

vi. *Discharge to a foul water or combined sewer is unacceptable.*

2. Site specific Flood Risk Assessments (FRAs) appropriate to the scale and nature of the development and the risks involved, and which takes account of future climate change, will be required for the following:

f. *Development proposals over 1ha in size;*

g. *Any other development proposals in flood zones 2 and 3;*

h. *Any other development proposals in flood zone 1 where evidence, in particular the Strategic Flood Risk Assessment or Surface Water Management Plans, indicates there are records of historic flooding or other sources of flooding, and/or a need for more detailed analysis.*

3. FRAs will need to meet national standards and local guidance (including recommendations of the South Cambridgeshire and Cambridge City Strategic Flood Risk Assessment (2010) and the Phase 1 and 2 Water Cycle Strategy or successor documents).

3.4.3 In January 2020 the **Greater Cambridge Sustainable Design and Construction Supplementary Planning Document** was adopted. This update is an addendum to the wider 2016 Cambridgeshire Flood and Water SPD and specially addresses the updates needed following the publication of the South Cambridgeshire Local Plan (2018). The adoption of this document was after the application for the site and approval given by the council.

3.4.4 A review of the document has however been undertaken to assess if there is any material change to the policies which are applicable to this site. This document confirms in Section 3.7, specific to Sustainable Drainage Systems and flood risk, paragraph 3.7.2 that the Sustainable Design and Construction SPD *focuses on guidance for the implementation of SuDS Policy in Cambridge Local Plan (2018). This guidance supplements the wider guidance on flooding and drainage provided for in the Cambridgeshire Flood and Water SPD. For applications in South Cambridgeshire, further guidance on policy implementation, alongside drainage checklists, is provided in the Cambridgeshire Flood and Water SPD*. Therefore, it can be concluded there is no material change to the policy for assessment against this site.

3.5 Design Best Practice

3.5.1 The method for incorporating climate change is included within the document named '**Flood Risk Assessments: Climate Change Allowances**' prepared by the EA in 2016. These proposals are for a residential development with an assumed design life of 100 years. In accordance with the EA advice, a 20% - 40% increase in rainfall intensity should be included in the drainage assessment calculations.

3.5.2 The method of disposing of surface water is stipulated by the **'Building Regulations – Approved Document H'**. It requires that rainwater from roofs and paved areas is collected from the surface to discharge to one of the following, listed in order of priority: i) an adequate soakaway or some other adequate infiltration system, or where this is not reasonable practicable, ii) watercourse, or where that is not practicable, iii) a sewer. This follows the requirements of Local Plan and Cambridgeshire SPD

3.5.3 It is acknowledged that Paragraph 3.2.5 of the Building Regulations Part H states infiltration drainage is not always possible and Infiltration devices should not be built within 5m of a building or road or in areas of unstable land (see Planning Policy Guidance Note 14 Annex 1).

3.5.4 The Building Regulations Part H require small soakaways draining impermeable area of 25m^2 or less to use a design rainfall of 10mm in 5 minutes as worst case. Soakaways serving an impermeable area of more than 25m^2 should determine the design rainfall in accordance with **BRE Digest 365**.

3.5.5 Good practice sustainable drainage systems design advice is given in **'The SuDS Manual (C753)'** released by CIRIA in 2015. The manual defines SuDS as 'drainage systems which are considered to be environmentally beneficial, causing minimal or no long term detrimental impact'. SuDS can be in a variety of forms, including infiltration basins, soakaways, swales and permeable surfaces.

3.5.6 **CIRIA report C753 'The SuDS Manual'** outlines the various types of SuDS, their benefits and limitations, and design considerations associated with each. Not all SuDS components/methods are feasible or appropriate for all developments; factors such as available space, ground conditions, and site gradient will influence the feasibility of different methods for a particular method.

3.5.7 **Chapter 25** of **The SuDS Manual** provides guidance on the suitability of using infiltration to dispose of surface water runoff, infiltration testing and design methods. This chapter notes a number of considerations which need to be fully evaluated before determining the extent to which infiltration can be used on site, as follows:

- Soil type and infiltration capacity
- Groundwater level beneath the site
- Risk of ground instability, subsidence or heave due to infiltration
- Risk of slope instability or solifluction (the slow creep of saturated soils down slopes due to infiltration
- Risk of pollution from mobilising existing contaminants on the site due to infiltration
- Risk of pollution from infiltrating polluted surface water runoff
- Risk of groundwater flooding due to infiltration
- Risk of groundwater leakage into the combined sewer due to infiltration

3.5.8 Whilst not a document produced on behalf of the area, Kent County Council have produced **The Soakaway Design Guide**, informed by other local Authorities, geotechnical consultants, and respected institutions including the Environment Agency (EA) and the Health and Safety Executive. Whilst it concentrates in sections of the report on the design requirements in chalk soils, it does also provide general guidance to the use of soakaways in all forms of strata. This document is therefore used within the industry to help inform soakaway designs. Chapter 2.9 of this document provides soakaway location guidance relating to distances between soakaways and the highway or dwelling. The general approach within this document is to locate conventional soakaway design no closer than 5m, or subject to the underlying soil characteristics or proximity to other infiltration and soakaway features this offset can be further.

3.5.9 The SuDS drain fact sheet "**Using SuDS Close to Building**", dated 2002 explores the options of locating infiltration systems within 5m of the proposed building foundations, subject to adequate testing and there being no risk to on-site and offsite flooding.

3.5.10 **Rainfall Management for developments, Report SC030219** dated October 2013, by the EA and DEFA, is a guide aimed at regulators, developers and local authorities to provide advice on the management of stormwater drainage for developments and in particular to assist in the sizing of storage elements for the control and treatment of stormwater runoff.

4 Review of Drainage Information

4.1 Foul Water Drainage Proposal

4.1.1 The proposal is illustrated on Drainage Layout Plan Ref 19/0321/100 Rev P9 (hereafter referenced as Drainage Layout Plan Rev P9) and shows the proposed dwelling will discharge foul drainage to an existing foul sewer in Fews Lane.

4.2 Surface Water Drainage Proposal

4.2.1 The Drainage Layout Plan Rev P9 shows the single dwelling is to discharge surface water to an attenuation tank located within the rear garden of the property.

4.2.2 The proposed tank is 1.5m x 7.0m x 0.4m and is stated in the Drainage Layout Plan Rev P9 as being capable of storing to up to the 1 in 100 year plus 40% climate change event. A hydrobrake flow control chamber is shown at the outfall to the proposed storage tank.

4.2.3 Supporting calculations supplied show the tank has been modelled to accommodate the storage required and the flow control is capable of limiting flow to the rate within the range of 1l/s. See Figure 3 below, which is a screen shot of the proposed drainage.

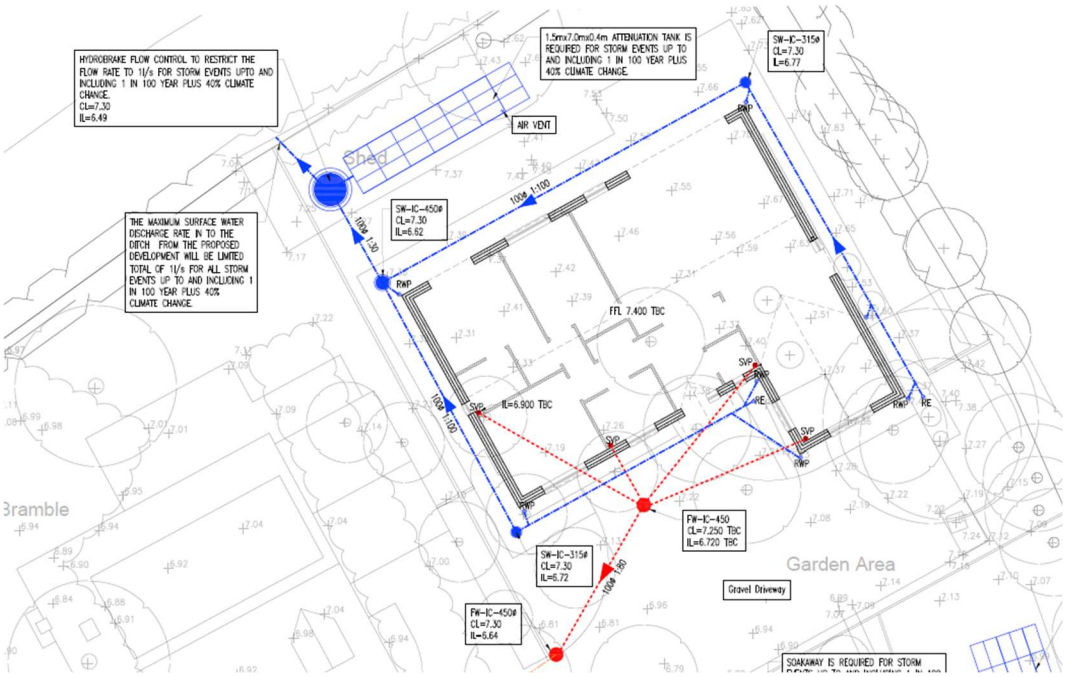

Figure 3 Drainage Layout Plan

4.2.4 The drainage plan shows the proposed driveway is a proposed gravel driveway operating as an infiltration feature. Refer to **Appendix B**.

4.2.5 Infiltration tests show infiltration rates within this location is at a rate of 6.97E-06 and therefore in accordance with **The SuDS Manual** is considered a suitable rate for use of infiltration. The geotechnical report also submitted in support of this design shows the land immediately to the west to be underlined with Clay Soil, the soil is classed as having a high to very high plasticity content. **Refer to Appendix C**.

4.2.6 The Drainage Layout Plan Rev 9 shows the proposed two new units, the southern site, and part of a separate planning application, are to use individual house soakaways within the rear gardens and porous paving in the driveway to discharge surface water runoff. The infiltration rates applicable to these two properties are a higher rate than the site.

4.3 Objections and Drainage Review

4.3.1 Objections have been submitted by both the Parish Council and the Fews Lane Consortium Ltd. The Fews Lane Consortium have provided detailed written correspondence received over the period of the drainage review for this report dated 02 June 2020, 13 July 2020, 16 July 2020 and 13 August 2020, most of points raised were relating to Condition 5. A copy of these objections is supplied in **Appendix A**. The objections have been reviewed and referenced in turn.

Condition 4: Foul Drainage and Objections Review

4.3.2 **Objection**: The application proposes discharge of foul water into the public sewerage system, but no evidence has been provided to demonstrate that the existing public sewerage system has the capacity for the additional flows from the proposed development or that discharge into the public sewerage system has been agreed with the relevant sewerage undertaker.

4.3.3 **Response**: CC/7 part 1a states "….development must demonstrate that: *There are adequate water supply, sewerage and land drainage systems (including water sources, water and waste water infrastructure) to serve the whole development, or an agreement with the relevant service provider to ensure the provision of the necessary infrastructure prior to the occupation of the development".*

4.3.4 As part of the consultation exercise with approving authorities the sewerage undertaker will take an assessment of the proposed discharge rate from the development proposals and the capacity of the receiving system. Written confirmation has been received from the approving authority (Anglian Water) who has confirmed recommendation for the discharge of Condition 4. Refer to **Appendix E** for a copy of the Anglian Water correspondence.

4.3.5 We therefore support the discharge of Condition 4 for this site.

Condition 5: Surface Water Drainage and Objections Review

4.3.6 **Objections**: *The surface water drainage arrangements proposed in this application fail to comply with policies CC/7, CC/8 and CC/9 of the South Cambridgeshire Local Plan 2018. In particular, policy CC/9 states that development will only be permitted where the destination of surface water discharge obeys the following priority order: (1) infiltration to ground, (2) discharge to a body of water, (3) discharge to a surface water sewer.*

4.3.7 **Response:** A review of policy CC/8 and CC/9 does not differentiate between the development of a single dwelling and that of major development, as defined within the NPPF. Therefore, the requirements of this policy are applicable to this application. The Chapter 6 of the Cambridge SPD also reinforces this through the statement "*this chapter needs to be complied with on all development sites.*

4.3.8 The Fews Lane Consortium makes refence to the **Sustainable Drainage Systems: Non-Statutory technical standards for sustainable drainage systems** in their reasons for refusal. It should be noted as detailed in paragraph 3.2.6 and as listed within the GOV.uk website, this technical standard is for development of **10 dwellings or more**, therefore this document is not applicable to this site.

4.3.9 A geotechnical investigation and the results from infiltration tests, have been undertaken and used to inform the design of the drainage for the site. The proposal is for the driveway to infiltrate and for the roof runoff to discharge to an attenuation tank, which has been designed to accommodate the 1 in 100 year plus 40% climate change event, and to discharge at a control rate of 1l/s to the adjacent watercourse.

4.3.10 The applicant has stated in consultation with the Local Planning Authority (LPA) on 26 June 2020 (Refer to **Appendix F**) that soakaway design for the roof runoff has been discounted for the site due to constricted space (this is in refence to previous consultation with the LPA at the planning application stage regarding a 5m offset from the proposed building foundations and the then subsequent proximity to the watercourse). This has been addressed further within this review.

4.3.11 A below ground drainage operation and maintenance strategy report, informed by the SuDS Manual, has been provided for the site and contained in **Appendix G**. This is a requirement of the SPD and CC/9.

4.3.12 A further review of the drainage is provided in this report, which will address whether it meets the requirements of CC/7, CC/8 and CC/9 of the local plan. However, it can be concluded, if the site cannot accommodate infiltration either by conventional soakaway or an alternative means of infiltration, then in accordance with the priority order of CC/9 the discharge to the local watercourse is the next suitable option.

Objection Text: *No surface water drainage arrangements for the proposed driveway are shown on the submitted plans. It is unclear if it is intended that permeable pavement should be used to discharge the driveway surface water by infiltration. However, if this is the case, no evidence has been submitted to suggest that the site is suitable for infiltration. The minimum information required would typically include infiltration testing conducted according to BRE Digest 365 together with a site plan showing the locations where tests were conducted.*

4.3.13 **Response**: Infiltration tests have been provided by the applicant and a gravel driveway is to be provided using infiltration at source. Soakaways have been discounted; this is assessed further within this review.

Objection Text: *The Council's unnamed surface water drainage engineer also comments on the surface water drainage arrangements proposed under this application (S/3215/19/DC) in the response for application S/ 3875/19/DC, stating that, "the dwelling towards the north [the bungalow to which application S/ 3215/19/DC pertains] appears to be too close to the watercourse to enable soakaways to be positioned 5m from the dwelling without impacting on the hedge and bank of the watercourse".*

However, there are numerous locations within the application site greater than 5 metres from the foundations of buildings. Furthermore, the 5-metre rule is simply a rough rule of thumb that can be assumed to be safe for any building site on any type of soil. With a proper geotechnical assessment, it may be possible in many soils to install infiltration features and traditional soakaways much closer to foundations

4.3.14 **Response**: A traditional soakaway will have an infiltration concentration ratio at the higher end of scale where it drains either a roof area, a road, or several houses. Therefore, it is a concentrated point source of water within the ground. These types of soakaways also allow water flows out sideways as well as through the base area of the feature. As a result, the risk of water affecting the soils under shallow foundations can be quite high if the soakaway is located close to buildings and this is confirmed by **Building regulations Part H**, which advises against soakaways within 5m of buildings and roads.

4.3.15 Based on the SuDS drain fact sheet "**Using SuDS Close to Building**", dated 2002 infiltration features close to buildings should normally be designed with a ratio of impermeable area to base area of less than 10:1 and the depth of the stored water should not be greater than 300mm. Thus, the flow of water from the base of the SuDS features is much less concentrated than in a normal soakaway. Because infiltration from a plane feature is much more dispersed, has a shallow height and has a short retention time there is less potential for flow to occur laterally in any significant quantities. Therefore, as an example, the use of porous paving and an underlying crate storage, which would need to be designed to be no greater than a depth of 0.3m, could allow for the roof runoff and parking to be infiltrated within a 5m of proposed building foundations. However, such a solution will need an attenuation volume made available to accommodate the 1 in 100 year plus climate change event and it is also subject to the underlying geology present at the site.

4.3.16 The results from the geotechnical information (**Appendix C**) shows clays with a high to very high plasticity index is present at the site. Clay -rich soil of high plasticity are more likely to be a risk of failure through the introduction of soakaways, due to their swelling and shrinkage characteristics. The proposed expansion of the soil, as estimated in the study by Holtz and Kovacs 1981 (Table 2 below) shows those with a plasticity index of greater than 35 will have a Very High degree of Expansion (i.e at higher risk from swelling and shrinkage). The Geotechnical report provided for the site, by Oakley Soils and Concrete Engineering Ltd, show the Plasticity Index for the clay to range between 42 -45 and will therefore sit in the Very High range for degree of Expansion. It is for this reason we would not recommend soakaways, or an infiltration feature accepting a concentrated runoff, to be located within 5m of the proposed building foundations or within proximity to the banks of the existing watercourse. This would therefore also discount a crate system below the driveway.

Degree of Expansion	Probable Expansion (as a percent of the total volume change)[1]	Colloidal Content (percent less than 1μm)	Plasticity Index	Shrinkage Limit
Very High	Greater than 30	Greater than 28	Greater than 35	Less than 11
High	20 - 30	20 - 31	25 - 41	7 - 12
Medium	10 - 20	13 - 23	15 - 28	10 - 16
Low	Less than 15	Less than 15	Less than 18	Greater than 15

Table 2: Probable Expansion of clay as estimated from classification test data (from Holtz and Kovacs 1981)

4.3.17 A 5m offset if applied to the footprint would therefore leave an area of approximately 2.5m distance from the bank of the existing watercourse. See Figure 4.

4.3.18 Locating soakaways adjacent to the watercourse is considered to result in a limited unsaturated zone, this would therefore do little to reduce rates into the watercourse, provide little water quality treatment and would therefore be contrary to **The Cambridgeshire SPD** and design best practice.

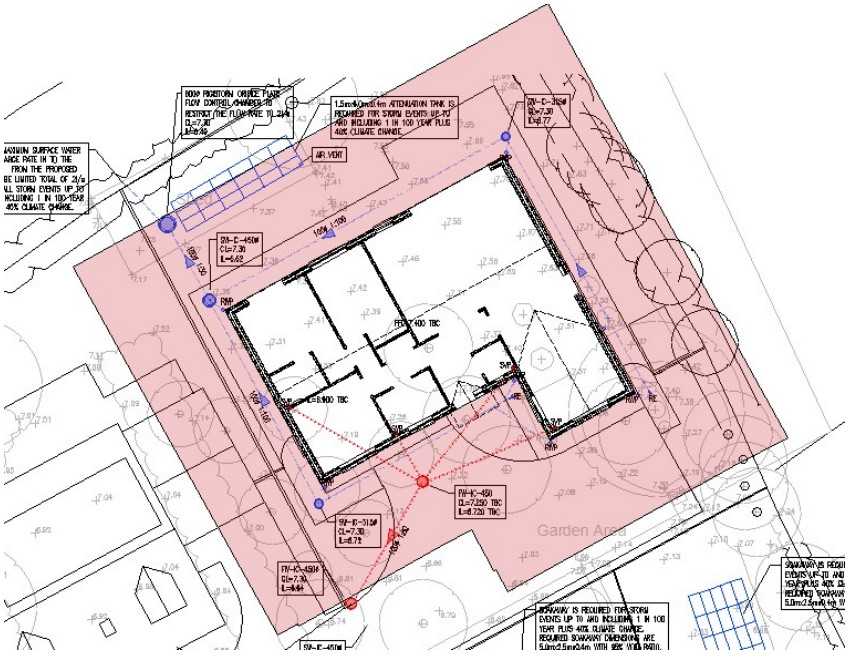

Figure 4:Soakaway 5m offset from buildings

4.3.19 It is noted there is space available along the frontage of the proposed property, outside of the 5m offset, as illustrated in Figure 4. However, locating a soakaway feature in this area would place it directly adjacent to the proposed two residential plots within the southern site, resulting in two soakaway features being within 3.5m of each other. This would further increase the potential risk from expansion of the soils. Levels within this area of the site are also higher than those within the rear of the property, requiring a deeper soakaway feature, making maintenance more of a challenge.

4.3.20 Relocating the future soakaways within the southern site to accommodate this solution (i.e relocate the proposed soakaways for the southern site to the front of the two proposed properties) would result in these features being within the 5m offset of the existing highway and therefore due to the risk from expansion, we recommend discounting this as an option. Having this site discharge via soakaway at the expense of removing the two soakaways within the southern site would also require a higher discharge rate into the existing watercourse.

4.3.21 Whilst it is agreed the 5m rule is not conclusive, it is considered that a soakaway should not be located closer than the 5m offset, in this instance, due to risk posed from the existing geology. The presence of a gravel driveway to accommodate runoff at source (i.e runoff generated by the driveway only) is however considered acceptable and in accordance with best practice. We therefore agree in accordance with the priority order of CC/9 the discharge to the local watercourse is the suitable option for the roof runoff for this site.

Objection Text: *The following three material considerations preclude the discharge of Condition 5. Issue 1) The scheme proposes an increase on the surface water discharged from the site into Longstanton Brook from the pre-development discharge volume, thereby increasing the flood risk of nearby properties. This is contrary to the stated reason for the condition, which is to prevent flooding. Issue 2) The scheme positions the outfall of the surface water drainage outside the redline boundaries of the development site. An application to discharge a planning condition cannot be used to extend the boundaries of the land which the planning relates. Issue 3) The relevant policies of the development plan are a material*

consideration and policies CC/8 and CC/9 of the Local Plan 2018 [10]militate against the approval of the application.

4.3.22 **Response to Issue 1:** Greenfield discharge rates have been provided for the site as follows:

- 0.1l/s for the 1 year
- 0.2 l/s for Qbar
- 0.4 l/s for 30 years
- 0.6 l/s for 100 years

4.3.23 Refer to **Appendix H** for a copy of the Greenfield runoff rates supplied by the applicant.

4.3.24 The proposed discharge rate for the site has been set to 1l/s using a hydrobrake. This was considered the lowest acceptable discharge rate with limited maintenance requirements and therefore poses a lower flood risk from potential blockages.

4.3.25 It is acknowledged that the proposed development will exceed the existing greenfield runoff calculated for the site. However, a pragmatic approach and understanding on the principles of greenfield runoff rates and development proposals must be applied.

4.3.26 The site is for a single dwelling and therefore the equivalent greenfield runoff rates for such as scheme will always be minimal. To provide attenuation at the greenfield rates estimated (as listed above) would require the use of a control feature of such a small size that it would be at a high risk from blockages. This itself would be considered a flood risk.

4.3.27 **The Rainfall Runoff Management for Developments**, Interim National Procedure Policies states, in paragraph 17, as follows "*Minimum limit of discharge rate. A practicable minimum limit on the discharge rate from a flow attenuation device is often a compromise between attenuating to a satisfactorily low flow rate while keeping the risk of blockage to an acceptable level. This limit is set at 5 litres per second, using an appropriate vortex or other flow control device. Where sedimentation could be an issue, the minimum size of orifice for controlling flow from an attenuation device should normally be 150mm laid at a gradient not flatter than 1 in 150, which meets the requirements of Sewers for Adoption 7th Edition" A second minimum discharge limit based on 1l/s/ha for QBAR is also applied where soil types produce lower calculated values when estimating greenfield runoff rates. This limit is applied to prevent the size of storage systems becoming unacceptably large and expensive.*

4.3.28 The drainage pro-forma provided within **The Cambridgeshire SPD** also states *"Hydrobrakes to be used where rates are between 2l/s to 5l/s. Orifices may not work below 5l/s as the pipes may block. Pipes with flows < 2l/s are prone to blockage, but this can be overcome with careful product selection and SuDS design."*

4.3.29 Since the production of The Cambridgeshire SPD and the Rainfall Runoff Management for Development reports, manufacturers have now developed hydrobrakes which can operate at a rate of 1l/s. It is noted the applicant is proposing such a control at this site. We consider this to be the minimum viable rate for sustainable control with limited maintenance requirements imposed on the future resident.

4.3.30 We do however acknowledge the concerns raised by the Few Lane Consortium regarding the flood risk to the local watercourse and in accordance with the SPD a desire for all developments to discharge at greenfield runoff rates. Therefore, we have provided further assessment regarding the potential flood risk associated with a discharge rate of 1l/s from the

[10] We assume militate as written by the author of the Fews Lane Consortium Ltd is a typo and means mitigate.

site. The existing watercourse dimensions are illustrated on the supporting ditch profile drawing Ditch Plan and Section drawing reference 19/0321/101 Rev P3 (**Appendix B**) and using this information we can confirm the following:

- 1.39m in height at the lowest bank,
- 2m width at the base level,
- 5.3m width at the top of bank, and
- Lidar information for the area shows the channel slope is approximately 0.005.

4.3.31 Using Manning's formula, it has been possible to estimate the capacity associated with the existing watercourse and required capacity to accommodate a discharge rate of 1l/s from the site. Refer to **Appendix I**. Using a worst case and conservative estimate, of 1:1 side slopes (assuming a top of bank width of 2m) and a bankfull depth of 1.24m, a Manning's n value of 0.05 and channel slope of 0.001, as a worst case assumption, it gives a bankfull flow capacity of the watercourse to be 2 m3/s. For a discharge rate of 1l/s (0.001 m/s) this will only amount to 0.05% capacity of the watercourse to be utilised for the proposed site. Therefore, the site amounts to a negligible impact on levels and flows associated with the existing watercourse.

4.3.32 Calculations have also been provided by the applicant for the operation of the tank during a 100 year 60 minute winter storm plus 40% climate change, and because of the lack of water levels known within the watercourse it has been modelled with a fully submerged outfall scenario (**Appendix J**). This shows in a worst-case scenario the proposed drainage will not flood nor will it cause a detriment to offsite areas. This is in accordance with the requirements of the NPPF, SPD and Local Plan.

4.3.33 It is acknowledged that best practice is to ensure proposed development does not exceed existing greenfield runoff rates. However, such a requirement for individual properties is erroneous and such an approach would likely hinder the development of small-scale individual properties in future, to the benefit of larger major developments. The implementation of controls to reduce rates to greenfield below 1l/s is considered a higher potential flood risk due to the potential higher maintenance requirements and if left unmanaged a blockage would result in unattenuated flow rates into the receptor.

4.3.34 **Response to Issue 2**: The redline boundary and legal permissions have not formed part of this drainage review. It has however been assumed riparian responsibilities are applicable to the applicant, as referenced in section 2.2 of this review, and therefore Ordinary Watercourse consent will be undertaken with the LLFA. This consent would be undertaken following the approval process and would not form part of this review.

4.3.35 **Response to Issue 3.** It is agreed the relevant policies of the development plan are a material consideration and specifically CC/8 and CC/9 regarding the surface water drainage.

4.3.36 The site is not at flood risk and below 1ha in size, therefore the requirements for an FRA is not necessary and the site is not subject to the Sequential Tests. Therefore, the site accords to the requirements of CC/8 and CC/9.

4.3.37 A Maintenance plan for the attenuation tank has been submitted by the applicant and confirmation that this will form part of the Health and Safety File for the site. The responsibility for the future management of the drainage will need to be transferred to the future owner of the property. We would also recommend a covenant is in place to ensure the driveway remains permeable construction in future. This we deem is acceptable in accordance with CC/8 and CC/9 of the Local Plan.

4.3.38 It is noted reference has been made by the Fews Lane Consortium that the applicant owns other land immediately adjoining the site that could be used for infiltration. It should be noted

management of the infiltration features would fall to the future owners of the property and such an approach would therefore locate the soakaway feature outside the redline boundary, beyond the future resident's control. This could result in a potential flood risk and would be contrary to policy.

4.3.39 It has been concluded, due to the high plasticity values of the clay, the 5m rule is recommended at the site and therefore the site cannot accommodate infiltration by conventional soakaway or a shallower alternative means of infiltration. In accordance with the priority order of CC/9 the discharge to the local watercourse is the next suitable option.

4.3.40 Discharge rates have been set in accordance with best practice for the reasons previously stated. The increase in rates are not considered to be a flood risk to offsite areas.

4.3.41 Based on the latest information supplied by the applicant and following a review of the evidence we support the discharge of Condition 5 for this site.

5 Conclusion

5.1.1 Based on the information submitted we find that it has been satisfactorily demonstrated that the scheme can provide a viable drainage strategy that will not increase flood risk elsewhere.

5.1.2 We conclude that the application would accord with Policy CC/7, for foul drainage.

5.1.3 We conclude the application would accord with CC/7, CC/8, CC/9 for surface water drainage.

5.1.4 We recommend the applicant undertakes ordinary watercourse consent prior to the installation of the outfall arrangement.

5.1.5 The future owner will need to be informed on the location of the underground storage tank, the maintenance responsibilities for the tank and covenant to ensure the driveway remains permeable in future.

5.1.6 The submission is considered consistent with the Cambridgeshire Flood and Water SPD for design of surface water drainage and paragraph 163 of the NPPF, which requires local planning authorities, when determining any planning applications, to ensure that flood risk is not increased elsewhere.

5.1.7 We therefore recommend the discharge to Conditions 4 and 5 for the site.

Appendix A Third Party Objections

Your ref no: SKBSQBQH

This form was started at:18/10/2019 00:25:19
This form was completed at:18/10/2019 00:33:30
Internal form classification:N / A

Your ref no: SKBSQBQH

Who are you

Mandatory fields are in bold

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

House Name / Number

The Elms

Street

Fews Lane

Town / City

Cambridge

County

Cambridgeshire

Postcode

CB24 3DP

Your ref no: SKBSQBQH

Comment Details

Please enter the planning reference number

S/3215/19/DC

Please tell us the address of the application you are commenting on

The Retreat, Fews Lane, Longstanton, Cambridge CB24 3DP

Commenter Type (optional)

Member of Public

Nature of comment (optional)

Object

Please limit your comments to 2 paragraphs. For longer representations please add as attachments.

Please ensure that no personal details (for example names, phone numbers) are included in your comment. For advice and guidance on how to compile your comment please visit our **website.**

You can also add photos and any other relevant documents.

Your comments

I reside immediately next to the site of the proposed development, and I object to the discharge of any part of condition No. 5 (surface water drainage). The details provided with this application are insufficient to assess whether the surface water scheme proposed complies with the relevant local and national planning policies.

Should the applicant submit further details, re-consultation should occur in order to allow consultees the opportunity to make representations on the application as amended.

UPLOAD FILE(S)

Your ref no: SKBSQBQH

Declaration

Please open the PDF below to review all of your answers, if the answers displayed are correct please tick the declaration box.

Open a read only view of the answers you have given (this will open in a new window)

Please note the preview of your PDF may not work with some browsers. We are working with our suppliers to resolve this issue. You will be emailed a copy of your form once it has been submitted.

Declaration

Please tick the box below to confirm that the information you have provided on the form is accurate, and then click submit to send us your comment.

Please note that your comment may take up to three working days to show on our website.

☑ I declare that the information I have provided on this form is accurate

Your ref no: VNPDXVSC

This form was started at:15/10/2019 14:26:29
This form was completed at:15/10/2019 14:33:08
Internal form classification:N / A

Your ref no: VNPDXVSC

Who are you

Mandatory fields are in bold

Title

Mrs

Forename / Initial (optional)

Libby

Surname

White

Company Name (if applicable) (optional)

Longstanton Parish Council

Telephone number (optional)

01954782323

Email address (optional)

clerk@longstanton-pc.gov.uk

House Name / Number

Longstanton Village Hall

Street

24 High Street

Town / City

Longstanton

County

Cambridgeshire

Postcode

CB24 3BS

Your ref no: VNPDXVSC

Comment Details

Please enter the planning reference number

S/3215/19/DC

Please tell us the address of the application you are commenting on

The Retreat, Fews Lane, Longstanton CB24 3DP

Commenter Type (optional)

Consultee

Nature of comment (optional)

Object

Please limit your comments to 2 paragraphs. For longer representations please add as attachments.

Please ensure that no personal details (for example names, phone numbers) are included in your comment. For advice and guidance on how to compile your comment please visit our **website.**

You can also add photos and any other relevant documents.

Your comments

Having considered this application at the full council meeting held on 14th October 2019, Longstanton Parish Council members recommend this application for OBJECTION as it proposes to discharge the surface water drainage directly into the village watercourse which is in contravention of planning condition 5 requiring surface water drainage to be filtered through the soil. Longstanton Parish Council support the comments made to the planning authority by neighbours in the letter dated 8th October 2019.

UPLOAD FILE(S)

Your ref no: VNPDXVSC

Declaration

Please open the PDF below to review all of your answers, if the answers displayed are correct please tick the declaration box.

Open a read only view of the answers you have given (this will open in a new window)

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Declaration

Please tick the box below to confirm that the information you have provided on the form is accurate, and then click submit to send us your comment.

Please note that your comment may take up to three working days to show on our website.

☑ I declare that the information I have provided on this form is accurate

[redacted]

8 October 2019

Ms Katie Christodoulides
South Cambridgeshire District Council
South Cambridgeshire Hall
Cambourne Business Park
Cambourne
Cambridge
CB23 6EA

Dear Ms Christodoulides

Re: S/3215/19/DC – Discharge of conditions 4 (Foul Water Drainage) and 5 (Surface Water Drainage) of planning permission S/2937/16/FL at land the rear of The Retreat, Fews Lane, Longstanton, Cambridge CB24 3DP

The Fews Lane Consortium is a community action group based in Longstanton that supports sustainable development within the villages of South Cambridgeshire and transparency and accountability in local government.

The Consortium notes that condition No. 4 (foul water drainage) is only capable of being discharged in part at this time.

The Consortium also notes that condition No. 5 (surface water drainage) is only capable of being discharged in part at this time.

The Consortium has no comment on the discharge of the pre-commencement part of condition No. 4 (foul water drainage).

The Consortium OBJECTS to the discharge of any part of condition No. 5 (surface water drainage) at this time. The details submitted by the applicant are insufficient to assess the proposal in regards to the relevant planning policies.

Given the history of community opposition in regards to the development of this site, the Consortium feels that in the public interest, and in the interests of all parties involved, the remaining applications to discharge conditions for applications S/2937/16/FL, S/2439/18/FL, and S/0277/19/FL should be subject to a brief 21-day period for public consultation, as has been the case with this discharge of conditions application.

Kind regards

[redacted]
Director

[redacted]

Fews
Lane
Consortium
Ltd

The Elms
Fews Lane
Longstanton
Cambridge
CB24 3DP

2 June 2020

South Cambridgeshire District Council
South Cambridgeshire Hall
Cambourne Business Park
Cambourne
Cambridge CB23 6EA

Dear Sirs

Re: Planning application S/3215/19/DC

Condition 4 of the relevant planning permission states that, "No construction work shall be commenced until full details of the proposed arrangements for foul water drainage have been submitted to the local planning authority and approved in writing."

The application proposes discharge of foul water into the public sewerage system, but no evidence has been provided to demonstrate that the existing public sewerage system has the capacity for the additional flows from the proposed development or that discharge into the public sewerage system has been agreed with the relevant sewerage undertaker.

Condition 5 of the relevant planning permission states that, "No construction work shall be commenced until full details of the proposed arrangements for surface water drainage, both from the building itself and from the proposed driveway area, have been submitted to the local planning authority and approved in writing."

The surface water drainage arrangements proposed in this application fail to comply with policies CC/7, CC/8 and CC/9 of the South Cambridgeshire Local Plan 2018.

In particular, policy CC/9 states that development will only be permitted where the destination of surface water discharge obeys the following priority order: (1) infiltration to ground, (2) discharge to a body of water, (3) discharge to a surface water sewer.

No surface water drainage arrangements for the proposed driveway are shown on the submitted plans. It is unclear if it is intended that permeable pavement should be used to discharge the driveway surface water by infiltration. However, if this is the case, no evidence has been submitted to suggest that the site is suitable for infiltration. The minimum information required would typically include infiltration testing conducted according to BRE Digest 365 together with a site plan showing the locations where tests were conducted. If infiltration is suitable for the driveway area of the site, no explanation has been submitted as to why it is not being used to discharge the surface water from the building.

The surface water drainage consultation response published by the Council in regards to this application is wholly unreasonable as it fails to consider the relevant particulars of the development proposed, the applicable local and national development policies, and the basic principles of sustainable urban drainage system design.

The Council's unnamed surface water drainage engineer also comments on the surface water drainage arrangements proposed under this application (S/3215/19/DC) in the response for application S/3875/19/DC, stating that, "the dwelling towards the north [the bungalow to which application S/3215/19/DC pertains] appears to be too close to the watercourse to enable soakaways to be positioned 5m from the dwelling without impacting on the hedge and bank of the watercourse".

However, there are numerous locations within the application site greater than 5 metres from the foundations of buildings. Furthermore, the 5-metre rule is simply a rough rule of thumb that can be assumed to be safe for any building site on any type of soil. With a proper geotechnical assessment, it may be possible in many soils to install infiltration features and traditional soakaways much closer to foundations.[1]

Kind regards

Daniel Fulton
Director

[1] Woods Ballard, B, et al. *The SuDS Manual.* 2015. Construction Industry Research and Information Association.

Fews
Lane
Consortium
Ltd

The Elms
Fews Lane
Longstanton
Cambridge
CB24 3DP

13 July 2020

South Cambridgeshire District Council
South Cambridgeshire Hall
Cambourne Business Park
Cambourne
Cambridge CB23 6EA

Dear Sir/Madam

Re: Planning application S/3215/19/DC – The Retreat, Fews Lane, Longstanton, Cambridge CB24 3DP

(1) Planning application S/3215/19/DC seeks to discharge conditions 4 and 5 (foul and surface water drainage) of the planning permission issued for the erection of a 3-bedroom bungalow with parking at The Retreat, Fews Lane, Longstanton, Cambridge CB24 3DP pursuant to planning application S/2937/16/FL.

(2) Condition 4 (foul water drainage) states that:

> "No construction work shall be commenced until full details of the proposed arrangement for foul water drainage have been submitted to the local planning authority and approved in writing. The new dwelling shall not be occupied or brought into use until the foul water drainage system has been installed and made operational, in accordance with these approved details."

(3) Condition 5 (surface water drainage) states that:

> "No construction work shall be commenced until full details of the proposed arrangements for surface water drainage, both from the building itself and form the proposed driveway area, have been submitted to the local planning authority and approved in writing. The new dwelling shall not be occupied or brought into use until the surface water drainage system has been installed and made operational, in accordance with these approved details."

(4) The following three material considerations preclude the discharge of condition 5 (surface water drainage).

1) The scheme proposes an increase in the surface water discharged from the site into Longstanton Brook from the pre-development discharge volume, thereby increasing the flood risk of nearby properties. This is contrary to the stated reason for the condition, which is "to prevent flooding".

2) The scheme positions the outfall for the surface water drainage system outside the red line boundaries of the development site. An application to discharge a planning condition can not be used extend the boundaries of the land to which a planning permission relates.

3) The relevant policies of the development plan are a material consideration, and policies CC/8 and CC/9 of the Local Plan 2018 militate against the approval of the application.

Issue 1: Proposal would increase the risk of flooding elsewhere

(5) Planning conditions are to be interpreted in a common sense way, having regards to the underlying purpose for the condition as is demonstrated by the reasons stated for the imposition of the condition or conditions in question (*R (Sevenoaks District Council) v Secretary of State* [2004] EWHC 771 (Admin)).

(6) The Appeal Decision granting permission in regards to application reference S/2937/16/FL states that, "in particular, conditions relating to foul and surface water drainage are necessary, to prevent flooding".

(7) However, under the scheme submitted by the applicant, the risk of flooding to nearby properties would actually be increased because the runoff volume from the development to the nearby surface watercourse for nearly all rainfall events would exceed the runoff volume for the same event prior to redevelopment.

(8) The increase in surface water proposed to be discharged from the site would flow into Longstanton Brook, which has an extensive history of flooding.

(9) The relevant local and national planning policies indicate that development of brownfield sites should seek to reinstate greenfield runoff rates wherever possible and, in any case, that the post-development discharge rate should never exceed the rate of discharge from the development prior to redevelopment.

Issue 2: Application proposes work outside boundaries of land to which the planning permission relates

(10) The land proposed to be used for the outflow of the surface water drainage system falls outside the red line boundary on the location plan identifying the land to which the planning permission relates.

(11) No planning permission has been granted for any development to take place in, on, over, or under land outside of the boundaries of the application site.

(12) If the applicant wishes to extend the red line boundaries of the application site to include the land proposed for the surface water outflow, an application must be submitted under section 73 of the 1990 Act.

(13) The Council can not use an application to discharge a planning condition to effect the same result that would properly be effected through an application submitted under section 73 of the 1990 Act.

Issue 3: Application does not accord with relevant policies of the development plan

(14) Policy CC/8 of the Local Plan 2018 states that:

> "Development proposals will be required to demonstrate that […] surface water drainage schemes comply with *Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems* and the *Cambridgeshire Flood and Water Supplementary Planning Document* or successor documents."

(15) *Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems* states in paragraph S3 that:

"For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but **should never exceed the rate of discharge from the development prior to redevelopment** for that event."

(16) *Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems* states in paragraph S5 that:

"Where reasonably practicable, for developments which have been previously developed, 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 must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but **should never exceed the runoff volume from the development site prior to redevelopment** for that event."

(17) The *Cambridgeshire Flood and Water Supplementary Policy Document* states in paragraph 6.3.8 that:

"**Brownfield (previously developed land) sites must reduce the existing runoff from the site as part of the redevelopment.** Where possible, in order to provide betterment, redevelopments should look to reinstate greenfield runoff rates."

(18) Under the scheme submitted by the applicant, the peak runoff rate of discharge from the development to the nearby surface watercourse would exceed the peak runoff rate of discharge of the site prior to redevelopment, which is contrary to policy CC/8 of the Local Plan 2018, contrary to paragraph S3 of *Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems*, and contrary to paragraph 6.3.8 of the *Cambridgeshire Flood and Water Supplementary Policy Document*.

(19) Under the scheme submitted by the applicant, the runoff volume from the development to the nearby surface watercourse for the 1 in 100 year, 6 hour rainfall would exceed the runoff volume for the same event prior to redevelopment, which is contrary to policy CC/8 of the Local Plan 2018 and contrary to paragraph S5 of *Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems*.

(20) Policy CC/9 of the Local Plan 2018 states that:

"In order to minimise flood risk, development will only be permitted where: […] The destination of the discharge obeys the following priority order:

i. Firstly to the ground via infiltration
ii. Then, to a water body;
iii. Then, to a surface water sewer;
iv. Discharge to a foul water or combined sewer is unacceptable."

(21) The information submitted by the applicant indicates that opportunities to use infiltration to discharge the surface water collected from the impermeable areas of the proposed development have not been adequately explored.

(22) It is a material consideration that the applicant owns other land immediately adjoining the application site that could be used to discharge the collected surface water through infiltration. (See Section 72(1) of the Town and Country Planning Act 1990.)

(23) Policy CC/9 of the Local Plan 2018 states that, "In order to minimise flood risk, development will only be permitted where: […] there would be no increase to flood risk elsewhere".

(24) The increase in surface water proposed to be discharged from the site would flow in Longstanton Brook, which has an extensive history of flooding. This would be contrary to policy CC/9 of the Local Plan 2018.

(25) Policies CC/8 and CC/9 of the Local Plan 2018 clearly militate against the approval of the details submitted with this application.

(26) Pursuant to section 38(6) of the Planning and Compulsory Purchase Act 2004, "If regard is to be had to the development plan for the purpose of any determination to be made under the planning Acts the determination must be made in accordance with the plan unless material considerations indicate otherwise."

(27) The applicant has not advanced any argument for why this application should be approved contrary to the policies of the development plan.

(28) Accordingly, condition 5 (surface water drainage) should not be discharged at this time.

Kind regards

Daniel Fulton
Director

Fews
Lane
Consortium
Ltd

The Elms
Fews Lane
Longstanton
Cambridge
CB24 3DP

16 July 2020

South Cambridgeshire District Council
South Cambridgeshire Hall
Cambourne Business Park
Cambourne
Cambridge CB23 6EA

Dear Sir/Madam

Re: Planning application S/3215/19/DC – The Retreat, Fews Lane, Longstanton, Cambridge CB24 3DP

(1) The Fews Lane Consortium Ltd has received legal advice that residential gardens within built-up areas are classified as greenfield land for planning purposes, not brownfield land, as was implied in the Consortium's letter dated 13 July 2020.

(2) Whilst this does not change the substance of the Consortium's objections to the proposed development, it does mean that different paragraphs of *Sustainable Drainage Systems: Non statutory technical standards for sustainable drainage systems* and the *Cambridgeshire Flood and Water Supplementary Policy Document* should have been quoted in the Consortium's representations.

(3) Policy CC/8 of the Local Plan 2018 states that:

> "Development proposals will be required to demonstrate that [...] surface water drainage schemes comply with *Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems* and the *Cambridgeshire Flood and Water Supplementary Planning Document* or successor documents."

(4) *Sustainable Drainage Systems: Non statutory technical standards for sustainable drainage systems* states in paragraph S2 that:

> "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) *Sustainable Drainage Systems: Non statutory technical standards for sustainable drainage systems* states in paragraph S4 that:

> "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.**"

(6) The *Cambridgeshire Flood and Water Supplementary Policy Document* states in paragraph 6.3.6 that:

> "**All new developments on greenfield land are required to discharge the runoff from the impermeable areas at the same greenfield runoff rate, or less than,** if locally agreed with an appropriate authority or as detailed within the local planning policies of District and City Councils."

(7) Under the scheme submitted by the applicant, the peak runoff rate of discharge from the development to the nearby surface watercourse would exceed the greenfield runoff rate for the 1 in 1 year and 1 in 100 year rainfall events, which is contrary to policy CC/8 of the Local Plan 2018, contrary to paragraph S2 of *Sustainable Drainage Systems: Non statutory technical standards for sustainable drainage systems*, and contrary to paragraph 6.3.6 of the *Cambridgeshire Flood and Water Supplementary Policy Document*.

(8) Under the scheme submitted by the applicant, the runoff volume from the development for the 1 in 100 year, 6 hour rainfall event would exceed the greenfield runoff volume for that event, which is contrary to policy CC/8 of the Local Plan 2018 and contrary to paragraph S4 of *Sustainable Drainage Systems: Non statutory technical standards for sustainable drainage systems*.

(9) Policy CC/9 of the Local Plan 2018 states that:

> "In order to minimise flood risk, development will only be permitted where: [...] The destination of the discharge obeys the following priority order:
>
> i. Firstly to the ground via infiltration
> ii. Then, to a water body;
> iii. Then, to a surface water sewer;
> iv. Discharge to a foul water or combined sewer is unacceptable."

(10) The information submitted by the applicant indicates that opportunities to use infiltration to discharge the surface water collected from the impermeable areas of the proposed development have not been adequately explored.

(11) It is a material consideration that the applicant owns other land immediately adjoining the application site that could be used to discharge the collected surface water through infiltration. (See Section 72(1) of the Town and Country Planning Act 1990.)

(12) Policy CC/9 of the Local Plan 2018 states that, "In order to minimise flood risk, development will only be permitted where: [...] there would be no increase to flood risk elsewhere".

(13) The increase in surface water proposed to be discharged from the site would flow in Longstanton Brook, which has an extensive history of flooding. This would be contrary to policy CC/9 of the Local Plan 2018.

(14) Policies CC/8 and CC/9 of the Local Plan 2018 clearly militate against the approval of the details submitted with this application.

(15) Pursuant to section 38(6) of the Planning and Compulsory Purchase Act 2004, "If regard is to be had to the development plan for the purpose of any determination to be made under the planning Acts the determination must be made in accordance with the plan unless material considerations indicate otherwise."

(16) The applicant has not advanced any argument for why this application should be approved contrary to the policies of the development plan.

(17) Accordingly, condition 5 (surface water drainage) should not be discharged at this time.

Kind regards

[redacted]
Director

Knowles, Stephanie

Subject: Consultee Comments for Planning Application S/3215/19/DC

From: Planning <planning@greatercambridgeplanning.org>
Sent: 11 August 2020 12:06
To: Emma Ousbey <emma.ousbey@greatercambridgeplanning.org>
Subject: Consultee Comments for Planning Application S/3215/19/DC

A consultee has commented on a Planning Application. A summary of the comments is provided below.

Comments were submitted at 12:05 PM on 11 Aug 2020 from Ms Libby White (clerk@longstanton-pc.gov.uk) on behalf of Parish - Longstanton.

Application Summary

Reference:	S/3215/19/DC
Address:	The Retreat Fews Lane Longstanton Cambridge Cambridgeshire CB24 3DP
Proposal:	Discharge of conditions 4 (Foul Water Drainage) and 5 (Surface Water Drainage) of planning permission S/2937/16/FL
Case Officer:	Emma Ousbey

Click for further information

Comments Details

Comments:	Following a meeting of Longstanton Parish Council on Monday 10th August, Longstanton Parish Council continue to object to this application as it continues to propose discharge the surface water drainage directly into the village watercourse which is in contravention of policies CC8 and CC9 of the South Cambridgeshire Local Plan 2018.

Fews
Lane
Consortium
Ltd

The Elms
Fews Lane
Longstanton
Cambridge
CB24 3DP

13 August 2020

South Cambridgeshire District Council
South Cambridgeshire Hall
Cambourne Business Park
Cambourne
Cambridge CB23 6EA

Dear Sir/Madam

Re: Planning application S/3215/19/DC – The Retreat, Fews Lane, Longstanton, Cambridge CB24 3DP

The use of Sustainable Drainage Systems ("SuDS") and the ability to integrate appropriate SuDS features into any development should be considered from the earliest phases of site selection and design. When considered at the appropriate time early in the design process, even the smallest sites can effectively integrate SuDS features, which can provide benefits in terms of reduced flood risks and provide positive contributions in terms of landscaping, residential amenity, and opportunities to enhance biodiversity.

In the case of this development, no consideration was given to the issues of surface water drainage at the design phase, and as a result, the applicant has proposed to discharge the collected surface water into the village's watercourses.

The proposed rate of attenuation of discharge is insufficient and would result in an increased volume and rate of surface water discharge from the site, which would increase the risk of flooding elsewhere. This outcome is contrary to the inspector's stated reason for imposing the surface water condition, which was to prevent flooding.

The applicant has failed to consider any of the numerous options to discharge the collected surface water through infiltration.

The details submitted by the applicant are also, by objective measures, contrary to policies CC/8 and CC/9 of the development plan.

Having failed to consider appropriate SuDS solutions at the design phase, the applicant can not now reasonably expect the Council to approve details that are contrary to the relevant policies of the development plan and that would increase the risk of flooding. This application should therefore be refused by the Council.

Kind regards

Daniel Fulton
Director

Appendix B Drainage Drawings

DRAINAGE

RAIN WATER

Connect new downpipes from dwellings to 100mm drains taken to soakaways positioned as shown on engineering site plan [Sited min. 5m from buildings]. See engineering site plan for details.

FOUL WATER

New 100mm dia. foul drainage system to be installed, connecting new dwellings to existing foul drain withIn Few's Lane. Note that capped lateral drain exists at site entrance to Plot 3.

New chambers [Max depth 900mm] to be of 450mm GRP Circular pre-formed type set on suitable concrete base. Frames to be Cast metal type with matching frames [No light-duty pressed steel type to be used]

All 100mm drains to be laid to suitable falls as stated on accompanying engineering drawings, installed in accordance with manuf. instructions

PLANTING

HEDGING TO FRONTAGE OF PLOTS 4 & 5

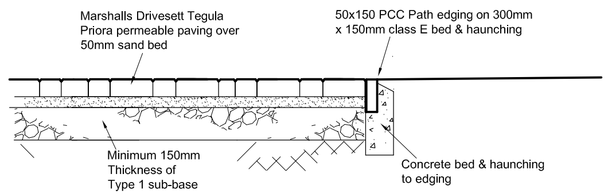
33% each mix of Hawtorn, Blackthorn and Dogwood, min 3 plants/meter planted in two staggered rows.

GROUNDCOVER PLANTING TO FRONTAGE AND REAR CORNER OF PLOT 4

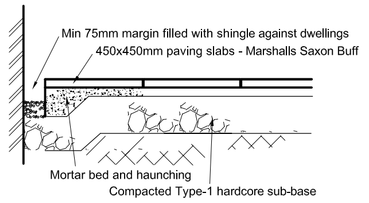
25% each mix of Hypericum Hidecote, Berberis Aggregata, Cotoneaster Monogyna and Forsythia, planted in groups at 500-600mm centres, all to be container -grown in 2-3 ltr pots.

All other un-surfaced areas to be turfed

PAVED PARKING AREA CONSTRUCTION 1:20

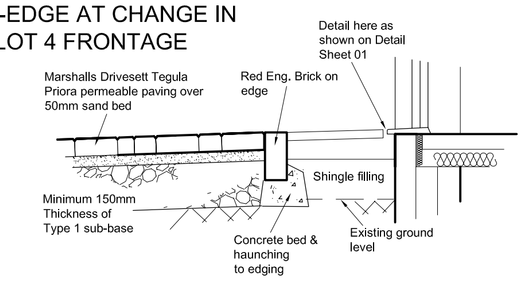


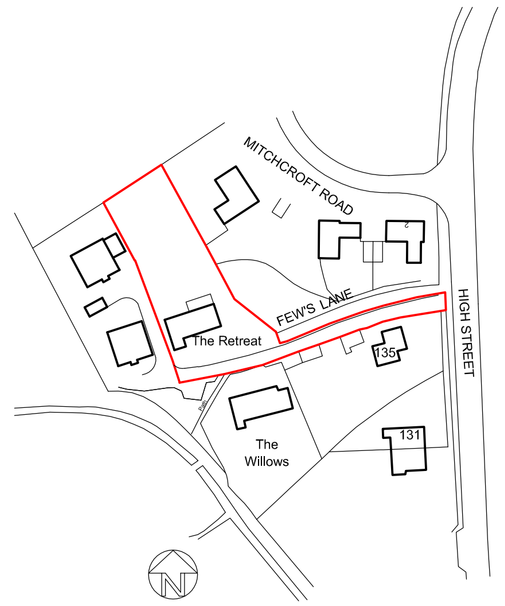
CONCRETE PAVING SLAB PATHS & PATIO AREAS



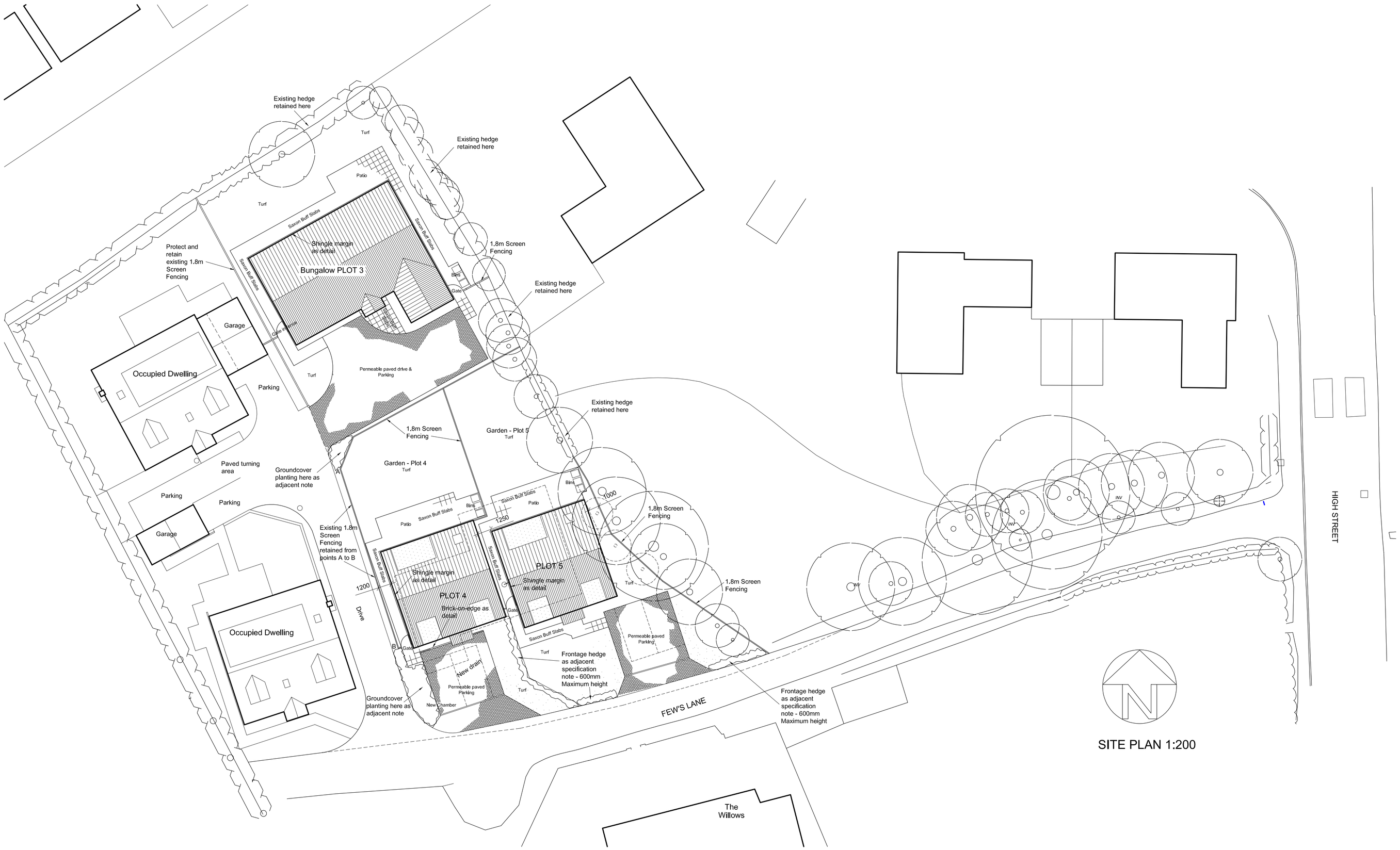
Note: Allow to provide brick edging placed on concrete bedding under sides of slabbed path where front access path rises to provide level access at front entrance door

BRICK-ON-EDGE AT CHANGE IN LEVEL - PLOT 4 FRONTAGE





Location Plan 1:1250



SITE PLAN 1:200

Read drawing in conjunction with Structural Engineers Details shown on drawings Ref: 19/0321

Rev.	Date	Int.	Amendment
.	.	.	.

SIMON WARD ARCHITECTURAL DESIGN
22 THE QUADRANT, ST. IVES,
CAMBRIDGESHIRE PE27 5PE
TEL: 01480 301018.

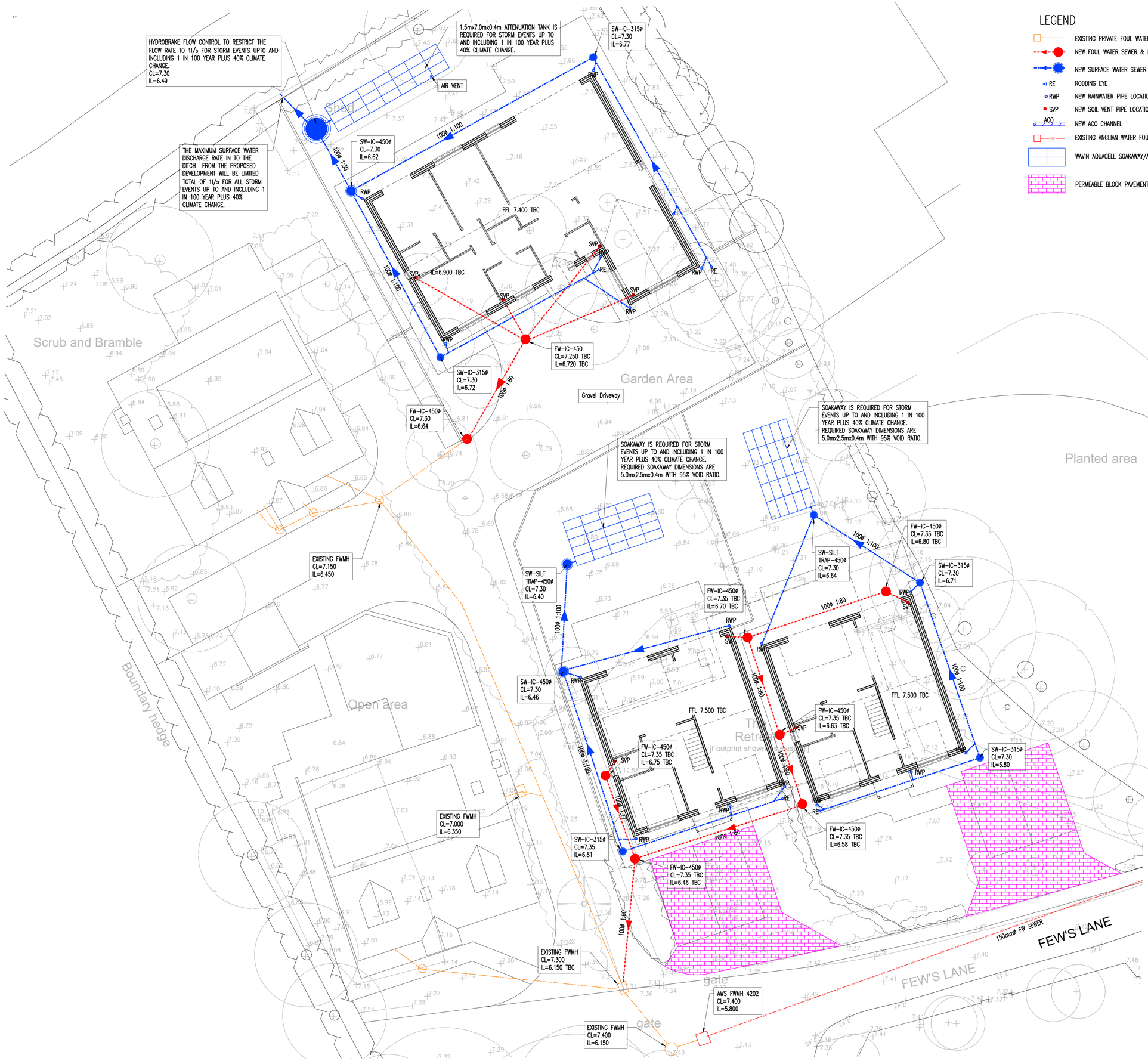
SIMON WARD
ARCHITECTURAL DESIGN
Wardraw@btconnect.com

LANDBROOK HOMES

3 DWELLINGS, THE RETREAT
FEW'S LANE, LONGSTANTON

Site Plan

Drawn by: SRW	Date: Aug' 19
Scale: As Shown [A1 Sheet]	File No.
Drg. No.: FLL - 345 - Site 01	Rev.



LEGEND

- EXISTING PRIVATE FOUL WATER DRAINAGE
- NEW FOUL WATER SEWER & MANHOLE
- NEW SURFACE WATER SEWER & MANHOLE
- RE RODDING EYE
- RWP NEW RAINWATER PIPE LOCATIONS
- SVP NEW SOIL VENT PIPE LOCATIONS
- ACO NEW ACO CHANNEL
- EXISTING ANGLIAN WATER FOUL WATER SEWER
- WAVIN AQUACELL SOAKAWAY/ATTENUATION TANK
- PERMEABLE BLOCK PAVEMENT

GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.

2. ANY GRID LINES, BUILDING LINES, ETC. ARE TO BE SET OUT IN ACCORDANCE WITH THE RELEVANT ARCHITECT'S PLAN.

3. DIMENSIONS ARE NOT TO BE SCALED FROM THIS DRAWING, EITHER MANUALLY OR ELECTRONICALLY.

4. DIMENSIONS MARKED * ARE SUBJECT TO CONFIRMATION BY SITE MEASUREMENT BEFORE CONSTRUCTION COMMENCES.

5. ANY DIMENSIONAL DISCREPANCIES ON THIS DRAWING ARE TO BE REFERRED TO THE ENGINEER BEFORE THE AFFECTED WORK PROCEEDS.

DRAINAGE NOTES

1. ALL DRAINAGE CONSTRUCTION, MATERIALS AND WORKMANSHIP SHALL COMPLY WITH BUILDING REGULATIONS PART "H", BSEN 752, AND NHBC STANDARDS. ALL DRAINAGE PRODUCTS TO BE CE MARKED.

2. LOCATIONS OF ALL FW AND SW OUTLETS FROM BUILDINGS ARE TO BE CHECKED AGAINST THE ARCHITECTS DRAWINGS TO ENSURE COMPATIBILITY PRIOR TO THE SITE WORKS COMMENCING.

3. CONTRACTOR TO SCAN FOR AND EXPOSE ALL EXISTING UNDERGROUND SERVICES (GAS, WATER, ELECTRICITY, COMMUNICATIONS ETC.) PRIOR TO ANY EXCAVATION WORKS.

4. THE CONTRACTOR IS TO EXPOSE AND VERIFY THE EXISTING PIPE SIZES AND LEVELS AND CONFIRM TO THE ENGINEER ANY DISCREPANCIES PRIOR TO COMMENCEMENT OF WORKS.

5. COVER LEVELS SHOWN ARE APPROXIMATE ONLY AND SHALL TIE INTO PROPOSED FINISHED SURFACE LEVELS.

6. PIPEWORK TO BE U-PVC TO BSEN 1401-1 OR CLAYWARE TO BSEN 295-1, FLEXIBLY JOINTED BY HEPWORTH OR EQUAL.

7. FW PIPEWORK TO BE LAID AT MINIMUM 1:60 GRADIENTS. SW PIPEWORK TO BE LAID AT MINIMUM 1:80 GRADIENTS UNLESS SHOWN OTHERWISE

8. ALL PIPEWORK IS TO BE 110mm DIA. UNLESS NOTED OTHERWISE

9. INSPECTION CHAMBERS NOTED ARE TO BE HEPWORTH POLYPROPYLENE INSPECTION CHAMBERS (PPIC), 300mm DIAMETER UP TO 600mm DP OR 475mm DIAMETER UP TO 1200mm DP INSTALLED WITH 150mm CONCRETE BED AND SURROUND TO MANUFACTURERS RECOMMENDATIONS. CHAMBERS TO HAVE ROUND, LOCKABLE DUCTILE IRON COVER AND FRAME TO SUIT LOADINGS.

10. MANHOLES TO BE PRECAST CONCRETE SECTIONS TO BS5911-1 AND BSEN 1916 INSTALLED ON 225mm THICK CONCRETE BASE WITH 150mm CONCRETE SURROUND. CONCRETE JOINTS TO BE SEALED WITH BUTYL RESIN SEALANT. STEP IRONS TO BE PROVIDED WHERE DEPTH IS GREATER THAN 1200mm. PRECAST CONCRETE COVER SLAB TO PROVIDE CLEAR OPENING FOR ACCESS COVER. INVERTS FORMED WITH CHANNEL PIPES. BENCHING TO SLOP 1:12 WITH A 20mm THK. HIGH STRENGTH CONCRETE TOPPING.

11. ROCKER PIPES (600mm LONG) TO BE PROVIDED AS CLOSE AS PRACTICABLE TO ALL CHAMBERS/MANHOLES AND FOUNDATIONS/WALLS.

12. LOADING GRADES FOR COVERS TO BSEN 124 TO BE A15 (PEDESTRIAN USE ONLY) B125 (LIGHT TRAFFIC USE) AND C250 (HEAVY TRAFFIC USE).

13. PIPEWORK BEDDING IN LANDSCAPE AREAS WHERE COVER IS LESS THAN 600mm AND IN TRAFFICKED AREAS WHERE COVER IS LESS THAN 900mm TO BE 150mm CONCRETE BED AND SURROUND OF GEN1 CONCRETE. PIPEWORK BEDDING IN LANDSCAPE AREAS WHERE COVER IS MORE THAN 600mm AND IN TRAFFICKED AREAS WHERE COVER IS MORE THAN 900mm TO BE 100mm GRANULAR BED AND SURROUND OF NOMINAL 10mm SIZE PEA GRAVEL.

14. WHERE PIPES PASS THROUGH STRUCTURES A FLEXIBLE JOINT SHALL BE PROVIDED WITHIN 150mm OF THE STRUCTURE EDGE WITH A SHORT ROCKER PIPE INSTALLED THEREAFTER. THE PIPE PENETRATION SHALL BE FORMED USING OVERSIZED PVC DUCTING WITH UNCOMPRESSED INSULATION MATERIAL PACKING THE VOID.

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Rev	Date	Description
P9	27/07/20	ISSUED FOR APPROVAL
P8	11/06/20	ISSUED FOR APPROVAL
P7	01/05/20	ISSUED FOR APPROVAL
P6	09/04/20	ISSUED FOR APPROVAL
P5	08/04/20	ISSUED FOR APPROVAL
P4	28/11/19	ISSUED FOR APPROVAL
P3	13/09/19	ISSUED FOR COMMENT
P1	30/08/19	ISSUED FOR COMMENT

STATUS **PRELIMINARY**

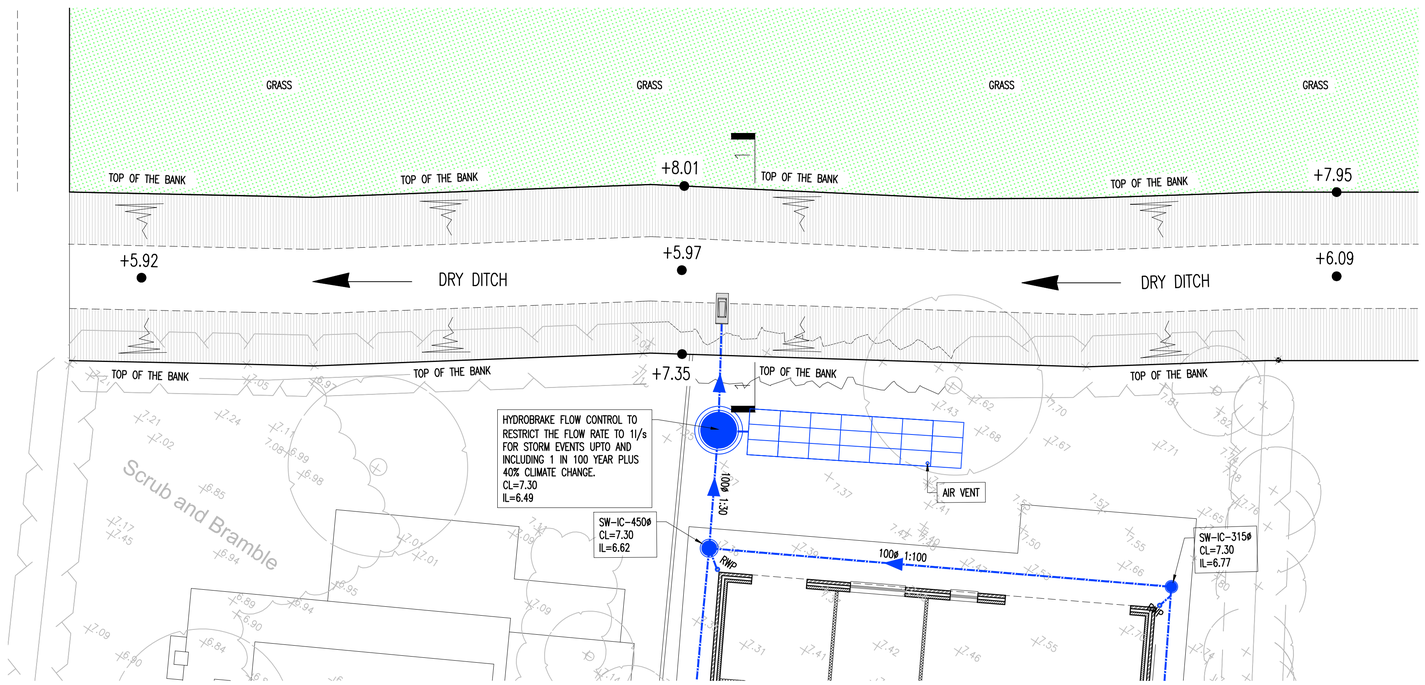
AFP ANDREW FIREBRACE PARTNERSHIP
STRUCTURAL & CIVIL ENGINEERING CONSULTANTS
Stable Barn, Park End, Swaffham Bulbeck, Cambridge CB25 0NA. Tel: 01223 811572 Fax: 01223 812719
E-mail: info@afpconsult.co.uk

CLIENT

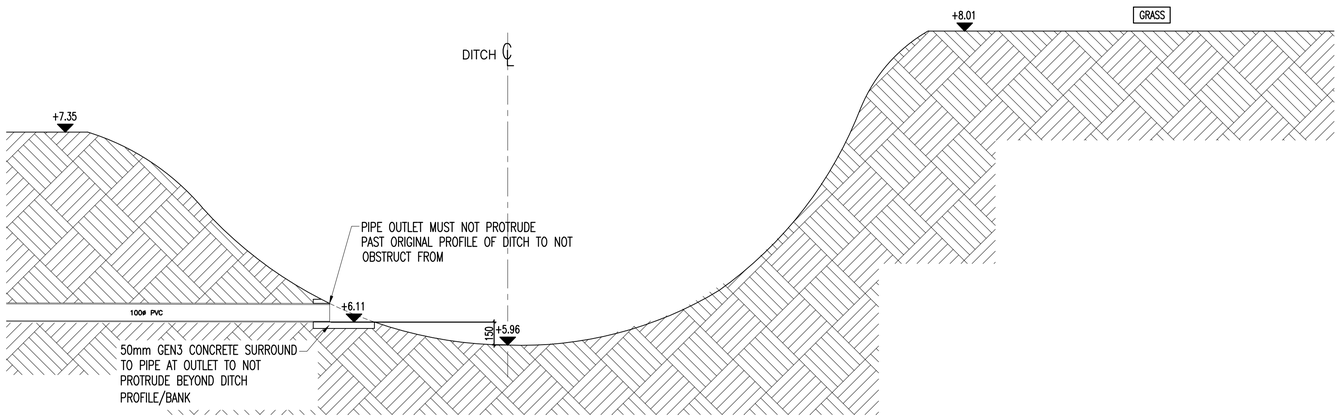
PROJECT FEWS LANE, LONGSTANTON

TITLE DRAINAGE LAYOUT

DRAWN CV	CHECKED MO	DRG No. 19/0321/100	REV P9
SCALES 1:100@A1	DATE AUG 2019		
Andrew Firebrace Partnership Limited	ACAD FILE No. 19.0321.100 P9.DWG		©copyright



DITCH PLAN
(SCALE 1:100)



SECTION 1
(SCALE 1:20)

GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.

2. ANY GRID LINES, BUILDING LINES, ETC. ARE TO BE SET OUT IN ACCORDANCE WITH THE RELEVANT ARCHITECT'S PLAN.

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4. DIMENSIONS MARKED * ARE SUBJECT TO CONFIRMATION BY SITE MEASUREMENT BEFORE CONSTRUCTION COMMENCES.

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Rev	Date	Description
P3	30/07/20	ISSUED FOR APPROVAL
P2	11/06/20	ISSUED FOR APPROVAL
P1	17/10/19	ISSUED FOR APPROVAL

STATUS **PRELIMINARY**

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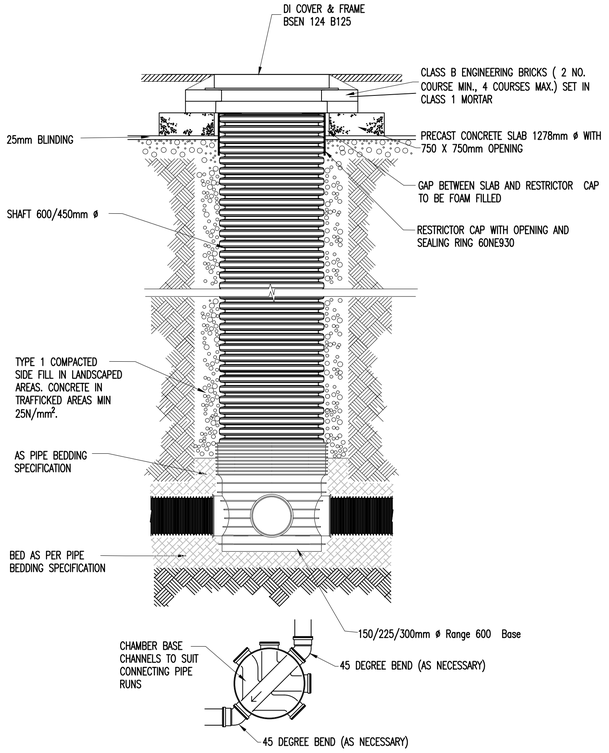
E-mail: info@afpconsult.co.uk

CLIENT

PROJECT FEWS LANE, LONGSTANTON

TITLE DITCH PLAN AND SECTION 1

DRAWN CV	CHECKED MO	DRG No. 19/0321/101	REV P3
SCALES 1:100@A1	DATE AUG 2019		
Andrew Firebrace Partnership Limited	ACAD FILE No. 19.0321.100 P9.DWG		



TYPICAL DETAIL OF WAVIN RANGE 450/600 INSPECTION CHAMBERS FOR DEPTHS UPTO 3.0m

Dia (mm)	Bd (m)	GRANULAR MATERIAL TO NOMINAL SINGLE SIZED AS FOLLOWS.
100	0.5	100 DIA. 10mm
150	0.6	150 DIA. 10mm/ 14mm.
225	0.7	200 DIA.
300	0.85	& ABOVE 10mm/ 14mm/ 20mm.
375	1.05	
450	1.15	
525	1.20	
600	1.35	
1050	1.80	

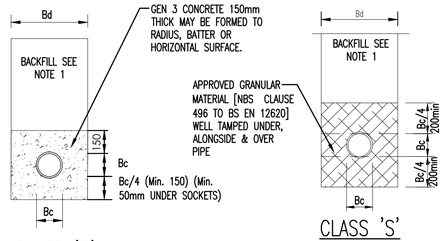
NOTE 1
Bd. = TRENCH WIDTH AT CROWN OF PIPE – (NARROW TRENCH WIDTH CONDITIONS)
Bc = OUTSIDE DIAMETER OF PIPE

CLASS 'Z' & CLASS 'S' FOR PIPE DIAMETERS 100 TO 525. GENERAL CASE CLASS 'S'. CLASS 'Z' FOR USE WHERE CROWN OF PIPE IS WITHIN 0.9m OF U/S OF PAVING IN TRAFFICKED AREAS AND 0.6m IN NON TRAFFICKED AREAS.

1. BACK FILL TO TRENCHES TO BE SELECTED GRANULAR MATERIAL. MAX. PARTICLE SIZE NOT EXCEEDING 75mm, AND NOT MORE THAN 10% PASSING 75mm SIEVE. MATERIAL SHALL NOT CONTAIN ANY CLAY LUMPS OR ANY OTHER FOREIGN MATTER.

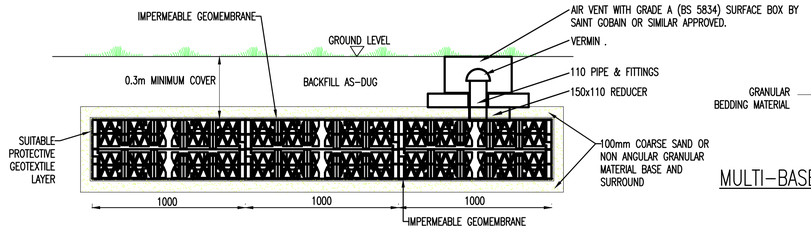
2. PIPES TO BE VITRIFIED CLAY TO BSEN 295 OR PVC–U TO BSEN 1404–1:1998 TO CONTRACTOR CHOICE

EXTERNAL PIPE BEDDING DETAILS



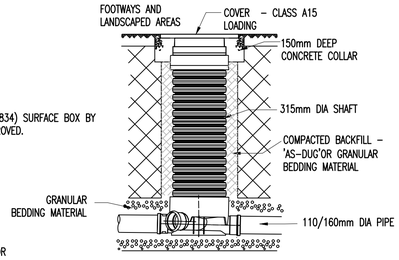
CLASS 'Z'
(SCALE 1:20)

CLASS 'S'
(SCALE 1:20)

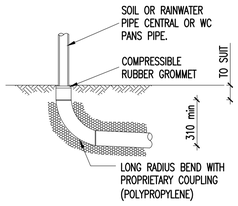


AQUACELL ECO SURFACE WATER ATTENUATION TANK DETAILS
(NON–TRAFFICKED)

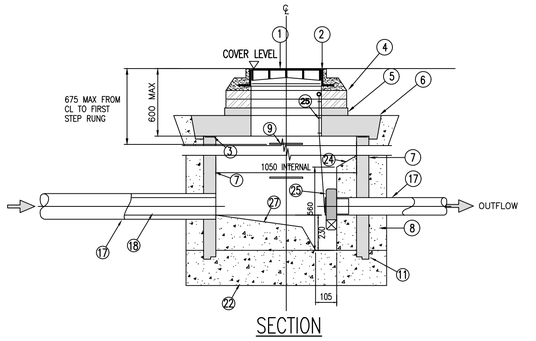
TYPICAL INSTALLATION NOTES :
1. EXCAVATE THE TRENCH TO THE REQUIRED DEPTH ENSURING THAT THE PLAN AREA IS SLIGHTLY GREATER THAN THAT OF THE AQUACELL UNITS.
2. LAY 100MM BED OF COARSE SAND, LEVEL AND COMPACT.
3. LAY THE GEOTEXTILE OVER THE BASE AND UP THE SIDES OF THE TRENCH.
4. LAY THE GEOMEMBRANE ON TOP OF THE GEOTEXTILE OVER THE BASE AND UP THE SIDES OF THE TRENCH.
5. LAY THE AQUACELL UNITS PARALLEL WITH EACH OTHER. IN MULTIPLE LAYER APPLICATIONS, WHEREVER POSSIBLE, CONTINUOUS VERTICAL JOINTS SHOULD BE
6. AVOIDED. AQUACELL UNITS CAN BE LAID IN A 'BRICK BONDED' FORMATION (I.E. TO OVERLAP THE JOINTS BELOW). FOR SINGLE LAYER APPLICATIONS USE THE
7. AQUACELL CLIPS AND FOR MULTI LAYERS USE THE AQUACELL CLIPS AND THE AQUACELL SHEAR CONNECTORS (VERTICAL RODS).
8. WRAP THE GEOMEMBRANE AROUND THE AQUACELL STRUCTURE AND SEAL TO MANUFACTURERS RECOMMENDATIONS.*
9. IF SIDE CONNECTIONS INTO THE AQUACELL UNITS IS REQUIRED, (OTHER THAN THE PREFORMED SOCKET), USE THE APPROPRIATE FLANGE ADAPTOR (6LB104
10. OR 6LB106). FIX THE FLANGE ADAPTOR TO THE UNIT USING SELF–TAPPING SCREWS. DRILL A HOLE THROUGH THE FLANGE ADAPTOR AND CONNECT THE
11. PIPEWORK. (6LB106 SHOULD NOT BE USED WITH AQUACELL ECO).
12. IN ORDER TO PREVENT SILT FROM ENTERING THE TANK, CLOGGING INLET PIPEWORK AND REDUCING STORAGE CAPACITY, IT IS RECOMMENDED THAT THE DOMESTIC
13. SILT TRAP (6LB300) OR THE STANDARD SILT TRAP (6LB600) IS INSTALLED PRIOR TO THE INLET PIPEWORK.
14. WRAP AND OVERLAP THE GEOTEXTILE COVERING THE ENTIRE AQUACELL STRUCTURE, TO PROTECT THE GEOMEMBRANE.
15. LAY 100MM OF COARSE SAND BETWEEN THE TRENCH WALLS AND THE AQUACELL UNITS AND COMPACT.
16. LAY 100MM BED OF COARSE SAND OVER THE GEOTEXTILE AND COMPACT. BACKFILL WITH SUITABLE MATERIAL.
17. NB: A STORAGE TANK MUST BE VENTED, AND IT IS RECOMMENDED THAT ONE VENT PIPE, 110MM IN DIAMETER IS PROVIDED PER 7,500 SQUARE METRES OF IMPERMEABLE CATCHMENT AREA ON A SITE, SEE GUIDANCE NOTE 3 FOR DESIGN.



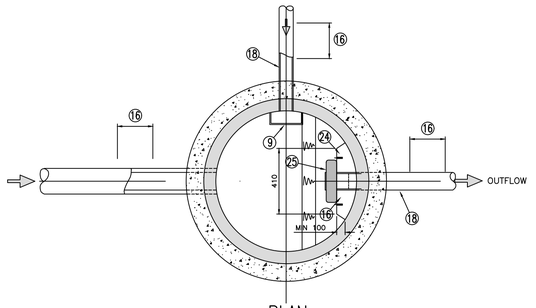
MULTI–BASE INSPECTION CHAMBERS 315mm FOR DEPTHS UP TO 0.6m



TYPICAL CONNECTION TO SOIL OR RAINWATER PIPES (uPVC)



SECTION



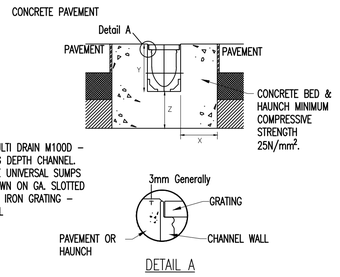
PLAN

TYPE 2 MANHOLE – VORTEX FLOW CONTROL (HYROBRAKE) CHAMBER
(NOT TO SCALE)

KEY
1. ACCESS COVER B125.
2. COVER FRAME BEDDED ON AND HAUNCHED IN CLASS M1, M2 OR EPOXY MORTAR NO GREATER THAN 20mm THICK. APPROVED PACKING MATERIAL MAY BE USED IF REQUIRED.
3. 10mm UNCOMPRESSED THICKNESS OF 'TOKSTIP' OR SIMILAR APPROVED COMPRESSIBLE SEALENT TO ALL HORIZONTAL JOINTS.
4. TYPE 2 COVER FRAME SEATING RINGS 600X600 CENTRAL ACCESS OPENING OR MIN TWO COURSES OF ENGINEERING BRICK.
5. TYPE 1 COVER FRAME SEATING RING WITH 600X600 ECCENTRIC OPENING (BS752–3) BEDDED ON MORTAR.
6. REINFORCED PRECAST CONCRETE (SULPHATE RESISTING) HEAVY DUTY COVER SLAB TO BS5911; PART200 WITH 750X800 ACCESS OPENING, BEDDED ON MORTAR.
7. PRECAST CONCRETE (SULPHATE RESISTING) CHAMBER RINGS TO BS 5911:PART 200.
8. MIX ST4 SULPHATE RESISTING CONCRETE SURROUND MIN 150 THICK.
9. POLYPROPYLENE ENCAPSULATED DOUBLE STEP RUNGS TO BS1247 PARTS 1& 2. MIN WIDTH 280mm AT 250mm CTRS.
10. GRAND CONCRETE BENCHING (MIN 200mm THICK) TO BE BROUGHT UP TO DENSE SMOOTH FACE NEATLY SHAPED AND FINISHED TO ALL BRANCH CONNECTIONS. BENCHING SLOPE TO BE 1 IN 10 AND 1 IN 30.
11. BOTTOM CHAMBER SECTION TO BE BUILT INTO BASE CONCRETE MIN 750mm.
12. CONSTRUCTION JOINT.
13. INVERT WITHIN THE CHAMBER TO BE FORMED USING A CHANNEL PIPE.
14. MIX ST4 CONCRETE.
15. DISTANCE BETWEEN TOP OF PIPE AND UNDERSIDE OF PRECAST CHAMBER TO BE 100.
16.

PIPE DIA	ROCKER PIPE LENGTH
150–600	600
875–750	1000
825+	1250

17. ALL PIPES ENTERING OR LEAVING MANHOLES SHALL HAVE FLEXIBLE JOINT WITHIN 600mm OF THE INSIDE FACE OF THE MANHOLE.
18. SHORT LENGTH PIPE TO BE SIMILAR LENGTH TO ROCKER PIPE.
19. PIPE JOINT WITHIN THE CHANNEL TO BE LOCATED MIN 100mm FROM INSIDE FACE OF CHAMBER.
20. TOE HOLES TO BE PROVIDED IN BENCHING OF SEWER GREATER THAN 450mmø FOR ACCESS TO INVERT.
21. 150 MIN STANDARD CONCRETE MIX 'ST2' SURROUND TO SUMP AND TO 150MIN ABOVE OUTGOING PIPE INVERT. ALTERNATIVELY, 150 MIN STANDARD CONCRETE MIX ST2' CAST INSITU SUMP IN LIEU OF PRECAST CONCRETE CHAMBER RINGS.
22. 225 MIN INSITU CONCRETE BASE SLAB (STANDARD MIX ST4').
23. INLETS AND OUTLETS THOROUGHLY PACKED AND SEALED WITH MORTAR AROUND PIPES.
24. 'HYDROBRAKE' FIXED TO CONCRETE MOUNTING BLOCK WITH MASONRY STUD ANCHOR FIXING BOLTS.
25. 'HYDROBRAKE FLOW CONTROL FITTED WITH PIVOTING BY–PASS DOOR. HYDRO–BRAKE® UNIT OPTIMUM REFERENCE MD–SHE–0054–1000–0500–1000 DESIGN HEAD (M) 0.500, DIAMETER (MM) 51, DESIGN FLOW (L/S) 1.0, INVERT LEVEL (M) 6.490. MANUFACTURED BY HYDRO INTERNATIONAL.
26. PIVOTING BY–PASS DOOR OPERATING STEEL ROPE WITH PULL HANDLE FIXED JUST UNDER ACCESS COVER FOR MANUAL OPERATING AT GROUND LEVEL.
27. CONCRETE BENCHING.



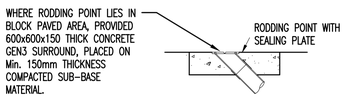
DETAIL A

MINIMUM DIMENSIONS OF CONCRETE SURROUND

LOAD CLASS		A15	B125	C250	D400*
MINIMUM DIMENSIONS (mm)	X	100	150	150	200
	Y	Full Channel Height (Less Y2 where necessary)			
	Z	100	150	150	200
MAXIMUM DIMENSIONS (mm)	Y_2†	35	35	35	35
	Y_3	100	60	60	60

*e.g. parking areas for all types of road vehicle.
Not suitable for carriageway of roads or industrial areas.
†Note dashed line printed on edge rails 35mm below top.

ACO CHANNEL DRAINAGE



RODDING POINT

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DRAINAGE NOTES

1. ALL DRAINAGE CONSTRUCTION, MATERIALS AND WORKMANSHIP SHALL COMPLY WITH BUILDING REGULATIONS PART 'H', BSEN 752, AND NHBC STANDARDS. ALL DRAINAGE PRODUCTS TO BE CE MARKED.

2. LOCATIONS OF ALL FW AND SW OUTLETS FROM BUILDINGS ARE TO BE CHECKED AGAINST THE ARCHITECTS DRAWINGS TO ENSURE COMPATIBILITY PRIOR TO THE SITE WORKS COMMENCING.

3. CONTRACTOR TO SCAN FOR AND EXPOSE ALL EXISTING UNDERGROUND SERVICES (GAS, WATER, ELECTRICITY, COMMUNICATIONS ETC.) PRIOR TO ANY EXCAVATION WORKS.

4. THE CONTRACTOR IS TO EXPOSE AND VERIFY THE EXISTING PIPE SIZES AND LEVELS AND CONFIRM TO THE ENGINEER ANY DISCREPANCIES PRIOR TO COMMENCEMENT OF WORKS.

5. COVER LEVELS SHOWN ARE APPROXIMATE ONLY AND SHALL TIE INTO PROPOSED FINISHED SURFACE LEVELS.

6. PIPEWORK TO BE U–PVC TO BSEN 1401–1 OR CLAYWARE TO BSEN 295–1, FLEXIBLY JOINTED BY HEPWORTH OR EQUAL.

7. FW PIPEWORK TO BE LAID AT MINIMUM 1:60 GRADIENTS. SW PIPEWORK TO BE LAID AT MINIMUM 1:80 GRADIENTS UNLESS SHOWN OTHERWISE

8. ALL PIPEWORK IS TO BE 110mm DIA. UNLESS NOTED OTHERWISE

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P2	27/07/20	ISSUED FOR COMMENT
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STATUS **PRELIMINARY**

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E-mail: info@afpconsult.co.uk

CLIENT

PROJECT FEWS LANE, LONGSTANTON

TITLE BELOW GROUND CONSTRUCTION DETAILS

DRAWN CV	CHECKED MO	DRG No. 19/0321/110	REV P2
SCALES 1:100@A1	DATE AUG 2019		
Andrew Firebrace Partnership Limited	ACAD FILE No. 19.0321.100 P2.DWG		©copyright

Appendix C Geotechnical Report and Infiltration Test Report

OAKLEY SOILS AND CONCRETE ENGINEERING LTD

REDE HALL FARM, REDE, BURY ST EDMUNDS, SUFFOLK, IP29 4UG

Tel: 01284 850555 Fax: 01284 850345 email: oakley@soils.fsnet.co.uk

FACTUAL DATA REPORT

JOB NO: AAA/79

GROUND INVESTIGATION: PROPOSED DEVELOPMENT

'THE RETREAT'

FEWS LANE

LONGSTANTON

CAMBRIDGESHIRE

CB24 3DP

JANUARY 2016

Contents

Client
Mr Gerry Caddoo
Landbrook Homes
The Retreat
Fews Lane
Longstanton
Cambridgeshire
CB24 3DP

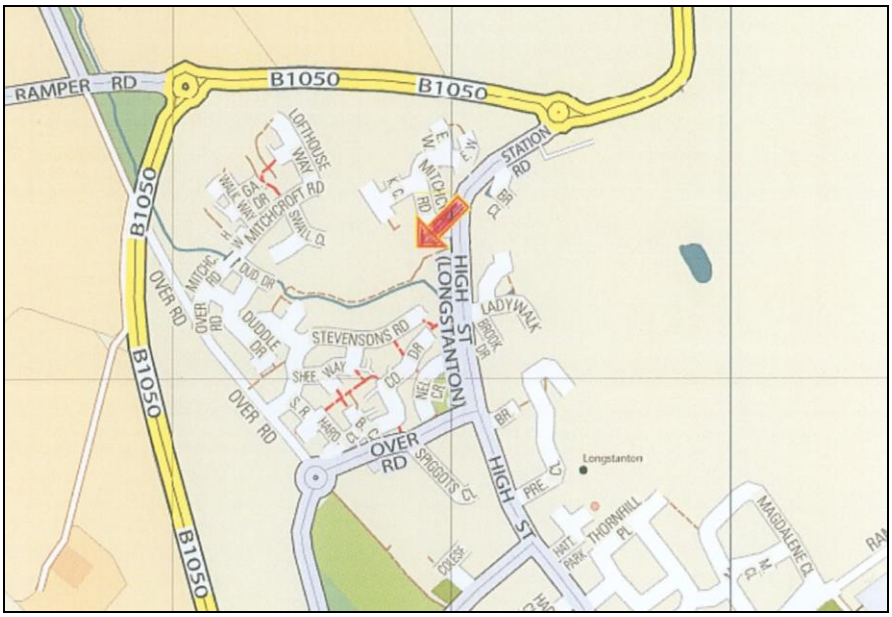
Consulting Engineers
Andrew Firebrace Partnership Ltd
Stable Barn
Park End
Swaffham Bulbeck
Cambridge
CB5 0NA

OAKLEY SOILS AND CONCRETE ENGINEERING LTD

SITE: 'THE RETREAT', FEWS LANE, LONGSTANTON, CAMBRIDGE, CB24 3DP

JOB NO: AAA/79

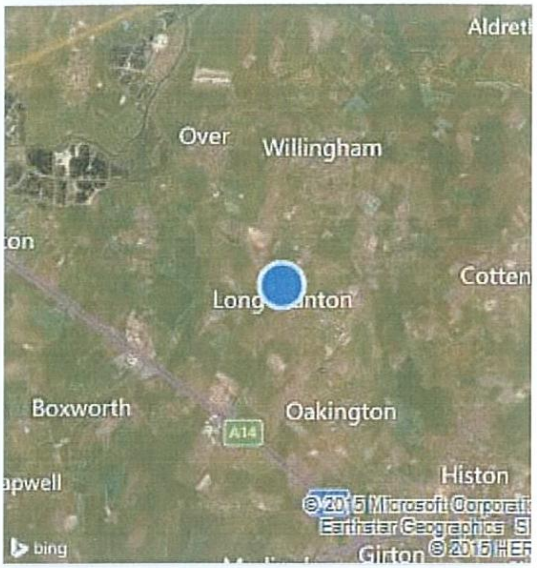
SITE LOCATION



bing Maps

CB24 3DP, Longstanton, Cambridgeshire

Proposed development:
'The Retreat'
Fews Lane
Longstanton
CB24 3DP



OAKLEY SOILS AND CONCRETE ENGINEERING LTD

SITE: 'THE RETREAT', FEWS LANE, LONGSTANTON, CAMBRIDGE, CB24 3DP

JOB NO: AAA/79

'STREETVIEW' ACCESS TO FEWS LANE FROM THE HIGH STREET

1. Cable Percussive Borehole Log

OAKLEY
SOILS AND CONCRETE ENGINEERING LTD

BOREHOLE No: BH1

Sheet 1 of 2 Job No: AAA/79

Type of boring: Cable Percussive
Type of rig: DANDO 2000
Dia of boring: 150mm to 18.0m
Casing details: 150mm dia to 3.0m

Feature: The Retreat
Location: Fews Lane, Longstanton, Cambridge, CB24 3DP
Ground Level:
GPS Co-ordinates ±5m: E N

Date & (Time)	Depth & diam of boring & (depth of casing)	Ground Water	Samples & Tests: Samples	Depth	Test & instr	Strata: Depth	Reduced Level	Legend	Thickness	Description
15.12.15						metres				
	PIT					0.00			0.25	TOPSOIL - lead drillers description.
						0.25			0.15	MADE/REWORKED GROUND: Soft to firm Topsoil with traces of Made Ground - lead drillers description.
			D	0.5		0.40			0.30	
			D	0.8		0.70				MADE/REWORKED GROUND: Firm mid greyish brown slightly sandy slightly gravelly clay with occasional black carbonaceous deposits, gravel is f/m and occasional coarse subangular to subrounded flint and f/m chalk.
	150mm			1.2-1.65		1.00			1.10	Very loose light to mid brown silty to very silty slightly gravelly to gravelly fine SAND with partings/bands of soft mid bluish grey slightly gravelly clay, gravel is f/m chalk and subangular flint.
			D	1.4	C N=2					
			D	1.9		1.80				Firm mid to dark grey CLAY with occasional olive mottling and traces of fine decayed roots.
			U	2.0-2.45	9 blows	2.00				D @ 1.9m HSV = 54kpa
			D	2.5						From 2.0-2.5m fine gypsum.
	3.00									D @ 2.5m HSV = 70kpa
	(3.00)		D	3.0-3.45		3.00				From 3.0m becoming firm to stiff fissured dark grey CLAY with occasional olive mottling and traces of fine decayed roots.
					S N=11					
			D	3.6						D @ 3.6m HSV = 78kpa: a rusty brown silt parting.
			U	4.0-4.45	16 blows	4.00				
15.12.15	4.50	DRY	D	4.5					5.50	D @ 4.5m HSV = 90kpa: becoming stiff fissured thinly laminated dark grey CLAY with rare olive mottling and rare shell fragments.
16.12.15 (08:00)	(3.00)	DRY				5.00				
			D	5.1-5.55						From 5.1m becoming stiff fissured thinly laminated dark grey CLAY with occasional shell fragments.
					S N=14					
			D	6.0		6.00				D @ 6.0m HSV = 90kpa
			U	6.5-6.95	20 blows					
			D	7.0		7.00				D @ 7.0m HSV = 132kpa
		seepage @ 7.4m	D	7.4		7.30			0.30	LIMESTONE recovered as: Coarse gravel and cobble sized medium strong mid to dark grey limestone.
						7.60				Stiff fissured dark grey CLAY with occasional shell fragments.
			D	8.1-8.55		8.00				
					S N=18					
			D	8.9		9.00			(10.85)	D @ 8.9m HSV = 134kpa
			U	9.6-10.05	32 blows					
						10.00				

- • Small disturbed sample
- ↕ Large disturbed sample
- I Undisturbed Sample
- ↓ Standard Penetration Test
- ▲ Water sample
- X Hand Shear Vane test (kpa)
- PP Pocket Penetrometer (kg/cm²)

Remarks :
Service plans reviewed and inspection pit excavated to 1.2m.
16.12.15 chiselling 7.3-7.5m 08:30-09:30 hrs.

Date started: 15.12.15
Date finished: 16.12.15

Scale 1:50 metres
Logged by: AW
Checked by: JBI
Date: 09.01.16

OAKLEY
SOILS AND CONCRETE ENGINEERING LTD

BOREHOLE No: BH1

Sheet 2 of 2 Job No: AAA/79

Type of boring: Cable Percussive
Type of rig: DANDO 2000
Dia of boring: 150mm to 18.0m
Casing details: 150mm dia to 3.0m

Feature: The Retreat
Location: Fews Lane, Longstanton, Cambridge, CB24 3DP
Ground Level:
GPS Co-ordinates ±5m: E N

Date & (Time)	Depth & diam of boring & (depth of casing)	Ground Water	Samples & Tests: Samples	Depth	Test & instr	Strata: Depth	Reduced Level	Legend	Thickness	Description
						metres				
						10.00				Stiff fissured dark grey CLAY with occasional shell fragments.
			D •	10.1						D @ 10.1m HSV = >136kpa
			D •	10.6						
			D •	11.0-11.45	S N=21	11.00				
			D •	11.8						D @ 11.8m HSV = >136kpa
			U	12.5-12.95	38 blows	12.00				
			D •	13.0		13.00				D @ 13.0m HSV = >136kpa
										From 13.0m becoming stiff to very stiff.
			D •	14.0-14.45	S N=24	14.00			(10.85)	
			D •	14.6						D @ 14.6m HSV = >136kpa
						15.00				
			U	15.5-15.95	41 blows					
			D •	16.0		16.00				D @ 16.0m HSV = >136kpa
			D •	17.0-17.45	S N=28	17.00				
16.12.15	18.00 (3.00)	18.0m*	D •	18.0-18.45	S N=31	18.00				
						18.45				END OF BOREHOLE
						19.00				
						20.00				

- • Small disturbed sample
- ↕ Large disturbed sample
- I Undisturbed Sample
- ↓ Standard Penetration Test
- ▲ Water sample
- x Hand Shear Vane test (kpa)
- PP Pocket Penetrometer (kg/cm²)

Remarks :
*Water level on completion of borehole.
Borehole backfilled with arisings.

Date started: 15.12.15
Date finished: 16.12.15

Scale 1:50 metres

Logged by: AW
Checked by: JBI
Date: 09.01.16

2. Insitu Standard Penetration Test (SPT) Results

OAKLEY SOILS AND CONCRETE ENGINEERING LTD

SUMMARY OF STANDARD PENETRATION TEST RESULTS

SITE: THE RETREAT, FEWS LANE, LONGSTANTON, CAMBRIDGE, CB24 3DP JOB NO: AAA/79

Borehole	Depth (m)	Spoon/ Cone	Seating Blows	Blow Count				N Value
			150mm	75mm	75mm	75mm	75mm	
BH1	1.2	Cone	1	0	1	0	1	2
	3.0	Spoon	2	2	2	3	4	11
	5.1	Spoon	3	2	3	4	5	14
	8.1	Spoon	4	4	4	5	5	18
	11.0	Spoon	5	4	5	6	6	21
	14.0	Spoon	6	5	6	6	7	24
	17.0	Spoon	6	6	7	7	8	28
	18.0	Spoon	7	6	7	8	10	31

3. Laboratory Testing:

- *Moisture Content & Atterberg Limits*

OAKLEY SOILS AND CONCRETE ENGINEERING LTD						Moisture Content & Atterberg Limits			
Job Number		AAA/79		Site Location		THE RETREAT, FEWS LANE, LONGSTANTON, CB24 3DP			
Borehole/ Trial Pit Number	Sample Number	Sample Depth (m)	Moisture Content (%)	% Retained 425 Sieve	Liquid Limit	Plastic Limit	Plasticity Index	Casagrande Classification	Description
BH1	D	0.5	23						
	D	1.4	22						
	D	1.9	37	0	73	28	45	CV	Inorganic clay of very high plasticity
	D	2.5	36						
	SPT	3.0-3.45	34	0	76	29	47	CV	Inorganic clay of very high plasticity
	SPT	5.1-5.55	29	0	68	26	42	CH	Inorganic clay of high plasticity
	SPT	8.1-8.55	28						
	SPT	11.0-11.45	27	0	66	24	42	CH	Inorganic clay of high plasticity
	SPT	14.0-14.45	27						
	SPT	15.0-15.45	26						
	SPT	18.0-18.45	26						

All samples tested in natural state. Determination of liquid limit by BS1377 1990 Part 2. Preferred method (Cone Penetrometer)

***Denotes prewash through 425 micron sieve.**

- *Soluble Sulphate & pH*

OAKLEY SOILS
AND CONCRETE ENGINEERING LTD

Chemical Test Results

Sulphate Content of Soil and Groundwater: BS1377 Part 3 1990

Job No	AAA/79		Site Location	The Retreat Fews Lane, Longstanton, CB24 3DP			
Borehole/ Trial Pit Number	Sample Number	Sample Depth (m)	Soluble (SO4) Sulphates in soil specimen finer than 2mm (g/l)	Percentage finer than 2mm in original sample (%)	Groundwater Sulphates (g/l)	pH	Class BRE Special Digest 1* 2005 Third Edition
BH1	D	0.5	0.29	84		7.4	
	D	1.4	0.47	97		8.1	
	D	2.5	0.90	100		7.7	
	SPT	8.1-8.55	0.81	100		7.5	

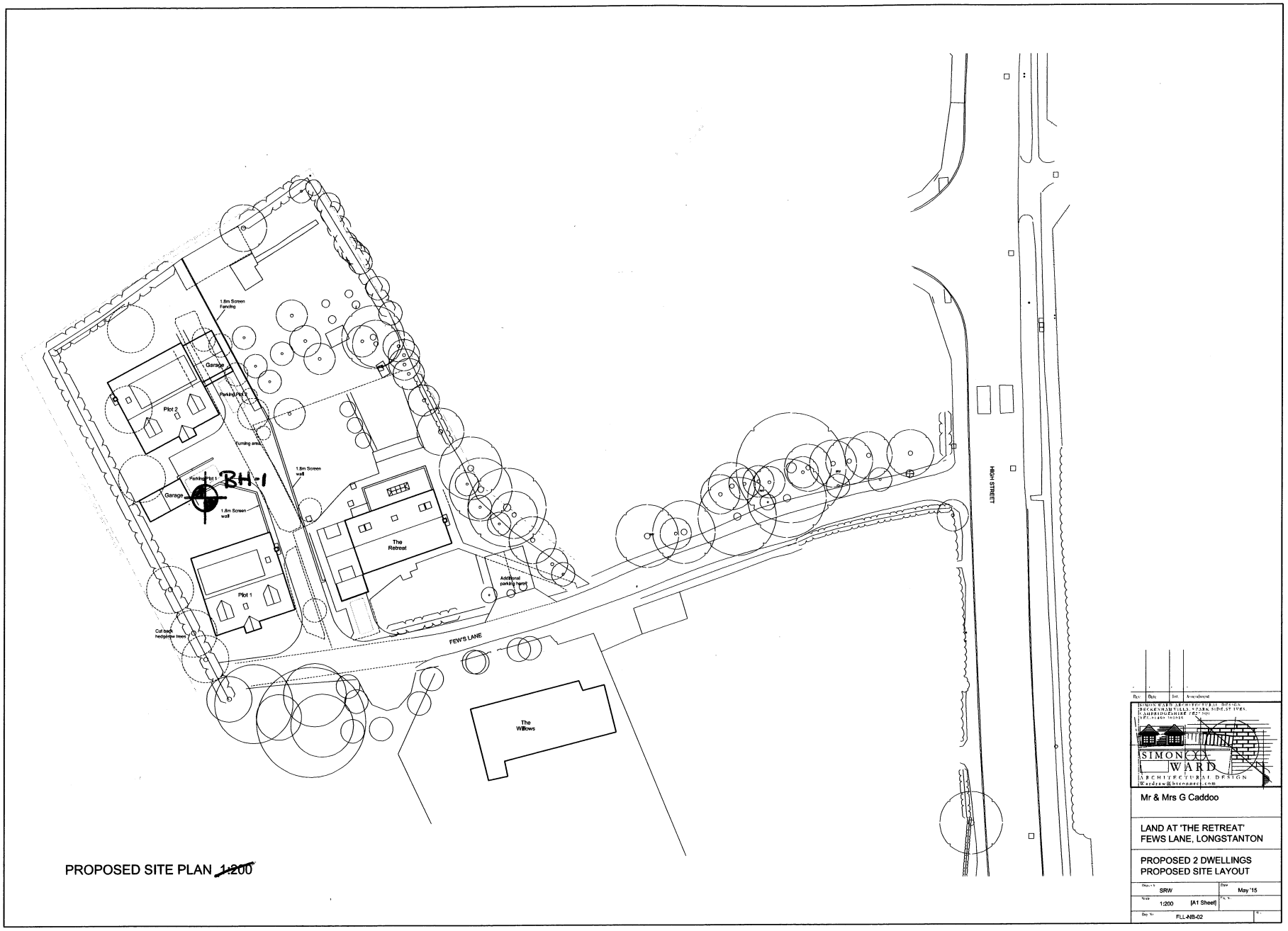
* Concrete in aggressive ground Part 1: Assessing the aggressive chemical environment.

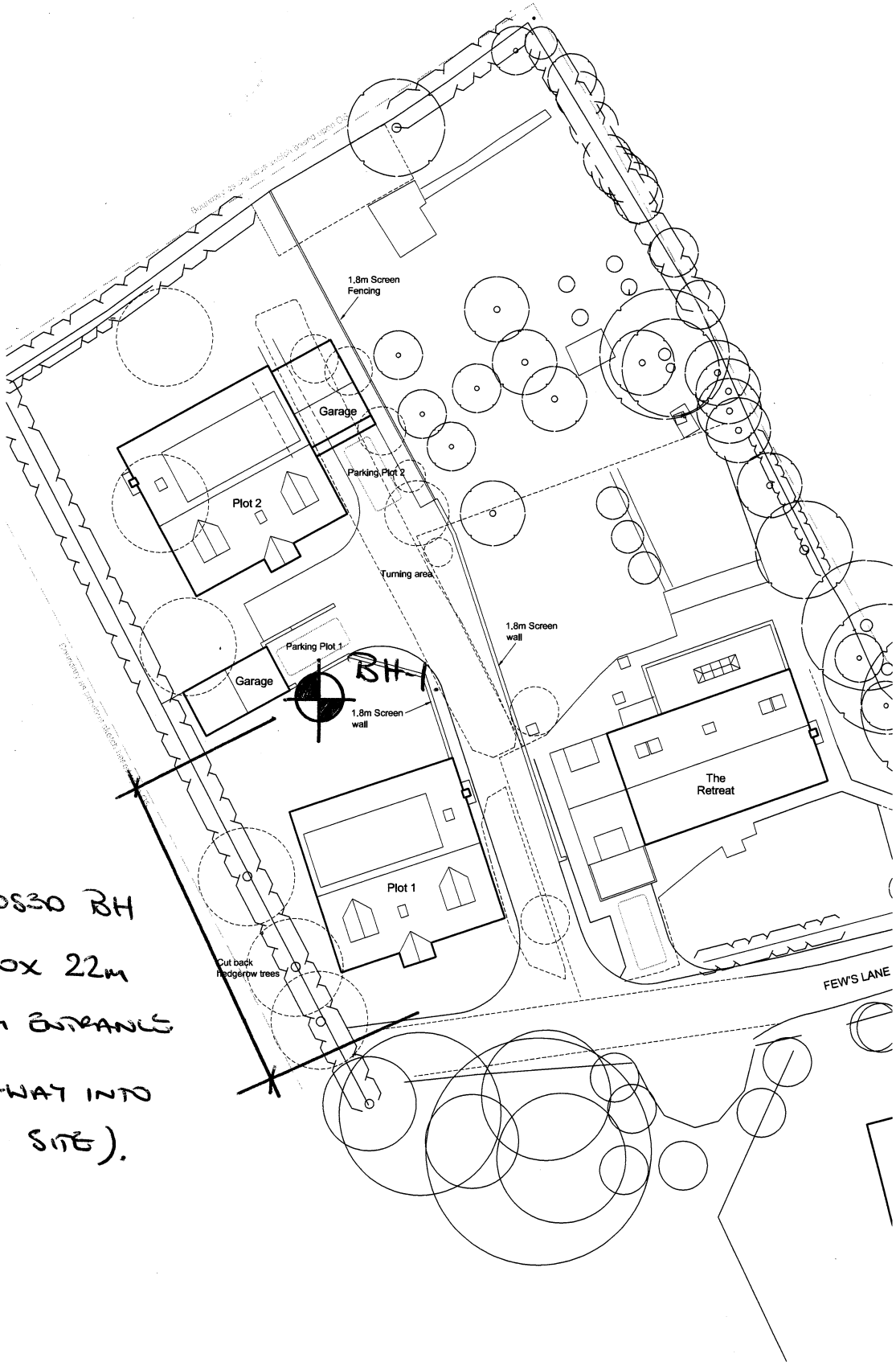
- *Unconsolidated Undrained Triaxial Tests*

OAKLEY SOILS AND CONCRETE ENGINEERING LTD				Quick Undrained Triaxial Tests						
Job Number		AAA/79		Site Location		THE RETREAT, FEWS LANE, LONGSTANTON, CB24 3DP				
Borehole/ Trial Pit Number	Sample Number	Sample Depth (m)	Cell Pressures kN/m²	Failure Strain (%)	Deviator Stress kN/m²	Bulk Density kg/m³	Moisture Content (%)	Cohesion kN/m²	Angle of Friction (°) (Assumed)	Description
BH1	U1	2.0-2.45	50	7.9	147.9	1928	36	74	-	Firm dark grey and olive mottled CLAY with traces of fine decayed roots. Fine gypsum and gypsum clusters.
	U2	4.0-4.45	90	6.0	132.1	1961	35	66	-	Firm to stiff fissured dark grey CLAY with occasional olive mottling, traces of fine decayed roots.
	U3	6.5-6.95	140	6.1	186.6	2014	28	95	-	Stiff fissured dark grey CLAY.
	U4	9.6-10.05	200	7.2	201.4	1989	29	101	-	Stiff fissured dark grey CLAY, occasional shell fragments.
	U5	12.5-12.95	260	6.3	274.7	2017	27	137	-	Stiff to very stiff fissured dark grey CLAY.
	U6	15.5-15.95	320	5.5	255.5	2097	26	128	-	Stiff to very stiff fissured dark grey CLAY, occasional shell fragments.

BS1377 Part 7 1990

4. Borehole Location Plan and Site Photographs


1.8m Screen Fencing
Garage
Plot 2
Parking Plot 2
Turning area
Parking Plot 1
Garage
1.8m Screen wall
1.8m Screen wall
RH-1
The Retreat
Additional parking here
Plot 1
Cut back hedgerow trees
FEWS LANE
The Willows
HIGH STREET
PROPOSED SITE PLAN 1:200
SIMON WARD
ARCHITECTURAL DESIGN
Mr & Mrs G Caddoo
LAND AT 'THE RETREAT'
FEWS LANE, LONGSTANTON
PROPOSED 2 DWELLINGS
PROPOSED SITE LAYOUT
SRW
May '15
1:200
[A1 Sheet]
FLL-NB-02



PROPOSED BH APPROX 22m FROM ENTRANCE (MID-WAY INTO SITE).

PROPOSED SITE PLAN 1:~~200~~

OAKLEY SOILS AND CONCRETE ENGINEERING LTD

JOB NO: AAA/79

SITE: LAND ADJACENT TO 'THE RETREAT', FEWS LANE, LONGSTANTON, CB24 3DP

DATE: 26.11.15

VIEW FROM REAR (NORTHERN BOUNDARY) OF SITE ACROSS PLOTS 1 & 2

VIEW FROM FRONT (SOUTHERN BOUNDARY) OF SITE ACROSS PLOTS 1 & 2

INFILTRATION TEST REPORT
FEWS LANE, LONGSTANTON

19/0321/PLS

08 April 2020

Andrew Firebrace Partnership Limited, Structural and Civil Engineering Consultants
Stable Barn, Park End, Swaffham Bulbeck, Cambridge, CB25 ONA.
Tel 01223 811572 Email info@afpconsult.co.uk

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APPENDICES

INTRODUCTION

This report has been prepared for the proposed development at the Retreat, Few's Lane, Longstanton. The purpose of this assessment is to provide information relating to permeability of the ground for the proposed surface water drainage systems of the proposed new houses.

This testing has been undertaken in accordance with BRE Digest 365 to determine if the ground conditions are favourable to discharge the surface water via infiltration.

Three trial pits were dug across the site at the locations shown on the plan in Appendix A. The trial pit 1 was dug to 1.20m below ground level with the width of 0.7m and length of 1.5m. The trial pit 2 was dug to 1.20m below ground level with the width of 0.8m and length of 2.1m. The trial pit 3 was dug to 1.10m below ground level with the width of 0.8m and length of 1.6m

SITE CONDITIONS

The weather at the time of the investigation was dry. No rainfall occurred during the test.

The tests were undertaken at three different locations, the TP1 was located to the front of the plot 4&5, TP2 was located to the rear of the plot 4&5 and TP3 was located to the rear of plot 3. General soil characteristic across the site are varies from firm to loose slightly sandy dark clay.

Groundwater was not observed within the trail pits and also the recently completed borehole confirmed that the ground water is not found up to 18.45m below ground level.

SOIL INFILTRATION RESULTS

Infiltration testing was undertaken in general accordance with BRE Digest 365. Water filled rapidly but carefully into each pit, then the water level fall rate was measured from a datum point. Each test was carried out till the water in each pit emptied, in line with BRE Digest 365 procedure. The test was then repeated a 2nd and 3rd time.

Infiltration rates were calculated based on the data collected from the tests are summarised in the table below:

Trial Pit No	Depth (mbgl)	Test 1 Rate (m/s)	Test 2 Rate (m/s)	Test 3 Rate (m/s)	Design Infiltration Rate (m/s)
TP01	1.20m	1.64E-05	1.33E-05	1.13E-05	**1.13E-05**
TP02	1.20m	1.56E-05	1.40E-05	1.26E-05	**1.26E-05**
TP03	1.10m	6.97E-06	8.00E-06	8.10E-06	**6.97E-06**

Three number of tests were completed within all three pits. The test results presented in the above table show that the lowest infiltration rate was obtained in the last test in trial pit 1&2 and first test in trial pit 3. Therefore the lowest infiltration test will need to be used as the design infiltration rate.

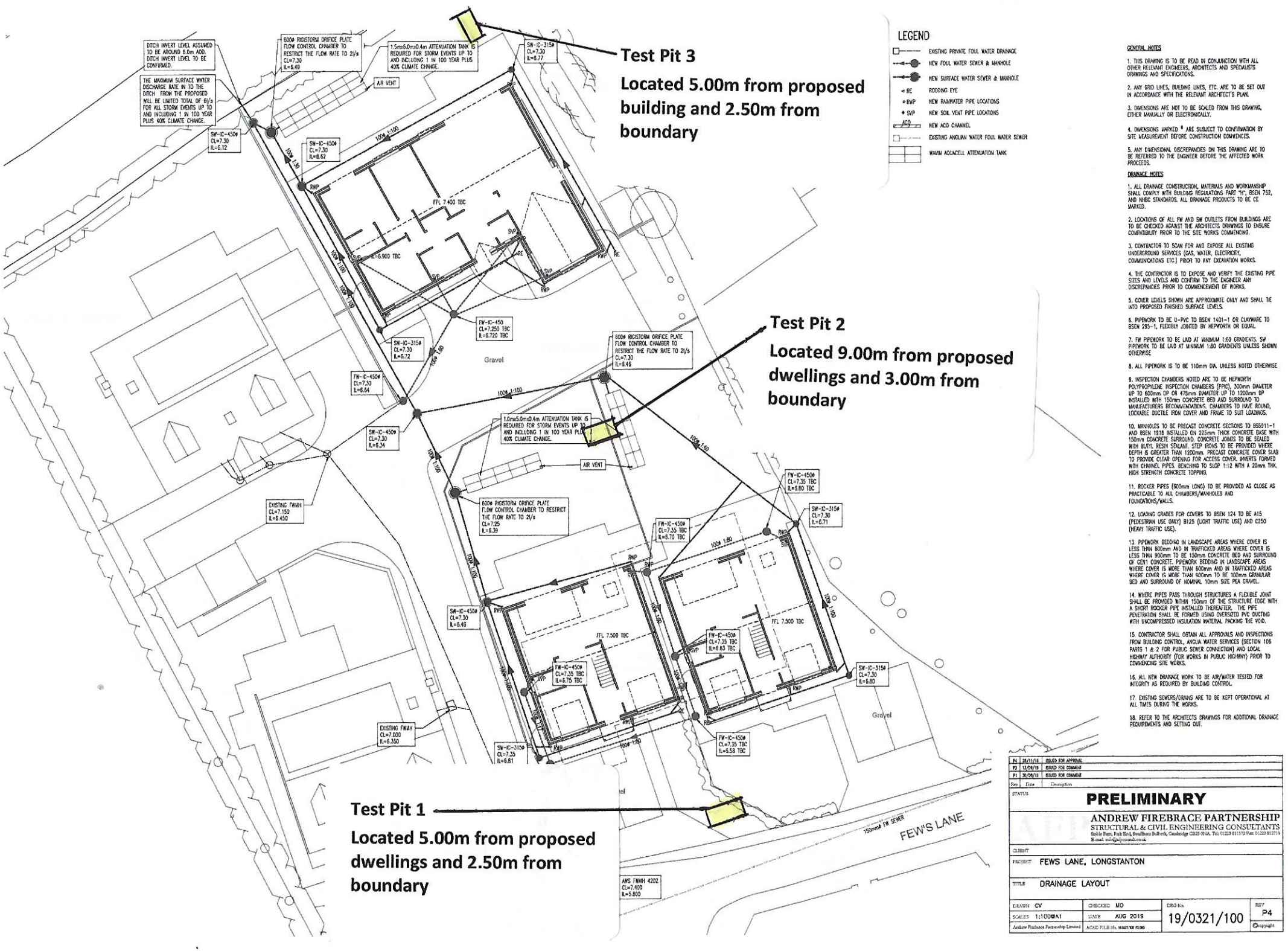
Infiltration rate calculation sheets are included in Appendix B.

CONCLUSION

This report demonstrates that the surface water generated from the proposed development can be infiltrated into ground via sustainable drainage systems. The design infiltration rate for the proposed soakaways should be taken as $1.26x10^{-5}$m/s.

APPENDIX A

Trial Pit Location Plan



GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS, ARCHITECTS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.

2. ANY GRID LINES, BUILDING LINES, ETC. ARE TO BE SET OUT IN ACCORDANCE WITH THE RELEVANT ARCHITECT'S PLAN.

3. DIMENSIONS ARE NOT TO BE SCALED FROM THIS DRAWING, EITHER MANUALLY OR ELECTRONICALLY.

4. DIMENSIONS MARKED * ARE SUBJECT TO CONFIRMATION BY SITE MEASUREMENT BEFORE CONSTRUCTION COMMENCES.

5. ANY DIMENSIONAL DISCREPANCIES ON THIS DRAWING ARE TO BE REFERRED TO THE ENGINEER BEFORE THE AFFECTED WORK PROCEEDS.

DRAINAGE NOTES

1. ALL DRAINAGE CONSTRUCTION, MATERIALS AND WORKMANSHIP SHALL COMPLY WITH BUILDING REGULATIONS PART "H", BSEN 752, AND NHBC STANDARDS. ALL DRAINAGE PRODUCTS TO BE CE MARKED.

2. LOCATIONS OF ALL FW AND SW OUTLETS FROM BUILDINGS ARE TO BE CHECKED AGAINST THE ARCHITECTS DRAWINGS TO ENSURE COMPATIBILITY PRIOR TO THE SITE WORKS COMMENCING.

3. CONTRACTOR TO SCAN FOR AND EXPOSE ALL EXISTING UNDERGROUND SERVICES (GAS, WATER, ELECTRICITY, COMMUNICATIONS ETC.) PRIOR TO ANY EXCAVATION WORKS.

4. THE CONTRACTOR IS TO EXPOSE AND VERIFY THE EXISTING PIPE SIZES AND LEVELS AND CONFIRM TO THE ENGINEER ANY DISCREPANCIES PRIOR TO COMMENCEMENT OF WORKS.

5. COVER LEVELS SHOWN ARE APPROXIMATE ONLY AND SHALL TIE INTO PROPOSED FINISHED SURFACE LEVELS.

6. PIPEWORK TO BE U-PVC TO BSEN 1401-1 OR CLAYWARE TO BSEN 295-1, FLEXIBLY JOINTED BY HEPWORTH OR EQUAL.

7. FW PIPEWORK TO BE LAID AT MINIMUM 1:60 GRADIENTS. SW PIPEWORK TO BE LAID AT MINIMUM 1:80 GRADIENTS UNLESS SHOWN OTHERWISE

8. ALL PIPEWORK IS TO BE 110mm DIA. UNLESS NOTED OTHERWISE

9. INSPECTION CHAMBERS NOTED ARE TO BE HEPWORTH POLYPROPYLENE INSPECTION CHAMBERS (PPIC), 300mm DIAMETER UP TO 600mm DP OR 475mm DIAMETER UP TO 1200mm DP INSTALLED WITH 150mm CONCRETE BED AND SURROUND TO MANUFACTURERS RECOMMENDATIONS. CHAMBERS TO HAVE ROUND, LOCKABLE DUCTILE IRON COVER AND FRAME TO SUIT LOADINGS.

10. MANHOLES TO BE PRECAST CONCRETE SECTIONS TO BS5911-1 AND BSEN 1916 INSTALLED ON 225mm THICK CONCRETE BASE WITH 150mm CONCRETE SURROUND. CONCRETE JOINTS TO BE SEALED WITH BUTYL RESIN SEALANT. STEP IRONS TO BE PROVIDED WHERE DEPTH IS GREATER THAN 1200mm. PRECAST CONCRETE COVER SLAB TO PROVIDE CLEAR OPENING FOR ACCESS COVER. INVERTS FORMED WITH CHANNEL PIPES. BENCHING TO SLOP 1:12 WITH A 20mm THK. HIGH STRENGTH CONCRETE TOPPING.

11. ROCKER PIPES (600mm LONG) TO BE PROVIDED AS CLOSE AS PRACTICABLE TO ALL CHAMBERS/MANHOLES AND FOUNDATIONS/WALLS.

12. LOADING GRADES FOR COVERS TO BSEN 124 TO BE A15 (PEDESTRIAN USE ONLY) B125 (LIGHT TRAFFIC USE) AND C250 (HEAVY TRAFFIC USE).

13. PIPEWORK BEDDING IN LANDSCAPE AREAS WHERE COVER IS LESS THAN 600mm AND IN TRAFFICKED AREAS WHERE COVER IS LESS THAN 900mm TO BE 150mm CONCRETE BED AND SURROUND OF GEN1 CONCRETE. PIPEWORK BEDDING IN LANDSCAPE AREAS WHERE COVER IS MORE THAN 600mm AND IN TRAFFICKED AREAS WHERE COVER IS MORE THAN 900mm TO BE 100mm GRANULAR BED AND SURROUND OF NOMINAL 10mm SIZE PEA GRAVEL.

14. WHERE PIPES PASS THROUGH STRUCTURES A FLEXIBLE JOINT SHALL BE PROVIDED WITHIN 150mm OF THE STRUCTURE EDGE WITH A SHORT ROCKER PIPE INSTALLED THEREAFTER. THE PIPE PENETRATION SHALL BE FORMED USING OVERSIZED PVC DUCTING WITH UNCOMPRESSED INSULATION MATERIAL PACKING THE VOID.

15. CONTRACTOR SHALL OBTAIN ALL APPROVALS AND INSPECTIONS FROM BUILDING CONTROL, ANGLIA WATER SERVICES (SECTION 106 PARTS 1 & 2 FOR PUBLIC SEWER CONNECTION) AND LOCAL HIGHWAY AUTHORITY (FOR WORKS IN PUBLIC HIGHWAY) PRIOR TO COMMENCING SITE WORKS.

16. ALL NEW DRAINAGE WORK TO BE AIR/WATER TESTED FOR INTEGRITY AS REQUIRED BY BUILDING CONTROL.

17. EXISTING SEWERS/DRAINS ARE TO BE KEPT OPERATIONAL AT ALL TIMES DURING THE WORKS.

18. REFER TO THE ARCHITECTS DRAWINGS FOR ADDITIONAL DRAINAGE REQUIREMENTS AND SETTING OUT.

Rev	Date	Description
P4	28/11/19	ISSUED FOR APPROVAL
P3	13/09/19	ISSUED FOR COMMENT
P1	30/08/19	ISSUED FOR COMMENT

STATUS **PRELIMINARY**

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Stable Barn, Park End, Southburn Bolbeck, Cambridge CB25 0NA. Tel: 01223 811572 Fax: 01223 812719
E-mail: mail@afpcamb.co.uk

CLIENT

PROJECT FEWS LANE, LONGSTANTON

TITLE DRAINAGE LAYOUT

DRAWN CV	CHECKED MO	DRG No. 19/0321/100	REV P4
SCALES 1:100@A1	DATE AUG 2019		
Andrew Firebrace Partnership Limited	ACAD FILE No. 190321 100 P3.DWG		©copyright

APPENDIX B

Infiltration Rate Calculation Sheets

AFP ANDREW FIREBRACE PARTNERSHIP
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PROJECT		JOB No. 19/0321
FEWS LANE, LONGSTANTON	BRE 365 INFILTRATION TEST	ENGINEER MO
		SHEET No.

Trial Pit Number 1 (TEST 1)

Trial Pit Length	L=	1.50	(m)
Trial Pit Width	W=	0.70	(m)
Trial Pit Depth	D=	1.20	(m)
Depth from ground level to water level at start of the test	D_s=	0.00	(m)
Depth to natural ground water level	D_w=	Dry	

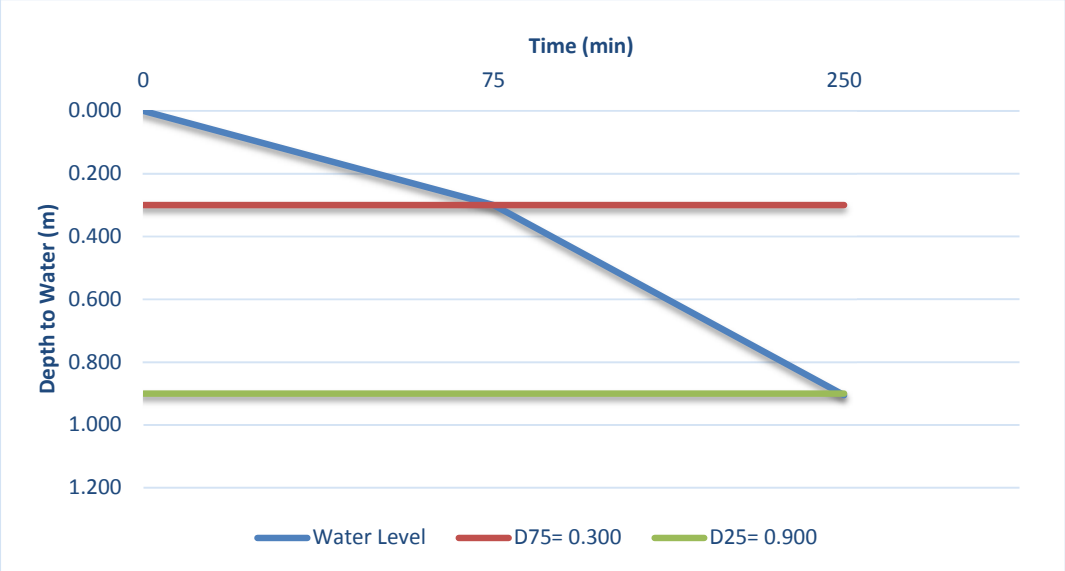
SOAKAGE TRIAL PIT INFILTRATION RESULTS

Time (min)	0	75	250											
Water L (m)	0.000	0.300	0.905											

Depths when trial pit is 75% and 25% full D_{25}= 0.900 (m) D_{75}= 0.300 (m)

Mean Surface Area for Outflow ap_{50}= 3.690 (m^2)

Volume from 75% to 25% full V_{75-25}= 0.630 (m^2)



Time when trial pit is 75% full t_{75}= 75 (min)

Time when trial pit is 25% full t_{25}= 249 (min)

SOIL INFILTRATION RATE **f= 1.64E-05 (m/s)**

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PROJECT		JOB No. 19/0321
FEWS LANE, LONGSTANTON	BRE 365 INFILTRATION TEST	ENGINEER MO
		SHEET No.

Trial Pit Number 1 (TEST 2)

Trial Pit Length	L=	1.50	(m)
Trial Pit Width	W=	0.70	(m)
Trial Pit Depth	D=	1.20	(m)
Depth from ground level to water level at start of the test	D_s=	0.00	(m)
Depth to natural ground water level	D_w=	Dry	

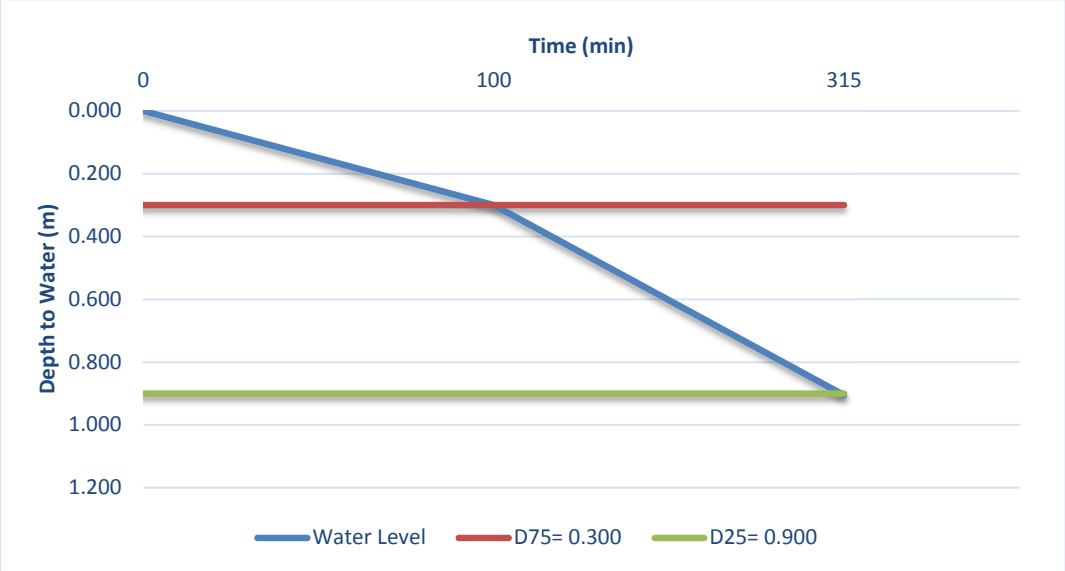
SOAKAGE TRIAL PIT INFILTRATION RESULTS

Time (min)	0	100	315											
Water L (m)	0.000	0.300	0.905											

Depths when trial pit is 75% and 25% full D_{25}= 0.900 (m) D_{75}= 0.300 (m)

Mean Surface Area for Outflow ap_{50}= 3.690 (m^2)

Volume from 75% to 25% full V_{75-25}= 0.630 (m^2)



Time when trial pit is 75% full t_{75}= 100 (min)

Time when trial pit is 25% full t_{25}= 313 (min)

SOIL INFILTRATION RATE **f= 1.33E-05 (m/s)**

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PROJECT		JOB No. 19/0321
FEWS LANE, LONGSTANTON	BRE 365 INFILTRATION TEST	ENGINEER MO
		SHEET No.

Trial Pit Number 1 (TEST 3)

Trial Pit Length	L=	1.50	(m)
Trial Pit Width	W=	0.70	(m)
Trial Pit Depth	D=	1.20	(m)
Depth from ground level to water level at start of the test	D_s=	0.00	(m)
Depth to natural ground water level	D_w=	Dry	

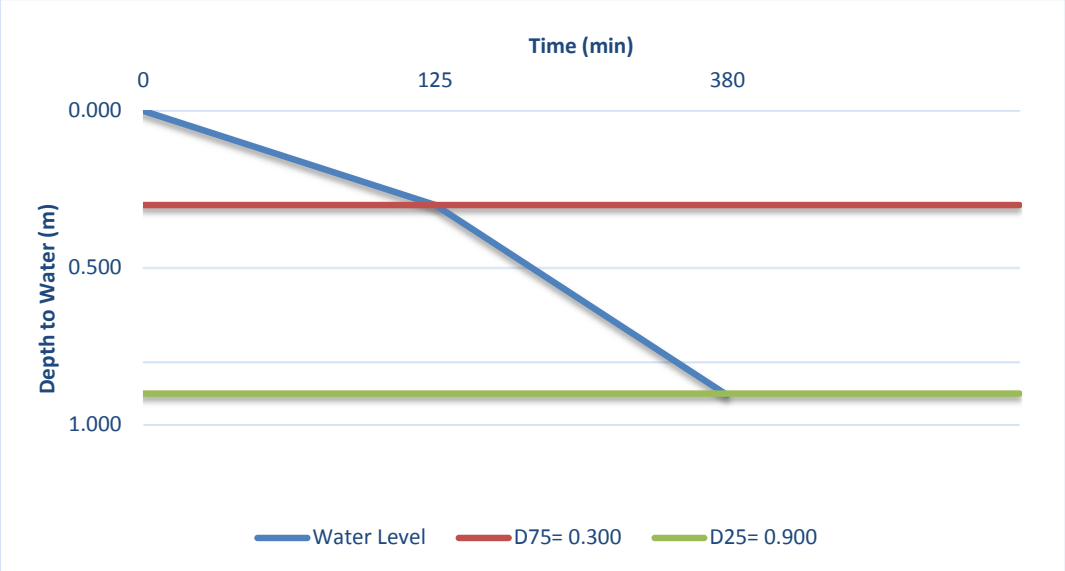
SOAKAGE TRIAL PIT INFILTRATION RESULTS

Time (min)	0	125	380											
Water L (m)	0.000	0.300	0.905											

Depths when trial pit is 75% and 25% full D_{25}= 0.900 (m) D_{75}= 0.300 (m)

Mean Surface Area for Outflow ap_{50}= 3.690 (m^2)

Volume from 75% to 25% full V_{75-25}= 0.630 (m^2)



Time when trial pit is 75% full t_{75}= 125 (min)

Time when trial pit is 25% full t_{25}= 378 (min)

SOIL INFILTRATION RATE **f= 1.13E-05 (m/s)**

AFP ANDREW FIREBRACE PARTNERSHIP
STRUCTURAL AND CIVIL ENGINEERING CONSULTANTS
Stable Barn, Park End, Swaffham Bulbeck, Cambridge CB5 0NA. Tel: 01223 811572 Fax: 01223 812719 E-mail: info@afpconsult.co.uk

PROJECT		JOB No. 19/0321
FEWS LANE, LONGSTANTON	BRE 365 INFILTRATION TEST	ENGINEER MO
		SHEET No.

Trial Pit Number 2 (TEST 1)

Trial Pit Length	L=	2.10	(m)
Trial Pit Width	W=	0.80	(m)
Trial Pit Depth	D=	1.20	(m)
Depth from ground level to water level at start of the test	D_s=	0.00	(m)
Depth to natural ground water level	D_w=	Dry	

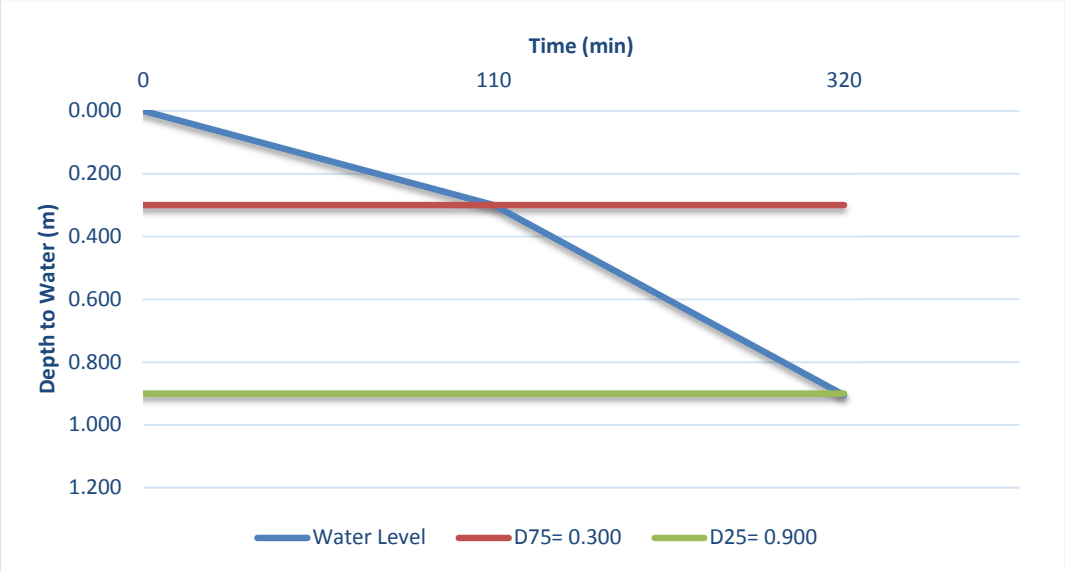
SOAKAGE TRIAL PIT INFILTRATION RESULTS

Time (min)	0	110	320											
Water L (m)	0.000	0.300	0.905											

Depths when trial pit is 75% and 25% full D_{25}= 0.900 (m) D_{75}= 0.300 (m)

Mean Surface Area for Outflow ap_{50}= 5.160 (m^2)

Volume from 75% to 25% full V_{75-25}= 1.008 (m^2)



Time when trial pit is 75% full t_{75}= 110 (min)

Time when trial pit is 25% full t_{25}= 318 (min)

SOIL INFILTRATION RATE **f= 1.56E-05 (m/s)**

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PROJECT		JOB No. 19/0321
FEWS LANE, LONGSTANTON	BRE 365 INFILTRATION TEST	ENGINEER MO
		SHEET No.

Trial Pit Number 2 (TEST 2)

Trial Pit Length	L=	2.10	(m)
Trial Pit Width	W=	0.80	(m)
Trial Pit Depth	D=	1.20	(m)
Depth from ground level to water level at start of the test	D_s=	0.00	(m)
Depth to natural ground water level	D_w=	Dry	

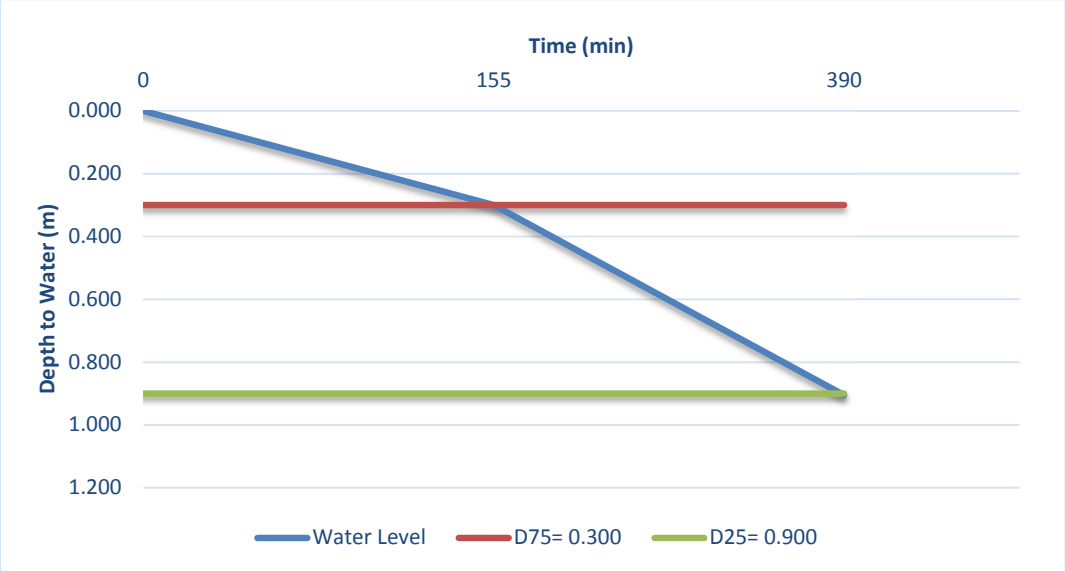
SOAKAGE TRIAL PIT INFILTRATION RESULTS

Time (min)	0	155	390											
Water L (m)	0.000	0.300	0.905											

Depths when trial pit is 75% and 25% full D_{25}= 0.900 (m) D_{75}= 0.300 (m)

Mean Surface Area for Outflow ap_{50}= 5.160 (m^2)

Volume from 75% to 25% full V_{75-25}= 1.008 (m^2)



Time when trial pit is 75% full t_{75}= 155 (min)

Time when trial pit is 25% full t_{25}= 388 (min)

SOIL INFILTRATION RATE **f= 1.40E-05 (m/s)**

AFP ANDREW FIREBRACE PARTNERSHIP
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Stable Barn, Park End, Swaffham Bulbeck, Cambridge CB5 0NA. Tel: 01223 811572 Fax: 01223 812719 E-mail: info@afpconsult.co.uk

PROJECT		JOB No. 19/0321
FEWS LANE, LONGSTANTON	BRE 365 INFILTRATION TEST	ENGINEER MO
		SHEET No.

Trial Pit Number 2 (TEST 3)

Trial Pit Length	L=	2.10	(m)
Trial Pit Width	W=	0.80	(m)
Trial Pit Depth	D=	1.20	(m)
Depth from ground level to water level at start of the test	D_s=	0.00	(m)
Depth to natural ground water level	D_w=	Dry	

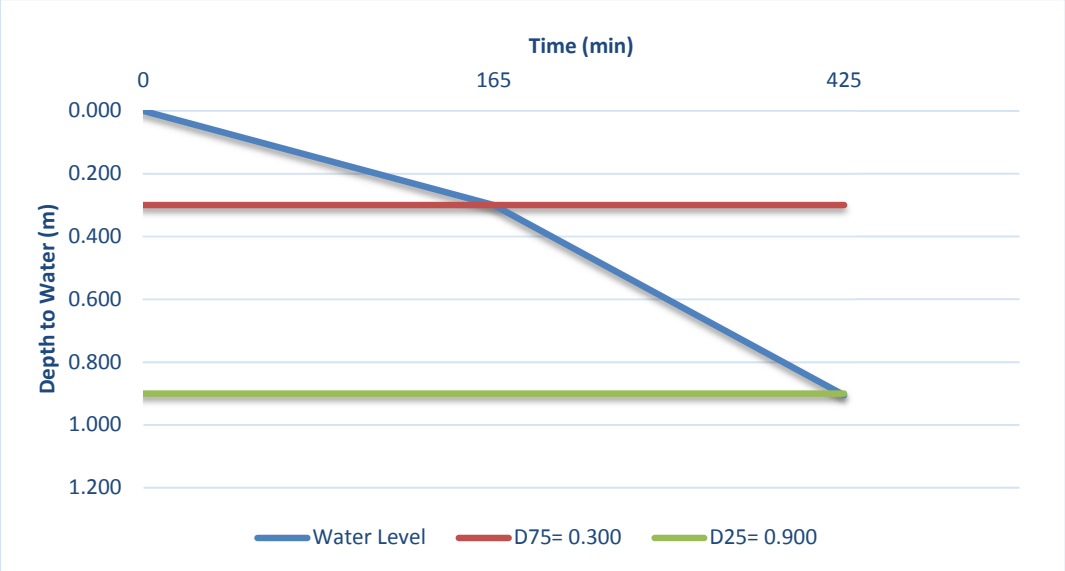
SOAKAGE TRIAL PIT INFILTRATION RESULTS

Time (min)	0	165	425											
Water L (m)	0.000	0.300	0.905											

Depths when trial pit is 75% and 25% full D_{25}= 0.900 (m) D_{75}= 0.300 (m)

Mean Surface Area for Outflow ap_{50}= 5.160 (m^2)

Volume from 75% to 25% full V_{75-25}= 1.008 (m^2)



Time when trial pit is 75% full t_{75}= 165 (min)

Time when trial pit is 25% full t_{25}= 423 (min)

SOIL INFILTRATION RATE **f= 1.26E-05 (m/s)**

AFP ANDREW FIREBRACE PARTNERSHIP
STRUCTURAL AND CIVIL ENGINEERING CONSULTANTS
Stable Barn, Park End, Swaffham Bulbeck, Cambridge CB5 0NA. Tel: 01223 811572 Fax: 01223 812719 E-mail: info@afpconsult.co.uk

PROJECT		JOB No. 19/0321
FEWS LANE, LONGSTANTON	BRE 365 INFILTRATION TEST	ENGINEER MO
		SHEET No.

Trial Pit Number 3 (TEST 1)

Trial Pit Length	L=	1.60	(m)
Trial Pit Width	W=	0.80	(m)
Trial Pit Depth	D=	1.10	(m)
Depth from ground level to water level at start of the test	D_s=	0.00	(m)
Depth to natural ground water level	D_w=	Dry	

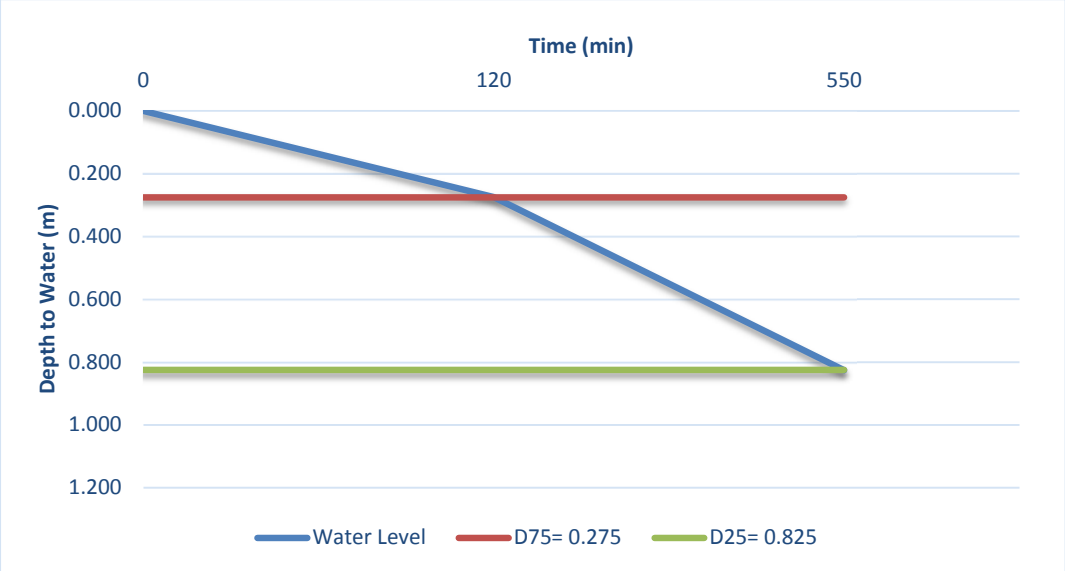
SOAKAGE TRIAL PIT INFILTRATION RESULTS

Time (min)	0	120	550											
Water L (m)	0.000	0.275	0.826											

Depths when trial pit is 75% and 25% full D_{25}= 0.825 (m) D_{75}= 0.275 (m)

Mean Surface Area for Outflow ap_{50}= 3.920 (m^2)

Volume from 75% to 25% full V_{75-25}= 0.704 (m^2)



Time when trial pit is 75% full t_{75}= 120 (min)

Time when trial pit is 25% full t_{25}= 549 (min)

SOIL INFILTRATION RATE **f= 6.97E-06 (m/s)**

AFP ANDREW FIREBRACE PARTNERSHIP
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PROJECT		JOB No. 19/0321
FEWS LANE, LONGSTANTON	BRE 365 INFILTRATION TEST	ENGINEER MO
		SHEET No.

Trial Pit Number 3 (TEST 2)

Trial Pit Length	L=	1.60	(m)
Trial Pit Width	W=	0.80	(m)
Trial Pit Depth	D=	1.10	(m)
Depth from ground level to water level at start of the test	D_s=	0.00	(m)
Depth to natural ground water level	D_w=	Dry	

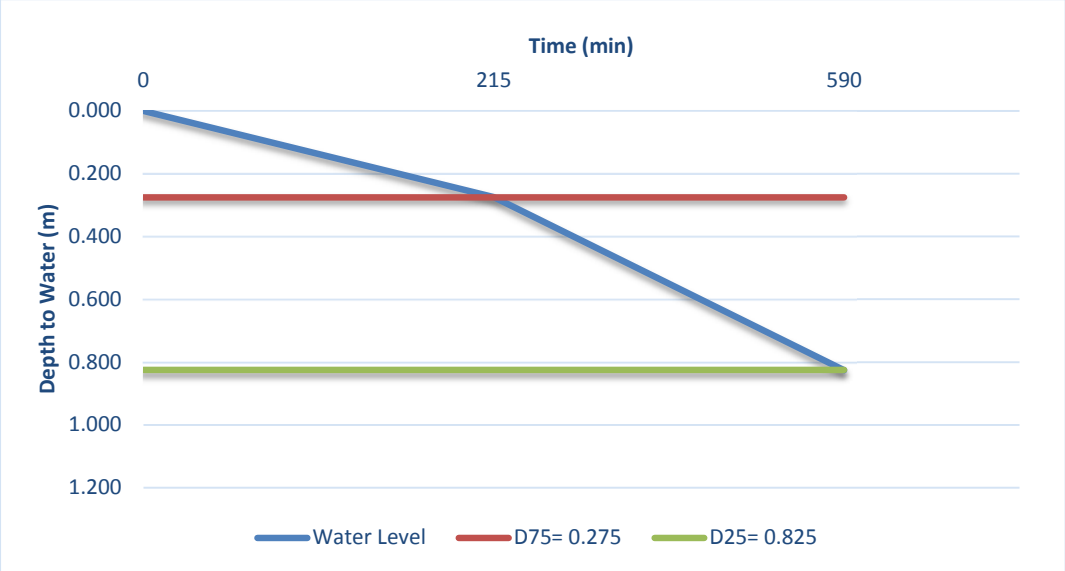
SOAKAGE TRIAL PIT INFILTRATION RESULTS

Time (min)	0	215	590											
Water L (m)	0.000	0.275	0.826											

Depths when trial pit is 75% and 25% full D_{25}= 0.825 (m) D_{75}= 0.275 (m)

Mean Surface Area for Outflow ap_{50}= 3.920 (m^2)

Volume from 75% to 25% full V_{75-25}= 0.704 (m^2)



Time when trial pit is 75% full t_{75}= 215 (min)

Time when trial pit is 25% full t_{25}= 589 (min)

SOIL INFILTRATION RATE **f= 8.00E-06 (m/s)**

AFP ANDREW FIREBRACE PARTNERSHIP
STRUCTURAL AND CIVIL ENGINEERING CONSULTANTS
Stable Barn, Park End, Swaffham Bulbeck, Cambridge CB5 0NA. Tel: 01223 811572 Fax: 01223 812719 E-mail: info@afpconsult.co.uk

PROJECT		JOB No. 19/0321
FEWS LANE, LONGSTANTON	BRE 365 INFILTRATION TEST	ENGINEER MO
		SHEET No.

Trial Pit Number 3 (TEST 3)

Trial Pit Length	L=	1.60	(m)
Trial Pit Width	W=	0.80	(m)
Trial Pit Depth	D=	1.10	(m)
Depth from ground level to water level at start of the test	D_s=	0.00	(m)
Depth to natural ground water level	D_w=	Dry	

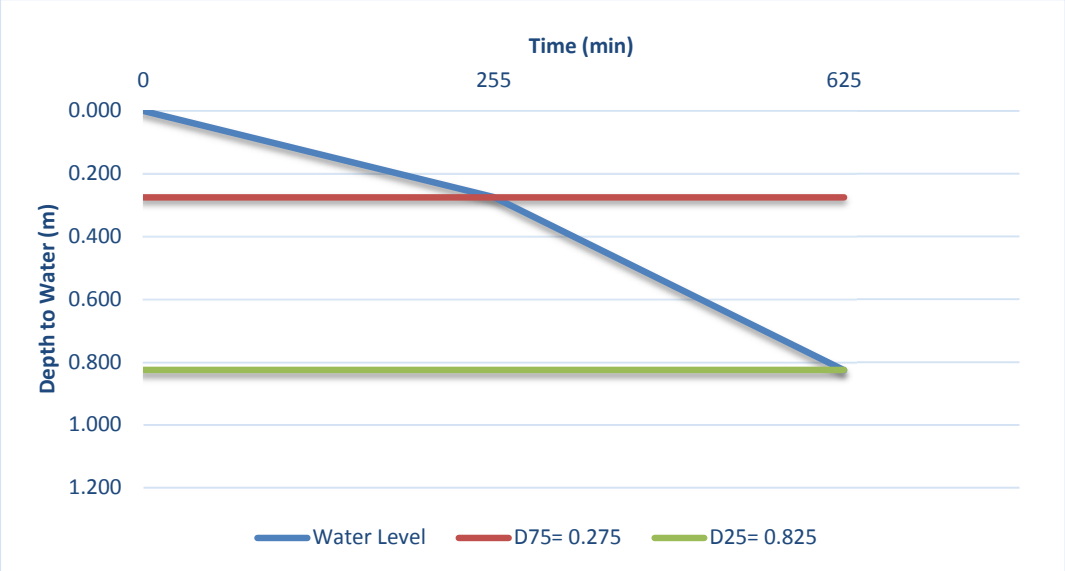
SOAKAGE TRIAL PIT INFILTRATION RESULTS

Time (min)	0	255	625											
Water L (m)	0.000	0.275	0.826											

Depths when trial pit is 75% and 25% full D_{25}= 0.825 (m) D_{75}= 0.275 (m)

Mean Surface Area for Outflow ap_{50}= 3.920 (m^2)

Volume from 75% to 25% full V_{75-25}= 0.704 (m^2)



Time when trial pit is 75% full t_{75}= 255 (min)

Time when trial pit is 25% full t_{25}= 624 (min)

SOIL INFILTRATION RATE **f= 8.10E-06 (m/s)**

APPENDIX C

Infiltration Test Photos

Test Pit 1

Test Pit 1

Test Pit 1

Test Pit 2

Test Pit 2

Test Pit 2

Test Pit 3

Test Pit 3

Appendix D Cambridgeshire SPD completed Pro-Forma

Appendix F Surface water drainage pro-forma

Applicants should complete this form and submit it to the LPA, referencing from where in their submission documents this information is taken. The proforma is supported by the DEFRA/ EA guidance on Rainfall Runoff Management. and uses the storage calculator on www.UKsuds.com. The proforma should be considered alongside other supporting SuDS Guidance, but focuses on ensuring flood risk is not made worse elsewhere. This proforma is based upon current industry standard practice.

1. Site details

Site	Plot 3 - Fews Lane, Longstanton
Address & post code or LPA reference	Fews Lane, Longstanton, CB24 3DP, S/3215/19/DC
Grid Reference	TL 39427 67259
Is the existing site developed or Greenfield?	Greenfield
Total Site Area served by drainage system (excluding open space) (Ha)(1)	0.050ha

1. The Greenfield runoff off rate from the development which is to be used for assessing the requirements for limiting discharge flow rates and attenuation storage from a site should be calculated for the area that forms the drainage network for the site whatever size of site and type of drainage technique. Please refer to the Rainfall Runoff Management document or CIRIA manual for detail on this.

2. Impermeable area

	Existing	**Proposed**	**Difference (Proposed-Existing)**	**Notes for developers and Local Authorities**
Impermeable area (ha)	0	0.017ha	0.017ha	If proposed > existing, then runoff rates and volumes will be increasing. Section 6 must be filled in. If proposed ≤ existing, then section 6 can be skipped & section 7 filled in.
Drainage Method (infiltration/sewer/watercourse)			N/A	If different from the existing, please fill in section 3. If existing drainage is by infiltration and the proposed is not, discharge volumes may increase. Fill in section 6.

3. Proposing to discharge surface water via

	Yes	No	Evidence that this is possible	Notes for developers and Local Authorities
Infiltration				e.g. soakage tests. Section 6 (infiltration) must be filled in if infiltration is proposed.
To watercourse	✓		There is a ditch	e.g. Is there a watercourse nearby?
To surface water sewer				Confirmation from sewer provider that sufficient capacity exists for this connection.
Combination of above				e.g. part infiltration part discharge to sewer or watercourse. Provide evidence above.

4. Peak Discharge Rates(1)

	Existing rates (l/s)	Proposed rates (l/s)	Difference (l/s) (Proposed-Existing)	Notes for developers and Local Authorities
Greenfield QBAR	0.2l/s	N/A	N/A	QBAR is approx. 1 in 2 storm event. Provide this if Section 6 (QBAR) is proposed.
1 in 1	0.1l/s	2l/s	1.9l/s	Proposed discharge rates (with mitigation) should be no greater than existing rates for all corresponding storm events. e.g. discharging all flow from site at the existing 1 in 100 event increases flood risk during smaller events.
1 in 30	0.4l/s	2l/s	1.6l/s	
1 in 100	0.6l/s	2l/s	1.4l/s	
1 in 100 + climate change	N/A	2l/s	n/a	To mitigate for climate change the proposed 1 in 100 +CC must be no greater than the existing 1 in 100 runoff rate. If not, flood risk increases under climate change. 30% should be added to the peak rainfall intensity.

1. This is the maximum flow rate at which storm water runoff leaves the site during a particular storm event.

5. Calculate additional volumes for storage[1]

	Existing volume (m^3)	Proposed volume (m^3)	Difference (m^3) (Proposed-Existing)	Notes for developers and Local Authorities
1 in 1				Proposed discharge volumes (without mitigation) should be no greater than existing volumes for all corresponding storm events. Any increase in volume increases flood risk elsewhere. Where volumes are increased section 6 must be filled in.
1 in 30				
1 in 100				
1 in 100 + climate change	9.137m3	4.4m3	-4.737m3	To mitigate for climate change the volume discharge from site must be no greater than the existing 1 in 100 storm event. If not, flood risk increases under climate change.

1. The total volume of water leaving the development site. New hard surfaces potentially restrict the amount of storm water that can go to the ground, so this needs to be controlled so not to make flood risk worse to properties downstream.

6. Calculate attenuation storage[1]

		Notes for developers and Local Authorities
Storage Attenuation volume (Flow rate control) required to retain rates as existing (m^3)	Attenuation tank and orifice flow control device will be used - 4.4m3	Volume of water to attenuate on site if discharging at existing rates. Can't be used where discharge volumes are increasing

1. Attenuation storage is provided to enable the rate of runoff from the site into the receiving watercourse to be limited to an acceptable rate to protect against erosion and flooding downstream. The attenuation storage volume is a function of the degree of development relative to the greenfield discharge rate.

7. How is Storm Water stored on site?(1)

			Notes for developers and Local Authorities
Infiltration	**State the Site's Geology and known Source Protection Zones (SPZ)**	No	Avoid infiltrating in made ground. Infiltration rates are highly variable and refer to Environment Agency website to identify and source protection zones (SPZ)
	Are infiltration rates suitable?	yes	Infiltration rates should be no lower than $1x10^{-6}$ m/s.
	State the distance between a proposed infiltration device base and the ground water (GW) level	grounwater level was not found in trial pits and boreholes	Need 1m (min) between the base of the infiltration device & the water table to protect Groundwater quality & ensure GW doesn't enter infiltration devices. Avoid infiltration where this isn't possible.
	Were infiltration rates obtained by desk study or infiltration test?		Infiltration rates can be estimated from desk studies at most stages of the planning system if a backup attenuation scheme is provided.
	Is the site contaminated? If yes, consider advice from others on whether infiltration can happen.		Water should not be infiltrated through land that is contaminated. The Environment Agency may provide bespoke advice in planning consultations for contaminated sites that should be considered.
In light of the above, is infiltration feasible?	**Yes/No? If the answer is No, please identify how the storm water will be stored prior to release**	No,There is not enough space on site to discharge via soakaways	If infiltration is not feasible how will the additional volume be stored? The applicant should then consider the following options in the next section.

1. Storage is required for the additional volume from site but also for holding back water to slow down the rate from the site. This is known as attenuation storage and long term storage. The idea is that the additional volume does not get into the watercourses, or if it does it is at an exceptionally low rate. You can either infiltrate the stored water back to ground, or if this isn't possible hold it back with on-site storage. Firstly, can infiltration work on site?

Storage requirements

The developer must confirm that either of the two methods for dealing with the amount of water that needs to be stored on site.

- **Option 1 Simple:**
  Store both the additional volume and attenuation volume in order to make a final discharge from site at QBAR (Mean annual flow rate). This is preferred if no infiltration can be made on site. This very simply satisfies the runoff rates and volume criteria.
- **Option 2 Complex:**
  If some of the additional volume of water can be infiltrated back into the ground, the remainder can be discharged at a very low rate of 2 l/sec/hectare. A combined storage calculation using the partial permissible rate of 2 l/sec/hectare and the attenuation rate used to slow the runoff from site.

		Notes for developers and Local Authorities
Please confirm what option has been chosen and how much storage is required on site.	Attenuation tank and orifice flow control device will be used- 4m3 storage required	The developer at this stage should have an idea of the site characteristics and be able to explain what the storage requirements are on site and how it will be achieved.

8. Please confirm

		Notes for developers and Local Authorities
Which SuDS measures have been used?	Attenuation tank and flow control device	SuDS can be adapted for most situations even where infiltration isn't feasible e.g. impermeable liners beneath some SUDS devices allows treatment but not infiltration. See CIRIA SUDS Manual C697.
Drainage system can contain in the 1 in 30 storm event without flooding	no flooding occurs in 1:30 year storm event	This a requirement for sewers for adoption & is good practice even where drainage system is not adopted.
Any flooding between the 1 in 30 & 1 in 100 plus climate change storm events will be safely contained on site.	no floding occurs in events up to and including 1in 100 year plus 40% climate change	Safely: not causing property flooding or posing a hazard to site users i.e. no deeper than 300mm on roads/footpaths. Flood waters must drain away at section 6 rates. Existing rates can be used where runoff volumes are not increased.
How are rates being restricted (hydrobrake etc)	orifice plate	Hydrobrakes to be used where rates are between 2l/s to 5l/s. Orifices may not work below 5l/s as the pipes may block. Pipes with flows < 2l/s are prone to blockage but this can be overcome with careful product selection and SuDS design.

		Notes for developers and Local Authorities
Please confirm the owners/adopters of the SuDS throughout the development. Please list all the owners.	Gerry Caddoo	If these are multiple owners then a drawing illustrating exactly what features will be within each owner's remit must be submitted with this Proforma.
How are the entire SuDS to be maintained?	will be maintained in accordance with the maintenance report	If the features are to be maintained directly by the owners as stated in answer to the above question please answer yes to this question and submit the relevant maintenance schedule for each feature. If it is to be maintained by others than above please give details of each feature and the maintenance schedule. Clear details of the maintenance proposals of all element of the proposed drainage system must be provided. Poorly maintained drainage can lead to increased flooding problems in the future.

9. Evidence

Pro-forma Section	Document reference where details quoted above are taken from:	Page Number
2	Site Plan	
3	Drainage Plan	
4	Microdrainage Greenfield Runoff rate and attenuation tank calcs	
5	Microdrainage Greenfield Runoff Volume and Attenuation Tank Calcs	
6	Drainage Plan and Microdrainage Attenuation Tank Calcs	
7	Below ground crate Attenuation Systems	

The above form should be completed using evidence from the Flood Risk Assessment where applicable, surface water drainage strategy and site plans. It should serve as a summary sheet of the drainage proposals and should clearly show that the proposed rate and volume as a result of development will not be increasing. If there is an increase in rate or volume, the rate or volume section should be completed to set out how the additional rate/volume is being dealt with. This form is completed using factual information from the Flood Risk Assessment and Site Plans and can be used as a summary of the surface water drainage strategy on this site.

Form completed by:	Mehmet Ozdemir
Qualification of person responsible for signing off this pro-forma:	Civil Engineer MEng (Hons)
Company:	Andrew Firebrace Partnership Ltd
On behalf of (Client's details):	Gerry Caddoo
Date:	26.06.20

Appendix E Anglian Water Correspondence

From: PlanningComments
To: Emma Ousbey
Subject: FW: Discharge of Condition
Date: 29 June 2020 10:33:05
Attachments: image001.jpg
image004.jpg
image005.jpg

Emma – for your please and uploading.

Rose Mills | Technical Support Officer

| **e**-mail Rose.Mills@greatercambridgeplanning.org Mobile phone no 07514921842
https://www.scambs.gov.uk/planning/
https://www.cambridge.gov.uk/planning

Greater Cambridge Shared Planning: a strategic partnership between Cambridge

---

From: no-reply-InFlow@anglianwater.co.uk <no-reply-InFlow@anglianwater.co.uk>
Sent: 26 June 2020 08:45
To: Planning <planning@greatercambridgeplanning.org>
Subject: Discharge of Condition

Dear case officer

The Retreat Fews Lane Longstanton Cambridge Cambridgeshire CB24 3DP, S/3215/19/DC, PLN-0087321

Thank you for your enquiry to discharge condition relating to the above development site. Please find our comments below.

Foul Water Comments: The foul water drainage strategy is acceptable to Anglian Water, we can therefore recommend the discharge of condition 4 of planning reference S/2937/16/FL.

Surface Water Comments: The surface water drainage strategy does not involve discharge to Anglian Water owned assets, we therefore have no comments to make regarding the discharge of condition 5 of planning reference S/2937/16/FL.

Should you have any queries or comments regarding this please contact us at planningliaison@anglianwater.co.uk or 0345 60 66 087 Option 1 quoting reference PLN-0087321.

Kind Regards
Development Services Pre-Development Team

Not you or need help?

Call us on **0345 60 66 087**

Appendix F Consultation Response with SCDC

1. Geotechnical investigation and BRE 365 soakaway tests (full accordance of BRE 365);

As attached

2. Commentary on the consideration of the drainage hierarchy, and any justification for not deploying infiltration techniques;

Based on the SUDs hierarchy. it is not feasible to deliver a workable soakaway solution for the site on plot 3 due to constricted space

The proposed method for disposal of the surface water is to discharge in to the existing ditch. Due to the restricted discharge rate, on-site attenuation will be required to accommodate the excess storm water. It is proposed that the storage system be installed within the garden area to provide an off-line attenuation system.

3. Drainage discharge calculations for pre and post development design;

Qbar Greenfield runoff rate for the plot 3 is 0.2l/s which is not possible to achieve therefore 2/s has been used to avoid the blockages.

Climate change/future proofing has been taken into account and surface water systems has been designed for storm events up to and including 1 in 100 year plus 40% climate change.

See attached – Plot 3 Greenfield Runoff Rate

4. Attenuation calculations to confirm size of attenuation and sensitivity tests on a submerged outfall during the applicable design event;

See attached – Plot 3 Attenuation Tank Calcs

5. Third Party agreement confirmation for the discharge of foul water runoff to a sewer with sufficient capacity. (Note this is in relation to the CC/7 policy requirement. I imagine this agreement with the third party was part of the wider site planning application; however it should be submitted under this application also).

LPA to consult with Anglian Water

6. Confirmation on the riparian ownership to the existing ditch;

The riparian owner of the existing ditch is Mr G & Mrs F Caddoo

7. A Completed Drainage Pro-Forma (Appendix F of the SPD);

See attached

8. A maintenance and management plan of the proposed SuDS systems, addressing responsibilities.

Maintenance of the surface water system will be completed in accordance with the attached Below Ground Drainage Maintenance Report

Appendix G Maintenance Plan

Below Ground Drainage Operation and Maintenance Strategy Report

General

All of the measures described in this document will form part of the Health and Safety file. All of the measures and designs will need to be adhered to in order to maintain the design life and design capacity of the surface water drainage systems.

The below ground drainage network is designed in accordance with Building Regulations Part H 2015, BSEN 752-2008, LASOO Non Statutory Technical Standards for Sustainable Drainage 2015 and Ciria C753 – The SUDS Manual.

General

Inspection chambers and access points are provided which can be jetted / cleaned. General checking of the below ground drainage systems should be every three (3) months. General maintenance / cleaning of the below ground systems should be after each major storm event and on an annual basis. This applies to all pipes, inspection chambers, manholes, channels etc.

Attenuation Tanks

For maintenance requirements see extract from SUDS Manual C753 for Attenuation Tank. Attenuation Tanks should also be maintained in accordance with manufacturers recommendations.

Heavy vibrating rollers are definitely not recommended around plastic pipes or tanks due to the high pressures that they can generate. Thin layers with smaller plant are recommended. DfT (2009) should be referred to for guidance for plant and methods for achieving compaction. The manufacturers' recommendations usually limit plant size above geocellular units to no more than 2300 kg/m width. However, the loading resulting from this will still need to be checked in the design. If such plant is to be used adjacent to the units, the resulting compaction pressures need to be checked.

Any arch or flexible pipe structures depend on the even resistance provided from soil or aggregate on both sides of the arch/pipe for their structural capacity. Even slight differences in the level of filling on each side of the arch/pipe as it progresses could potentially cause uneven deflections and increase the stress within the structure above design values. Close supervision during backfilling is therefore vital. The backfill around geocellular tanks should also be brought up evenly around all sides.

Bedding directly below a concrete pipe should have minimal compaction. The fill at the side of the pipe should be well compacted to a level 300 mm above the crown of the pipe. Only light compaction should be applied to the backfill directly over the crown of the pipe to a point 300 mm above it. With reasonable workmanship and supervision, the bedding factors used in the design should be relatively conservative.

21.12.6 Wrapping

All storage tanks should be watertight in accordance with the relevant standards. Geocellular and similar structures using geomembranes to hold water should be sealed in accordance with waterproofing standards (ie welded joints rather than adhesive taped) and the integrity of the seal checked on site through the use of non-destructive testing, to ensure that it is leak-proof. Advice on appropriate integrity and seam tests for geomembranes, that could be adapted for testing membranes around storage tanks, is provided in Mallett *et al* (2014). Care needs to be taken during installation to protect against damage of both the tank structure and the geotextile and the geomembrane wrapping. Follow-on trades can also cause damage and put the integrity and performance of the structure at risk.

21.13 OPERATION AND MAINTENANCE REQUIREMENTS

Regular inspection and maintenance is required to ensure the effective long-term operation of below-ground storage systems. Maintenance responsibility for systems should be placed with a responsible organisation. Table 21.3 provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required.

Maintenance Plans and schedules should be developed during the design phase, and will be specific to the type of tank that is adopted. Specific maintenance needs of the system should be monitored, and maintenance schedules adjusted to suit requirements. Further detail on the preparation of maintenance specifications and schedules of work is given in Chapter 32.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

- Generic health and safety guidance is provided in Chapter 36.

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks

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

21.14 REFERENCES

BARNES, G E (2010) *Soil mechanics: principles and practice, third edition*, Palgrave Macmillan, Hampshire, UK (ISBN: 978-0-23057-980-4)

BCA (2014) *Design standards for box culverts*, BCA Technical Advice Note, Box Culvert Association, Leicester, UK. Go to: **http://tinyurl.com/qy6bmfx**

BETTESS, R (1996) *Infiltration drainage – manual of good practice*, R156, CIRIA, London, UK (ISBN: 978-0-86017-457-8). Go to: **www.ciria.org**

BRE (1991) *Soakaway design*, BRE Digest 365, Buildings Research Establishment, Bracknell, UK (ISBN: 0-85125-502-7)

CPSA (2013) *Technical design guide*, Concrete Pipeline Systems Association, Leicester, UK. Go to: **www.concretepipes.co.uk/page/technical-guide**

D'ARCY, B, ELLIS, J, FERNER, R, JENKINS, A and DILS, R (2000) *Diffuse pollution impacts, the environmental and economic impacts of diffuse pollution in the UK*, Terence Dalton Publishers, Suffolk, UK (ISBN: 978-1-87075-246-6)

DECC (2012) *Government response to "Home insulation. A report on the call for evidence carried out by OFT"*, Department of Energy and Climate Change, London, UK. Go to: **http://tinyurl.com/n9l4psx**

DfT (1998) *Manual of contract documents for highway works. Volume 1: Specification for highway works*, HMSO, London, UK (ISBN: 978-0-11552-705-0). Go to: **http://tinyurl.com/nuhk8c3**

DfT (2001) *Manual of contract documents for highway works. Volume 1: Series 2500 Special structures*, HMSO, London, UK. Go to: **http://tinyurl.com/l3tap4z**

DfT (2009) *Manual of contract documents for highway works. Volume 1: Series 600 Earthworks*, HMSO, London, UK. Go to: **http://tinyurl.com/phx5yj**

Appendix H Greenfield Runoff Calculations

Greenfield Runoff Volume

FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	20.000
Ratio R	0.450
Areal Reduction Factor	1.00
Area (ha)	0.050
SAAR (mm)	550
CWI	45.000
Urban	0.000
SPR	47.000

Results

Percentage Runoff (%)	30.62
Greenfield Runoff Volume (m^3)	9.137

Appendix I Manning's Equation for Watercourse

Appendix J

Manning Formula Uniform Trapezoidal Channel Flow at Given Slope and Depth

Ditch at rear of Fews Lane, Longstandon

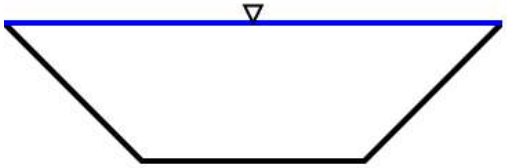
Bankfull dimensions estimated from survey drawing. Conservative estimate for channel slope and Manning's roughness.

Inputs

Bottom width	2	m
Side slope 1 (horiz./vert.)	1	
Side slope 2 (horiz./vert.)	1	
Manning roughness, n ?	0.05	
Channel slope	0.001	rise/run
Flow depth	1.24	m
Bend Angle? (for riprap sizing)	0	
Stone specific gravity (2.65)	2.65	

Results

Flow area	4.0176	m^2
Wetted perimeter	5.5072	m
Hydraulic radius	0.7295	m
Velocity, v	0.5125	m/s
Flow, Q	2.0591	m^3/s
Velocity head, h_v	0.0134	m
Top width, T	4.4800	m
Froude number, F	0.17	
Shear stress (tractive force), tau	7.1536	N/m^2
Implied design ? riprap size based on n	1.3788	m
Required bottom angular riprap size, D50, Maricopa County	0.0100	m
Required side slope 1 angular riprap size, D50, Maricopa County	0.0141	m
Required side slope 2 angular riprap size, D50, Maricopa County	0.0141	m
Required angular riprap size, D50, per Maynord, Ruff, and Abt (1989)	0.0049	m
Required angular riprap size, D50, per Searcy (1967)	0.0058	m



Appendix J Micro-drainage Surface Water Calculations – submerged outfall

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.450	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)
0-4	0.000

Total Area Contributing (ha) = 0.000

Total Pipe Volume (m³) = 0.050

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	3.598	0.020	179.9	0.000	3.00	0.0	0.600	o	100	Pipe/Conduit	
S1.001	2.748	0.380	7.2	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	3.11	6.510	0.000	0.0	0.0	0.0	0.57	4.5	0.0
S1.001	50.00	3.12	6.490	0.000	0.0	0.0	0.0	2.89	22.7	0.0

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Back (m
STANK	7.300	0.790	Open Manhole	1200	S1.000	6.510	100				
SHYDROBRAKE	7.300	0.810	Open Manhole	1200	S1.001	6.490	100	S1.000	6.490	100	
S	7.200	1.090	Open Manhole	0		OUTFALL		S1.001	6.110	100	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	100	STANK	7.300	6.510	0.690	Open Manhole	1200
S1.001	o	100	SHYDROBRAKE	7.300	6.490	0.710	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	3.598	179.9	SHYDROBRAKE	7.300	6.490	0.710	Open Manhole	1200
S1.001	2.748	7.2	S	7.200	6.110	0.990	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.000	0.000	0.000

Surcharged Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.001	S	7.200	6.110	6.110	0	0

Datum (m) 5.970 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
60	0.400	540	0.400	1020	0.400	1500	0.400	1980	0.400	2460	0.400
120	0.400	600	0.400	1080	0.400	1560	0.400	2040	0.400	2520	0.400
180	0.400	660	0.400	1140	0.400	1620	0.400	2100	0.400	2580	0.400
240	0.400	720	0.400	1200	0.400	1680	0.400	2160	0.400	2640	0.400
300	0.400	780	0.400	1260	0.400	1740	0.400	2220	0.400	2700	0.400
360	0.400	840	0.400	1320	0.400	1800	0.400	2280	0.400	2760	0.400
420	0.400	900	0.400	1380	0.400	1860	0.400	2340	0.400	2820	0.400
480	0.400	960	0.400	1440	0.400	1920	0.400	2400	0.400	2880	0.400

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	1
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.450		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SHYDROBRAKE, DS/PN: S1.001, Volume (m³): 0.9

Unit Reference	MD-SHE-0054-1000-0500-1000
Design Head (m)	0.500
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	54
Invert Level (m)	6.490
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	1.0
Flush-Flo™	0.151	1.0
Kick-Flo®	0.332	0.8
Mean Flow over Head Range	-	0.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.0	1.200	1.5	3.000	2.2	7.000	3.4
0.200	1.0	1.400	1.6	3.500	2.4	7.500	3.5
0.300	0.9	1.600	1.7	4.000	2.6	8.000	3.6
0.400	0.9	1.800	1.8	4.500	2.7	8.500	3.7
0.500	1.0	2.000	1.9	5.000	2.8	9.000	3.8
0.600	1.1	2.200	1.9	5.500	3.0	9.500	3.9
0.800	1.2	2.400	2.0	6.000	3.1		
1.000	1.4	2.600	2.1	6.500	3.2		

Storage Structures for Storm

Cellular Storage Manhole: STANK, DS/PN: S1.000

Invert Level (m) 6.510 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	10.5	10.5	0.500	0.0	17.3
0.400	10.5	17.3			

Time Area Diagram at Pipe Number S1.001 for Storm

Total Area (ha) 0.017

Time (mins) From:	To:	Area (ha)
0	4	0.017

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	1
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.450
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	STANK	15 Winter	1	+0%	30/15 Summer			
S1.001	SHYDROBRAKE	15 Winter	1	+0%	1/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	STANK	6.546	-0.064	0.000	0.12		0.5	OK	
S1.001	SHYDROBRAKE	6.625	0.035	0.000	0.06		1.0	SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	1
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.450
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	STANK	30 Winter	30	+0%	30/15 Summer			
S1.001	SHYDROBRAKE	15 Winter	30	+0%	1/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	STANK	6.673	0.063	0.000	0.22		0.8	SURCHARGED	
S1.001	SHYDROBRAKE	6.683	0.093	0.000	0.06		1.0	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	1
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.450
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	STANK	60 Winter	100	+40%	30/15 Summer			
S1.001	SHYDROBRAKE	60 Winter	100	+40%	1/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	STANK	6.905	0.295	0.000	0.22		0.8	SURCHARGED	
S1.001	SHYDROBRAKE	6.906	0.316	0.000	0.06		1.0	SURCHARGED	