

Oakleigh Farm, Codicote Road, Welwyn

Flood Risk Assessment and Drainage Strategy

November 2023

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Report Reference

19367/FRA and DS

Revision History

Rev	Amendments	Prepared By	Checked By	Date
First Issue	N/A	GBR	GBR	17/11/2023
A	Updated to suit latest layout	ShD	GBR	23.09.2024

Introduction

Introduction

The following paragraphs state the purpose of this document and provides a summary of existing and future site details.

- 1.1 This Flood Risk Assessment (FRA) and Drainage Strategy has been prepared by Woods Hardwick Ltd on behalf of Kingshall Estates Ltd in support of a Full Planning Application for a residential development comprising 7 dwellings and associated infrastructure on a site known as 'Oakleigh Meadows', Codicote Road, Welwyn. A copy of the Site Location Plan is provided in **Appendix A** and the proposed Site Layout Plan is included as **Appendix B**.
- 1.2 This planning application seeks to make a number of amendments to extant planning permission ref 20/00598/FP for the demolition of all existing buildings and structures, the change of use of the western section of the site to residential comprising the erection of seven new detached dwellings with associated detached garages, parking and amenity areas. The change of use of the eastern section to paddocks and upgrading the existing access road. In September 2021 the planning permission was allowed at appeal, for reference, the appeal decisions for both North Herts District Council (NHDC) and Welwyn Hatfield Borough Council (WHBC) are as follows; APP/C1950/W/21/3269378 and APP/X1925/W/21/3269379.
- 1.3 The Drainage Strategy prepared for the proposed development has been prepared in line with the previously agreed principles of the previously submitted and approved planning applications.
- 1.4 The application site is located in the Green Belt and lies south-east of Codicote and to the rear of existing residential and commercial properties.
- 1.5 The application boundary for the site covers an area of approximately 1.02ha and currently comprises undeveloped land.
- 1.6 The application site straddles the boundary between NHDC and WHBC and consequently an application to each authority is made.
- 1.7 In terms of flood risk, the proposed development will be situated in Flood Zone 1, land which has less than a 1 in 1,000 annual probability of river or sea flooding. The document is prepared on the basis that the site area is greater than 1ha.
- 1.8 This document has been written in accordance with the guidance contained within the Flood Risk and Coastal Change section of the Government's Planning Practice Guidance (FRCC, PPG).
- 1.9 This FRA concludes that the proposed development will not impede flood flows and will not increase the risk of flooding on the site itself, adjacent properties or to third parties situated either upstream or downstream of the site.

- 1.10 This document includes a Surface Water Drainage Strategy that identifies a suitable sustainable strategy for the disposal of surface water from the proposed development site that conforms with the guidance contained within the following documents:
- CIRIA C753 SuDS Manual (2015)
 - Hertfordshire County Council's (HCC) LLFA Summary Guidance for developers (August 2021)
- 1.11 The proposed Drainage Strategy is based on a maximum allowance of 40% climate change in accordance with LLFA guidance.
- 1.12 A suitable foul water outfall by way of direct connection into Thames Water (TW) assets located in within the proposed access road to the south of the site has also been identified for the proposed development.
- 1.13 Both the surface and foul water drainage strategies follow the principles of the previously approved strategy and in fact provide a greater level of detail than the previously approved strategies.
- 1.14 The risk of flooding to the site has not changed since the previously approved strategy was submitted and the proposals therefore remain acceptable in this regard.
- 1.15 From the findings of this report, and considering the above, the development proposals are considered appropriate for the site location; therefore, should be fully supported through the Planning Process in terms of Flood Risk and Foul and Surface Water Drainage.

Existing Site and Proposed Development

Existing Site and Proposed Development

The following paragraphs provide detail on the existing and proposed future development site; in relation to location, land uses and topography.

- 2.1 The proposed development site is located to the rear of existing properties along Codicote Road / B656 and is situated in the south eastern extent of Codicote.
- 2.2 As noted earlier, the application site straddles the boundary between NHDC and WHBC consequently applications are submitted to each planning authority.
- 2.3 The site covers an area of approximately 1.02 ha and is located in the Green Belt. The site lies south-east of Codicote and to the rear of existing residential and commercial properties.
- 2.4 The existing buildings on the site currently have an established mixed use of industrial and equestrian and are surrounded by expansive areas of open storage and hardstanding.
- 2.5 The immediate surrounding area includes residential properties to the south and south west and industrial buildings to the north west. To the east and the south east is predominantly open countryside. Oakleigh Meadows lies to the south east beyond which there are further residential properties.
- 2.6 A Topographical Survey of the site was carried out by Woods Hardwick in November 2023. During the survey, information was recorded on the location and type of land features observed, including type of surface finishes, land boundaries, access routes and vegetation. All surveyed elevations were recorded at heights in metres above Ordnance Datum (mAOD). Ground levels and spot levels are also indicated on the drawing where they were recorded onsite. A copy of the Topographical Survey is provided in **Appendix C**.
- 2.7 In terms of existing drainage utilities, TW sewer records confirm the presence of an existing foul water sewers within the back gardens of the existing properties on the eastern side of Codicote Road / B656 to the south of the site. The topographical survey confirms the presence of this sewer which flows beneath the proposed site access road.
- 2.8 Development proposals are for 7 detached residential dwellings and associated infrastructure. Vehicular accesses will be taken off Codicote Road / B656 to the south of the site. Refer to Site layout in **Appendix B** for further details.

Flood Risk

Flood Risk

The following paragraphs will identify whether or not there are any flood risks associated with the future development which may affect the proposals impact on the surrounding environment.

- 3.1 This FRA has been prepared in accordance with the National Planning Policy Framework (NPPF) which was published in March 2012 (last updated July 2021) and accompanying Planning Practice Guidance (PPG) published in November 2016 (last updated June 2021).
- 3.2 Table 1 of the Flood Risk and Coastal Change (FRCC), PPG seeks to define Flood Risk Zones. An extract of this table is shown in Figure 3.1 on the following page.
- 3.3 Annex 3 of the FRCC, PPG defines 'Flood Risk Vulnerability Classification'. Whilst Table 3 of the same document compares the suitability of a development within a particular Flood Zone based on its corresponding Flood Risk Vulnerability Classification.
- 3.4 As previously mentioned, the proposals are for residential development comprising 7 dwellings and associated infrastructure.
- 3.5 The Environment Agency (EA) Flood Map demonstrates that the site lies within Flood Zone 1 and is therefore classified as having less than 1 in 1,000 annual probability of flooding from rivers or seas. A copy of the EA Flood Map covering the immediate surrounding area for the proposed development is shown in **Appendix D**.
- 3.6 According to Annex 3, residential dwellings are classified under the 'More Vulnerable' category which is considered by the EA to be appropriate for development within Flood Zone 1. Therefore, there is no need to carry out a Sequential Test or Exception Test.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 0.1% annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b)
Zone 2 Medium Probability	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise: • land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or • land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding). Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Figure 3.1: Flood Zone Definitions - Planning Practice Guidance Extract

Risk of Flooding to the Development from Known Sources

- 3.7 Notwithstanding the above, presented below is a summary and analysis of the potential for the site to flood from known sources.

Flooding from Rivers and/ or Watercourses

- 3.8 The EA Flood Map enclosed in **Appendix D** shows that the proposed development land is situated in Flood Zone 1, land which has less than a 1 in 1,000 annual probability of river or sea flooding. Therefore, it is considered that the site is not at risk of flooding from this source.

Flooding from the Sea

- 3.9 The nearest sea to the site is the North Sea, which is approximately 85km to the east at its closest point.
- 3.10 Given the distance of the proposed development site from the sea, the proposed residential scheme is not considered to be at a risk of flooding from this source.

Flooding from Land

- 3.11 The potential for overland flow needs to be considered to ensure that neither the development nor adjacent land and/ or property, including that which may be under the responsibility of a third party is placed at an unacceptable risk of flooding.
- 3.12 From the EA Surface Water Flood Map for the site, which is enclosed in **Appendix E**, the majority of site is considered to be at very low risk of surface water flooding. The mapping confirms that the proposed properties will not be at risk.
- 3.13 However, the map shows that the proposed access to the site is at risk of low to high risk of flooding from surface water, variable at different locations.
- 3.14 Consistent with the previously approved scheme the proposed access road is to be kept at the existing level such that it does not impede any flows. The proposed access road will be formally drained which will assist in intercepting some flows.
- 3.15 The above approach was considered to be acceptable in relation to the previously approved scheme.

Flooding from Groundwater

- 3.16 Inspection of the British Geological Survey (BGS) website identifies that the site's underlying ground conditions comprise Lewes Nodular Chalk Formation and Seaford Chalk Formation. Copies of the BGS maps are provided in **Appendix F**.
- 3.17 A Site Investigation (SI) report was undertaken by WDE Consulting in November 2023. The report confirms that no groundwater was encountered within the trial pits which were excavated to a maximum depth of 4.0m. The site is therefore not considered to be at risk from this source. Copies of the relevant pages of the WDE report are included within **Appendix G**.

Flooding from Sewers

- 3.18 A copy of the TW Wastewater Plan illustrating the site extents and the immediate surrounding areas on Ordnance Survey (OS) mapping; together with approximate locations of TW assets is enclosed in **Appendix H**.
- 3.19 The TW Asset Plan confirms that there are no existing surface water sewers in the vicinity of the site. The plans confirm that a foul water sewer crosses the site access road. There are no known incidents of flooding of this sewer, given that the sewer is at a lower level than the proposed dwellings the site would not be at risk in any event.

Flooding from Reservoirs, Canals and Other Artificial Sources

- 3.21 The EA Reservoir Flood Map shows that no part of the site or any immediately neighbouring land is shown to be at risk of flooding from reservoirs.
- 3.22 It should be noted that an occurrence of flooding from reservoirs is considered by the EA to be extremely rare. There has been no loss of life in the UK from reservoir flooding since 1925.
- 3.23 Based on the above, the proposed residential development is not considered to be at risk of flooding from the aforementioned source.

Risk of Flooding from the Proposed Development

- 3.24 Presented below is a summary and analysis of the potential for the site to exacerbate the risk of flooding to third parties both upstream and downstream.

Encroachment onto Floodplain

- 3.25 As outlined above, the site does not lie within the floodplain, there is therefore no risk of encroachment upon the floodplain.

Impedance of Flood Flows

- 3.26 As the site lies out of the floodplain, there is no risk of the site impeding flood flows.

Contribution of Flood Flows by Development Drainage

- 3.27 As previously mentioned, the existing site covers an area of approximately 1.02ha.
- 3.28 The development proposals comprise 7 residential dwellings and associated infrastructure. These elements will all contribute to the development's surface water discharge.
- 3.29 If considered appropriate at the detailed design stage, additional flood routing measures will be incorporated to ensure that flood waters in excess of those for which the site has been designed to accommodate, will be routed away from the more vulnerable areas of the site.

- 3.30 The surface and foul water disposal strategies for the site are described in greater detail in the following 'Chapter 4 - Proposed Development Drainage Strategy'.

Climate Change

- 3.31 There is an increasing body of scientific evidence that suggests that the global climate is changing as a result of human activity. Past, present and future emissions of greenhouse gases are expected to cause significant climate change during this century.
- 3.32 The nature of climate change will vary for the UK. Projections of future climate change indicate that more frequent short-duration, high-intensity rainfall and more frequent periods of long-duration rainfall can be expected. These kinds of changes will have implications on river-flooding and also localised flash flooding.
- 3.33 The Planning Practice Guidance requires developments to consider the potential impacts of climate change. In February 2016 the EA released new guidance titled 'Flood risk assessments: climate change allowances' (FRA:CC), in which the peak rainfall intensity allowance in small and urban catchments is assessed.
- 3.34 Considering the above, the climate change allowance that the proposed development's drainage strategy will be based on, is set at a value of +40% ('Upper End' value i.e., 90th Percentile, taken from Table 2 of the FRA: CC, representing the total potential change anticipated for 2070 to 2115).

Proposed Development Drainage Strategy

Proposed Development Drainage Strategy

The following paragraphs will provide detail on the proposed site generated foul and surface water disposal methods, design criteria, maintenance regimes and potential third-party legal agreements.

- 4.1 In addition to ensuring that the development is not at risk of flooding from external sources, it is also important to ensure that the scheme itself does not exacerbate flood risk for others. It is therefore essential that the arrangements for storm and foul water disposal are fully assessed to guarantee that the effects are mitigated and that there will be no impact on the existing land drainage regime.

Surface Water Drainage Strategy

- 4.2 All of the recent guidance on the arrangements for storm water disposal from new developments has encouraged the application of a hierarchy for surface water disposal. This has now been formalised in the Building Regulations Part H. The hierarchy is also the basis of the advice on surface water disposal contained within HCC's LLFA Summary Guidance for developers.
- 4.3 The first choice for surface water disposal which should be pursued is via infiltration. Only where it has been determined that the ground conditions are not suitable should the second choice of disposal to a ditch and/ or watercourse be considered. If there is no alternative the third and last choice of disposal to the public sewer can be considered.

Method of Surface Water Discharge

Infiltration

- 4.4 Infiltration Testing was carried out by WDE Consulting in 2023 at the locations of the proposed infiltration systems that had not previously infiltration tests undertaken. These tests consisted of an extensive assessment of the infiltration characteristics of the ground. This included an assessment of infiltration at shallow depths where SUDS features such as permeable paving are adopted and at a deeper level, where features such as trench infiltration and soakaways could be adopted. The results are provided in **Appendix G**.
- 4.5 In addition to the most recent testing undertaken by WDE Consulting testing was previously undertaken by both Ian Farmer Associates and Soil Environmental Services Ltd the results of which are also included alongside the WDE Consulting results within **Appendix G**.

- 4.6 As previously mentioned, the first choice for surface water disposal which should be pursued is via infiltration. Only where ground conditions are not suitable should the second and third choice of disposal be explored, these being to a ditch and/ or watercourse and via disposal to the public sewer respectively.
- 4.7 As outlined above, infiltration testing has proved that infiltration is possible at the site. Therefore, surface water discharge will be solely via infiltration and it is not necessary to explore further options of surface water disposal.

Discharge Strategy & SuDS Proposed

- 4.8 A range of SuDS systems have been proposed as part of the development, including more preferable above ground features such as basins and swales. These are however not considered feasible in this instance as detailed below.
- 4.9 It is not considered appropriate to introduce above ground SuDS such as basins or swales in rear gardens as these would be required to be extremely deep in places to accommodate changes in levels across the site. Additionally, such features would become a possible maintenance liability and potentially be infilled by future residents.
- 4.10 The proposed dwellings will therefore be discharging via infiltration to individual soakaways located within rear gardens.
- 4.11 Regarding the shared private access/main access road. These areas will discharge either via permeable paving or soakaways beneath the access, both methods would ensure surface water is dealt very close to the source and suitable treated which is the most preferred method of surface water disposal. Due to the steep nature of this area of the site baffles and a soakaway for additional storage are incorporated within the design. The details are shown on the Drainage Strategy drawing included within **Appendix J**.
- 4.12 Due to the tree root protection zones and application/ownership boundary, there is insufficient space to locate above ground features within this corridor. The main access road utilises soakaways as permeable paving would become easily blocked and a maintenance liability from tractors serving the existing property.

Hydraulic Calculations

- 4.13 Separate hydraulic calculations have been completed for each of the 7 soakaways serving individual properties, the proposed permeable access roads and for the 2 surface water drainage systems serving the proposed main access road, with the surface water network also modelled where proposed.
- 4.14 To ensure calculations are accurate of the ground conditions, each hydraulic calculation has utilised the worst-case infiltration rate associated with the closest trial pit to that system.
- 4.15 Additionally, a CV value of 1 has been used for all hydraulic calculations whilst 10% urban creep has been applied to all dwelling roof areas, how this has been incorporated is demonstrated in the table below, whilst an impermeable area plan is provided in **Appendix K**.

Plot/soakaway Number	Driveway Area (m ²)	Roof Area (m ²)	10% urban creep Area (m ²)	Total Area used in calculations (m ²)
Soakaway 01	115	225	22.5	360
Soakaway 02	30	195	19.5	245
Soakaway 03	70	210	21	300
Soakaway 04	60	190	19	275
Soakaway 05	65	200	20	285
Soakaway 06	65	200	20	285
Soakaway 07	75	195	19.5	290

- 4.16 Supporting calculations for all surface water drainage systems are provided in **Appendix L**. The calculations assess the proposed drainage system during both the 1 in 30 year and 1 in 100 year plus 40% climate change event and demonstrate that the proposed drainage system provides sufficient capacity whilst also achieving necessary half drain times during such events.
- 4.17 Network 1 calculations indicate some surcharging during 50% AEP event, however it should be noted that this system models permeable paving only rather than a pipe system. Permeable paving is a shallow system with the top of the sub-base, which is used for storage, sitting only 0.23m below ground level. Therefore, for the storage to be fully utilized the water level will be designed to reach the top of the sub-base and subsequently it is expected to see some surcharging.
- 4.18 Network 3 also shows some surcharging, however this is only shown to be on the “outfall pipe” which is a dummy pipe required to be modelled downstream of infiltration systems. In reality, this pipe would not exist, and the surcharging is simply demonstrating that the soakaway located immediately upstream of this is being utilized during the storm event.

- 4.19 Dwelling finished floor levels are required to be set a minimum of 300mm above the design 1 in 100 year plus 40% climate change water level. As mentioned above, such events can be suitably accommodated within the proposed on site drainage system whilst the table below clearly demonstrates that sufficient freeboard is achieved to finished floor levels.

Plot	FFL	Soakaway Water level	Freeboard
1	84.2	81.883	2.317m
2	83.4	82.110	1.290m
3	86.1	84.443	1.657m
4	85	83.132	1.868m
5	83.85	80.994	2.856
6	84	81.124	2.876
7	83	80.728	2.272

- 4.20 The hydraulic calculations demonstrate that there is no above ground flooding during events up to and including the 1 in 100 year plus 40% climate change event, thus there is no above ground extent, depth or velocity to demonstrate on the drainage strategy drawing. Exceedance flow routes have however been provided in **Appendix M**, to demonstrate that should an event exceeding a 1% AEP rainfall event including climate change occur flows would be directed away from the proposed dwellings.

Sustainability and Water Quality

- 4.21 Surface water discharge from roof areas, which is considered clean discharge will be directly to the proposed individual soakaways. Surface water from these areas will receive one treatment stage filtering pollutants as water passes through the permeable membrane in which the soakaway would be wrapped.
- 4.22 Surface water discharge from part of the access road and area of private parking will be treated via permeable block paving. Surface water will initially be treated as it passes through the permeable surfacing which will remove pollutants such as hydrocarbons. A second treatment stage will then be provided by filtration through the membrane in which the permeable paving sub-base will be wrapped.
- 4.23 Surface water discharge from the remaining access road will receive an initial treatment stage via the proposed gullies which incorporate a silt trap and will trap any silt/sediment prior to discharge to the proposed soakaways.
- 4.24 All surface water will then drain through a catchpit manhole which would capture any further debris prior to discharge to the soakaways, which would provide a final treatment stage as water is filtered through the permeable membrane in which the soakaway would be wrapped.

- 4.25 It is therefore considered that surface water from all areas will receive an appropriate level of treatment in line with requirements prior to discharge to the ground.

Surface Water Drainage Maintenance

- 4.26 The arrangements for further maintenance of the surface water drainage system needs to be fully considered and, in that respect, it is proposed that all elements of the network will remain private.
- 4.27 The proposed maintenance responsibility of the soakaways to be provided within back gardens will therefore be the responsibility of the individual homeowners. This will also be the case for the permeable paving proposed on the individual driveways. The maintenance responsibility will be confirmed to residents at the time of purchase and within their Welcome Pack.
- 4.28 The maintenance responsibility relating to the proposed access road will be the responsibility of a developer funded management company.
- 4.29 A summary of the likely maintenance requirements relating to the permeable paving is provided on the following pages.

Table 4.2: Recommended Maintenance for Permeable Paving

Permeable Paving		
Monitoring	Frequency	Responsibility
Initial Inspection	Monthly for three months after installation	Homeowner/Management Company
Inspect for evidence of poor operation and/or weed growth - if required, take remedial action.	Monthly for three months after installation, 48h after large storms in first 6 months.	
Establish appropriate brushing frequencies.	Annual	
Regular Maintenance		
Brush regularly and remove sweepings from all hard surfaces	Annually, as required	Homeowner/Management Company
Occasional Maintenance		
Brush surface once a year to prevent silt blockage and enhance design life. Particular attention must be taken to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment.	Annually, after leaf fall, or reduces frequency as required, based on site-specific observations of clogging or manufacturers recommendations.	Homeowner/Management Company
Remedial Work		
Monitor effectiveness of permeable pavement and when water does into infiltrate seek advice for possible need of reinstatement of top layers or specialist cleaning.	As required	Homeowner/Management Company

- 4.31 It should be noted that the maintenance schedule should be considered indicative only. The frequency and type of maintenance tasks to be carried out should be reviewed as necessary to ensure that the schedule remains relevant to the nature and location of the proposed development.

Foul Water Drainage Strategy

- 4.32 The TW sewer records show an existing public foul water sewer flows within the rear gardens of the properties on the eastern side of Codicote Road / B656 to the south of the site. The sewer crosses beneath the proposed access road and its exact location is confirmed by the topographical survey.
- 4.33 The levels of the site are such that discharge via gravity to this sewer is achievable. The proposed onsite network and point of connection is shown on the Drainage Strategy drawing contained within **Appendix I**.
- 4.34 In accordance with relevant drainage policy, TW are obliged to accept foul water flows from a proposed development, subject to the site receiving planning consent. In anticipation that such a consent will be granted for the proposed residential scheme, it is expected that TW will make the necessary arrangements to ensure that the required provision within their public foul sewer network and treatment works will be available at the time that the Applicant wishes to connect the site's foul sewers to the public foul sewer.

Foul Water Drainage Maintenance

- 4.35 In anticipation that the proposed development will be connected to the TW public foul sewer network; it is considered reasonable to expect that TW will act in their full capacity as the wastewater provider for the local area, to ensure that maintenance of their public sewers will be carried out as required from the point at which the existing private sewer outfalls connect to the public sewer network.

Summary and Conclusion

Summary and Conclusions

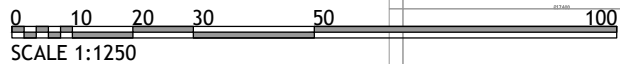
The following paragraphs summarise the findings of this Flood Risk Assessment and Drainage Strategy. Details of foul and surface water outfalls and SuDS features are also provided.

- 5.1 This Flood Risk Assessment (FRA) and Drainage Strategy has been prepared by Woods Hardwick Ltd on behalf of Kingshall Estates Ltd in support of a Full Planning Application for a residential development comprising 7 dwellings and associated infrastructure on a site known as 'Oakleigh Meadows', Codicote, Welwyn.
- 5.2 The application boundary for the site covers an area of approximately of 1.022ha and currently comprises a collection of existing buildings. The existing buildings on the site currently have an established mixed use of industrial and equestrian and are surrounded by expansive areas of open storage and hardstanding.
- 5.3 In terms of flood risk, the application site is situated in Flood Zone 1, land which has less than a 1 in 1,000 annual probability of river or sea flooding. This document has been prepared on the basis that the total site area exceeds 1ha.
- 5.4 All potential sources of flooding to the proposed development have been considered and it has been demonstrated that the site will not be at any significant risk of flooding.
- 5.5 It has also been demonstrated that the proposed development will not exacerbate the risk of flooding to third parties either upstream or downstream from the site.
- 5.6 The drainage strategy has been developed in accordance with the hierarchy for sustainable surface water disposal.
- 5.7 Accordingly, all elements of the proposed development will drain via infiltration through a combination of soakaways and permeable paving.
- 5.8 Calculations are provided to confirm that the drainage features are designed with sufficient capacity to accommodate the necessary half drain times and to provide the required storage volume during a 1 in 100 year storm (+40% climatic change).

- 5.9 In terms of maintenance, it is proposed that the soakaways located within back gardens will be maintained by the homeowners. The permeable paving on the individual driveways will also be the responsibility of the homeowners while the permeable paving on the access road will be maintained by a developer funded management company.
- 5.10 A foul water drainage strategy has also been prepared, the proposal is to discharge via gravity to the adopted foul water sewer that crosses the site access road.
- 5.11 Thames Water are obliged to accept foul water flows from a proposed development, subject to the site receiving planning consent. In anticipation that such a consent will be granted for the proposed residential scheme, it is expected that TW will make the necessary arrangements to ensure that the required provision within their public foul sewer network and treatment works will be available at the time that the Applicant wishes to connect the site's foul sewers to the public foul sewer.
- 5.12 From the information provided within this report in terms of drainage or flood risk, it is considered that the residential development proposed for Oakleigh Meadows should be fully supported through the planning process.

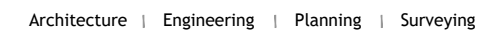
Appendix A

Site Location Plan



1. Contractors must check all dimensions on site. Only figured dimensions are to be worked from. Discrepancies must be reported to the Architect or Engineer before proceeding.
© This drawing is copyright.
2. Reproduced from OS Sitemap ® by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationery Office. © Crown copyright 2008. All rights reserved. Licence number 100007126.
3. Direct scaling off the drawing is permissible for planning purposes only.
4. Existing buildings are subject to demolition following Approval of Discharge of Conditions 5, 12 & 13 against the Approved Consent: APP/C1950/W/21/3269378 & APP/X1925/W/21/3269379.

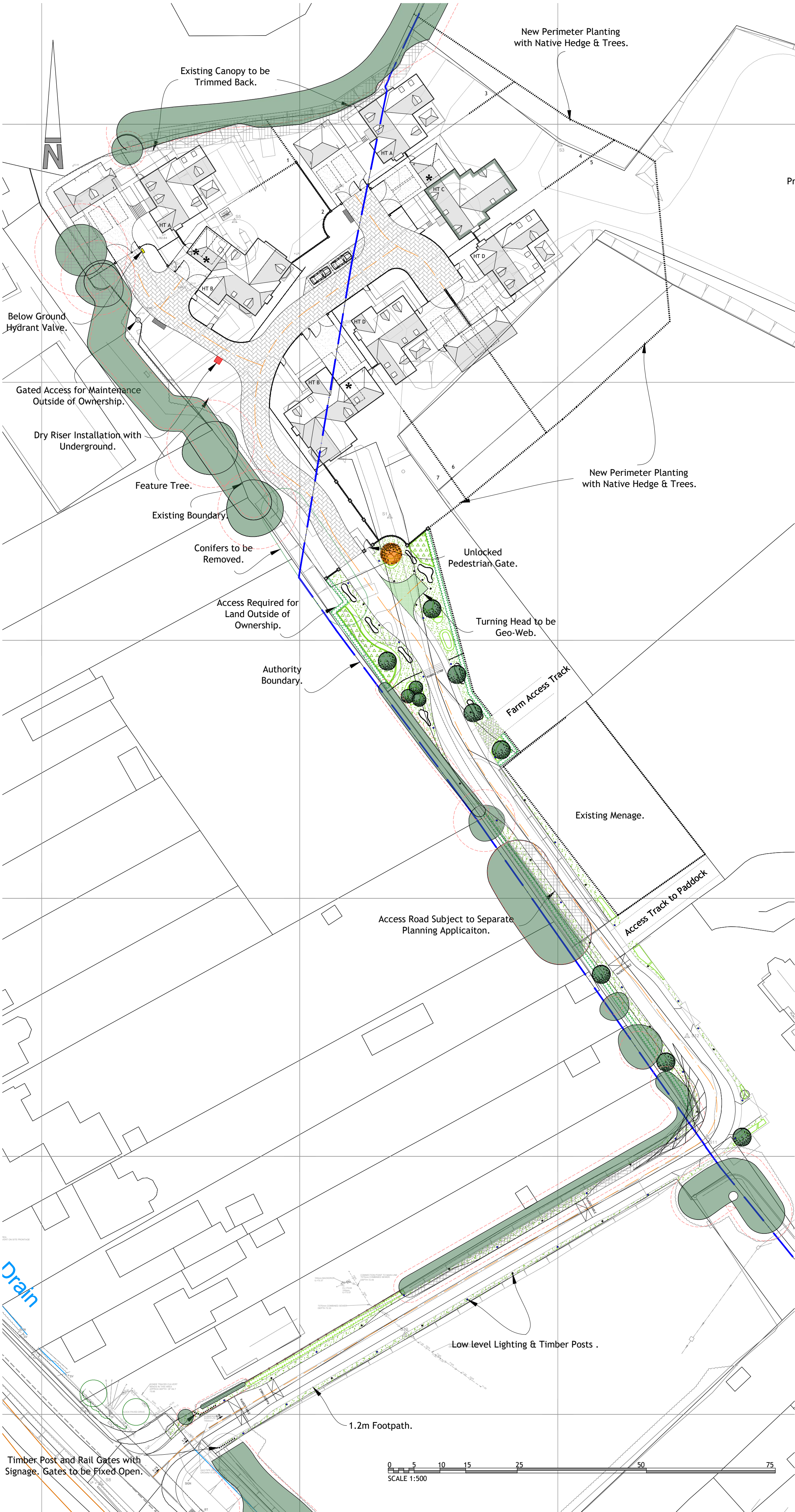
DETAILS



ONLINE: mail@woodshardwick.com | woodshardwick.com

Appendix B

Site Layout



- NOTES**
- Contractors must check all dimensions on site. Only figured dimensions are to be worked from. Discrepancies must be reported to the Architect or Engineer before proceeding.
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DRAWING LEGEND:

- Landscaping:**
- Denotes Proposed Hedgerow.
 - Denotes Proposed Shrub/Low Level Planting.
 - Denotes Proposed Tree.
- N.B. Landscaping is indicative only, please refer to detailed landscaping proposals for further information.

- Boundary Treatment:**
- Denotes 1.8m High Brick Screen Wall with 2.1m high piers.
 - Denotes Plot Division.
 - Denotes Garden Gate.
 - Denotes 1.5m High Estate Railings.
 - Denotes Timber Post and Rail Fence.
 - Denotes Dwarf Wall & Railings.

- Hardstanding:**
- Denotes Block Paving in Adoptable Highway (Laid in Herringbone Pattern).
 - Denotes Resin Bound Gravel in Private Drive (Laid in contrasting colour and/or pattern).
- N.B. All road surfaces to be blacktop/tarmac throughout unless noted otherwise.

- Miscellaneous:**
- Denotes Car Parking Space.
 - Denotes Visitor Parking Opportunity.
 - Denotes Car-Port/Barn.
 - Denotes Render.
 - Denotes Below Ground Hydrant Valve.
 - Denotes Dry Riser Installation with Underground Feed.
 - Denotes Authority Boundary.

Drawing revised to form part of the re-submission to Welwyn Hatfield District Council. Garages to Plot 4, 5 & 6 Revised, and the boundary landscaping has been enhanced.				AT	JAL	19.09.2024
Access road updated to reflect changes made to S73 access road; addition of 1.2m footpath. Method of access also amended.				AT	JAL	07.03.2024
REV	DESCRIPTION			DRN	CHD	DATE
☒ PRELIMINARY	☐ INFORMATION			☐ TENDER		
☐ CONSTRUCTION	☐ AS BUILT					
SCALE	1:500 @ A2			DATE	Oct. 2023	
DRAWN	AT			CHK	JAL	
DRAWING NO.	19359-1002			REV	B	
TITLE						
Oakleigh Meadows Codicote Road, Welwyn,						
DETAILS						
Planning Layout.						

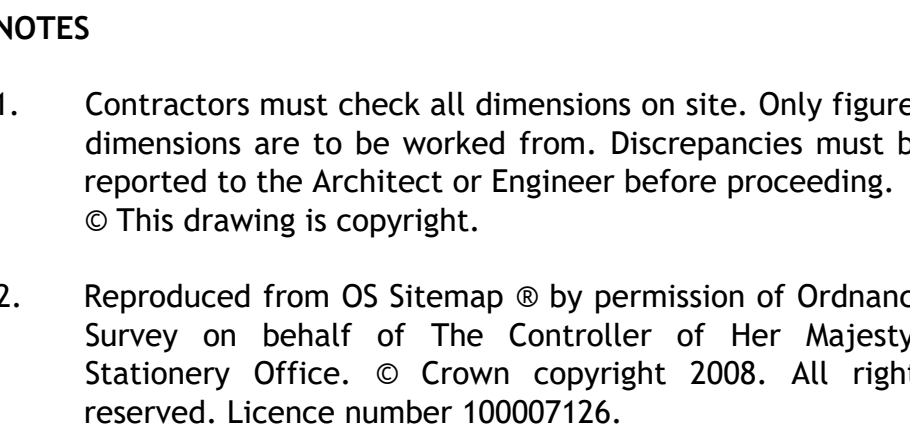
 **Woods Hardwick**
Architecture | Engineering | Planning | Surveying

BEDFORD : HEAD OFFICE 15-17 Goldington Road Bedford MK40 3NH T: +44 (0) 1234 268862	BIRMINGHAM Fort Dunlop, Fort Parkway Birmingham B24 9FE T: +44 (0) 121 6297784
ONLINE: mail@woodshardwick.com woodshardwick.com	

PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS DRAWING

Appendix C

Topographical Survey



PAS 128:2014 Quality Level Guide		
Quality Level	Description	Accuracy
QB4	A utility is expected to exist but cannot be detected - (AR) (RL) (CV)	Undefined
QB3	Horizontal location only using one geophysical technique.	±500mm Horizontal
QB2P	Horizontal location - (AR)	±500mm Horizontal
QB2	Horizontal and vertical location only using one geophysical technique.	±1250mm or ±1/40% of depth whichever is greater
QB1P	Horizontal and vertical location only using two geophysical techniques.	±1250mm or ±1/15% of depth whichever is greater
QA	Service verified in an open excavation, inside an inspection chamber (or man pit, or at the point the service enters / exits the ground).	±50mm Horizontal ±50mm Vertical

DETECTION SURVEY

DRAINAGE

Drainage was lifted with pipe sizes and invert levels recorded. Wherever possible the chamber sizes have been recorded and positioned on the drawing. All connections from gullies, external rainwater pipes and external soil stacks have been proven wherever possible into manholes and sewer runs by radio sonic location and/or GPR. Where a saddle connection is present the position is assumed only until proven to Q82 or above. In instances where other detection methods were unsuccessful connections between manholes have been assumed to be straight and labelled as Q84. All drainage should be cross checked in critical areas by CCTV survey or verification survey type A. Unable to lift some MHPs due to offset, damaged or gate.

[illegible]

- | REV | DESCRIPTION | DRN | CHD | DATE |
|---|--------------------------------------|---------------------------------|-----|------|
| ☒ PRELIMINARY | ☐ INFORMATION | ☐ TENDER | | |
| ☐ CONSTRUCTION | ☐ AS BUILT | | | |

DRAWN NC CHK NC

TITLE OAKLEIGH FARM

 **Woods Hardwick**
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Appendix D

Environment Agency - Flood Map for Planning

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
522318/217575

Created
15 Nov 2023 15:41

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger than 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2022 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>



Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
522318/217575

Scale
1:2500

Created
15 Nov 2023 15:41

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

0 20 40 60m

Appendix E

Environment Agency - Surface Water Flood Map

Oakleigh Meadows, Welwyn

Surface Water Flood Map 1 in 30 Year



Surface Water Flood Map 1 in 100 Year



Surface Water Flood Map 1 in 1000 Year



Appendix F

British Geological Survey Maps



MAP LAYERS

☐ Superficial Geology

☐ Bedrock Geology

☒ Combined Geology

About this layer:

Combination of bedrock and superficial geology



Info



Opacity



Legend

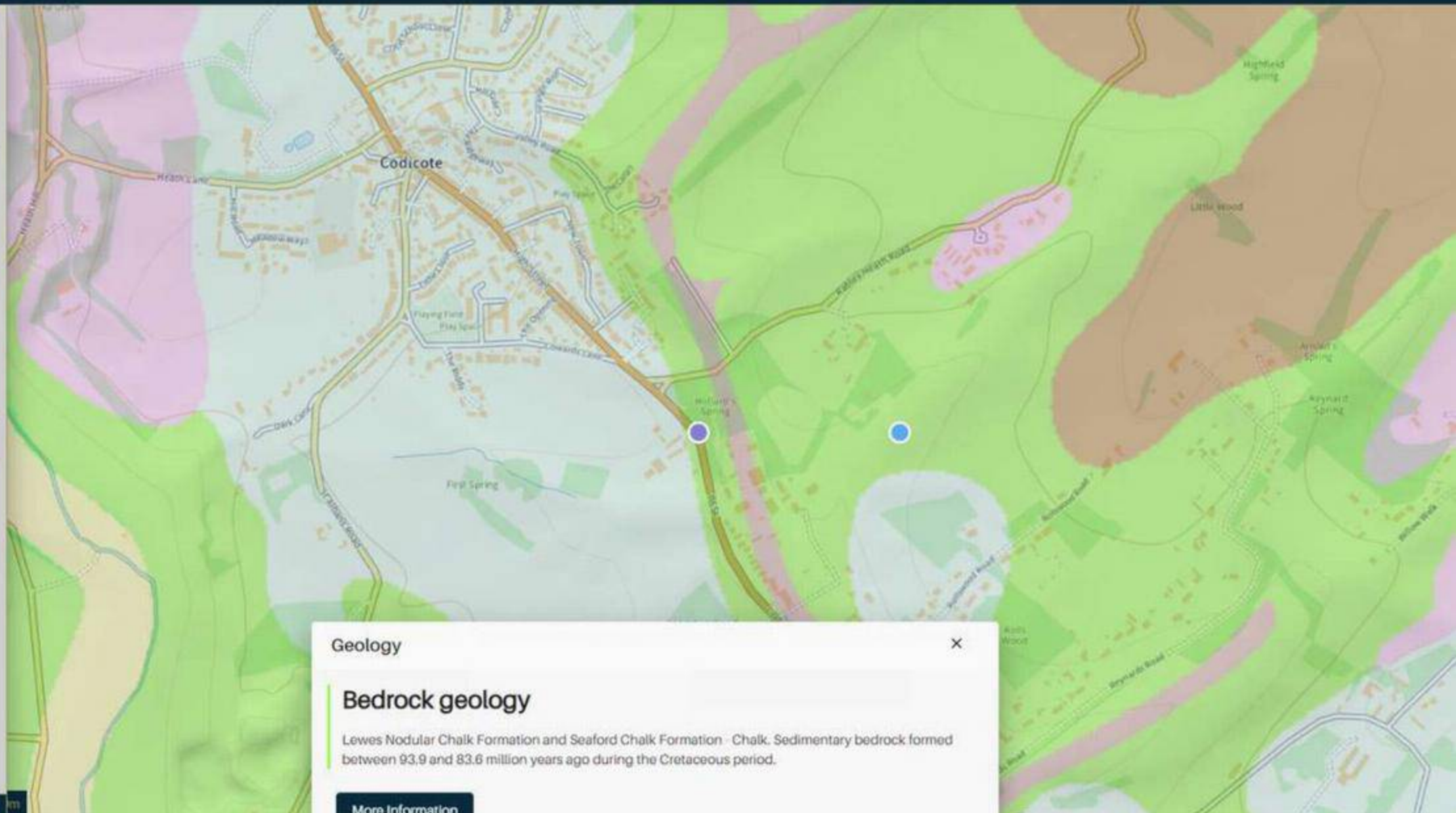
OPTIONS

Select Basemap

Settings

Contact BGS

More data? Try BGS GeoIndex



Geology



Bedrock geology

Lewes Nodular Chalk Formation and Seaford Chalk Formation - Chalk. Sedimentary bedrock formed between 93.9 and 83.6 million years ago during the Cretaceous period.

[More Information](#)

Appendix G

WDE Site Investigation Report Extracts

Geo-Environmental Assessment
Codicote Road
Welwyn
AL6 9TY

Kingshall Estates (UK) Ltd

Issue Date: November 2023
Report Ref: 21240R1 (Issue A)



CONTAMINATION



FOUNDATIONS



DRAINAGE



4.4.2 Groundwater

A summary of the groundwater monitoring results are presented in Table 12.

Table 12 – Groundwater Field Monitoring Results (m bgl)

Date	BH1	BH2	BH3
17/10/2023	Dry	Dry	Dry

4.4.3 Contamination Observations

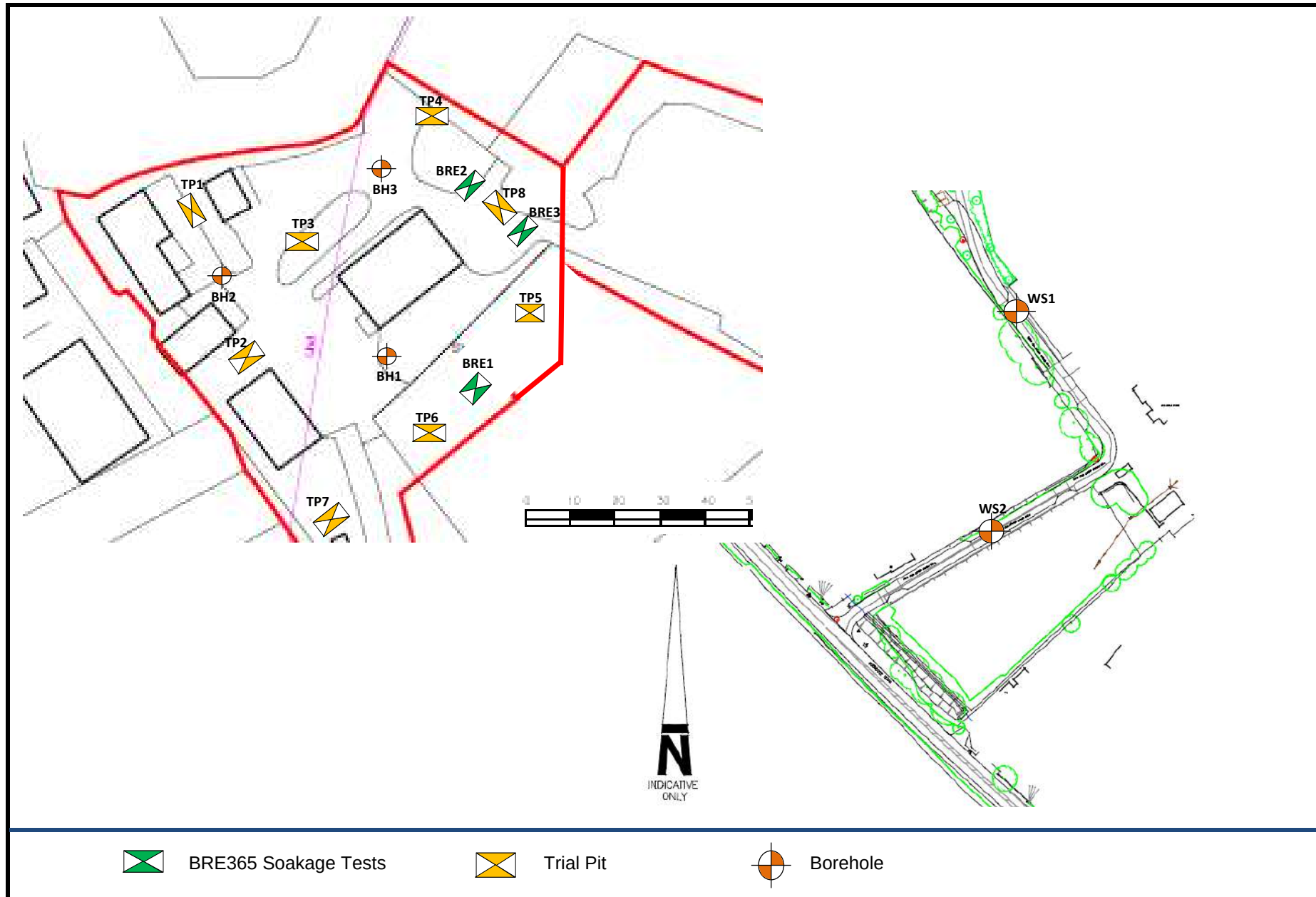
No grossly contaminated materials were observed during the investigation with all PID values <0.1ppm.

4.4.4 Permeability Results

A summary of the BRE365 soakage testing (including the previous findings¹) results is presented in Table 13 and are presented in full in [Appendix E](#).

Table 13 – Soakage Test Results

Location	Test Type	Material	Depth of Test m bgl	Test No	Drainage (m/sec)	Adopted Value (m/sec)	Qualitative Soakage Potential
2023 BRE1	BRE365	Chalk	1.45	1	1.86E-05	1.33E-05	Moderate
				2	1.78E-05		
				3	1.33E-05		
2023 BRE2	BRE365	Clayey Sand	1.5	1	1.00E-04	5.72E-05	Moderate
				2	9.66E-05		
				3	5.72E-05		
2023 BRE3	BRE365	Clay	2.90	1	N/A	<10-06	Very Poor
2020 TP1	BRE365	Chalk	3.00	1	4.11E-05	5.32E-05	Moderate
				2	5.32E-05		
				3	No data		
2020 TP2	BRE365	Chalk	3.10	1	2.93E-05	3.25E-05	Moderate
				2	3.25E-05		
				3	No data		



[illegible]

BRE1 (Test 1)

The graph displays the depth of a point below the ground level over a period of 10,000 seconds. The y-axis represents depth in meters, ranging from 0 to -1.2. The x-axis represents time in seconds, ranging from 0 to 10,000. A blue line with diamond markers shows the depth decreasing from approximately -0.85m at 0 seconds to about -1.05m at 10,000 seconds. Two horizontal red lines are drawn at approximately -0.9m and -1.0m.

Time (seconds)	Depth (m) below ground level
0	-0.85
4000	-0.98
6000	-1.00
9000	-1.05

Vp	Amount of Water Lost	DTW bgl
75%	0.1425	-0.8975
25%	0.0475	-0.9925

1.86E-05

Our Ref: EM/em/2240050

20th February 2020

Scott White and Hookins
Fountain House
26 St John's Street
Bedford
Bedfordshire
MK42 0AQ

F.A.O Jason Daniels

Dear Sirs,

Re: Oakleigh Farm, Codicote Road, Welwyn, AL6 9TY

We have pleasure in enclosing the findings of the site works undertaken at the above location, together with our invoice no. SI7501575 for the work carried out. We would be grateful if you could approve the invoice and forward for payment.

Two trial pits, designated TP1 and TP2, were excavated by mechanical excavator for the purpose of infiltration testing at the positions shown on the attached exploratory hole location plan, Figure A1.1.

The depths of trial pits, descriptions of strata encountered and comments on groundwater conditions are given in the trial pit records, Figure A2.1, together with photographs of the trial pits included in Figure A2.3.

Infiltrations tests were carried out in general accordance with BRE Digest 365.

The results of the tests undertaken in the trial pits at depths of between 2.70m and 3.10mbgl gave a coefficient of permeability (k) of between $k=2.93 \times 10^{-5} \text{m/s}$ and $k=5.32 \times 10^{-5} \text{m/s}$, suggesting good drainage characteristics at these locations.

The results of the infiltration tests are given in Figure A2.3.

We trust our report is satisfactory for your requirements, but should you have any queries please do not hesitate to contact us.

Yours faithfully

Emma Moore
Senior Geotechnical Engineer

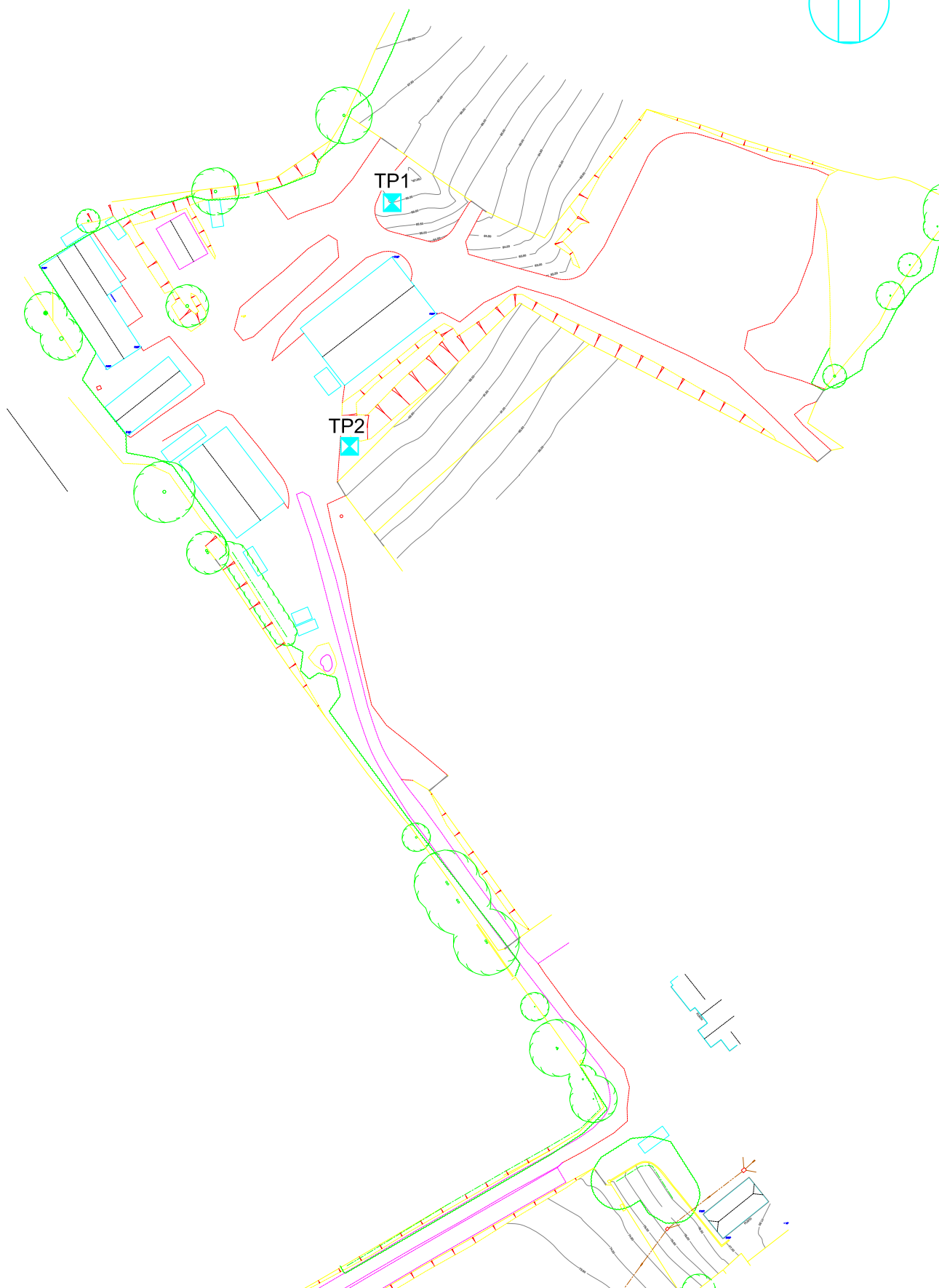
Encs.

Figure A1.1 – Exploratory Hole Location Plan

Figure A2.1 – Trial Pit Logs

Figure A2.2 – Trial Pit Photographs

Figure A2.3 – Results of Infiltration Tests



Scale : N.T.S.

Drawn By : P.L.E.

Job No: 2240050

Fig: A1.1

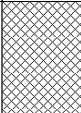
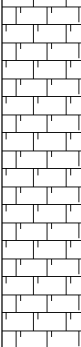
				Trial Pit Log			Trialpit No TP1 Sheet 1 of 1		
Project Name: Oakleigh Farm, Codicote Road, Welwyn, AL6 9TY				Project No. 2240050		Co-ords: - Level:		Date 31/01/2020	
Location: OS Grid reference - TL 223 176				Dimensions (m):		1.8 		Scale 1:25	
Client: Scott White and Hookins LLP				Depth 3.00		0.8 		Logged SG	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.20	B		0.40			MADE GROUND comprising grass over topsoil composed of soft light brown slightly gravelly very sandy clayey SILT with rare concrete fragments. (MGR)		
	1.20	B		1.80			Orange brown gravelly very silty clayey fine to coarse SAND with medium cobble content. Cobbles are are subangular and subrounded of flint. Gravel is subangular and subrounded fine to coarse of flint. (HEAD)		
	3.00	B		3.00			Recovered as structureless CHALK composed of white and orange brown stained, gravelly very sandy SILT. Gravel is very weak and weak, medium and high density, off-white with rare black specks. Occasional flint cobbles. (LESE)		
	End of pit at 3.00 m								
Remarks: Groundwater not observed.									
Stability:									



Figure A2.1

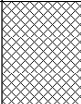
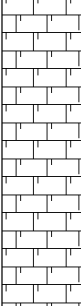
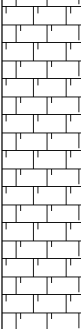
				Trial Pit Log			Trialpit No TP2 Sheet 1 of 1					
Project Name:		Oakleigh Farm, Codicote Road, Welwyn, AL6 9TY		Project No.		2240050		Co-ords: - Level:		Date 31/01/2020		
Location: OS Grid reference - TL 223 176				Dimensions (m):		2 0.6		Scale 1:25		Logged SAG		
Client: Scott White and Hookins LLP				Depth 3.10								
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description					
	Depth	Type	Results									
	0.20	B		0.35			MADE GROUND comprising compact blackish grey angular to subrounded fine and medium GRAVEL of ballast and clinker with frequent concrete and brick fragments, and occasional pockets of firm grey clay. (MGR)					
	0.50	B										
	1.10	B		0.95			Firm light reddish brown slightly gravelly sandy clayey SILT with a medium cobble content. Cobbles are angular to subrounded of flint. Gravel is angular to subrounded fine to coarse of flint and occasional chalk. (HEAD)					1
	2.00	B		2.00			Recovered as structureless CHALK composed of orangish cream, becoming lighter with depth, gravelly sandy SILT. Gravel is extremely weak and very weak, low and medium density, cream mottled orange brown. Occasional subrounded flint cobbles. (LESE)					2
				3.10			Recovered as possibly structured CHALK composed of silty, angular GRAVEL and COBBLES. Clasts weak, high density, off white with black specks. Matrix is off white. Rare flint gravel. (LESE)					3
						----- End of pit at 3.10 m -----						4
												5
Remarks: Groundwater not observed.												
Stability:												

Figure A2.1



Photo 1 – TP1.



Photo 2 – TP1 location and spoil heap.



Photo 3 – TP2 location and spoil heap.



Photo 4 – TP2 top of pit.



Photo 5 – TP2 base of pit.

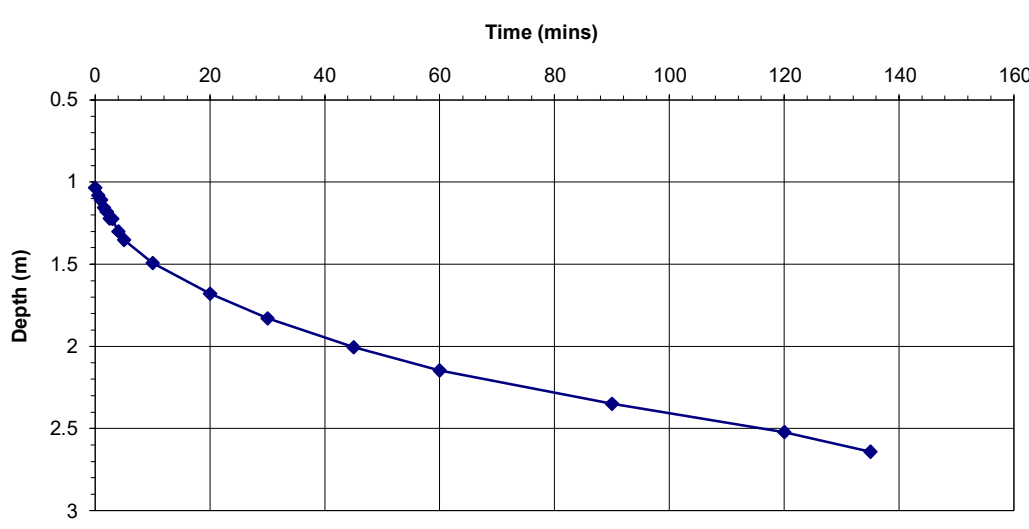
CALCULATION OF INFILTRATION RATE IN ACCORDANCE WITH BRE DG 365: 2016					
Client:	Scott, White and Hookins				
Site:	Oakleigh Farm, Welwyn, AL6 9TY				
Job No:	2240050	Test No:	TP1 - Test 1		
Date	31/01/2020	Weather:	Cloudy, dry		
INPUT DATA AND CALCULATION					
Time (min)	Depth (m)	Size of Trial Pit		Length (m) =	1.80
0	1.035			Width (m) =	0.80
0.5	1.08			Depth (m) =	3.00
1	1.108				
1.5	1.156	Depth to water at start of test (m) =		1.04	
2	1.18	Depth to water at end of test (m) =		2.64	
2.5	1.221	Depth to water at 75% level (m) =		1.44	
3	1.223	Depth to water at 50% level (m) =		1.84	
4	1.3	Depth to water at 25% level (m) =		2.24	
5	1.351				
10	1.492	Base area of pit (m ²) =		1.44	
20	1.68	Effective area of loss a _{s50} (m ²) =		6.55	
30	1.83	V _{P75} - V _{P25} (m ³) =		1.16	
45	2.005				
60	2.146				
90	2.35	From the graph:			
120	2.522	t _{p75} (min) =		8.5	
135	2.64	t _{p25} (min) =		80	
		Soil infiltration rate, f, (m/s) =		4.11E-05	normal test
		Tested by:	SAG	Date:	31/01/2020
		Checked by:	EM	Date:	11/02/2020
 The graph plots Depth (m) on the y-axis (0 to 3) against Time (mins) on the x-axis (0 to 160). Data points are plotted at (0, 1.035), (0.5, 1.08), (1, 1.108), (1.5, 1.156), (2, 1.18), (2.5, 1.221), (3, 1.223), (4, 1.3), (5, 1.351), (10, 1.492), (20, 1.68), (30, 1.83), (45, 2.005), (60, 2.146), (90, 2.35), (120, 2.522), and (135, 2.64). A smooth curve is fitted to these points, showing a decreasing rate of infiltration over time.					
Notes					
End of test depth 2.70m.					

Figure A2.3

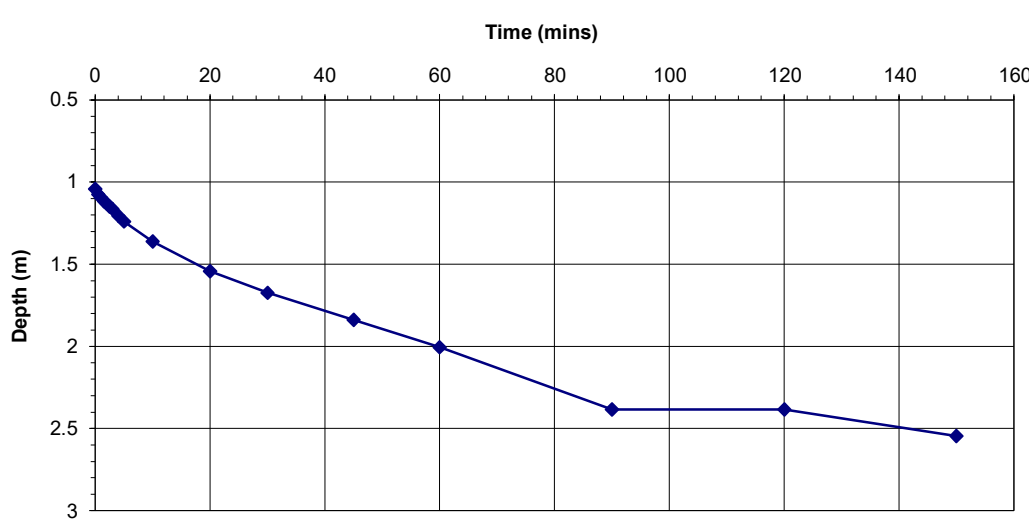
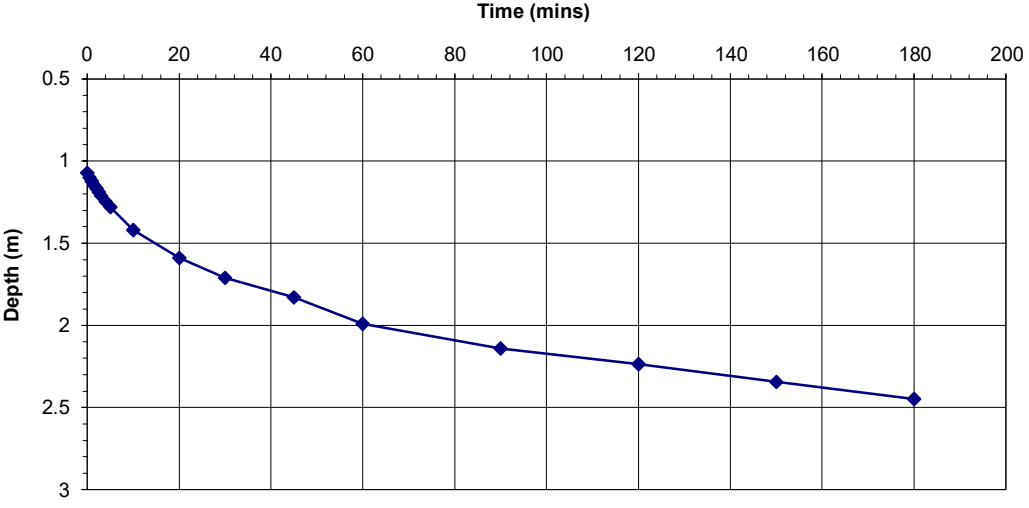
CALCULATION OF INFILTRATION RATE IN ACCORDANCE WITH BRE DG 365: 2016					
Client:	Scott, White and Hookins				
Site:	Oakleigh Farm, Welwyn, AL6 9TY				
Job No:	2240050	Test No:	TP1 - Test 2		
Date	31/01/2020	Weather:	Cloudy, dry		
INPUT DATA AND CALCULATION					
Time (min)	Depth (m)	Size of Trial Pit	Length (m) =	1.80	
0	1.042		Width (m) =	0.80	
0.5	1.076		Depth (m) =	2.70	
1	1.094				
1.5	1.116	Depth to water at start of test (m) =		1.04	
2	1.13	Depth to water at end of test (m) =		2.55	
2.5	1.15	Depth to water at 75% level (m) =		1.42	
3	1.164	Depth to water at 50% level (m) =		1.79	
4	1.205	Depth to water at 25% level (m) =		2.17	
5	1.24				
10	1.36	Base area of pit (m ²) =		1.44	
20	1.542	Effective area of loss a _{s50} (m ²) =		5.75	
30	1.674	V _{P75} - V _{P25} (m ³) =		1.08	
45	1.838				
60	2.006				
90	2.384	From the graph:			
120	2.384	t _{p75} (min) =		14	
150	2.546	t _{p25} (min) =		73	
		Soil infiltration rate, f, (m/s) =		5.32E-05	normal test
		Tested by:	SAG	Date:	31/01/2020
		Checked by:	EM	Date:	11/02/2020
					
Notes					
End of test depth 2.60m.					

Figure A2.3

CALCULATION OF INFILTRATION RATE IN ACCORDANCE WITH BRE DG 365: 2016					
Client:		Scott, White and Hookins			
Site:		Oakleigh Farm, Welwyn, AL6 9TY			
Job No:		2240050	Test No:	TP2 - Test 1	
Date:		31/01/2020	Weather:	Cloudy, dry	
INPUT DATA AND CALCULATION					
Time (min)	Depth (m)	Size of Trial Pit		Length (m) =	2.00
0	1.072			Width (m) =	0.60
0.5	1.101			Depth (m) =	3.10
1	1.121				
1.5	1.146	Depth to water at start of test (m) =		1.07	
2	1.167	Depth to water at end of test (m) =		2.45	
2.5	1.188	Depth to water at 75% level (m) =		1.42	
3	1.211	Depth to water at 50% level (m) =		1.76	
4	1.245	Depth to water at 25% level (m) =		2.10	
5	1.28				
10	1.42	Base area of pit (m²) =		1.20	
20	1.59	Effective area of loss a_{s50} (m²) =		6.47	
30	1.71	V_{P75} - V_{P25} (m³) =		0.83	
45	1.83				
60	1.99				
90	2.141	From the graph:			
120	2.235	t_{p75} (min) =		10	
150	2.344	t_{p25} (min) =		82.5	
180	2.449				
		Soil infiltration rate, f, (m/s) =		2.93E-05	normal test
		Tested by:	LB	Date:	31/01/2020
		Checked by:	EM	Date:	11/02/2020

Time (mins)



Notes

End of test depth 2.80m.

Figure A2.3

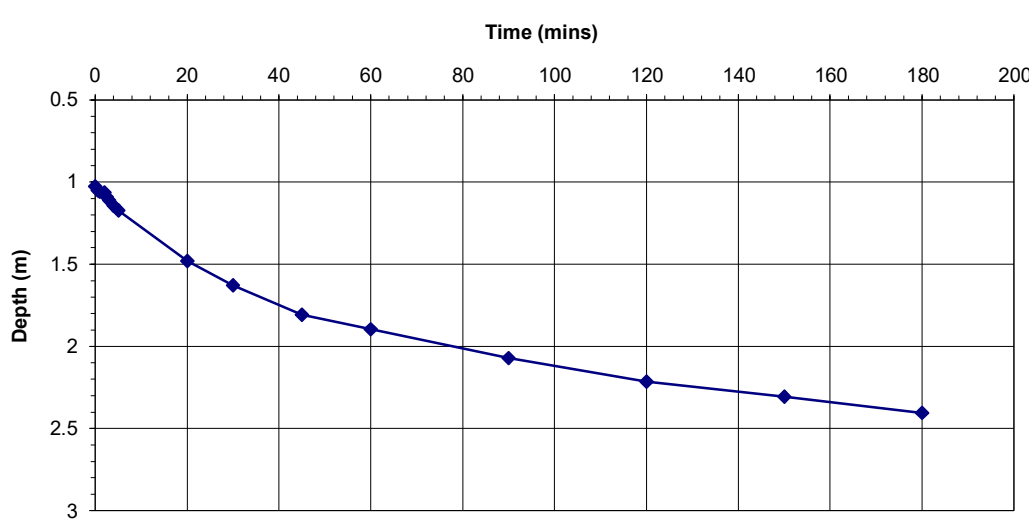
CALCULATION OF INFILTRATION RATE IN ACCORDANCE WITH BRE DG 365: 2016					
Client:	Scott, White and Hookins				
Site:	Oakleigh Farm, Welwyn, AL6 9TY				
Job No:	2240050	Test No:	TP2 - Test 2		
Date	31/01/2020	Weather:	Cloudy, dry		
INPUT DATA AND CALCULATION					
Time (min)	Depth (m)	Size of Trial Pit		Length (m) =	2.00
0	1.026			Width (m) =	0.60
0.5	1.049			Depth (m) =	2.80
1	1.059				
2	1.062	Depth to water at start of test (m) =		1.03	
2.5	1.089	Depth to water at end of test (m) =		2.41	
3	1.11	Depth to water at 75% level (m) =		1.37	
4	1.143	Depth to water at 50% level (m) =		1.72	
5	1.172	Depth to water at 25% level (m) =		2.06	
20	1.479				
30	1.628	Base area of pit (m ²) =		1.20	
45	1.807	Effective area of loss a _{s50} (m ²) =		5.81	
60	1.895	V _{P75} - V _{P25} (m ³) =		0.83	
90	2.071				
120	2.214				
150	2.306				
180	2.405				
		From the graph:			
		t _{p75} (min) =		15	
		t _{p25} (min) =		88	
		Soil infiltration rate, f, (m/s) =		3.25E-05	normal test
		Tested by:	LB	Date:	31/01/2020
		Checked by:	EM	Date:	11/02/2020
					
Notes					
End of depth test 2.55m.					

Figure A2.3

[illegible]

BRE1 (Test 2)

The graph displays the depth of a point over time. The y-axis represents depth in meters below ground level, ranging from 0 to -1.2. The x-axis represents time in seconds, ranging from 0 to 10000. A blue line with diamond markers shows a linear increase in depth. Two horizontal red lines are drawn at -0.8m and -1.0m.

Time (seconds)	Depth (m) below ground level
0	-0.71
2500	-0.79
5000	-0.88
7500	-1.00
10000	-1.08

Vp	Amount of Water Lost	DTW bgl
75%	0.3	-0.8
25%	0.1	-1

1.78E-05

ap50	2.160
V ₇₅	2150
V ₂₅	9100
tp75 - 25	6950



Soil Infiltration Rate (m/sec)	1.33E-05
--------------------------------	----------

ap50	1.870
V ₇₅	500
V ₂₅	1300
tp75 - 25	800



Vp	Amount of Water Lost	DTW bgl
75%	0.225	-1.275
25%	0.075	-1.425

1.00E-04

[illegible]

BRE2 (Test 3)

The graph displays the depth of a point below the ground level over time. The x-axis represents Time in seconds, ranging from 0 to 4000. The y-axis represents Depth in meters below ground level, ranging from 0 to -1.6. A blue line with diamond markers shows the measured depth, which starts at approximately -1.22 m at 0 seconds and increases to approximately -1.48 m at 3250 seconds. Two horizontal red lines are drawn at approximately -1.30 m and -1.42 m, likely representing design or reference depths.

Time (seconds)	Depth (m) below ground level
0	-1.22
1150	-1.31
1850	-1.38
3250	-1.48

Vp	Amount of Water Lost	DTW bgl
75%	0.21	-1.29
25%	0.07	-1.43

5.72E-05

[illegible]

BRE3 (Test 1)

Time (seconds)

Depth (m) below ground level

0, 5000, 10000, 15000

0, -0.5, -1, -1.5, -2, -2.5, -3

V_{75}
 V_{25}

Time (seconds)	Depth (m) below ground level
0	-2.65
3000	-2.65
6000	-2.65
15000	-2.65

Failed Test

Soil Infiltration Rate (m/sec)	<10-06
--------------------------------	--------

BRE 365 SOAKAWAY ASSESSMENT

ASC Contracts Limited

**Oakleigh Farm, Codicote Road
Welwyn**



**Soil Environment Services Ltd
July 2020**

Client:

ASC Contracts Limited
Town Mills
Canklow Road
Rotherham
S60 2JG

BRE 365 SOAKAWAY ASSESSMENT

**Oakleigh Farm, Codicote Road
Welwyn**

A report prepared on behalf of *Soil Environment Services* by:

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Environmental Consultant

Checked by:

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Managing Director

This report has been prepared by Soil Environment Services with all reasonable skill, care and diligence, within the terms of The Contract with The Client. The report is the property of The Client who can assign this report to any third party who will then be afforded the same assurances as detailed within the terms of the original Contract with The Client.

Soil Environment Services

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DRAWING 1

Trial Pit locations

1. SCOPE OF WORKS

Soil Environment Services Ltd was instructed to conduct analyse results of BRE365 soakaway tests (conducted by the client) at:

Oakleigh Farm
Codicote Road
Welwyn
AL6 9TY

OS Grid Ref: 522312, 217671

(Drawing 1)

The objective of the investigation is to ascertain infiltration rates of water and permeability of the ground to aid in the design of soakaway and drainage solutions in accordance with BRE365.

The work was conducted in general accordance with:

BRE DG 365 Revised 2016 Soakaway Design- Section 3.2.3.

Site work was undertaken by the client on the 3rd July to excavate nine soakage trial pits to determine infiltration rates.

The scope of works undertaken on site included:

- Four soakage trial pits to BRE365 specification into the chalk. The pit specifications were 50 cm x 130 cm x 200 cm depth.
- Four shallow trial pits to BS6297 approximate specification. The pit specifications were 50 cm x 120 cm x 70 cm depth.

All of the soakage pits were filled with a water bowser three times to to record the water levels and time of infiltration as per the BRE365 method.

2. SITE SETTING

The site assessed for this investigation comprises an area of land located at Oakleigh Farm. Farm buildings occupy the site (Photo 1). The site and surrounding land slopes down to the south.

PHOTO 1 Aerial view



2.1 Surface conditions

At the time of the investigation the site surface comprised hardstanding and soil.

PHOTO 2 Trial Pit 3 (TP3)



PHOTO 3 Trial Pit 4 (TP4)



2.2 BGS/Soil survey mapped Geology and drift

Current soils, geology and hydrology

British Geological Survey (BGS) maps indicate that the site is located on:

Superficial geology

No superficial deposits recorded.

Bedrock:

1:50 000 scale bedrock geology description: Lewes Nodular Chalk Formation and Seaford Chalk Formation (undifferentiated) - Chalk. Sedimentary Bedrock formed approximately 84 to 94 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas.

One BGS listed borehole log mapped 200 m north and within the same strata as mapped for this site (record of a well - BH TL21NW212) informs of water at approximately 31 m bgl.

2.3 Drainage, hydrogeology and encountered strata

Surface water flow/runoff could possibly find a route to surface water drains and channels to the south leading to the drain mapped 130 m south of the site. Also, given the slope and gravelly clay strata over chalk at depth, groundwater flow would be expected to be to the south.

The ground conditions encountered during the survey were approximately 0.7 m bgl of slightly sandy very gravelly clay made ground over chalky gravelly clay to 2 m bgl.

3. SOAKAWAY TEST

3.1 Test results

Table 1 Soakaway test results

Pit 1

BRE365 Soakaway parameters		Test 1	Test 2	Test 3		Units
Effective depth (max)		0.600	0.600	0.600		m
Pit depth		0.700	0.700	0.700		m
Pit length		1.200	1.200	1.200		m
Pit width		0.500	0.500	0.500		m
Water depth 1		0.450	0.450	0.450		m
Water depth 2		0.175	0.175	0.175		m
Volume (D1 to D2)*		0.165	0.165	0.165		m3
Surface area of test zone		0.770	0.770	0.770		m2
Time of flow - D1 to D2		132.000	185.000	164.000		min
Effective storage volume change (~75% to ~25%)		39.286	39.286	39.286		%
Infiltration rates		2.71E-05	1.93E-05	2.18E-05		m/sec
Design (lowest) infiltration rate			1.93E-05			m/sec
* Zone of measurement in BRE365 - this may vary on site						

Pit 2						
BRE365 Soakaway parameters		Test 1	Test 2	Test 3		Units
Effective depth (max)		1.000	1.000	1.000		m
Pit depth		2.000	2.000	2.000		m
Pit length		1.300	1.300	1.300		m
Pit width		0.500	0.500	0.500		m
Water depth 1		0.750	0.750	0.750		m
Water depth 2		0.250	0.250	0.250		m
Volume (D1 to D2)*		0.325	0.325	0.325		m3
Surface area of test zone		1.800	1.800	1.800		m2
Time of flow - D1 to D2		35.000	49.000	98.000		min
Effective storage volume change (~75% to ~25%)		25.000	25.000	25.000		%
Infiltration rates		8.60E-05	6.14E-05	3.07E-05		m/sec
Design (lowest) infiltration rate			3.07E-05			m/sec
* Zone of measurement in BRE365 - this may vary on site						

Pit 3						
BRE365 Soakaway parameters		Test 1	Test 2	Test 3		Units
Effective depth (max)		0.600	0.600	0.600		m
Pit depth		0.700	0.700	0.700		m
Pit length		1.200	1.200	1.200		m
Pit width		0.500	0.500	0.500		m
Water depth 1		0.450	0.450	0.450		m
Water depth 2		0.150	0.150	0.150		m
Volume (D1 to D2)*		0.180	0.180	0.180		m3
Surface area of test zone		0.770	0.770	0.770		m2
Time of flow - D1 to D2		104.000	97.000	35.000		min
Effective storage volume change (~75% to ~ 25%)		42.857	42.857	42.857		%
Infiltration rates		3.75E-05	4.02E-05	1.11E-04		m/sec
Design (lowest) infiltration rate			4.02E-05			m/sec
* Zone of measurement in BRE365 - this may vary on site						

Pit 4						
BRE365 Soakaway parameters		Test 1	Test 2	Test 3		Units
Effective depth (max)		0.600	0.600	0.600		m
Pit depth		0.700	0.700	0.700		m
Pit length		1.200	1.200	1.200		m
Pit width		0.500	0.500	0.500		m
Water depth 1		0.450	0.450	0.450		m
Water depth 2		0.350	0.350	0.350		m
Volume (D1 to D2)*		0.060	0.060	0.060		m3
Surface area of test zone		0.770	0.770	0.770		m2
Time of flow - D1 to D2		132.000	145.000	139.000		min
Effective storage volume change (~75% to ~ 25%)		14.286	14.286	14.286		%
Infiltration rates		9.84E-06	8.96E-06	9.34E-06		m/sec
Design (lowest) infiltration rate			8.96E-06			m/sec
* Zone of measurement in BRE365 - this may vary on site						

Pit 5					
BRE365 Soakaway parameters	Test 1	Test 2	Test 3		Units
Effective depth (max)	0.600	0.600	0.600		m
Pit depth	0.800	0.800	0.800		m
Pit length	1.500	1.500	1.500		m
Pit width	0.500	0.500	0.500		m
Water depth 1	0.500	0.500	0.500		m
Water depth 2	0.350	0.350	0.350		m
Volume (D1 to D2)*	0.113	0.113	0.113		m3
Surface area of test zone	1.000	1.000	1.000		m2
Time of flow - D1 to D2	77.000	145.000	85.000		min
Effective storage volume change (~75% to ~25%)	18.750	18.750	18.750		%
Infiltration rates	2.44E-05	1.29E-05	2.21E-05		m/sec
Design (lowest) infiltration rate		1.29E-05			m/sec
* Zone of measurement in BRE365 - this may vary on site					

Pit 6					
BRE365 Soakaway parameters	Test 1	Test 2	Test 3		Units
Effective depth (max)	0.600	0.600	0.600		m
Pit depth	0.700	0.700	0.700		m
Pit length	1.500	1.500	1.500		m
Pit width	0.500	0.500	0.500		m
Water depth 1	0.450	0.450	0.450		m
Water depth 2	0.350	0.350	0.350		m
Volume (D1 to D2)*	0.075	0.075	0.075		m3
Surface area of test zone	0.950	0.950	0.950		m2
Time of flow - D1 to D2	135.000	140.000	138.000		min
Effective storage volume change (~75% to ~25%)	14.286	14.286	14.286		%
Infiltration rates	9.75E-06	9.40E-06	9.53E-06		m/sec
Design (lowest) infiltration rate		9.40E-06			m/sec
* Zone of measurement in BRE365 - this may vary on site					

Pit 7						
BRE365 Soakaway parameters		Test 1	Test 2	Test 3		Units
Effective depth (max)		1.000	1.000	1.000		m
Pit depth		2.000	2.000	2.000		m
Pit length		1.700	1.700	1.700		m
Pit width		0.500	0.500	0.500		m
Water depth 1		0.750	0.750	0.750		m
Water depth 2		0.250	0.250	0.250		m
Volume (D1 to D2)*		0.425	0.425	0.425		m3
Surface area of test zone		2.200	2.200	2.200		m2
Time of flow - D1 to D2		200.000	140.000	164.000		min
Effective storage volume change (~75% to ~ 25%)		25.000	25.000	25.000		%
Infiltration rates		1.61E-05	2.30E-05	1.96E-05		m/sec
Design (lowest) infiltration rate			1.61E-05			m/sec
* Zone of measurement in BRE365 - this may vary on site						

Pit 8						
BRE365 Soakaway parameters		Test 1	Test 2	Test 3		Units
Effective depth (max)		0.600	0.600	0.600		m
Pit depth		0.700	0.700	0.700		m
Pit length		1.500	1.500	1.500		m
Pit width		0.500	0.500	0.500		m
Water depth 1		0.450	0.450	0.450		m
Water depth 2		0.150	0.150	0.150		m
Volume (D1 to D2)*		0.225	0.225	0.225		m3
Surface area of test zone		0.950	0.950	0.950		m2
Time of flow - D1 to D2		33.000	49.000	90.000		min
Effective storage volume change (~75% to ~ 25%)		42.857	42.857	42.857		%
Infiltration rates		1.20E-04	8.06E-05	4.39E-05		m/sec
Design (lowest) infiltration rate			4.39E-05			m/sec
* Zone of measurement in BRE365 - this may vary on site						

Pit 9						
BRE365 Soakaway parameters		Test 1	Test 2	Test 3		Units
Effective depth (max)		1.000	1.000	1.000		m
Pit depth		2.000	2.000	2.000		m
Pit length		1.600	1.600	1.600		m
Pit width		0.700	0.700	0.700		m
Water depth 1		0.750	0.750	0.750		m
Water depth 2		0.250	0.250	0.250		m
Volume (D1 to D2)*		0.560	0.560	0.560		m3
Surface area of test zone		2.300	2.300	2.300		m2
Time of flow - D1 to D2		98.000	70.000	110.000		min
Effective storage volume change (~75% to ~ 25%)		25.000	25.000	25.000		%
Infiltration rates		4.14E-05	5.80E-05	3.69E-05		m/sec
Design (lowest) infiltration rate			3.69E-05			m/sec
* Zone of measurement in BRE365 - this may vary on site						

DRAWING 1

Trial Pit locations

NOTES:

Soil Environment Services

Project: ASC Contracts

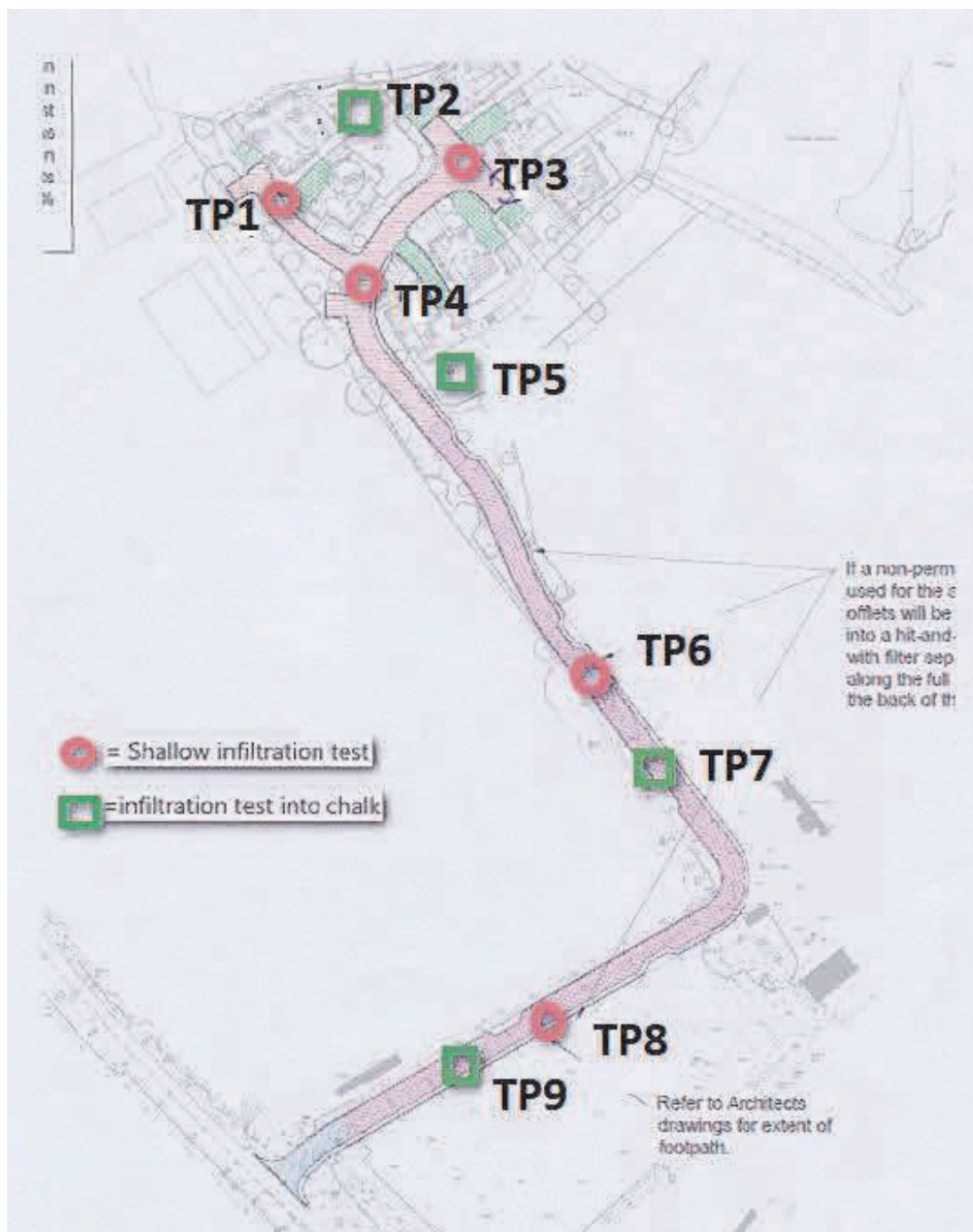
Client: Oakleigh Farm

Drawing Title: Trial pit locations

Drawing No.: 1

Scale: 1:375

Date: 09/07/2020



Appendix H

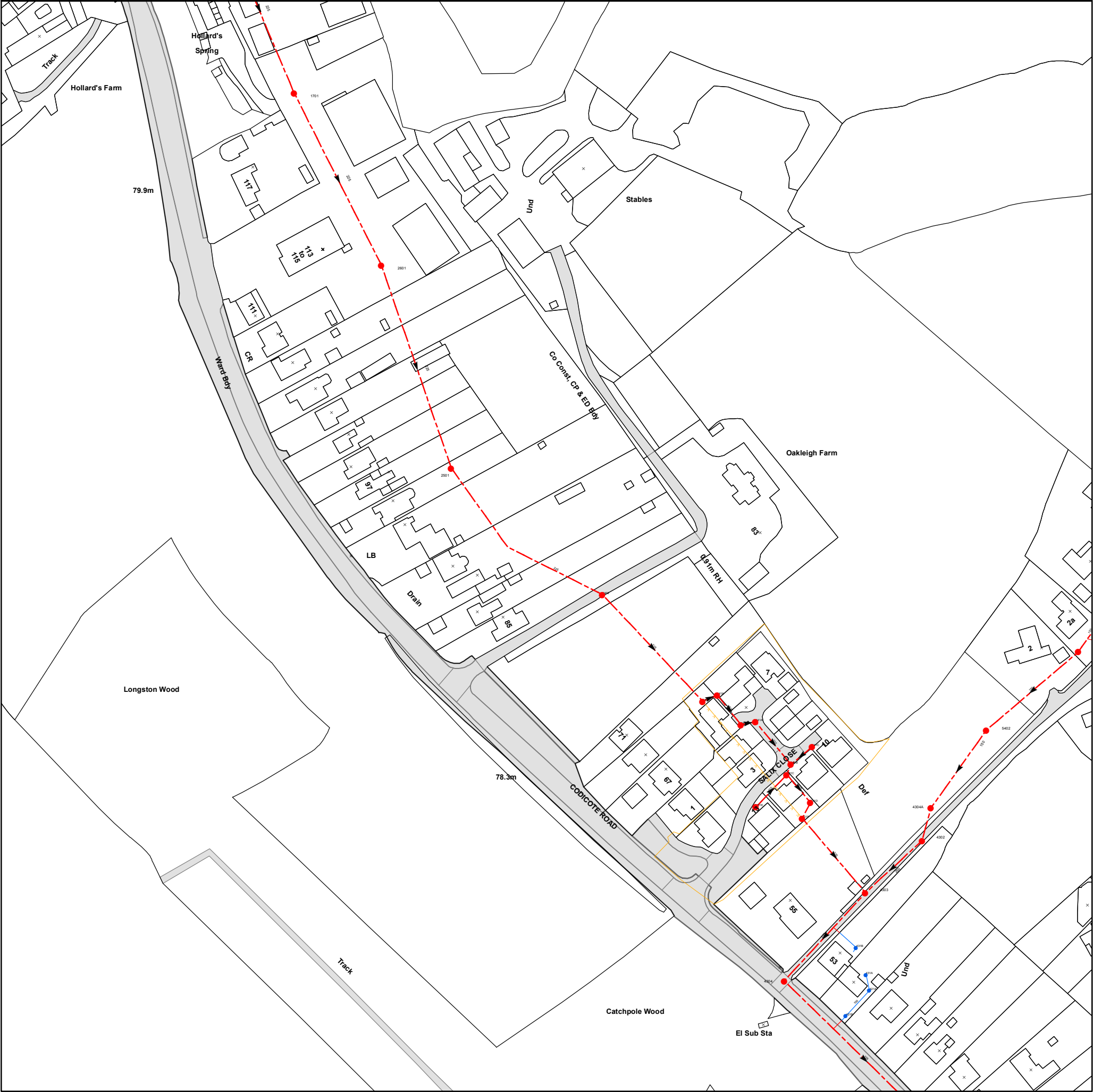
Thames Water Services Wastewater Map



Woods Hardwick
Architecture | Engineering | Planning | Surveying

Based on the Ordnance Survey Map with the
sanction of the Controller of H.M Stationary
Office License Number 10019345

ALS/ALS Standard/2019_4081502



0 10 20 40 60 80
Meters

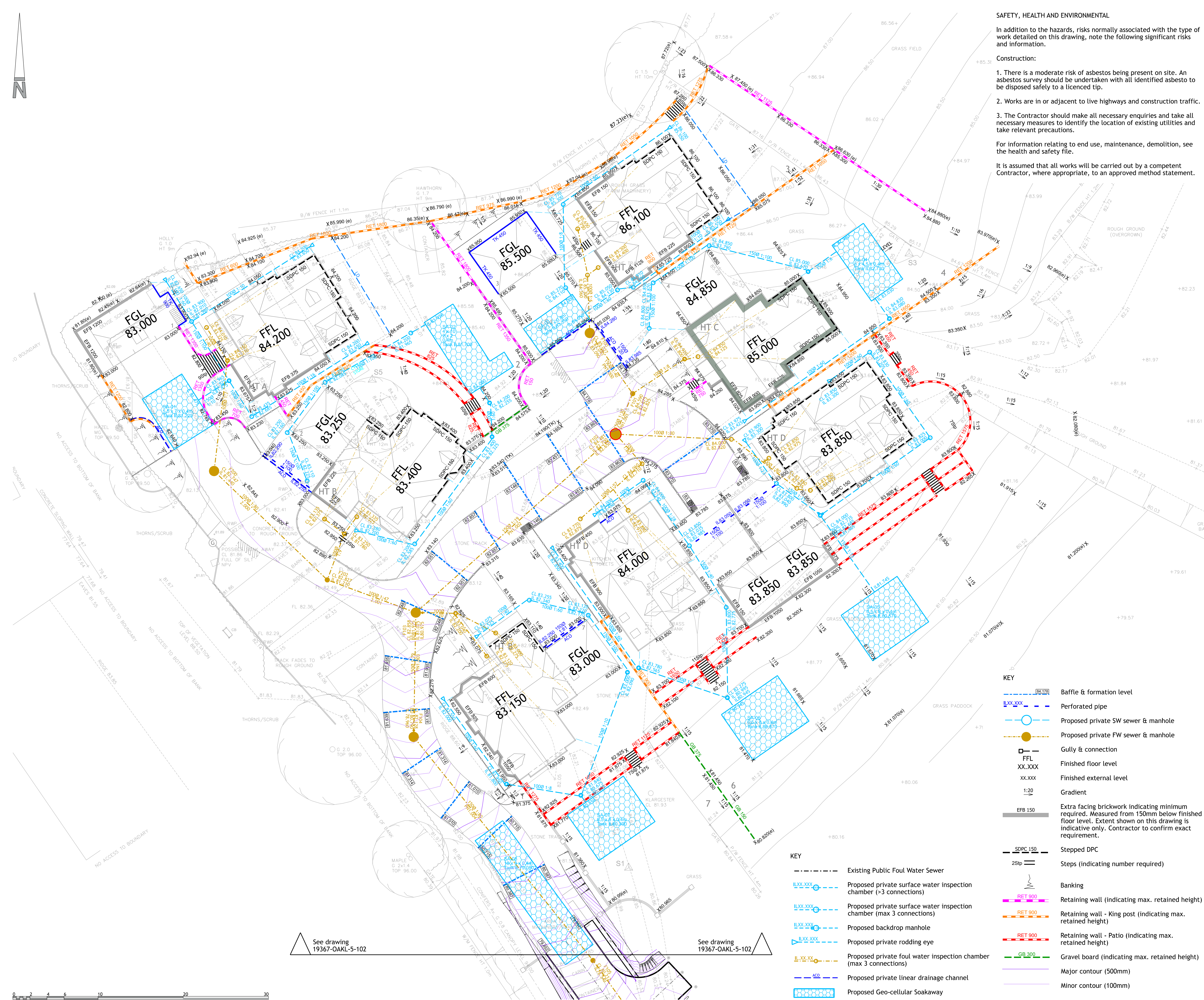
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale: 1:1790
Width: 500m
Printed By: dshivaji
Print Date: 25/09/2019
Map Centre: 522308,217500
Grid Reference: TL2217SW

Comments:

Appendix J

Drainage Strategy



SAFETY, HEALTH AND ENVIRONMENTAL

In addition to the hazards, risks normally associated with the type of work detailed on this drawing, note the following significant risks and information.

Construction:

1. There is a moderate risk of asbestos being present on site. An asbestos survey should be undertaken with all identified asbesto to be disposed safely to a licenced tip.
2. Works are in or adjacent to live highways and construction traffic.
3. The Contractor should make all necessary enquiries and take all necessary measures to identify the location of existing utilities and take relevant precautions.

For information relating to end use, maintenance, demolition, see the health and safety file.

It is assumed that all works will be carried out by a competent Contractor, where appropriate, to an approved method statement.

NOTES

1. Contractors must check all dimensions on site. Only figured dimensions are to be worked from. Discrepancies must be reported to the Architect or Engineer before proceeding. © This drawing is copyright.
 2. All plans and drawings are drawn true to stated scales and can be used for the purpose of planning only. Responsibility is not accepted for errors made by others in scaling from this drawing.
 3. Reproduced from OS Sitemap © by permission of Ordnance Survey on behalf of The Controller of His Majesty's Stationary Office. © Crown copyright 2008. All rights reserved. Licence number 100007126.
 4. Until technical approval has been obtained from the relevant authorities, all drawings are issued as preliminary and not for construction. Should the Contractor commence site work prior to approval being given it is entirely at their own risk.
 5. The designer, developer and contractor shall comply with all current requirements in relation to health, safety and welfare.
 6. Exact location and level of all existing sewers, drains and services to be checked on site before commencing works.
 7. All sewers must be laid from outfall working upstream. Precise depth of outfalls to be checked prior to proceeding with any other works.
 8. No surface water shall drain from private land or un-adoptable highway onto adopted highway or vice versa.
- Building Drainage Notes
9. All drainage to comply with Section H of the Building Regulations 2010 & BS.8301:1985.
 10. All drains to be 100mm diameter unless otherwise shown. Drains to be flexibly jointed 'supersleve' by Wavin or similar approved, with granular bed & surround where necessary. Drains under buildings to be backfilled to underside of slab with granular material. Drains passing through walls to have lintels over. All manholes to be on one side or other of boundaries. Manholes to be performed shallow access chambers, GRP inspection chambers or rectangular section P.C. concrete segments of the appropriate size for depth in accordance with BS.8301:1985 i.e. n.e. 1.0m deep to be 450x450 (internal), 1.0-2.7m deep to be 750x1200mm (internal) or as otherwise agreed. All manholes over 900mm deep to have step irons. Foundations to be taken down to invert level of drains where drains are less than 1.0m away from building.
 11. The contractor is to check the relationship between as-built centreline of road & back of footpath to verify levels opposite principal mobility access to ensure compliance with Part M of the building regulations. Any discrepancy with design information to be confirmed with Woods Hardwick Ltd. and the Developer before setting finished floor levels of affected properties.

General notes:

1. All stubs and invert levels to be verified prior to connection of private surface & foul drainage.
2. Existing topo survey is based on the original ground levels and makes no allowance for ground raising.
3. All materials subject to " & " approval.
4. All flights of steps to primary level access, with more than 2 steps are to be provided with handrailing, except where the steps are 900mm or more apart.

H	Updated to revised layout	ShD	SD	23.09.24
G	Soakaways revised following LLFA comments	ShD	SD	11.06.24
F	Revised retaining walls as per clients request	ShD	SD	03.04.24
E	Revised external levels to suit clients request	ShD	SD	21.03.24
D	External levels of Plots 1,3 & 4 updated at clients request	ShD	SD	14.03.24
C	Foul run 1.000 updated to 1500 at client request	CG	SD	13.02.24
B	Drainage updated	ShD	SD	07.02.24
A	Level adjustments to suit Client comments	ShD	SD	17.11.23

REV	DESCRIPTION	DRN	CHD	DATE
	☒ PRELIMINARY		☐ INFORMATION	☐ TENDER
	☐ CONSTRUCTION		☐ AS BUILT	

SCALE	1:200 @ A1	DATE	NOV 2023
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DRAWN	ShD	CHK	SD
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DRAWING NO.	19367-OAKL-5-101	REV	H
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TITLE	OAKLEIGH MEADOWS WELWYN
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DETAILS	PRIVATE LEVELS AND DRAINAGE SHEET 1
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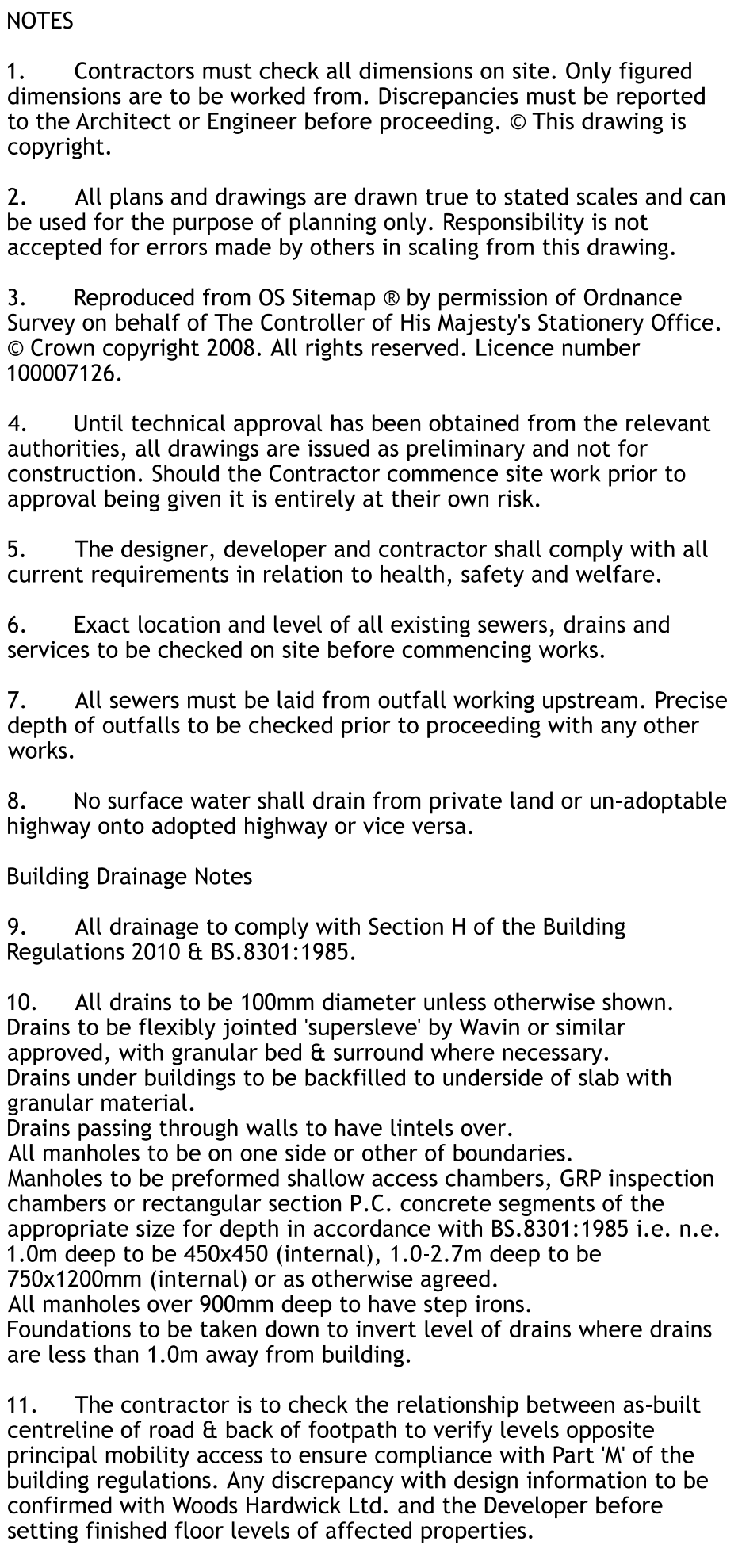
Woods Hardwick

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General notes:

1. All stubs and invert levels to be verified prior to connection of private surface & foul drainage.
2. Existing top survey is based on the original ground levels and makes no allowance for ground raising.
3. All materials subject to " & " approval.
4. All flights of steps to primary level access, with more than 2 steps are to be provided with handrailing, except where the steps are 900mm or more apart.

SAFETY, HEALTH AND ENVIRONMENTAL

In addition to the hazards, risks normally associated with the type of work detailed on this drawing, note the following significant risks and information.

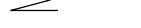
Construction:

1. There is a moderate risk of asbestos being present on site. An asbestos survey should be undertaken with all identified asbestos to be disposed safely to a licenced tip.
2. Works are in or adjacent to live highways and construction traffic.
3. The Contractor should make all necessary enquiries and take all necessary measures to identify the location of existing utilities and take relevant precautions.

For information relating to end use, maintenance, demolition, see the health and safety file.

It is assumed that all works will be carried out by a competent Contractor, where appropriate, to an approved method statement.

Exact position, depth and diameter of existing foul sewer to be confirmed on site prior to construction and reported to drainage engineer.

	Existing Public Foul Water Sewer
	Proposed private surface water inspection chamber (>3 connections)
	Proposed private surface water inspection chamber (max 3 connections)
	Proposed backdrop manhole
	Proposed private rodding eye
	Proposed private foul water inspection chamber (max 3 connections)
	Proposed private linear drainage channel
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	
	

J	Updated to latest layout	SHO	SO	23.09.24
I	Access updated following S278 comments	SHO	SO	13.05.24
G	Retaining walls updated as per clients request	SHO	SO	06.04.24
H	Journal levels updated following highway comments	SHO	SO	23.03.24
I	1.2m Footpath added to access	SHO	SO	14.03.24
E	Drainage notes amended following TW comments	SHO	SO	13.03.24
D	Drainage notes added following TW comments	SHO	SO	19.02.24
C	Fault run 1.000 updated to 1500 at client request	CG	SO	13.02.24
B	Drainage updated	SHO	SO	07.02.24
A	Level adjustments to suit Client comments	SHO	SO	17.11.23
REV	DESCRIPTION	DRN	CHD	DATE

☒ PRELIMINARY
 ☐ INFORMATION
 ☐ TENDER
☐ CONSTRUCTION
 ☐ AS BUILT

SCALE	1:200 @ A0	DATE	NOV 2023
DRAWN	ShD	CHK	SD

DRAWING NO. 19367-OAKL-5-102 REV J

OAKLEIGH MEADOWS
WELWYN



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PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS DRAWING