

LAND NORTH OF SCHOOL ROAD, ARBORFIELD CROSS
FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

CROUDACE HOMES, VORTAL HOMES LIMITED AND FALCON DEVELOPMENTS (SE) LIMITED

20 MARCH 2025



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1.0 Introduction

Context

- 1.1. This Flood Risk Assessment (FRA) has been prepared by Abley Letchford Partnership Ltd (ALP), on behalf of Croudace Homes, Vortal Homes Limited and Falcon Developments (SE) Limited to support an outline planning application for a proposed residential development of up to 70 dwellings together with open space and associated works at School Road in Arborfield Cross.

Development Proposals

- 1.2. The proposals are for a residential development of up to 70 dwellings together with open space and associated works. Means of Access to be considered (with Appearance, Landscaping, Layout and Scale to be reserved). The proposed scheme is shown on the Illustrative within **Appendix A**.
- 1.3. The Site forms the western extent of an application for outline planning permission (planning reference 242421) that was refused by Wokingham Borough Council on 20th December 2024. Design work has been ongoing since December and this planning application takes account of the Officer's Report and the consultation responses received during the application process, while addressing the reasons for refusal. In regard to the previous application, it should be noted that WBC's Flood Risk and Drainage officer raised no objection on the grounds of flood risk nor surface water flooding in a post-development scenario, subject to a planning condition relating to the drainage strategy.

Requirement for a Flood Risk Assessment

- 1.4. The requirement for an FRA is set out in Section 14 of the revised National Planning Policy Framework (NPPF) as revised in December 2024.
- 1.5. The footnote accompanying Paragraph 181 states:

'A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.'
- 1.6. The Site is arable farmland with existing access taken from Wood Lane to the east. It is contained by belts of mature and semi-mature trees and hedgerows. The site area is 5.52 hectares. As the site area extends greater than 1 hectare, a site-specific flood risk assessment is required. To comply with the requirements of the NPPF, matters related to flood risk and drainage are addressed within this report.

Report Aim and Formation

- 1.7. The principal aims of this report are to demonstrate that the proposed development complies with national and local planning policy in respect to flood risk and to demonstrate that a suitable drainage strategy can be provided as part of development.



- 1.8. This report will also summarise the impacts the development could have on flood risk to the surrounding area and outlines the mitigation strategies that will be implemented to minimise this risk.
- 1.9. The drainage design embraces the guiding principles of Sustainable Drainage Systems (SuDS) which are central to the design of the surface water drainage strategy for the proposed development.

Report Structure

- 1.10. This report addresses the requirements of revised NPPF and considers the following aspects:
- Section 2: Policy and Sources of Information – a review of policy relevant to the assessment and sources of information used to inform the assessment.
 - Section 3: Site Setting – a description of the site location, topography, geology and hydrology.
 - Section 4: Overview of Flood Risk – a review of data for flooding from all sources to determine the baseline flood risk to the site and an assessment of the impacts of the development on flood risk.
 - Section 5: Sequential Test and Exception Test – a description of the proposed development and a classification of the vulnerability in the context of the Sequential Test and Exception Test.
 - Section 6: Flood Risk Mitigation – the mitigation measures implemented to manage the potential flood risk to the development.
 - Sections 7 and 8: Drainage Strategy – a summary of appropriate strategies to manage the surface water and foul water drainage from the site in the post development scenario.
 - Section 9: Conclusion – a summary of the development proposals in the context of site vulnerability and the requirements of the NPPF.

2.0 Policy and Sources of Information

Introduction

- 2.1. This chapter provides a review of policy relevant to the assessment and the available information on all sources of flood risk.

National Planning Policy

- 2.2. National Policy in relation to flood risk is set out in Section 14 of the National Planning Policy Framework, Dec 2024 (NPPF) and Planning Practice Guidance ID:7 for Flood Risk and Coastal Change, Aug 2022 (PPG). Flood Risk is discussed at Paragraphs 170 to 182 of the NPPF.
- 2.3. Paragraphs 173 to 176 discuss the sequential approach with respect to individual applications. Paragraph 174 refers to the Strategic Flood Risk Assessment (SFRA) that would form the basis of applying the Sequential Test for local authorities to allocate developments, whilst Paragraphs 177-179 relate to Exception Tests.
- 2.4. Paragraph 181 discusses the determination of planning applications stating:
- ‘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. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:*
- 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;
 - The development is appropriately flood resistant and resilient, such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;
 - It incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
 - Any residual risk can be safely managed; and
 - Safe access and escape routes are included where appropriate, as part of an agreed emergency plan.’
- 2.5. The proposed development is for up to 70 dwellings at the site which covers approximately 5.52 hectares and would, therefore, be classed as a Major development because the site is greater than 0.5 hectares. Paragraph 182 states:

‘...Sustainable drainage systems provided as part of proposals for major development should:

- a) Take account of advice from the lead local flood authority;*
- b) Have appropriate proposed minimum operational standards; and*
- c) Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development.’*



- 2.6. The PPG sets out more specific guidance on how to apply and implement the NPPF policies. This includes guidance on when a Sequential Test is required and considerations on how to apply the test. In paragraph 023 of the PPG the aim of the sequential approach is clarified and includes the following:

'The approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk.'

- 2.7. In applying the Sequential Test to planning applications, NPPF paragraph 175 confirms specific development cases when the test is not applicable:

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

Environment Agency

- 2.8. The Flood and Water Management Act (2010) provides the Environment Agency (EA) a strategic overview role for all forms of flooding and coastal erosion. They also have direct responsibility for the prevention, mitigation and remediation of flood damage for main rivers and coastal areas. The EA is a statutory consultee in relation to flood risk and planning dependent upon criteria.
- 2.9. The EA Flood Map for Planning, EA Long Term Flood Risk Mapping and the Catchment Data Explorer websites have been interrogated in respect to flood risk extents and sources.

Local Authorities

- 2.10. The site lies within the administrative area of Wokingham Borough Council (WBC). WBC is the Local Planning Authority (LPA). WBC is also the Lead Local Flood Authority (LLFA).
- 2.11. Planning guidance published by WBC regarding the flood risk was referred to in order to assess the methodology best suited to suit the local area. The following key documents were reviewed:
- Wokingham Borough Council Adopted Core Strategy Development Plan (dated January 2010);
 - Wokingham Borough Council Local Flood Risk Management Strategy (dated April 2015);
 - Wokingham Borough Council Preliminary Flood Risk Assessment (PFRA) (dated June 2011) and PFRA addendum (dated 2017);
 - WBC Level 1 Strategic Flood Risk Assessment (SFRA) (dated May 2023);
 - WBC Level 2 Strategic Flood Risk Assessment (SFRA) (dated August 2023) and
 - WBC SuDS Strategy (dated January 2017).
- 2.12. WBC became the LLFA under the Flood and Water Management Act 2010. WBC provide guidance to assess, manage and inform flood risk.



- 2.13. As LLFA, WBC's Flood and Water Management Team provide a Sustainable Drainage Systems Strategy Guide to assist developers seeking planning permission for new sites by setting criteria to be met as part of the design of the drainage strategy and a list of documentation to be presented in the associated FRA. A copy of the Planning Application Drainage Checklist is included within **Appendix B**.
- 2.14. WBC has permissive rights over any Ordinary Watercourses including land drainage ditches. If any work is required within the watercourse (improvements or crossings) then approval from the LLFA is required under the Land Drainage Act 1991.

Local Water Authority

- 2.15. Thames Water (TW) are responsible for the supply of clean water and disposal of wastewater for the Wokingham Borough.
- 2.16. Information with regards to sewer and water main flooding contained within the WBC Level 1 SFRA has been reviewed as part of this FRA. All water companies have a statutory obligation to maintain a register of properties and areas which are at risk of flooding from the public sewerage system and is shown on the DG5 Flood Register.

Other Sources of Information

- 2.17. A desktop study of the site was carried out using the following websites to ascertain local features, hydrology and soil characteristics:
- DEFRA's Magic Map portal;
 - British Geological Survey (BGS) 'Geology of Britain' online viewer; and
 - Cranfield University 'Soilscapes' portal.
- 2.18. A site walkover conducted during May 2024 allowed observation of existing topography, watercourses, and the general drainage regime at the site.
- 2.19. Guidance with respect to Sustainable Drainage Systems (SuDS) is contained within DEFRA document Sustainable Drainage Systems, Non-statutory technical standards for sustainable drainage systems March 2015, CIRIA C753 The SuDS Manual and within the NPPF Planning Practice Guidance (PPG) – 'Flood Risk and Coastal Change'.
- 2.20. Additional guidance on development and flood risk is contained within CIRIA C624 Development and Flood Risk – Guidance for the Construction Industry which identifies several key aims for a development to ensure it is sustainable in flood risk terms.

3.0 Site Setting

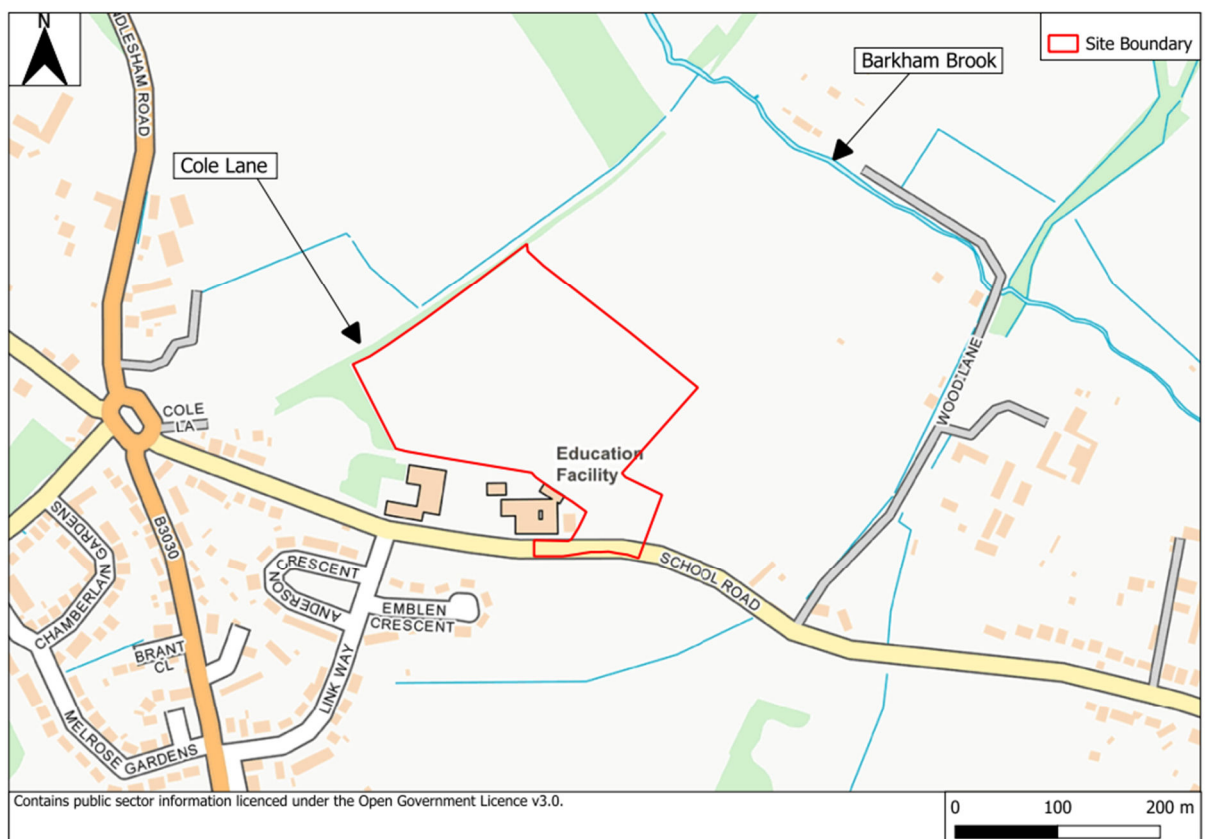
Introduction

- 3.1. This chapter provides a description of the site location, its topography, hydrological context, geology and hydrogeology.

Site Location

- 3.2. The site is located to the east of Arborfield Cross. The nearest postcode is RG2 9NX. The site centre grid reference is SU 76631 67078. The site location is shown in **Figure 1**.

Figure 1 – Site Location

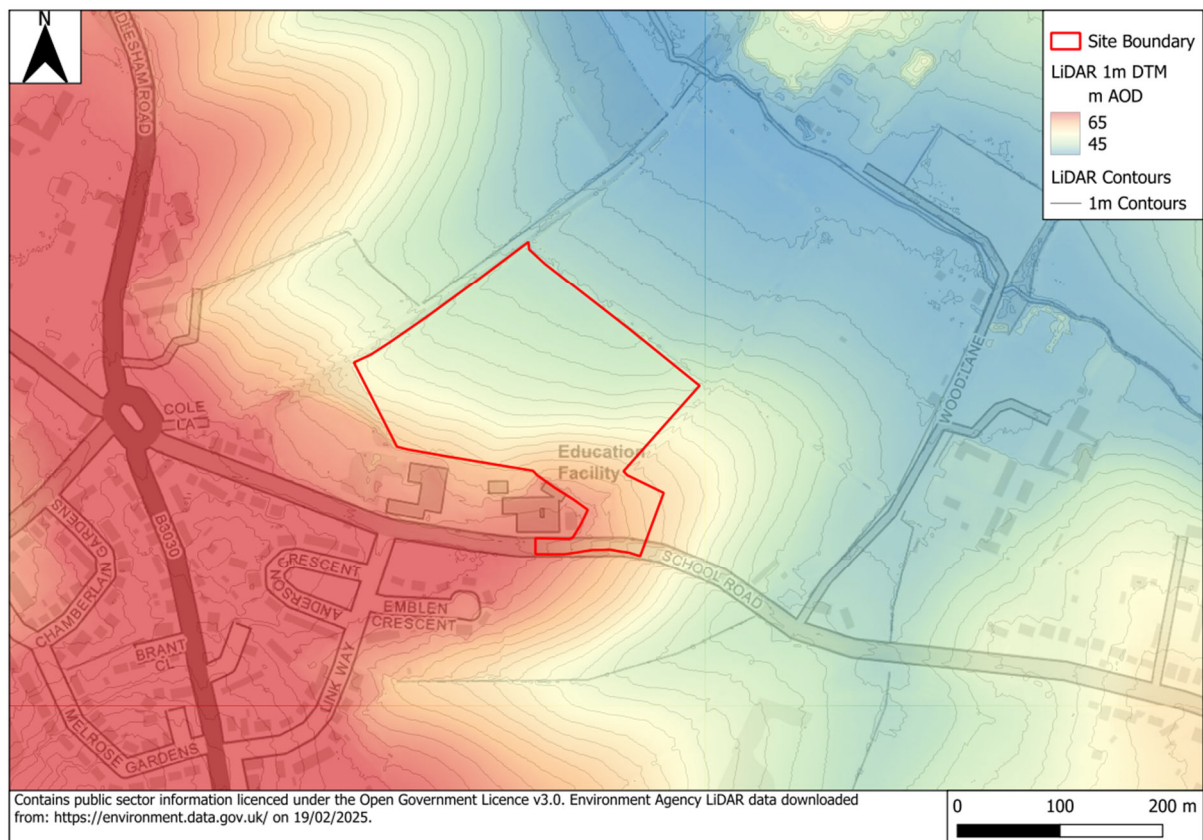


- 3.3. The site is bounded to the south by School Road and a primary school with residential development beyond. To the east of the Site is further agricultural land and beyond this is Wood Lane, with some commercial and residential developments beyond. To the western boundary is Cole Lane and an Ordinary Watercourse that runs parallel to the northwestern boundary of the site. To the north of the site are arable and equestrian fields and the Barkham Brook.
- 3.4. The site consists predominantly of agricultural land which is bounded by mature trees and hedgerow.
- 3.5. The site covers an area of approximately 5.52 hectares.

Topography

- 3.6. The ground levels across the site are shown by LiDAR in **Figure 2**.
- 3.7. The LiDAR shows that the ground levels across the site slope downwards from the south to both the eastern and northwestern corners. According to the LiDAR, the ground levels across the site are between 62.1m AOD on the site's southern boundary and 48.3m AOD in the eastern corner which is the lowest point of the site.

Figure 2 – Site Topography

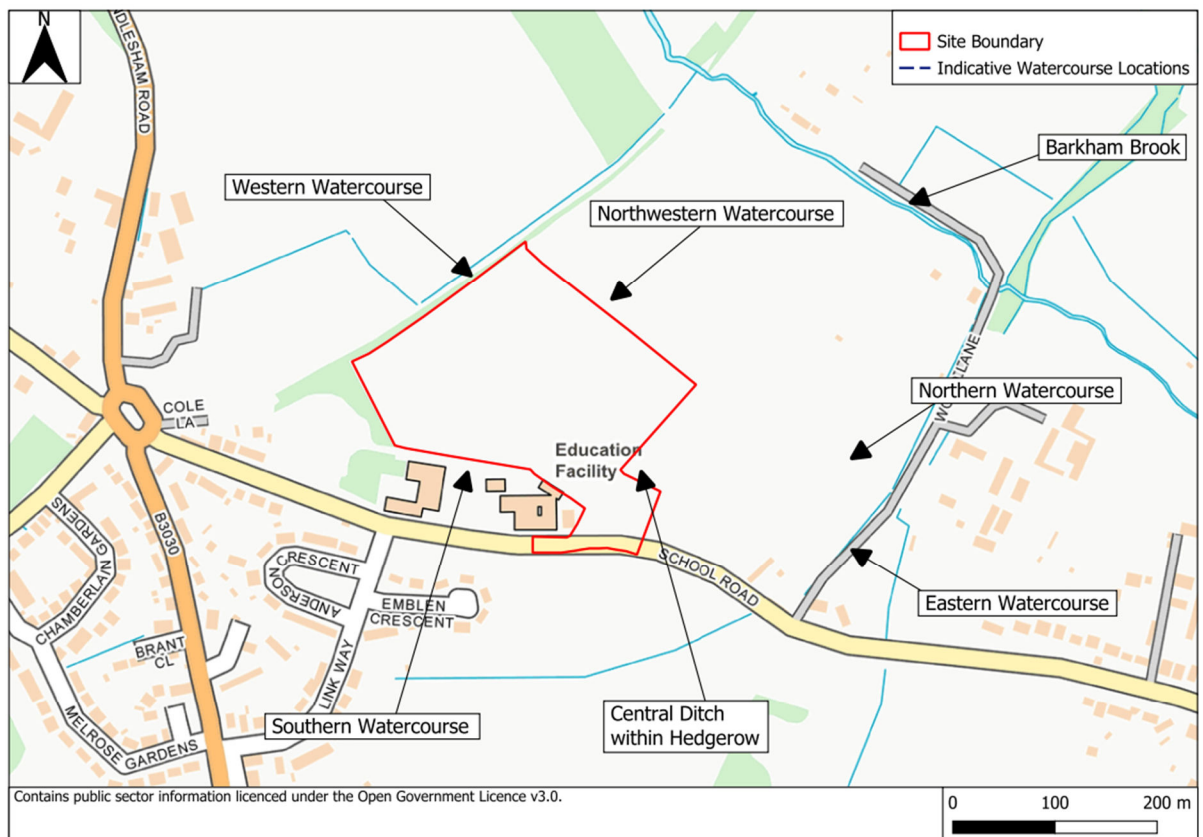


- 3.8. A topographical survey of the site has been completed by Encompass Surveys in May 2024. A copy of the topographical survey is included in **Appendix A**. It confirms that ground levels across the site slope down from south to northeast and northwest. According to the detailed topographical survey, the highest point of the site is to the south by the school with a ground level of 63.3 m AOD. The lowest point of the site is in the northeastern corner of the site with an elevation of 49.4 m AOD.

Watercourses and Ditches

- 3.9. A review of the Ordnance Survey (OS) mapping shows formal ordinary watercourses along both the western and eastern boundaries of the site. This was confirmed by the site walkover when additional watercourses were also noted. These watercourses are shown in **Figure 3**.

Figure 3 – Indicative Watercourse Locations



- 3.10. The watercourses are generally split into two systems: to the east and west of the site. There is also a shallow ditch within the hedgerow running through the centre of the site.
- 3.11. The southern watercourse runs along the boundary with the school and flows west into the western watercourse; this is shown in the photograph in **Figure 4**. The northwestern watercourse also flows west, along the site boundary and into the western watercourse. The western watercourse flows northwards outside the site boundary and along the path to the Barkham Brook.

Figure 4: Southern watercourse adjacent to school boundary



- 3.12. The northern watercourse flows eastwards along the site boundary and into the eastern watercourse that flows along Wood Lane and northwards onto the Barkham Brook. The eastern watercourse is shown in a photograph in **Figure 5**.

Figure 5: Eastern watercourse



- 3.13. The nearest main river is the Barkham Brook. This is located approximately 250m from the site's northern boundary.

Surface and Foul Water Sewers

- 3.14. Sewer asset records obtained from Thames Water confirm that there are no surface water sewers within the site's boundary or in the vicinity of the site. A 300mm dia foul sewer runs to the east of the site, parallel to another foul sewer (either 150mm or 200mm dia) in Wood Lane, both of which flow northwards, across the Barkham Brook and then west to the wastewater treatment works. Another foul sewer (150mm or 175mm dia) runs east along School Road into the foul sewer at Wood Lane.
- 3.15. A copy of Thames Water Asset Record is included within **Appendix A**.

Geology and Hydrogeology

- 3.16. British Geological Survey (BGS) 'Geology of Britain' online viewer indicates that the geology underlying the site is predominantly London Clay Formation, clay, silt and sand. There are no records of superficial deposits across the site.



- 3.17. The Cranfield University 'Soilscapes' online viewer indicates to the south of the site overlays slowly permeable seasonally wet slightly acid but base- rich loamy and clayey soils. To the north of the site, it is situated over slightly acid loamy and clayey soils with impeded drainage.
- 3.18. The DEFRA Magic Map online viewer indicates that the site lies outside of any Groundwater Source Protection Zone (SPZ), or Principle Aquifer designation.

4.0 Overview of Flood Risk

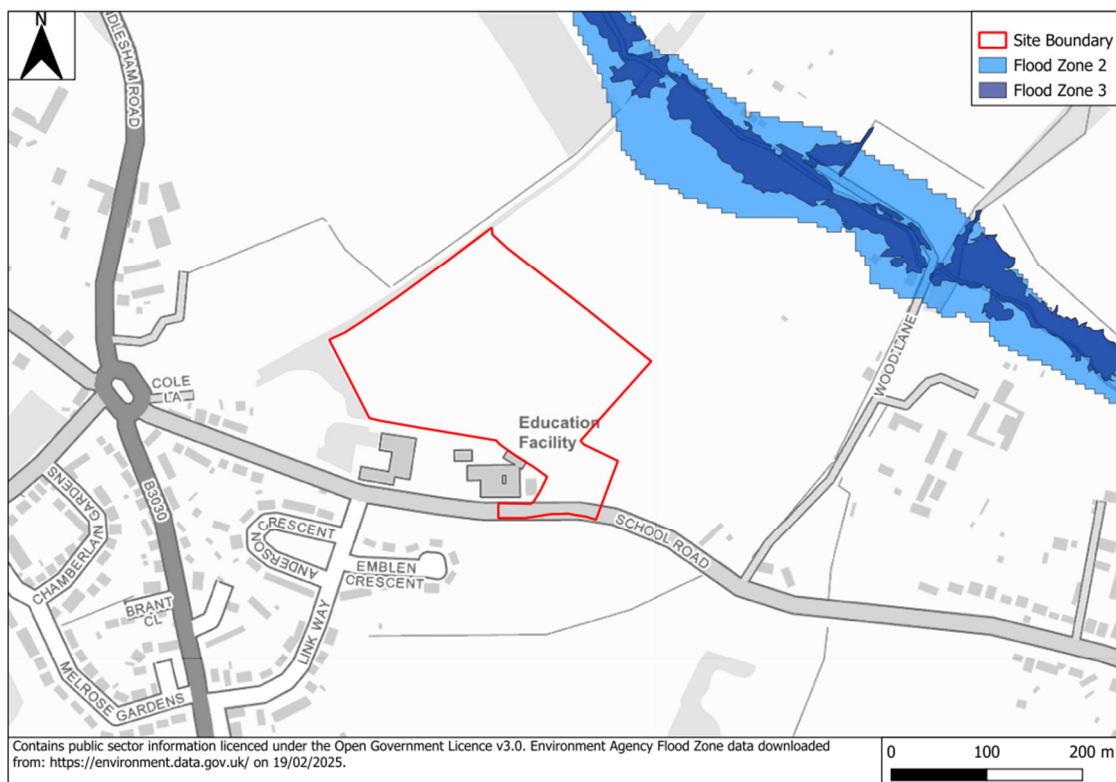
EA Flood Zone Map

4.1. The EA Flood Map for Planning provides an initial indication of the extent of Flood Zones. In the NPPF, Flood Zones are defined as follows:

- Flood Zone 1 'Low Probability' – Land less than 1 in 1,000 (0.1%) annual probability of river or sea flooding.
- Flood Zone 2 'Medium Probability' – Land between 1 in 100 (1%) and 1 in 1,000 (0.1%) annual probability of river flooding, or between 1 in 200 (0.5%) and 1 in 1,000 (0.1%) annual probability of sea flooding.
- Flood Zone 3 'High Probability' – Land at 1 in 100 (1%) or greater annual probability of river flooding, or 1 in 200 (0.5%) or greater annual probability of sea flooding.

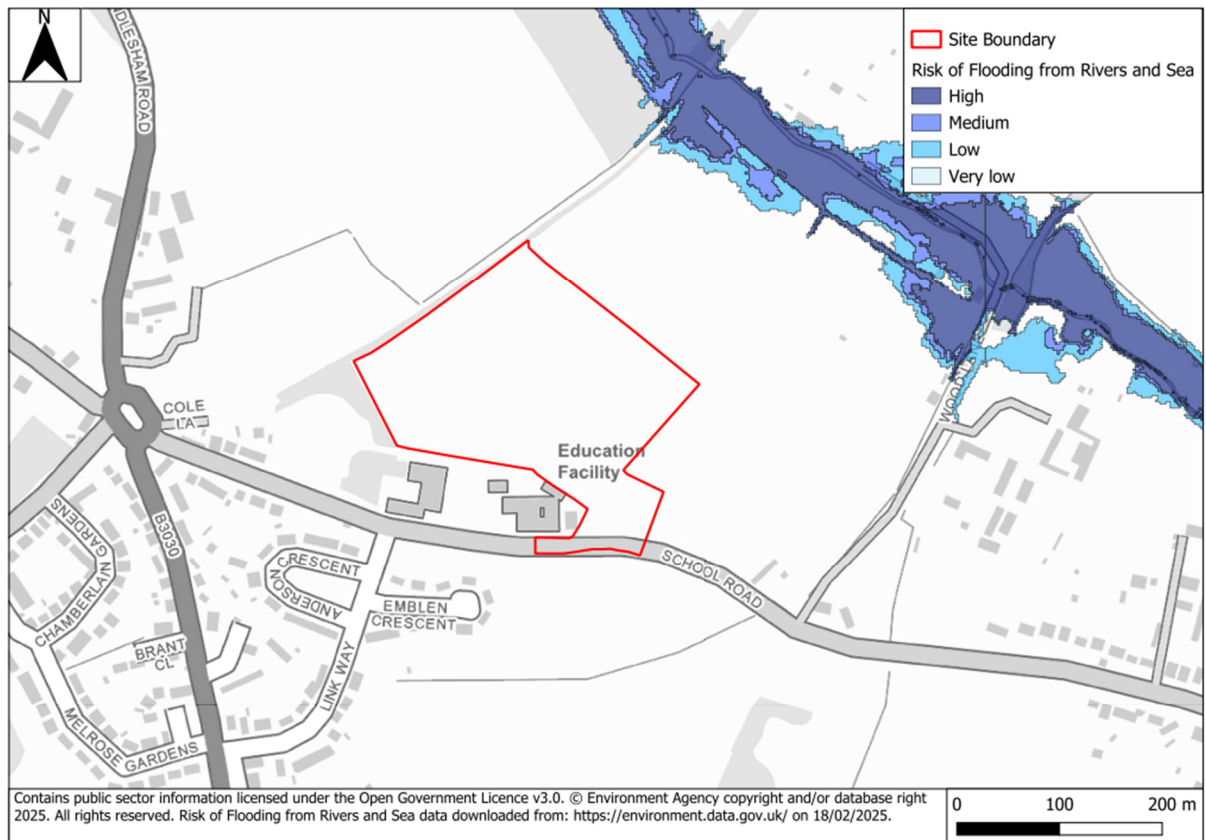
4.2. **Figure 5** shows the EA Flood Zone mapping.

Figure 5 – EA Flood Zone Map



4.3. **Figure 5** shows the entirety of the site lies within Flood Zone 1. Areas closest areas to the site that lie within Flood Zone 2 and 3 are located approximately 200m to the northeast.

Figure 6 – NaFRA Flood Risk from Rivers and Sea

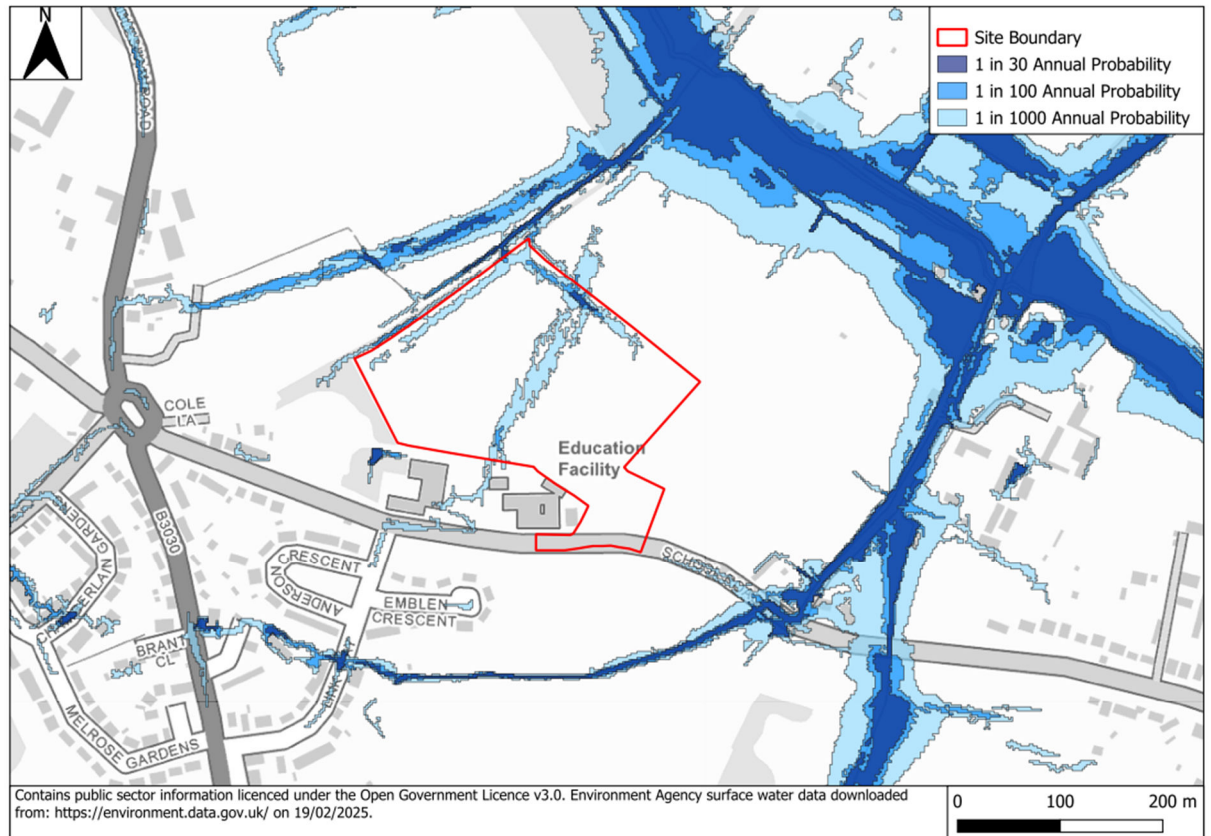


- 4.4. **Figure 6** shows the updated NaFRA mapping of risk of flooding from Rivers and Sea. Consistent with the EA Flood Map for Planning, the entire site lies within an area of no risk to flooding from Rivers and Sea.

Flood Risk from Surface Water

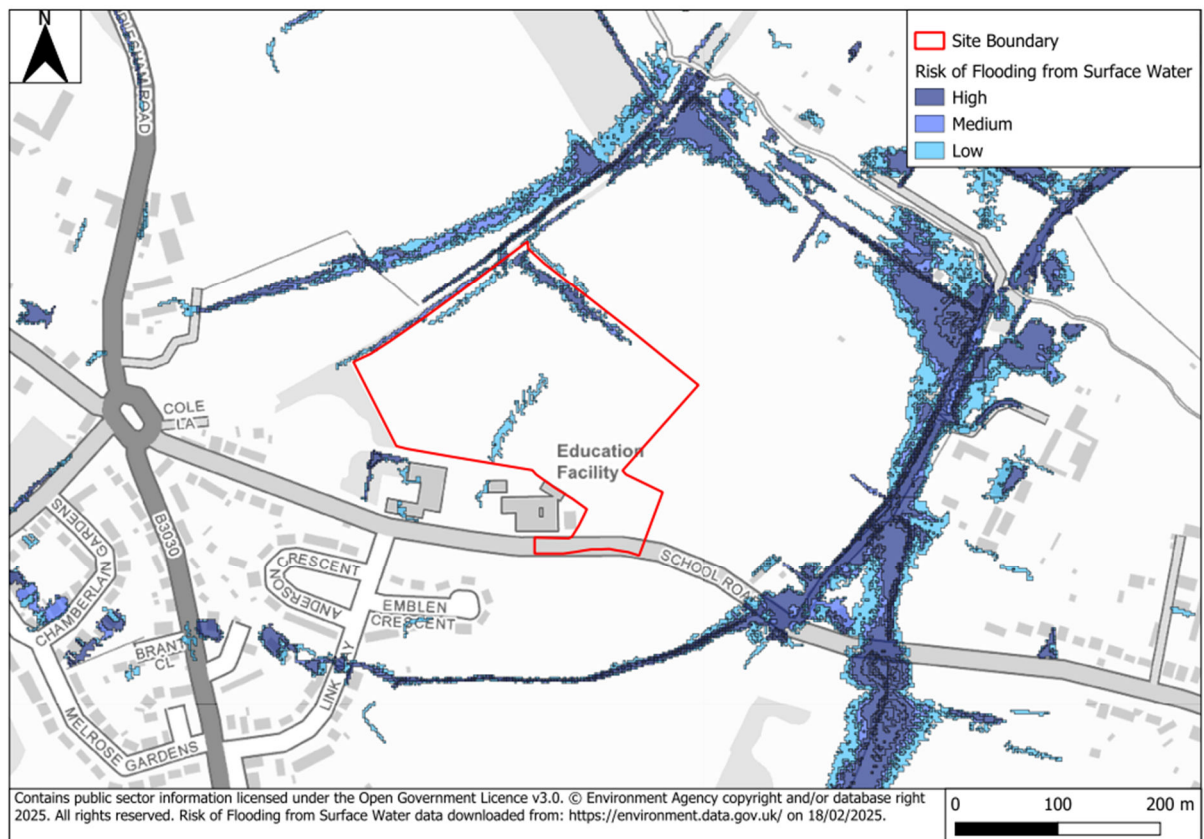
- 4.5. The EA's Risk of Flooding from Surface Water mapping indicates areas that could be susceptible to surface water flooding during extreme rainfall events. The EA surface water mapping defines rainfall events based on the following:
- 1 in 30 (3.3%) annual probability 'High Risk'
 - 1 in 100 (1%) annual probability 'Medium Risk'
 - 1 in 1,000 (0.1%) annual probability 'Low Risk'
 - Lower than 1 in 1,000 (0.1%) annual probability 'Very Low Risk'.
- 4.6. The NPPF PPG – 'Flood Risk and Coastal Change' includes the 1 in 100 annual probability of surface water flood (including climate change) within the definition of the design flood event to be used to inform a FRA.
- 4.7. **Figure 7** shows the potential flood risk from surface water.

Figure 7 - EA Flood Risk from Surface Water (mapping from pre 28th Jan 2025)



- 4.8. In January 2025, the EA published new NaFRA mapping including for surface water flooding, This new mapping is based on current data and is shown in **Figure 8**.

Figure 8 – NaFRA Risk of Flooding from Surface Water



- 4.9. The current surface water flood mapping shows significantly less extensive areas of potential flooding within the site when compared to the earlier mapping. This is more consistent with site observations.
- 4.10. The mapping shows a flow route through the site from the school. However, this was not observed during the site walkover and instead there are physical features that would prevent this flow route.
- 4.11. As noted earlier within this report, there are watercourses along the site's western perimeter, and these would intercept any overland flow and convey it to the western watercourse and onwards to the Barkham Brook.
- 4.12. The minor overland flow route shown is to be expected as the EA surface water mapping is based on a national scale surface water ground surface model. The model does not consider any site-specific local information or below ground drainage infrastructure. The mapping therefore provides a guide to vulnerable areas based on the topography of the area and is not a detailed assessment of surface water flooding for a specific site.
- 4.13. The WBC Level 1 SFRA indicates that there have been no incidents of surface water flooding within the site boundary.
- 4.14. The risk from surface water flooding is therefore assessed to be low.



Flood Risk from Groundwater

- 4.15. Groundwater flooding has the potential to occur after prolonged periods of unusually high rainfall. During such periods, more water than usual infiltrates through the ground, raising the water table above its normal depth below the surface. Where the water table is at a shallow depth in any case, the water table can reach the surface. This can cause groundwater to merge with rainfall and cause localised flooding.
- 4.16. The WBC Level 1 SFRA has assessed the area for susceptibility to groundwater flooding. This is based off 1km grid squares to show the percentage that is susceptible to ground water flooding. The site is located within a 1km grid square of which less than 25% risk of this grid square is at risk of groundwater flooding. The WBC Level 1 SFRA does not contain any records of groundwater flooding to the site. The risk of flooding from groundwater sources is considered low.
- 4.17. The EA Long Term Flood Risk Service states that 'flooding from groundwater is unlikely in this area'.

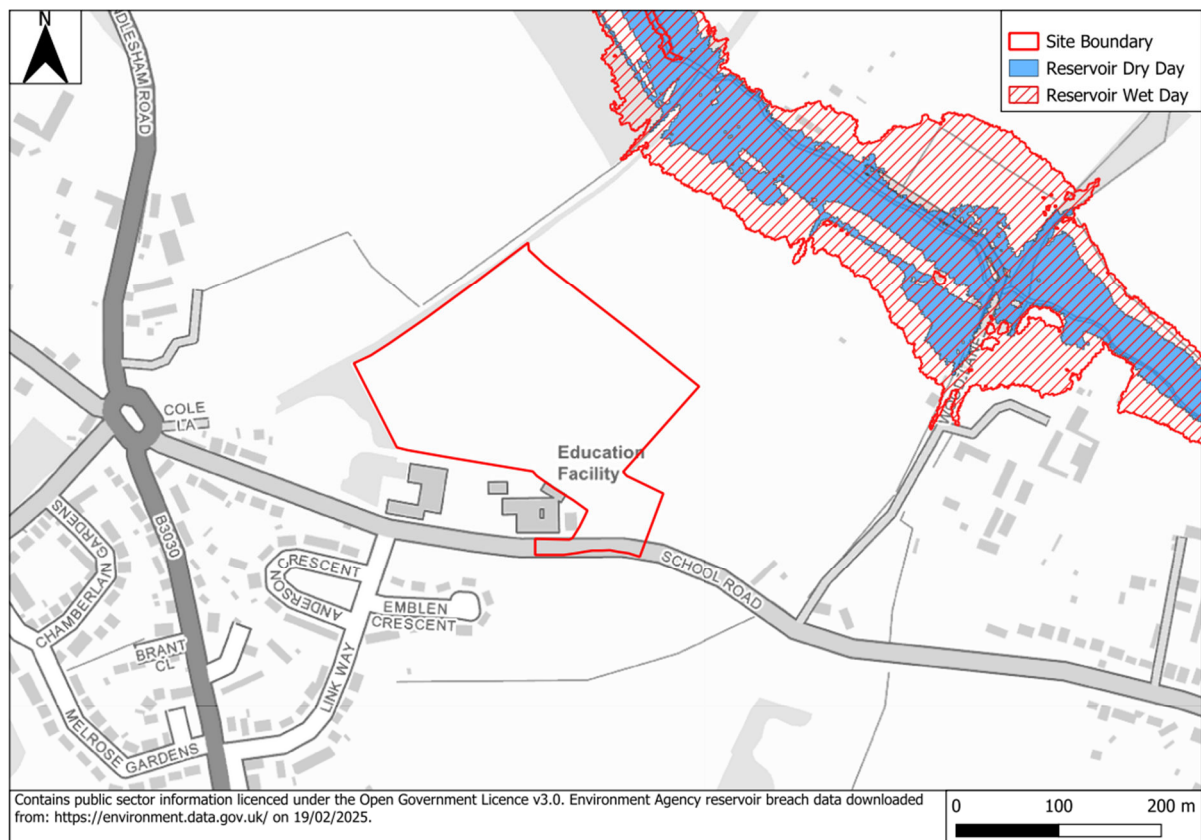
Flood Risk from Sewers

- 4.18. When exceeded, surcharged sewer networks can lead to flooding from backed up manholes and gully connections.
- 4.19. There is a Foul sewer to the east of the site, but this is located away from the developable area and the ground in this location slopes to the east, therefore the risk of flooding from sewers can be considered low.

Flood Risk from Reservoirs

- 4.20. The EA flood risk from reservoirs mapping shows areas that would be at risk of flooding in the event of a reservoir breach.

Figure 9 – EA Flood Risk from Reservoir



- 4.21. **Figure 9** shows that the entirety of site is not at risk of flooding in the event of a reservoir breach, both in dry and wet events. Therefore, risk from reservoir flooding is considered to be very low.
- 4.22. The EA Long Term Flood Risk Service states that 'flooding from reservoirs is unlikely in this area'.

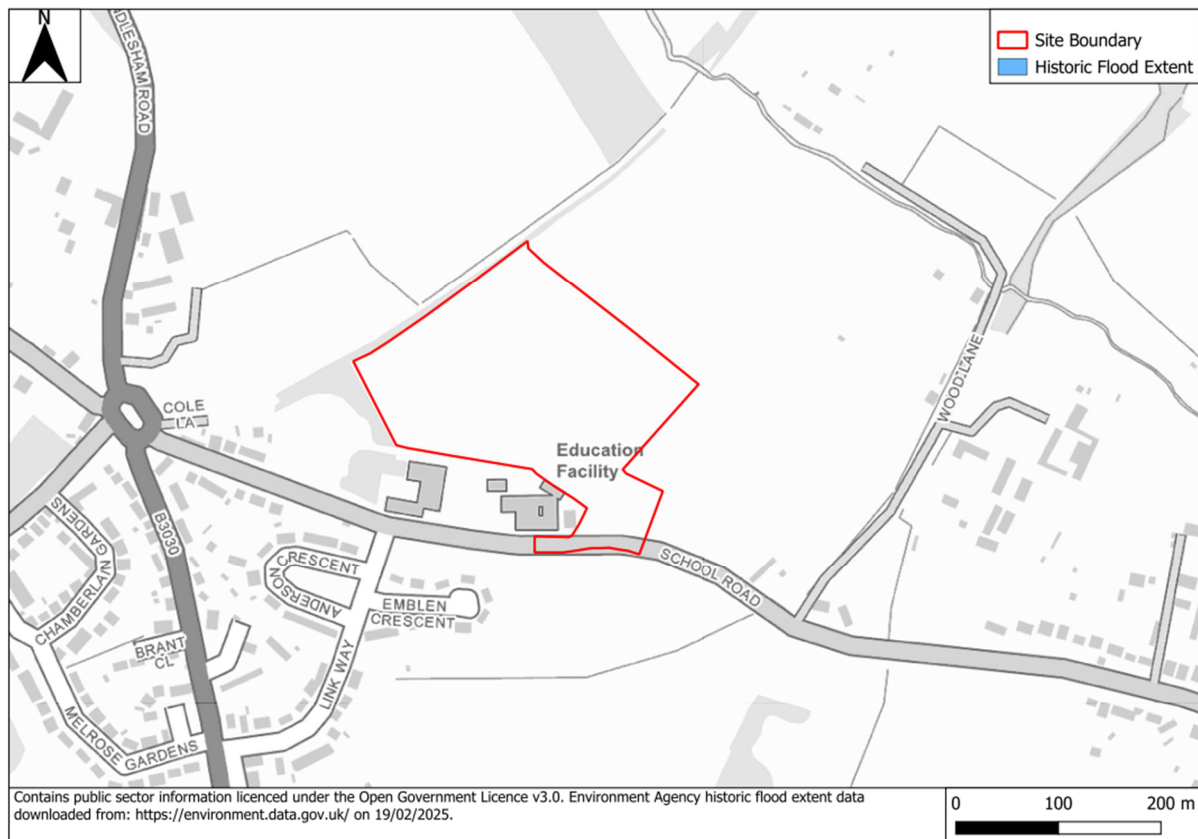
Flood Risk from Other Sources

- 4.23. The EA flood risk maps, WBC PFRA and WBC Level 1 SFRA indicate that the site is not at risk of flooding from canals or other artificial sources. The WBC Level 1 and Level 2 SFRA uses national inundation Reservoir Mapping (Long term flood risk map) from the EA.

Historic Flooding

- 4.24. The EA Historic Flood Map shows the maximum extent of recorded flood events.

Figure 10 – Historic Flood Extents



4.25. Figure 10 shows that the site is not shown to have been impacted by a historic flood event.

Flood Risk Summary

4.26. A summary of flooding from all sources is provided in **Table 1**.

Table 1 – Summary of Flood Risk

Source of Flooding	High	Medium	Low	Comments
Fluvial			✓	The site is located within Flood Zone 1. The WBC Flood Zone confirms that the site is located within Flood Zone 1.
Pluvial			✓	The majority of the site is at a 'Very Low' or 'Low' risk of surface water flooding. The EA mapping shows a possible flow route but observations and physical features on site demonstrate that this would not occur, with any overland flow being intercepted and conveyed to the western watercourse.
Groundwater			✓	The WBC Level 1 SFRA shows that the site is located within a 1km grid square that is at a less than 25% susceptibility to groundwater flooding for the square.
Sewers			✓	Limited sewers across the site and the SFRA does not indicate the site to be at risk.
Reservoirs, canals and other artificial sources			✓	EA and SFRA Level 1 mapping do not indicate the site to be at risk.

4.27. The site is deemed to be at low risk of flooding.



5.0 Sequential Test and Exception Test

NPPF Sequential Test

- 5.1. NPPF states that Local Planning Authorities allocating land for development should apply the Sequential Test to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed.
- 5.2. WBC Level 1 Strategic Flood Risk Assessment states *“Developers are required to apply the sequential test to all development sites, unless the site is:*
 - 1) *A strategic allocation and the test has already been carried out by the LPA as part of preparing the local plan;*
 - 2) *A change of use (except to a more vulnerable use);*
 - 3) *A minor development (householder development, small non-residential extensions with a footprint of less than 250m²);*
 - 4) *A development in fluvial flood zone 1 unless there are other flooding issues in the area of the development (i.e. surface water, ground water, sewer flooding).”*
- 5.3. The site is located within Flood Zone 1. This FRA has assessed the potential for flooding from surface water flooding as low and the potential for flooding from other sources is also low.
- 5.4. It is therefore deemed that the Sequential Test is not required.

Exception Test

- 5.5. Given that the Sequential Test is not needed, there is no requirement for the Exception Test.

6.0 Flood Mitigation Strategy

Sequential Approach

- 6.1. The NPPF encourages a 'sequential approach' in master planning for new development: locating the more vulnerable uses of the development in the areas of lowest flood risk from all sources.
- 6.2. This FRA has confirmed that the site is at very low potential of flooding from all sources with surface water flow tending to be intercepted by ditches around the site. The proposed development areas are set back from these ditches and the development strategy has therefore followed a sequential approach.

Building Ground Floor Levels

- 6.3. The requirements for setting ground floor levels for new developments are set out in BS8533:2017 'Assessing and Managing Flood Risk in New Developments – Code of Practice' based on the fluvial flood level and the WBC Level 1 SFRA also sets out requirements related to surface water flooding. However, neither of these is relevant as the areas for development have been shown to be outside areas of potential flooding.
- 6.4. Where the site is located outside of the fluvial flood extents, ground floor levels should be set a minimum of 150mm above the surrounding ground level to mitigate the residual flood risk from surface water runoff events. It is recommended that surrounding ground levels are appropriately contoured to direct surface water away from the development.

Floodplain Storage and Flow Routes

- 6.5. The site is located outside of the fluvial and surface water flood extents. There is therefore no impact on fluvial or surface water floodplain storage or flow routes.

Safe Access

- 6.6. The site is shown to be a low risk of flooding. Continuous safe access is therefore available.

Residual Risk

- 6.7. The NPPF PPG – 'Flood Risk and Coastal Change' defined residual risk as coming from 'flood risk management infrastructure' and the 'residual risk to a development once any site-specific flood mitigation measures are taken into account'.
- 6.8. Residual risk to the site includes a breach in the raised flood defences, the failure of a reservoir and a flood event greater than the designed standards.
- 6.9. The residual risk to the site is low. The EA AIMS dataset which contains information of flood defences indicates that the site does not benefit from raised flood defences. The EA mapping for reservoir breaches indicates that the site is not located within an area at risk of flooding in the event of a reservoir. The site is located outside of the 1 in 1,000 annual probability flood extent.
- 6.10. Therefore, residual risk is low.

7.0 Surface Water Drainage

Introduction

- 7.1. This chapter provides details on the surface drainage strategy and includes measures to drain the proposed development site.

Overall Strategy

- 7.2. The proposed drainage strategy has been designed to exceed the requirements of the NPPF by providing a comprehensive drainage system which embraces the SuDS philosophy and key principles. The utilisation of Sustainable Drainage Systems (SuDS) not only provides the benefit of controlling waters at source and online treatment of collected surface water but also allows enhanced aesthetics through improved landscaping, biodiversity, and ecological opportunities.
- 7.3. These features offer a holistic treatment train and management system to the benefit of new residents, members of the wider community, downstream receptors and the environment.
- 7.4. The alteration of natural surface water flow patterns through developments can lead to problems elsewhere in the catchment, particularly flooding downstream. Changes of land uses can have significant downstream impacts where existing drainage systems may not have sufficient capacity for any additional surface water flow.
- 7.5. A surface water management strategy is therefore required to manage and reduce the flood risk posed by the surface water runoff from the site. The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates to the pre-development scenario, unless specific off-site arrangements are made and result in the same net effect.
- 7.6. Sustainable water management measures (SuDS) should be introduced to control the surface water runoff from the proposed development site therefore, managing the flood risk to the site and surrounding areas from the surface water runoff.
- 7.7. The Construction Industry Research and Information Association, CIRIA's C690 states the following:
- **Prevention** – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hard standing surfaces)
 - **Source Control** – control of runoff at or very near its source (such as the use of rainwater harvesting)
 - **Site Control** – management of water from several sub-catchments (including routing water from roofs and car parks to one or several soakaways for the entire site)
 - **Regional Control** – management of runoff from several sites, typically in a detention basin or wetland.



- 7.8. The SuDS Manual 2015 (C753) provides best practice guidance on the planning, design, construction, operation and maintenance of SuDS. This document provides guidance to ensure that SuDS are planned and designed to maximise the opportunities and benefits of surface water management.
- 7.9. The four main categories of benefits that can be achieved by SuDS, referred to as the four pillars of SuDS design, are:
- **Water quantity** – control the quantity of runoff to support the management of flood risk, and maintain and protect the natural water cycle;
 - **Water quality** – manage the quality of the runoff to prevent pollution
 - **Amenity** – create and sustain better places for people
 - **Biodiversity** – create and sustain better places for nature.
- 7.10. Supplemental to CIRIA guidance, Document H of the Building Regulations 2015 sets out three possible options to discharge surface water runoff. Rainwater shall discharge to one of the following, listed in order of priority:
- An adequate soakaway or some other adequate infiltration system; or where that is not reasonably practicable,
 - A watercourse; or where that is not reasonably practicable
 - A sewer.
- 7.11. As geological data indicates that infiltration is not a viable method of disposal, the surface water drainage proposals will be designed to attenuate runoff with controlled discharge to the existing local watercourses i.e. the existing Ordinary Watercourse to the east and north-west of the site which would be feasible points of discharge.
- 7.12. Implementation of SuDS will ensure that flood risk downstream is not increased due to the proposed development. These features will also provide positive improvements to the quality of surface water runoff.
- 7.13. The following SuDS components are deemed applicable to the site:
- Conveyance systems – components that convey flows to downstream storage systems, e.g. swales and filter drains.
 - Storage systems – components that control flow, and possibly volumes, by storing water and releasing it slowly, e.g. geocellular units, attenuation basins and wetlands.
 - Treatment systems – components that remove or facilitate the degradation of contaminants present in runoff, e.g. filter strips and proprietary treatment systems.

Pre and Post Development Areas/Rates

- 7.14. The overall site is approximately 5.52 hectares. It is classified as a greenfield site.
- 7.15. Given the underlying geology, it is assumed part of the rainfall infiltrates to the ground and the rest occurs as overland flow at source towards the lower parts of the site.

- 7.16. In order to quantify any potential increase in surface water runoff, the existing Greenfield runoff rate from the site must initially be determined. The rates of runoff have been determined using the current 'industry best practice' guidelines as outlined in the Interim Code of Practice for SuDS. The recommended methodology for sites up to 200 hectares in area is the IH124 method.
- 7.17. An assessment of existing surface water runoff has been undertaken, to determine the potential surface water options and attenuation requirements for the site utilising the following parameters:
- Average Annual Rainfall (SAAR): 651mm
 - Soil: 0.3
 - Region No.: 6

Pre-Development Discharge Areas & Rates

- 7.18. With an overall site area of 5.52 hectares, the calculated Greenfield run off discharge rates and volumes are as presented in **Table 2**. The corresponding runoff outputs created via HR Wallingford and a drainage software can be found within **Appendix C**.

Table 2 – Pre-Development Runoff Rates/Volumes

Annual Probability	Greenfield/Pre-Development Runoff Rate per hectare (l/s)	Greenfield/Pre-Development Runoff Rate for 5.45ha (l/s)	Greenfield/Pre-Development Volume 360 minute storm (m ³)
1 in 1 year storm event	1.4	7.7	-
1 in 2 year storm event	-	-	307
QBar	1.7	9.4	-
1 in 30 year storm event	3.9	21.5	767
1 in 100 year storm event	5.3	29.3	1,027

- 7.19. Based on the Illustrative Masterplan, it has been conservatively estimated that the impermeable surfaces will be approximately 65% of the developable area. The use of 65% therefore provides for a robust assessment which allows for fluctuations in residential density, and future urban creep of up to 10% on private curtilage areas, which typically results in approximately 5% of the total area, in accordance with The SuDS Manual (CIRIA 753).
- 7.20. The post development impermeable area of the dwellings has been calculated to approximately 1.373ha and the future urban creep of 10% in accordance with The SuDS Manual (CIRIA 753) has been calculate to 0.137ha. Therefore, the total impermeable area of the residential buildings is 1.510ha and the total impermeable area of the proposed development including the dwellings, the roads, the basins and general infrastructure is 1.970ha.
- 7.21. In order to comply with best practice as stipulated in EA Report SC030219 'Rainfall Runoff Management for Developments', proposed discharge rates should be restricted to one of two methods for all storms up to and including the 1 in a 100 year storm event plus a 40% allowance for climate change.

Post-Development Discharge Areas & Rates

- 7.22. For the purposes of this report and to provide a robust analysis, all attenuation requirements have been calculated to restrict all discharge flows to greenfield runoff rates(QBAR) 3.3l/s.
- 7.23. With the above in mind and having assessed limiting the offsite discharge rate to QBAR, the anticipated attenuation volumes for a 100 year storm with a 40% allowance for climate change are presented in **Table 3** below:

Table 3 – Required Attenuation Volumes and Proposed Discharge Rates

Annual Exceedance Probability	Proposed Discharge Rate for 1.97ha of impermeable area (l/s)	Attenuation Volume (m ³) Required Based on a 3.3l/s Discharge Rate (QBAR) for each Storm Event
1 in 2 year Storm Event (50% AEP)	3.3	482
1 in 30 year Storm Event (3.3% AEP)	3.3	1,109
1 in 30 year Storm Event plus 35% CC (3.3% AEP)	3.3	1,567
1 in 100 year Storm Event (1% AEP)	3.3	1,413
1 in 100 year Storm Event (1% AEP) plus 40% Climate Change	3.3	2,048

Surface Water Proposals

- 7.24. It is proposed to provide a network of trapped gullies, pipes and Sustainable Drainage (SuDS) features to collect the surface water runoff from impermeable areas such as roads, roofs and driveways. The traditional system will work in combination with such features as permeable paving, roadside swales and basins to provide attenuation storage and high-quality water benefits.
- 7.25. A ditch that runs along the northern boundary of the site will receive the surface water runoff from the proposed development, in order to mimic the existing drainage conditions.
- 7.26. Drawing HD083-003, a copy of which is included within **Appendix C**, provides a high level overview of the drainage proposals together with the estimated requirements for the required storage and SuDS features.
- 7.27. This drawing shows an option for the location and size of the basin. The location and form for the basin may be varied at detailed design stage to integrate further with the landscape and biodiversity aspirations for the scheme. The drainage strategy may be revised at a later stage if site investigation including soakage testing shows that infiltration is a viable means for the discharge of surface water.
- 7.28. The locations and general form of the basin demonstrate that there is adequate space for a suitable feature at this stage. The final details will be confirmed at detailed design.



- 7.29. The banks of the SuDS basin will be designed in accordance with the SuDS Manual C753 in respect to having a maximum gradient of 1 in 5 and an appropriate freeboard above the maximum water level. This allows landscaping of both wetland and wildflower mixes to provide an appropriate landscape context in the vicinity of the features through the provision of permanent water pools.
- 7.30. Open SuDS features will be designed so as not to compromise the safety of residents, visitors and their property. Generally open boundaries are provided, and perimeter planting could be utilised to define the extents of the features.
- 7.31. Proposed discharge rates will be restricted to QBAR for all storm events up to and including the 1 in 100 year storm event plus 40% allowance for climate change. This would negate the requirement for Long Term Storage and flows would be attenuated on site and discharged utilising on-site flow control devices such as a Hydrobrakes.
- 7.32. All conveyance systems will be designed to cater for the 1:30 year storm event, in accordance with industry standard, with all attenuation features designed to allow for the 1 in 100 year storm event plus 40% climate change allowance.
- 7.33. The proposals draw reference to the DEFRA document Sustainable Drainage Systems, Non-statutory technical standards for sustainable drainage systems March 2015, as well as CIRIA C753 The SuDS Manual.
- 7.34. Current uncontrolled pluvial runoff exhibited onsite during high rainfall events will be mitigated as a result of the Development. This will occur by virtue of the change in surface from greenfield to positively drained impermeable areas, which will serve to capture, attenuate and delay surface water runoff. This will be a benefit to downstream receptors.
- 7.35. This proposal identifies the principle components of the surface water strategy and is subject to further detailed localised investigations as part of the subsequent Reserved Matters applications. These assumptions are subject to evolution as the design develops and the individual parcels are further realised.
- 7.36. There is scope to utilise source control techniques (such as swales, granular strips and permeable paving) which will assist with the reduction of larger attenuation storage features. This should be embraced and investigated as the project progresses.
- 7.37. Subject to the provision of additional geotechnical information, the attenuation basins may require partial lining to protect against the ingress of natural groundwater. Such lining provides the ability to create localised, small permanent bodies of water which adds landscaping and biodiversity opportunities to the scheme.

Exceedance Flood Routing

- 7.38. Flows in excess of the above design storms, which may flood from the network for storms in excess of the 1 in 100 year storm plus 40% climate change, will be kept within the internal road network, until such time as they can be directed into adjacent landscaping areas or existing vegetation/woodland. This ensures that no onsite or offsite residential units are afforded an increased level of protection from flood waters until such time as the rain events become significant.

- 7.39. The attenuation basin of the Development is designed to provide 300mm freeboard and therefore can accept additional flood water from manholes upstream within the development area and drainage strategy.

Water Quality Improvements

- 7.40. CIRIA report C753 The SuDS Manual outlines the methodology for assessing water quality risks associated with new development. This is a simple index approach which provides a high level scoping analysis of the land usage and gives guidelines for appropriate treatment stages.
- 7.41. This process identifies features necessary to provide adequate substance removal in line with Environment Agency requirements. This is a three step process of Allocation, Mitigation and Review.
- 7.42. Surfaces generating runoff are 'graded' on their potential to contribute to various harmful pollutants and gives each surface a risk of pollution from each element. An extract of Table 26.2 within the SuDS Manual is set out overleaf.

Table 4 – Extract from Table 26.2 SuDS Manual

Land Use	Pollution Hazard Level	Total Suspended Solids	Metals	Hydrocarbons
Residential Roofs	Very Low	0.2	0.2	0.05
Other Roofs	Low	0.3	0.2-0.8	0.05
Low traffic residential roads and non-residential parking with infrequent change.	Low	0.5	0.4	0.4
Commercial yard, parking with frequent change, other roads,	Medium	0.7	0.6	0.7
Sites with heavy pollution	High	0.8	0.8	0.9

- 7.43. Historically, PPG3 documentation would recommend that pollutants were removed utilising oil separators, but since its superseding, more recent guidance has shifted to the use of SuDS features to remove pollutants; thereby providing significant improvements in treatment.
- 7.44. The use of non-mechanical features decreases the requirements for maintenance and increase natural biodiversity. That said, the SuDS Manual does not remove the possibility of utilising separators, so long as they are considered in partnership with a comprehensive overall SuDS regime.
- 7.45. Without adequate treatment, the pollutants would cause damage if they were to enter the watercourse or water table in large volumes. The use of SuDS features to slow down and degrade these pollutants is critical to the provision of an acceptable discharge.
- 7.46. The respective cleansing abilities of common SuDS features are given by corresponding mitigation indices within the SuDS Manual. An extract of Table 26.3 is set out below highlighting the key proposed SuDS feature within the drainage strategy.

Table 5 – Extract from Table 26.3 SuDS Manual

Type of SuDS component	Total Suspended Solids	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter Drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable Paving	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8

- 7.47. The individual pollution indices are totalled, with the first SuDS component utilising its full value and subsequent downstream SuDS features acting with 50% efficiency. This provides a realistic strategy which mimics the reduced cleansing effectiveness as the concentration of a pollutant decreases along the SuDS train.
- 7.48. The pollution indices for the proposed development do not exceed the “Low Pollution Hazard” (TSS:0.5, Metals:0.4, Hydrocarbons:0.4) level and the proposed detention basin (TSS: 0.5, Metals: 0.5, Hydrocarbons: 0.6) provides adequate pollution mitigation.
- 7.49. In line with Environment Agency guidance, before the design phase is concluded, the proposals are reviewed and analysed in order to identify potential shortcomings and to ensure that adequate volume of SuDS features are provided to mitigate the risk of pollution from each source.

SuDS Maintenance Strategy

- 7.50. For the water treatment effects of SuDS features to remain effective, a comprehensive maintenance strategy should be implemented.
- 7.51. During construction, maintenance of SuDS features should be undertaken by the Contractor. Upon completion, the assets should be passed over to the Management Company, statutory authority, or community group commissioned to maintain the features in perpetuity.
- 7.52. As part of the strategy, a regular maintenance regime will be created, which consists of several primary measures required to ensure the longevity of the system. These should be undertaken on a regular basis to ensure consistent performance. Typical maintenance activities consist of:
- Inspecting and reporting; relatively regular review of the condition identifying issues and providing resolutions. Periodic review from the maintenance contractor;
 - Litter and debris removal;
 - Grass trimming, overall cutting and localised strimming preventing blockages;
 - Weed and evasive plant control;
 - Shrub management;
 - Aquatic and shoreline vegetation management;
 - Sweeping pervious surfaces; and
 - Oil removal from proprietary systems.



- 7.53. A remedial maintenance schedule would be recommended as part of the handover of the SuDS features, remedial maintenance is required to provide repairs to the system and monitor long term damage ensuring the system remains consistently productive. the schedule could consist of;
- Structure rehabilitation and repair;
 - Infiltration surface rehabilitation;
 - Scarifying to remove “Thatch”;
 - Spiking or Tining the soil;
 - Air pressure treatment.
- 7.54. The maintenance schedule contents and timing will depend upon multiple factors including usage, contents of water utilising the system, location and biology. To this end, it is suggested that the schedule be finalised as part of detailed design; ensuring the most comprehensive maintenance schedule is incorporated for the phase in hand.
- 7.55. Community outreach can be undertaken as part of the development, which will raise awareness on the importance of SuDS to both flood risk and water quality in the local area. Imparting the new residents with knowledge on the risks associated with pollution to the surface water drainage system is key, as is the direct effect their actions may have on water quality and biodiversity in the area.

Adoption and Ownership

- 7.56. The drainage system is designed to the appropriate standards including the new Sewerage Sector Guidance (SSG), the Building Regulations and the requirement of the National Planning Policy Framework
- 7.57. The intention of adoption and ownership of drainage and SuDS is as follows:
- Surface water sewers within development parcels to be offered for adoption to Thames Water under the Section 104 process of the Water Industry Act.
 - Surface water highway drains, gullies and leads within adopted roads to be maintained by the Highway Authority.
 - Above ground attenuation (i.e. swales and basins) to be maintained by a private maintenance company funded by residential properties or subject to agreement with the Local Authority.
 - SuDS features serving single properties, for example, permeable paved driveways to single dwellings, will be owned and maintained by the owner of that property.
- 7.58. Suitable adoption and maintenance regimes for SuDS should be submitted in support of the Reserved Matters application.



8.0 Foul Water Drainage

Introduction

- 8.1. This chapter provides details on the proposed foul water drainage strategy and measures to convey effluent.

Overall Strategy

- 8.2. Due to the topography of the site and location of the existing foul sewer point of connection, wastewater from the site will require pumping to the receiving Thames Water public sewer.
- 8.3. An existing Thames Water foul sewer is running along School Road and an outfall can be found at the road access of the proposed development.
- 8.4. The connection to the existing public sewer system will be made via a S106 Agreement with Thames Water.
- 8.5. The proposed foul water sewers will be designed in collaboration with Thames Water as approving body in accordance with the new Sewerage Sector Guidance (SSG) and will be offered to Thames Water for adoption under S104 Agreement of the Water Industry Act.
- 8.6. An indicative foul route can be seen in Drawing HD083-002 Drainage Strategy in **Appendix C**.

Adoption and Ownership

- 8.7. The drainage system is designed to the appropriate standards including the new Sewerage Sector Guidance (SSG), the Building Regulations and British Standards.
- 8.8. Foul water sewers within the development and offsite to the point of connection are to be offered for adoption to Thames Water under the Section 104 process of the Water Industry Act.



9.0 Conclusion

Flood Risk

- 9.1. The EA Flood Risk mapping was reviewed alongside the Wokingham Borough Council (WBC) Preliminary Flood Risk Assessment (PFRA) and Level 1 and Level 2 Strategic Flood Risk Assessment (SFRA).
- 9.2. This Flood Risk Assessment (FRA) concludes that:
- The entire site is located within Flood Zone 1 'Low Probability' (land at less than 1 in 1,000 (0.1%) annual probability of river or sea flooding').
 - EA flood maps suggest that there may be a potential flow route for surface water flooding through the site; however, site observations and a more detailed assessment confirm that any overland flow would be intercepted by the perimeter ditches and would be conveyed within the existing ditches around the site. Additionally, the recent NaFRA surface water mapping shows that the extent of potential surface water flooding is less than previously mapped. Surface water flood risk is therefore low.
 - The WBC Level 1 SFRA confirm that there are no records of groundwater flooding at the site. The mapping shows that the site is within a 1km grid square with less than 25% risk of groundwater flooding. The site is therefore considered to be at a low risk of flooding from groundwater.
 - There is a Foul sewer running within the site's boundary however this is located away from the built development. This will be assessed further at detailed design.
 - The site is not at risk of flooding in the event of a reservoir breach.
- 9.3. The site is therefore at a low risk of all sources. This FRA confirms that there will be no increased risk because of this development.

Vulnerability and the Sequential Test

- 9.4. The proposed development is classed as 'More Vulnerable' and development. These uses are considered appropriate within Flood Zone 1 and areas with a 'Low' or 'Very Low' risk of surface water flooding without the need for the Sequential Test to be undertaken. The Exception Test is not needed for this site.

Mitigation Strategy

- 9.5. Where the site is located outside of the fluvial flood extent, ground floor levels should be set a minimum of 150mm above the surrounding ground level to mitigate the residual flood risk from surface water runoff events. It is recommended that surrounding ground levels are appropriately contoured to direct surface water away from houses.



- 9.6. The proposed surface water drainage strategy will manage the surface water runoff from the site. Any increase in surface water run-off will be managed using SuDS source control techniques as well as attenuation features to provide storage in extreme storm events. All surface water drainage systems will be designed to restrict drainage discharge rates to QBAR runoff rates and store the balance of water for all events up to and including the 1 in 100 year event including allowance for a 40% increase in rainfall intensities as a result of climate change and urban creep.
- 9.7. The basin shown in the FRA demonstrate that a suitable strategy can be delivered at the site although the location and form for the basin is indicative at this stage. The final form will be confirmed at detailed design.

Summary

- 9.8. This FRA demonstrates that the proposed development complies with national and local planning policy with respect to flood risk and drainage. The risk of flooding is adequately managed, and, with the implementation of a suitable surface water drainage strategy, the offsite flood risk is not increased.



Appendices

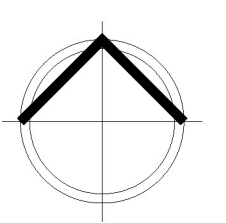


Appendix A - Plans

Illustrative Masterplan

Topographical Survey

Thames Water Sewer Asset Plan



Status **FINAL**

Notes:
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This drawing is for planning purposes only and is not to be used as a basis for construction.
Do not scale from this drawing - use figured dimensions only.

Client: **Croudace Homes**

Project title: **Land North of School Road, Arborfield Cross**

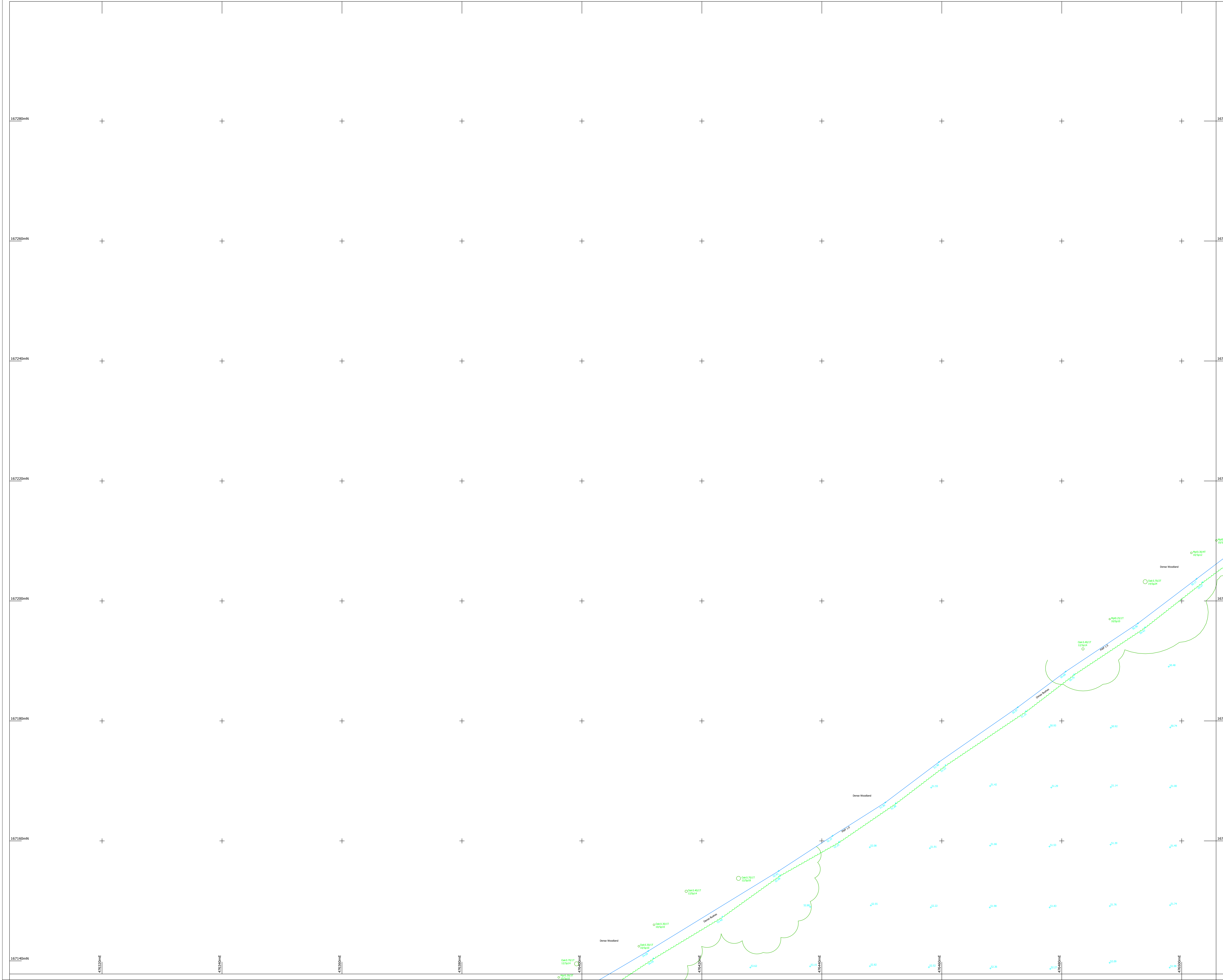
Drawing title: **Illustrative Masterplan**

Scale: 1:1500@A2
Date: 11.03.2025
Drawn by: DR/RVP
Checked by: MV
Drawing no.: 2522477.4
Revision: G

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e: info@marrons.co.uk



NOTES:

Drainage: Inspection Covers are filled where possible and all drainage invert information has been obtained through visual inspection only, with no entry into manholes. Therefore the complete accuracy cannot be guaranteed. Where drainage is of critical importance we suggest the services of a specialist drainage expert be used.

Trees: Every effort has been made to identify and detail all trees on site but where trees are of critical importance we suggest the use of a specialist such as an arborist. Tree spread and heights are indicative.

GPS: GPS detail is relative to the time and date of survey. GPS levels and grids are obtained using industry standard guidelines and can vary according to the quality of the GPS network at the time of survey. Unless stated otherwise, surveys are Scale Factor 1 and Horizontal and Vertical Datums are established from a central site fix and baseline orientation station utilizing GNSS correction data.

Survey notes: Survey specification is linked to the original purpose of the survey commissioned at source and is to be used for this purpose only. Survey is accurate within limitations of site conditions at the time of survey. In areas difficult to survey due to restricted access, lines of sight or dense vegetation, critical dimensions and positions should be verified following suitable clearance. Survey detail obtained and shown is relative to the plotting scale.

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LEGEND

OVERALL TREE SPECIES INFORMATION

ALDER	ALD	LONDON PLANE	LPH
ASH	ASH	MAGNOLIA	MAG
ASPEN	ASP	MAPLE	MPL
BEECH	BCH	OAK	OAK
CHERRY	CHY	PINE	PNE
ELM	ELM	POPLAR	POP
SPR	SPR	SHADDOLOONS	SDN
FRUIT	FRT	SCOTCH	SCN
HAWTHORN	HWT	SILVER BEECH	SBR
HAZEL	HAZ	SWEET CHESTNUT	SCN
HOLLY	HOL	WALNUT	WNT
HORSE CHESTNUT	HCH	WILLOW	WILW
LIME	LIM	YEW	YEW
LOCUST	LOC	SPECIES UNKNOWN	SUN
		COMPASS	COMP

TREE ANNOTATIONS: Tree Species / Tree Name Size / Age of Bole Tree Height / Tree Canopy Spread

FENCE INFORMATION	LEVEL INFORMATION		
BARBED WIRE FENCE	BWF	RED LEVEL	RL
CHAIN LINK FENCE	CLF	COVER LEVEL	CL
CHERRY PICKING FENCE	CPF	PAVING LEVEL	PL
CLOSE BOARD FENCE	CBF	INVERT LEVEL	IL
CONCRETE SILL FENCE	CSF	OUTLINE LEVEL	OL
CORRUGATED IRON FENCE	CIF	THRESHOLD LEVEL	TNL
CHAIN FENCE	CF	POOL WATER	FW
MISCELLANEOUS FENCE	MF	SPRINKLER WATER	SW
IRON RAILING	IRF	UNABLE TO LIFT	UL
SURFACE FENCE	SF	WATER LEVEL	WL
MISCELLANEOUS FENCE	MF		
POST AND RAIL FENCE	PRF		
POST AND CHAIN FENCE	PCF	CONCRETE	CL
POST AND RAIL FENCE	PRF	BRICK PAVING	BP
POST AND WIRE FENCE	PWF	FLUSHING	FL
SECURITY FENCE	SF	PAVING SLAB	PS
STOCK WIRE FENCE	SWF	RETAINING WALL	RW
THICK FENCING	TF	SCAFFOLD	SC
WIRE MESH FENCE	WMF	TACTILE PAVING	TP

FEATURE INFORMATION

BOUNDARY	BO	WIRE PLATE	WP
TELEPHONE	TE	WATER BOARD	WB
BUS STOP	BS	POST	P
CABLE TELEVISION	CTV	ROAD MARKING	RM
PAVING	PA	ROAD SIGN	RS
ELECTRICITY CABLE	EC	ROADSIDE	RD
ELECTRICITY POLE	EP	SERVICE WARDEN POST	SWP
FREE PHONE	FP	SOIL BERRY POST	SBP
FLAG POLE	FP	STOP VALVE	SV
GLASS POST	GP	TELEPHONE POLE	TP
INSPECTION COVER	IC	TRAFFIC SIGNAL	TS
LAMP POST	LP	TRAFFIC SIGNALS	TSC
LETTER BOX	LB	WASH OUT	WO
WATER OUTLET	WO	WATER METER	WM

Level Datum:
Levels are related to OSGB15 derived from the GPS network

Grid:
Grid is related to OSGB15 derived from the GPS network

Northpoint:

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Tel: (+44)2380 692002 Email: info@encompass-surveys.co.uk
Website: encompass-surveys.co.uk

Client: Cradock Homes

Survey Location: Land North of School Road
Arboretum Cross
Wokingham RG41 4TN

Survey type: Topographical Scale: 1:200@A0

Drawing ref: ENC/020524/3336-S1 Date: May 2024

Drawn/QA: MH/DH Plot No: 1 of 7

NOTES:

Drainage Inverts are lifted where possible and all drainage invert information has been obtained through visual inspection only, supported by ground truthing. Therefore, there is no guarantee that the above information is guaranteed. Where drainage is of critical importance we suggest the services of a specialist drainage expert be used.

Fresh earth has been made to identify and detail all trees on site and ensure they are protected from any potential damage.

The following specialist surveyors have been engaged:

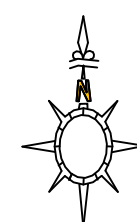
- GPS Detail relative to the time and date of survey. GPS levels and elevations are obtained using industry standard guidelines and can vary according to the quality of the GPS network at the time of survey.
- Soil types, soil moisture, surface water flow rates and flow control and Vertical Datumations are established from a central site fix and orientation station utilising GNSS correction.

Survey notes:

Survey specification is linked to the original purpose of the survey and therefore it is important to note that the purpose of this survey is accurate within limitations of site conditions at the time of survey. The survey was undertaken during daylight hours, in light or dense vegetation, critical dimensions and positions should be verified following suitable clearance.

Survey detail and accuracy shown is relative to the plotting scale.

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LEGEND

OVERALL TREE SPECIES INFORMATION

ALDER	ALD	LONDON PLANE	LMN
ASH	ASH	MAGNOLIA	MAG
ASPEN	ASP	MAPLE	MPL
BEECH	BCH	OAK	OAK
CHERRY	CHY	PINE	PNE
ELM	ELM	POPULAR	POP
FIR	FIR	RHODODOENDROS	RDN
FRUIT	FRT	ROWAN	RWN
MYRTHORN	MHW	SILVER BIRCH	SIB
HAZEL	HLY	SWEET CHESTNUT	SCH
HOLLY	HLY	WALNUT	WNT
HORSE CHESTNUT	HCH	WILLOW	WLW
LIME	LIM	YEW	YEW
LOCUST	LOC	GRASSES UNKNOWN	SPU
		SPERMATOPHYTES	OSP

TREE ANNOTATIONS: Tree Species / Tree Bole Size / No of Boles

FENCE INFORMATION		LEVEL INFORMATION	
BARRED WIRE FENCE	BWF	BED LEVEL	BL
CHAIN LINK FENCE	CLF	COVER LEVEL	CL
CHESTNUT PALING FENCE	CPF	FLOOR LEVEL	FL
CLOSE BOARD FENCE	CBF	INVERT LEVEL	IL
CONCRETE SLAT FENCE	CSF	OUTFALL LEVEL	OL
CORRUGATED IRON FENCE	CIF	THRESHOLD LEVEL	THL
CRASH BARRIER	CBR	FOUL WATER	FW
HANDRAIL	HDL	SURFACE WATER	SW
IRON RAILINGS	IRP	UNABLE TO LIFT	UFL

SURFACE INFORMATION

POST AND CHAIN FENCE	PCF	CONCRETE	Cc
POST AND RAIL FENCE	PRF	BRICK PAVING	BP
POST AND WIRE FENCE	PWF	FLOWERBED	FB
SECURITY FENCE	SOF	PAVING SLABS	PS
STOCK WIRE FENCE	SWF	RETAINING WALL	RWall
TRELLIS FENCING	TLF	SCALPINGS	Scalp
WIRE MESH FENCE	WMF	TACTILE PAVING	Tac

FEATURE INFORMATION

ROLLAD	BO	NAME PLATE	NF
TELEPHONE IC	BTIC	NOTICE BOARD	NB
BUS STOP	BS	POST	P
CABLE TELEVISION IC	CATV	RAIN WATER PIPE	RWP
EARTHING ROD	ER	ROAD SIGN	RS
ELECTRICITY CABLE PIT	ELP	ROOFS EYE	RE
ELECTRICITY POLE	ELP	SERVICE WAREHOUSE	SWP
FLAME PROTECT	FP	SOIL VENT PIPE	SVP
FLAG POLE	FP	STOP VALVE	SV
GLUEB POST	GP	TELEGRAPH POLE	TP
INSPECTION COVER	IC	TRAFFIC SIGNAL	TS
LAMP POST	LP	TRAFFIC SIGNALS IC	TSIC
LETTER BOX	LB	WASH OUT	WO

REVISIONS

PLOT MAP

1	2	
3	4	5
	6	7

Level Datum:

Levels are related to OSGB15 derived from the GPS net

Gold:

Grid is rel.



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Hampshire, PO15 7AX

Tel: (+44)2380 692002 Email: info@encompass-surveys.co.uk
Website: encompass-surveys.co.uk

	Microscopic	Chromogenic, non-fluorescent

Client: Croudaoe Homes

Survey Location:	Land North of School Road
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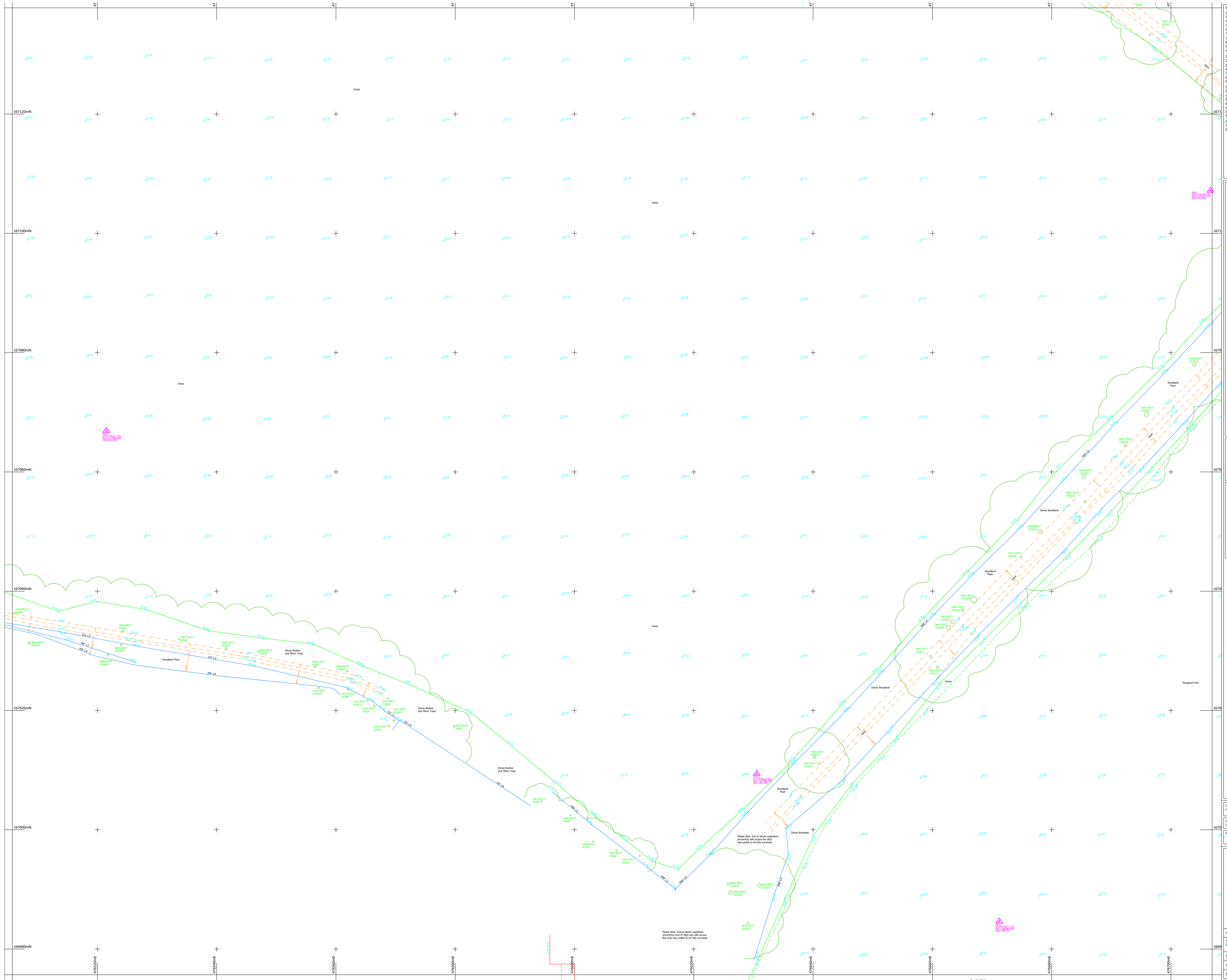
Location: Airborne Cross
Wokingham RG41 4TN

Survey type:	Topographical	Scale:	1:200 @ A0
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Revision ref:	ENC000E3413336_C1	Date:	May 2024
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Drawing Ref.	ENC/020524/3330-31	Date:	May 2024

Drawn/QA: MH/DH	Plot No. 3 of 7
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NOTES:
Drainage:
Inspection Covers are lifted where possible and all drainage invert information has been obtained through visual inspection only, with no entry into manholes. Therefore the complete accuracy cannot be guaranteed. Where drainage is of critical importance we suggest the services of a specialist drainage expert be used.
Trees:
Every effort has been made to identify and detail all trees on site and where trees are of critical importance we suggest the use of a specialist such as an arborist. Tree spread and heights are indicative.

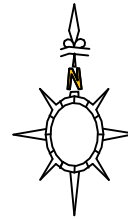
GPS detail is relative to the time and date of survey. GPS levels and grid are obtained using industry standard guidelines and can vary according to the quality of the GPS network at the time of survey. Unless stated otherwise, surveys are Scale factor 1 and Horizontal and Vertical Datums are established from a central site fix and baseline orientation station utilising GNSS correction data.

Survey notes:

Survey specification is linked to the original purpose of the survey commissioned at source and is to be used for this purpose only.

Survey is accurate within limitations of site conditions at the time of survey. In areas difficult to survey due to restricted access, lines of sight or dense vegetation, critical dimensions and positions should be verified following suitable clearance.

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LEGEND

OVERALL TREE SPECIES INFORMATION

ALDER	ALD	LONGLEAF PLANE	LPM
ASH	ASH	MAGNOLIA	MAG
ASPEN	ASP	MAPLE	MAP
BEECH	BCH	OAK	OAK
CHERRY	CHY	PINE	PNE
ELM	ELM	POPULAR	POP
FIR	FIR	RHODODENDRONS	RDM
FRUIT	FRT	ROWAN	ROW
HAWTHORN	HAW	SILVER BERRY	SEB
HAZEL	HAZ	SWEET CHESTNUT	SCH
HOLY	HLY	WALNUT	WNT
HORSE CHESTNUT	HCH	WILLOW	WIL
LYME	LYM	YEW	YEW
LOCUST	LOC	SPECIES UNKNOWN	SPU
		COMPOSED	COO

TREE ANNOTATIONS:

S: Tree Species / Tree Bole Size / No.

FENCE INFORMATION

LEVEL INFORMATION

BARBED WIRE FENCE	BWF	BED LEVEL	BL
CHAIN LINK FENCE	CLF	COVER LEVEL	CL
CONCRETE PAILING FENCE	COP	FLOOR LEVEL	FL
COLOR LOGO FENCE	CLO	INVERT LEVEL	IL
CONCRETE SLAT FENCE	COS	OUTFALL LEVEL	OL
COATED HORN FENCE	CH	THRESHOLD LEVEL	TL
CRAZY BARRIER FENCE	CBF	POOL WATER	PW
HARDWARE	HDL	SURFACE WATER	SW
IRON RAILINGS	IRL	UNABLE TO LIFT	UNL
LAWN LAMPS FENCE	LFL	WATER LEVEL	WL
MISCELLANEOUS FENCE	MSF		
PAULISADE FENCE	PSF		
PICKET FENCE	PIF		
POST AND CHAIN FENCE	PCF	CONCRETE	Cc
POST AND RAIL FENCE	PRF	BRICK PAVING	Br
POST AND WIRE FENCE	PWF	FLOWERBED	FB
SECURITY FENCE	SOF	FRAMING SLABS	FS
SCOT WIRE FENCE	SWF	RETAINING WALL	RW
TRELLIS FENCING	TWF	SCALPINGS	Scap
WIRE MESH FENCE	WMF	TACTILE PAVING	TP

FEATURE INFORMATION

BOLLARD	BO	NAME PLATE	NP
TELECONS IC	BTIC	NOTICE BOARD	NB
BLUS STOP	BS	POST	P
CABLE TELEVISION IC	CATV	RAIN WATER PIPE	RWP
EARTHING CABLE	ER	ROAD SIGN	RS
ELECTRICITY CABLE PIT	ELP	ROOFTOP EYE	RE
ELECTRICITY POLE	EP	SERVICE MARKER POST	SMP
FIRE HYDRANT	PH	SOIL VENT PIPE	SVP
FLAG POLE		STOP VALVE	SV
GUIDE POST	GP	TELEGRAPH MAST	TM
INSPECTION COVER	IC	TRAFFIC SIGNAL	TS
LAMP POST	LP	TRAFFIC SIGNALS IC	TSC
LETTER BOX	LB	WASH COT	WO
WATER OUTLET	WO	WATER METER	WM

REVISION

PLOT MAP

1	2	
3	4	5
	6	7

Level Datum:

Levels are related to USGB15 derived from the GPS net

Grid:

Grid is related to OSGB15 derived from the GPS network



Encompass Surveys Ltd
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Solent Business Park
Whiteley, Fareham
Hampshire, PO15 7AX

Tel: (+44)2380 692002 Email: info@encompass-surveys.co.uk
Website: encompass-surveys.co.uk

Client: Croudaire Homes

Survey section:	Land North of School Road 1.1, 1.1.1
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Location:	Arboretum Cross Wokingham RG41 4TN
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Survey type:	Topographical	Scale:	1:200@A0
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Drawing ref:	ENC/020524/3336-S1	Date:	May 2024
Drawn by:	MH/DH	Plot No.	1 of 7

Phone No.	Page No.	Page No.	Page No.
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NOTES:
Drainage:
 Inspection Covers are lifted where possible and all drainage invert information has been obtained through visual inspection only, with no entry into manholes. Therefore the complete accuracy cannot be guaranteed. Where drainage is of critical importance we suggest the services of a specialist drainage expert be used.
Trees:
 Every effort has been made to identify and detail all trees on site but where trees are of critical importance we suggest the use of a specialist such as an arborist. Tree spread and heights are indicative



LEGEND

OVERALL TREE SPECIES INFORMATION

ALDER	ALD	LONDON PLANE	LPM
ASH	ASH	MAGNOLIA	MAG
ASPEN	ASP	MAPLE	MPL
BEECH	BCH	OAK	OAK
CHERRY	CHY	PINE	PNE
ELM	ELM	POPULAR	POP
FIR	FIR	RHOODENDRONS	RDN
FRUIT	FRF	ROWAN	RWN
HAWTHORN	HAW	SILVER BIRCH	SBH
HAZE	HAZ	SWEET CHESTNUT	SCN
HOLLY	HOL	WALNUT	WLN
HORSE CHESTNUT	HCH	WILLOW	WLV
LIME	LYM	YEW	YEW
LOCUST	LOC	SPECIES UNKNOWN	SPU
		COPPOD	COP

TREE ANNOTATIONS: Tree Species / Tree Bole Size / No of Boles
Tree Height / Tree Canopy Spread

FENCE INFORMATION		LEVEL INFORMATION	
BARBED WIRE FENCE	BWF	BED LEVEL	BL
CHAIN LINK FENCE	CLF	COVER LEVEL	CL
CHESTNUT PALING FENCE	CPF	FLOOR LEVEL	FL
CLOSE BOARD FENCE	CBF	INVERT LEVEL	IL
CONCRETE SLAT FENCE	CCF	OUTFALL LEVEL	OL
CORRUGATED IRON FENCE	CIF	THRESHOLD LEVEL	THL
CRASH BARRIER	CBR	FOLI WATER	FW
HANDRAIL	HDL	SURFACE WATER	SW
IRON RAILINGS	IRP	UNABLE TO LIFT	UTL

SURFACE INFO

POST AND CHAIN FENCE	PCF	CONCRETE	CZ
POST AND RAIL FENCE	PRF	BROOK PAVING	BP
POST AND WIRE FENCE	PWF	FLOWERBED	FB
SECURITY FENCE	SOF	PAVING SLABS	PS
STOCK WIRE FENCE	SWF	RETAINING WALL	RWall
TRELLES PAVING	TUF	SCALPINGS	Scalp
WIRE MESH FENCE	WMF	TACTILE PAVING	Tac

FEATURE INFORMATION

ROLLAD	BO	NAME PLATE	NP
TELEPHONE IC	BTIC	NOTICE BOARD	NP
END	BS	POST	PS
CABLE TELEVISION IC	CATV	RASH WATER PIPE	RWP
EARTHING ROD	ER	ROAD SIGN	RS
ELECTRICITY CABLE PIT	ELOP	ROOFTOP EYE	RE
ELECTRICITY POLE	EP	SERVICE MARKER POST	SMP
PIPE HORIZONTAL	PH	SOIL VENT PIPE	SVP
FLUO. POLE	FP	STAC POLE	SP
GUIDE POST	GP	TELEGRAPH POLE	TP
INSPECTION COVER	IC	TRAFFIC SIGNAL	TS
LAMP POST	LP	TRAFFIC SIGNALS IC	TSC
LETTER BOX	LB	WASH OUT	WO
WATER OUTLET	WO	WATER METER	WM

REVISION

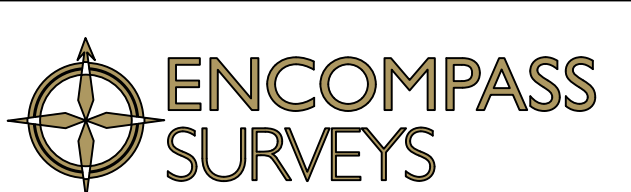
PLOT MAP

1	2	
3	4	
	6	

Level Datum:

Grid: _____

Northpoint:



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Solent Business Park
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Hampshire, PO15 7AX

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Website: encompass-surveys.co.uk

Client: Croudace Homes

Survey Location: Land North of School Road
Arboretum Cross
Middleburg, NC 27155, USA

Survey type:	Topographical	Scale:	1:200@A0
Project name:	XXXXXXXXXXXXXXXXXXXX		
Project no.:	XXXXXXXXXXXX		

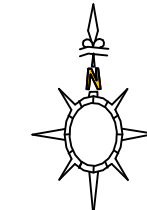
Drawn/By: MH/DR Plot No. 5 of 7

NOTES:

Drainage:
Inspection Covers are lifted where possible and all drainage invert information has been obtained through visual inspection only, with no entry into manholes. Therefore the complete accuracy cannot be guaranteed. Where drainage is of critical importance we suggest the services of a specialist drainage expert be used.

Trees:
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GPS:
GPS detail is relative to the time and date of survey. GPS levels and grid are obtained using industry standard guidelines and can vary according to the quality of the GPS network at the time of survey. Unless stated otherwise, surveys are Scale Factor 1 and Horizontal and Vertical Datums are established from a central site fix and baseline orientation station utilising GNS3 correction data.



LEGEND

OVERALL TREE SPECIES INFORMATION

ALDER	ALD	LONDON PLANE	LMN
ASH	ASH	MAGNOLIA	MAG
ASPEN	ASP	MAPLE	MPL
BEECH	BCH	OAK	OAK
CHERRY	CHY	PINE	PIN
ELM	ELM	POPULAR	POP
FIR	FIR	RHODODENDRONS	RDN
FRUIT	FRT	ROVER	RWN
HAWTHORN	HAW	SILVER BIRCH	SIB
HAZEL	HAZ	SWEET CHESTNUT	SCH
HOLLY	HLY	WALNUT	WNT
HORSE CHESTNUT	HCH	WILLOW	WLS
LIME	LIM	YEW	YEW
LOCUST	LOC	GRASSES UNKNOWN	SPU
		UNIDENTIFIED	UDF

TREE ANNOTATIONS: Tree Species / Tree Bole Size / No of Boles
Tree Height / Tree Canopy Spread

FENCE INFORMATION		LEVEL INFORMATION	
BARBED WIRE FENCE	BWF	BED LEVEL	BL
CHAIN LINK FENCE	CLF	COVER LEVEL	CL
CHESTNUT PALING FENCE	CPF	FLOOR LEVEL	FL
CLOSE BOARD FENCE	CBF	INVERT LEVEL	IL
COMPOSITE SLAT FENCE	CSF	OUTFALL LEVEL	OL
CORRUGATED IRON FENCE	CIF	THRESHOLD LEVEL	THL
CRASH BARRIER	CBR	POOL WATER	PW
HANDRAIL	HDL	SURFACE WATER	SW
IRON RAILINGS	IRP	UNABLE TO LIFT	UTL

SURFACE INFORMATION

POST AND CHAIN FENCE	PCF	CONCRETE	Cc
POST AND RAIL FENCE	PRF	BRICK PAVING	BP
POST AND WIRE FENCE	PWF	FLOWERBED	FB
SECURITY FENCE	SOF	PAVING SLABS	PS
STOCK WIRE FENCE	SWF	RETAINING WALL	RWall
TRELLIS FENCING	TLP	SCALPINGS	Scalp
WIRE MESH FENCE	WMF	TACTILE PAVING	Tac

FEATURE INFORMATION

ROLLAW	RO	NAME PLATE	NP
TELEVISIONS IC	RTVC	NOTICE BOARD	NB
BUS STOP	BS	POST	P
CABLE TELEVISION IC	CB	RAIN WATER FEE	RWF
ELECTRIC FOD	ER	ROAD SIGN	RS
EARTHING CABLE PIT	ELP	ROOING EYE	RE
ELECTRIC POLE	EL	SERVICE WAREHO POST	SWP
FIRE HYDRANT	FI	SOIL VENT FEE	SVF
FLAG POLE	FP	STOP VALVE	SV
GLUEP POST	GP	TELEGRAPH POLE	TP
INSPECTION COVER	IC	TRAFFIC SIGNAL	TS
LAMP POST	LP	TRAFFIC SIGNALS IC	TSIC
LETTER BOX	LB	WASH CUT	WC
SEW OUTLET	SO	WATER METER	WM

REVISION

PLOT MAP

1	2	
3	4	5
	6	7

Level Datum:

Grid:
Grid is related to OSGB15 derived from the GPS network

Northpoint



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Hampshire, PO15 7AX

Tel: (+44)2380 692002 Email: info@encompass-surveys.co.uk
Website: encompass-surveys.co.uk

Client:	Croudace Homes		
Survey Location:	Land North of School Road Arboretfield Cross Wokingham RG41 4TN		
Survey type:	Topographical	Scale:	1:200@A0
Drawing ref:	ENC/020524/3336-S1	Date:	May 2024



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 476250,166750

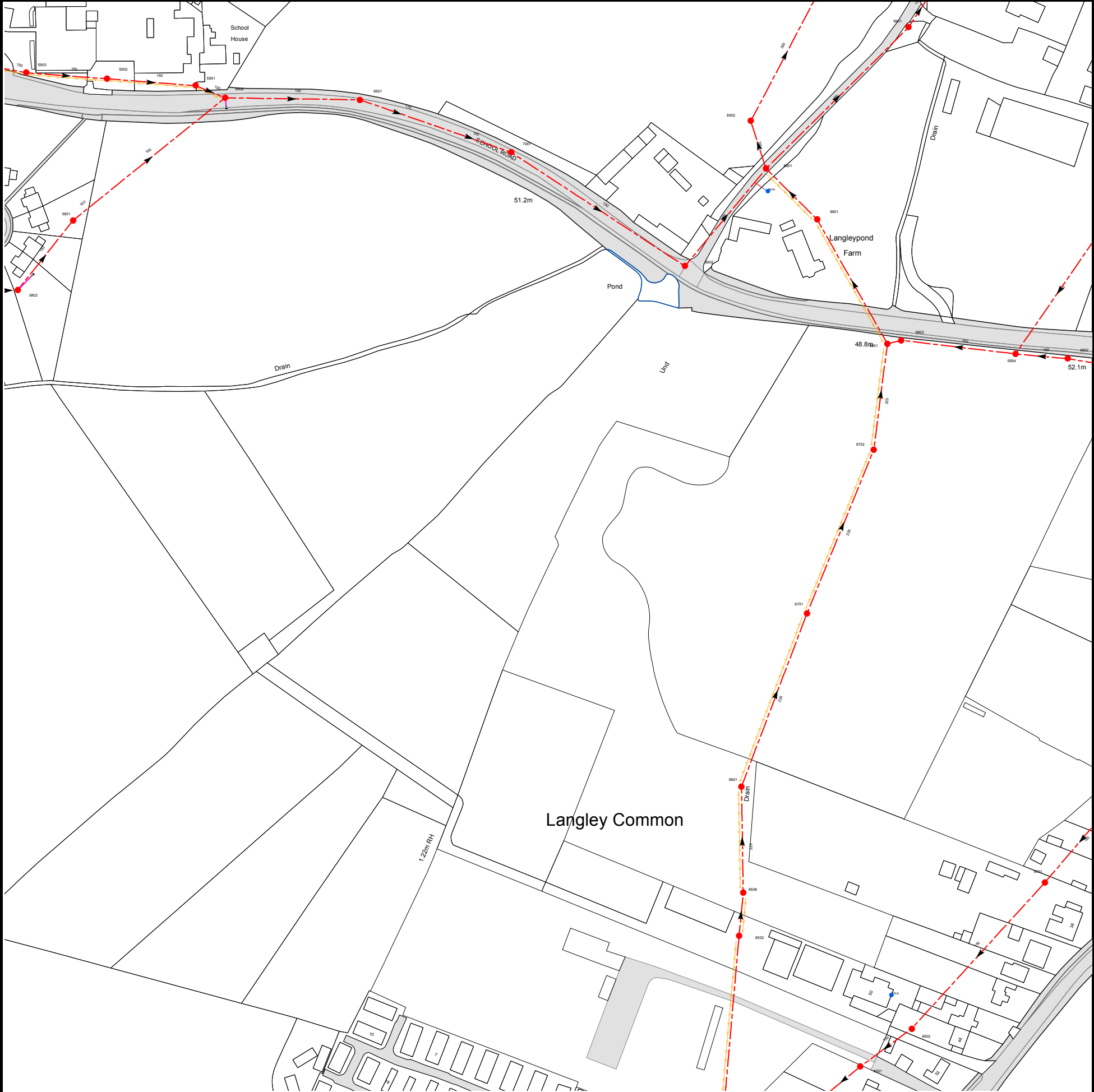
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual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

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NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
3601	67.83	66.28
3703	67.77	65.84
3702	66.04	65.06
3701	66.34	64.8
3704	67.22	65.99
3810	65.84	64.58
381B	n/a	n/a
381C	n/a	n/a
381A	n/a	n/a
381D	n/a	n/a
381E	n/a	n/a
3806	65.31	64.06
3802	63.37	62.35
3805	n/a	n/a
3803	n/a	n/a
3804	65.12	63.56
3801	63.3	62
4803	n/a	n/a
4804	n/a	n/a
4801	61.86	60.93
4802	62.48	61.19
3808	65.25	64.13
4901	62.73	60.45
4902	62.71	60.55
4903	63.05	60.94
3901	62.62	61.38
1902	65.25	64.15
1953	65.26	64.08
1903	66.53	64.58
1951	66.67	65.46
1904	66.6	65.04
1952	67.23	66.09
1950	67.54	65.78
1901	67.38	66.19
191A	n/a	n/a
191B	n/a	n/a
1905	68.22	66.8
2902	67.91	66.02
2903	68	66.12
281B	n/a	n/a
291C	n/a	n/a
2901	67.62	65.7
291A	n/a	n/a
291E	n/a	n/a
3550	66.15	64.48
2650	67.38	65.69
2651	67.81	65.8
261A	n/a	n/a
2606	n/a	n/a
2605	67.73	67.29
2604	67.86	67.24
2603	67.82	66.92
2602	67.89	66.73
3602	67.5	66.63
2601	68.1	66.69
1701	73.66	72.29
2703	71.75	70.35
171C	n/a	n/a
171A	n/a	n/a
1703	70.62	69.41
3705	67.72	66.24
2701	68.38	67.15
2702	70.59	69.12
171E	n/a	n/a
171D	n/a	n/a
1702	70.15	69.03
0802	67.52	66.56
2805	67.91	67.21
1802	69.48	68.1
0801	67.24	66.39
2804	67.21	66.5
2803	66.78	66.12
2809	68.14	67.39
1807	67.5	66.09
1801	n/a	n/a
3809	66.73	65.82
2808	67.57	67
2807	66.61	66.14
2814	67.57	66.23
1806	67.28	65.88
2806	66.71	65.76
1805	67.21	65.85
2802	66.52	65.45
1804	67.17	65.71
2813	67.49	65.47
2812	n/a	n/a
2811	67.59	65.24
0806	65.32	62.9
1803	67.65	65.59
3807	65.75	64.54
281A	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
2801	65.49	64.43
2810	66.7	64.86
2815	67.36	65.51
1850	64.58	62.41
1809	64.56	63.6
0854	63.93	62.07
1808	63.67	62.81
1851	64.78	63.16
2816	n/a	n/a
071C	n/a	n/a
071B	n/a	n/a
071A	n/a	n/a
081A	n/a	n/a
0853	65.39	63.02
0804	63.91	62.21
0852	64.22	61.66
0805	63.8	62.48
0851	63.46	61.55
0803	62.6	61.47
0850	62.77	61.05
0905	61.66	60.22
0955	61.6	60.09
0903	62.11	60.96
0904	60.78	59.4
0954	60.88	59.24
0906	61.25	60.17
0902	61.18	60.62
091B	n/a	n/a
091C	n/a	n/a
091A	n/a	n/a
0901	61.99	61.01
0957	n/a	n/a
0956	63.69	62.85
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 and established on site before any works are undertaken.		



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 476750,166750

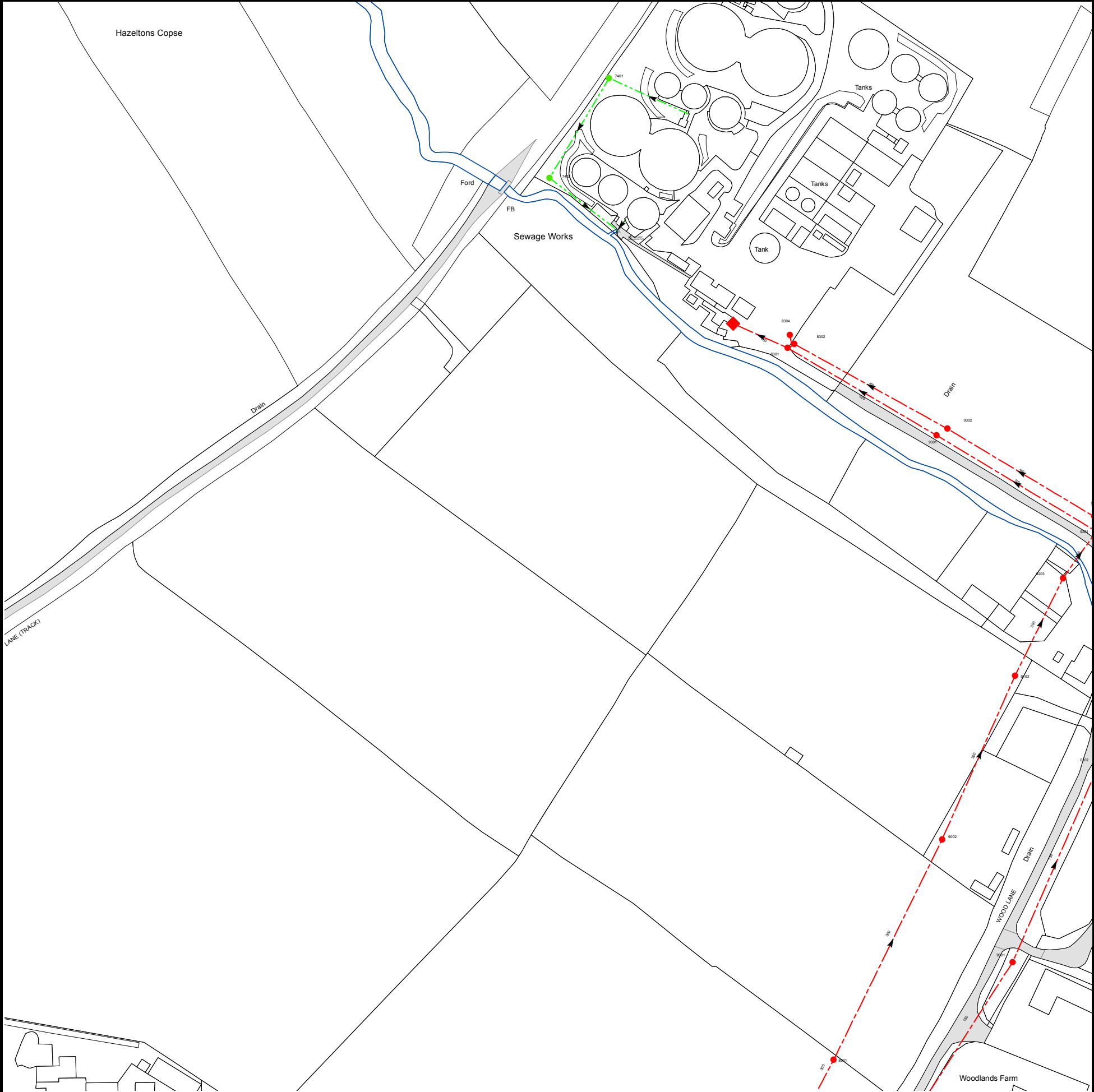
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NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
8501	53.48	52.26
9502	n/a	n/a
951A	n/a	n/a
8502	51.11	49.75
8508	50.83	49.58
9501	53.98	52.78
8601	50.47	49.02
8701	49.69	48.53
8702	49.13	47.96
9802	51.66	50.51
9804	n/a	n/a
9801	48.64	47.48
9803	48.66	47.65
8802	49.76	47.34
8801	48.64	46.93
891A	n/a	n/a
8901	48.272	46.592
7901	52.62	50.7
8902	48.86	46.4
9901	47.55	46.09
5802	61.97	60.53
5801	63.31	60.2
6901	58.14	56.3
6902	61.5	59.21
5901	62.62	59.67
5902	63.53	60
5903	63.49	60.25

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 and established on site before any works are undertaken.



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 476750,167250

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 and established on site before any works are undertaken.

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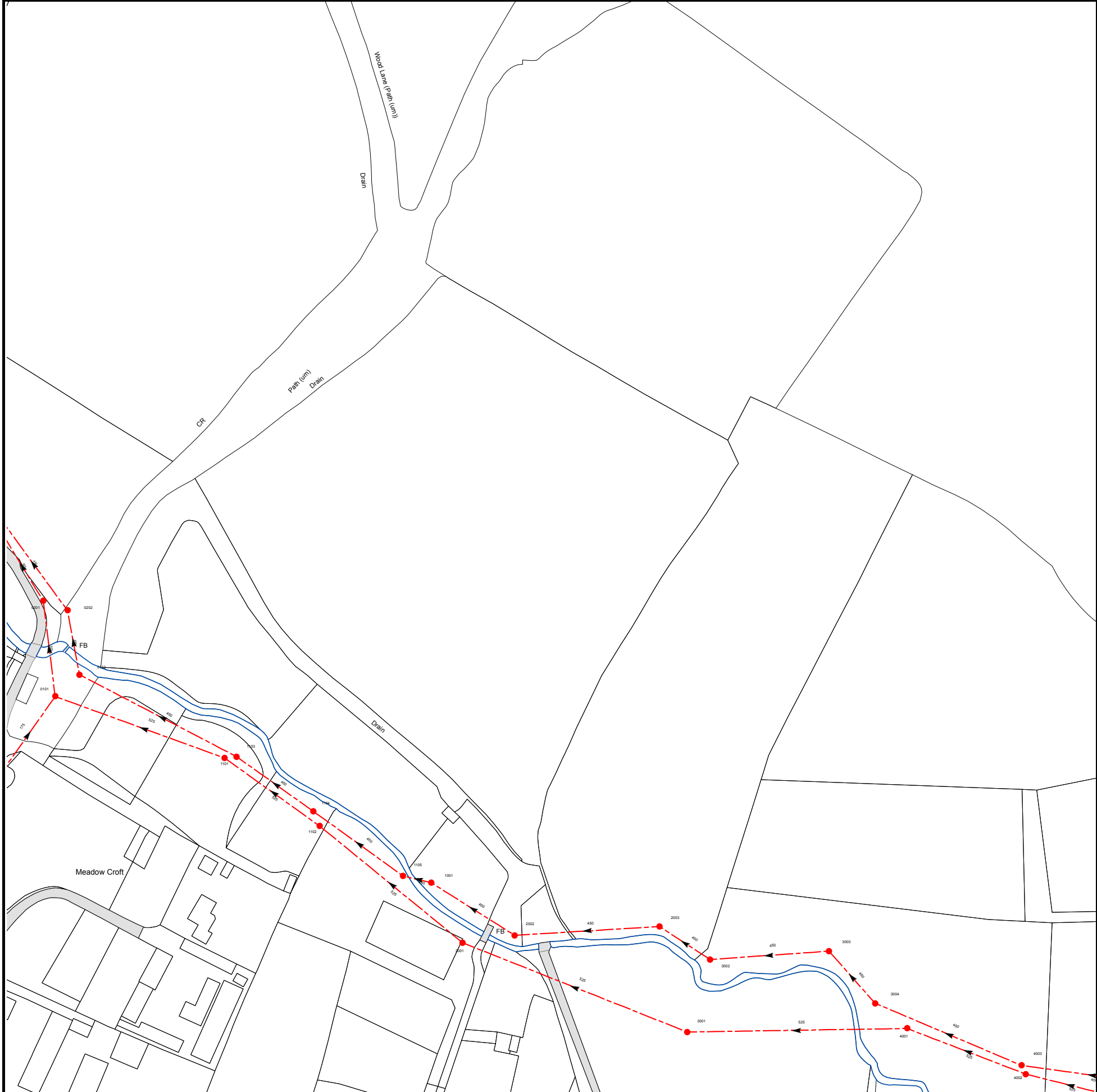
NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
8001	48.34	45.78
9001	46.85	45.41
9002	47.54	44.97
0102	n/a	n/a
9103	45.7	43.93
9203	45.64	43.35
9201	46.007	43.287
9202	46.142	43.232
9301	45.85	43.17
9302	46.019	43.119
8301	45.55	43.1
8302	45.66	43.04
8304	n/a	n/a
7402	n/a	n/a
7401	n/a	n/a
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 and established on site before any works are undertaken.		

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
3001	63.56	62.25
0001	64.13	62.55
1050	65.87	63.72
1001	67.08	65.55
1051	66.8	64.98
2004	65.7	63.85
201A	n/a	n/a
201B	n/a	n/a
2002	65.75	63.75
201C	n/a	n/a
2001	64.57	63.01

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 and established on site before any works are undertaken.



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 477250,167250

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NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
2003	47.45	43.92
3001	47.14	43.8
3002	46.61	43.97
3003	46.94	44.05
3004	46.74	44.09
4001	46.86	n/a
4003	47.41	44.31
4002	47.19	n/a
2001	47.03	n/a
2002	46.45	43.82
1001	46.27	43.75
1105	46.47	43.72
1102	n/a	n/a
1104	46.2	43.64
1101	46.49	n/a
1103	46.2	43.56
0101	45.99	43.4
0103	46	43.43
0202	46.101	43.311
0201	46.11	43.33
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 and established on site before any works are undertaken.		



Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

	Foul Sewer: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.
	Surface Water Sewer: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.
	Combined Sewer: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.
	Storm Sewer
	Sludge Sewer
	Foul Trunk Sewer
	Surface Trunk Sewer
	Combined Trunk Sewer
	Foul Rising Main
	Surface Water Rising Main
	Combined Rising Main
	Vacuum
	Thames Water Proposed
	Vent Pipe
	Gallery

Other Sewer Types (Not operated and maintained by Thames Water)

	Sewer		Culverted Watercourse
	Proposed		Decommissioned Sewer
	Content of this drainage network is currently unknown		Ownership of this drainage network is currently unknown

Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.
- 2) All measurements on the plan are metric.
- 3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
- 4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

	Air Valve		Meter
	Dam Chase		Vent
	Fitting		

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

	Ancillary		Drop Pipe
	Control Valve		Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol. Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

	Inlet		Outfall
	Undefined End		

Other Symbols

Symbols used on maps which do not fall under other general categories.

	Change of Characteristic Indicator		Public / Private Pumping Station
	Invert Level		Summit

Areas

Lines denoting areas of underground surveys, etc.

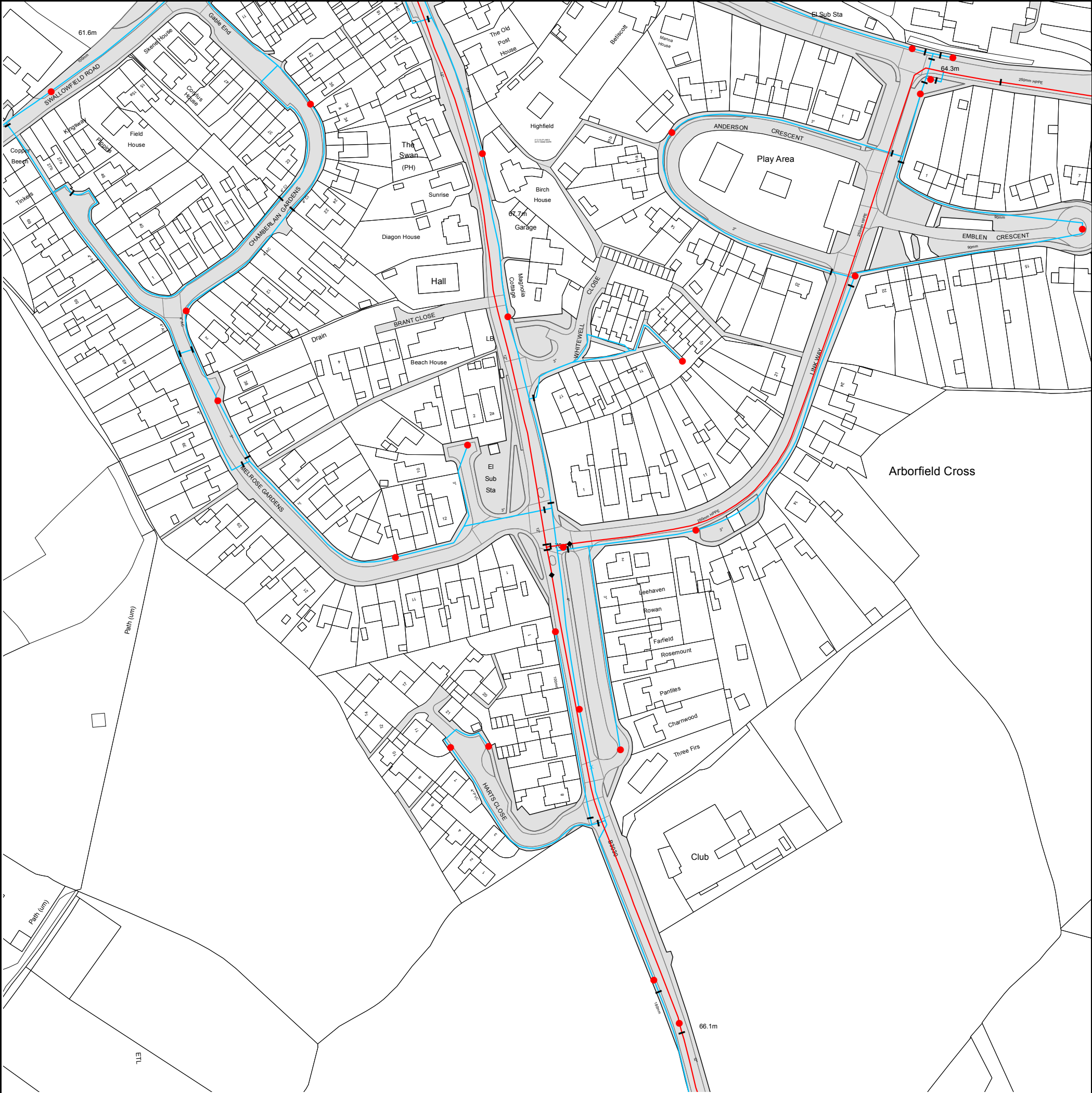
	Agreement
	Chamber
	Operational Site

Ducts or Crossings

	Casement	Ducts may contain high voltage cables. Please check with Thames Water.
	Conduit Bridge	
	Subway	
	Tunnel	

5) 'na' or '0' on a manhole indicates that data is unavailable.

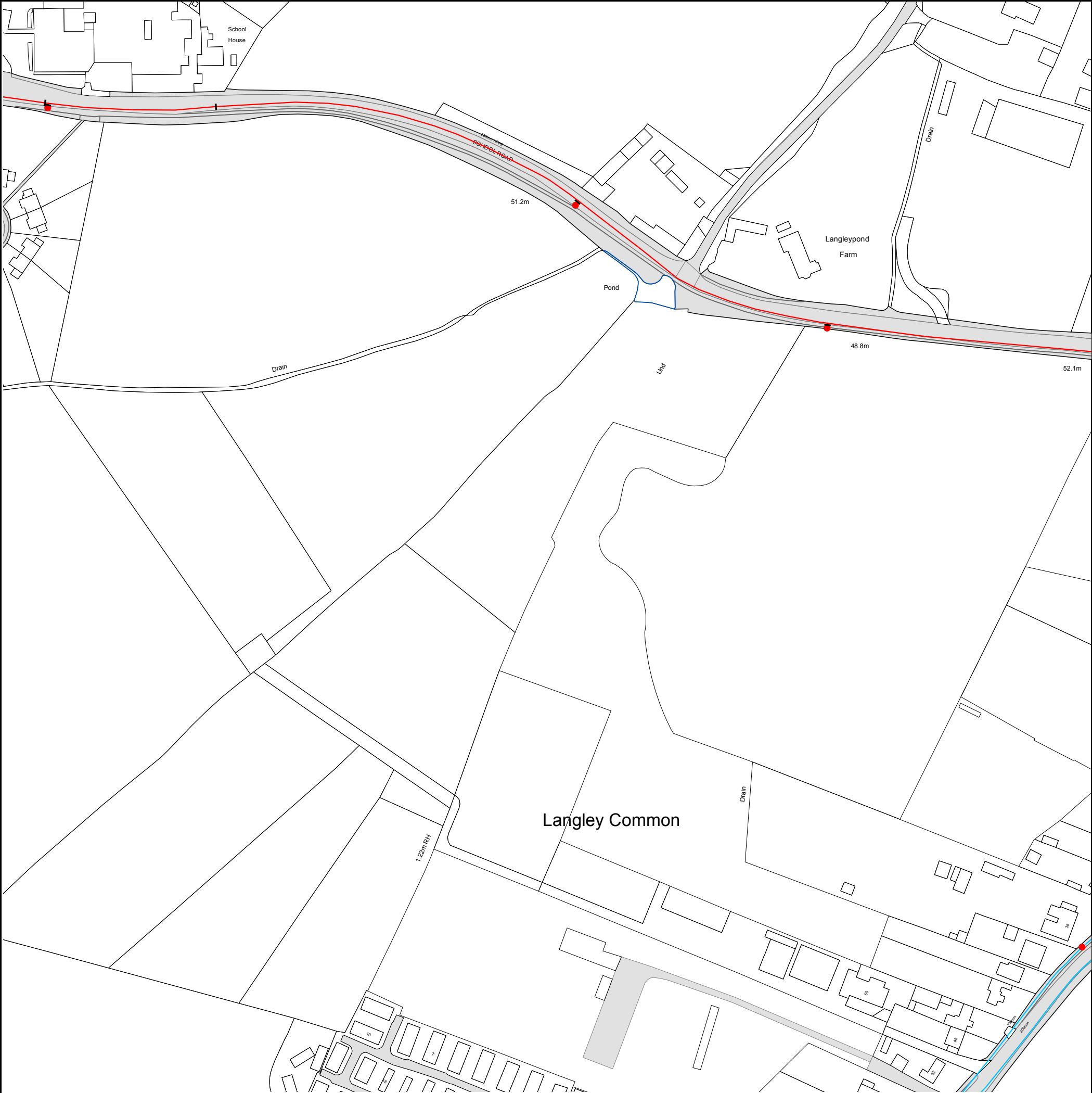
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology, please contact Property Searches on 0800 009 4540.



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 476250,166750

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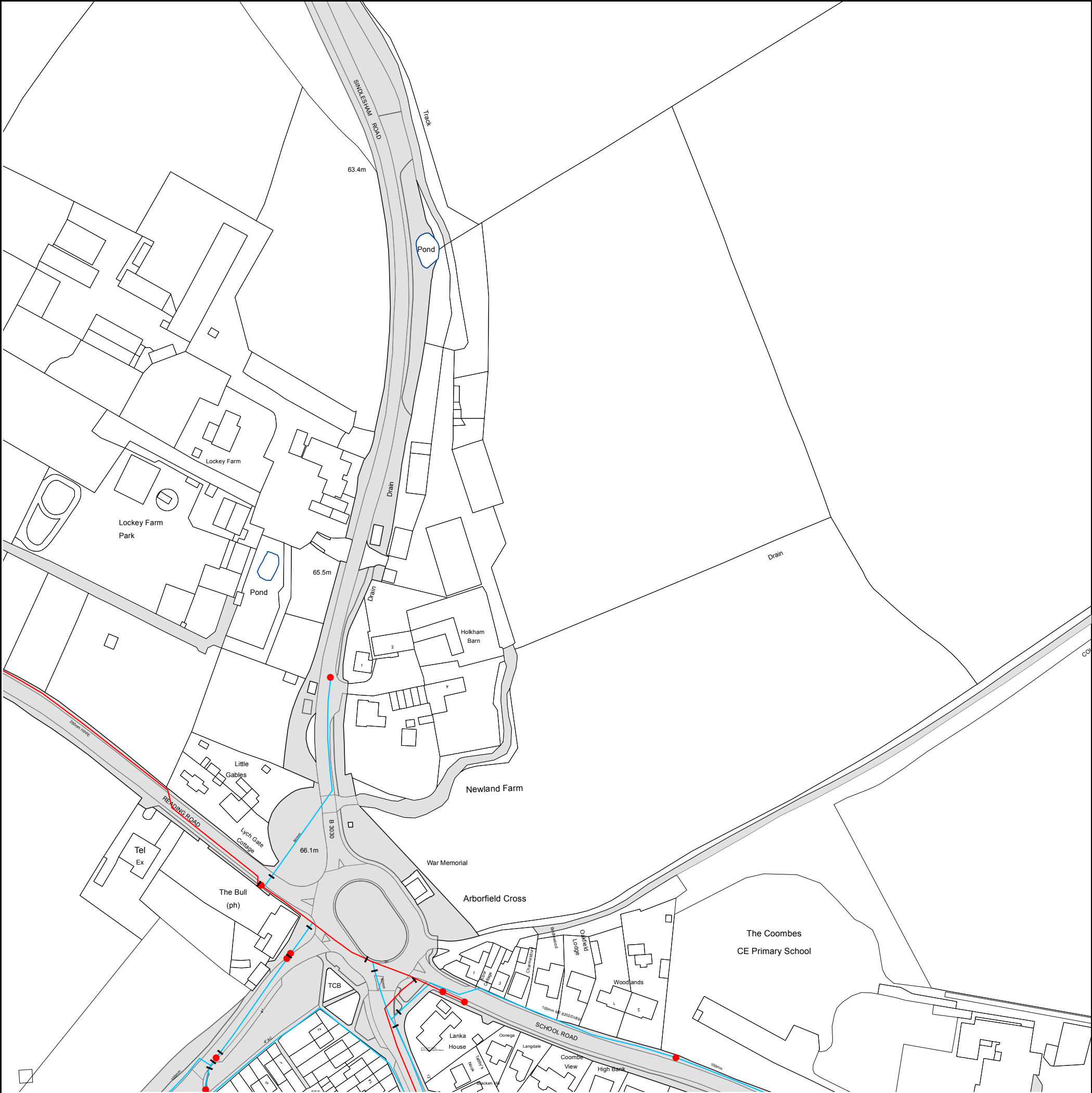
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The width of the displayed area is 500m and the centre of the map is located at OS coordinates 476750,166750

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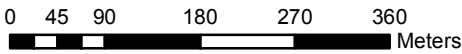
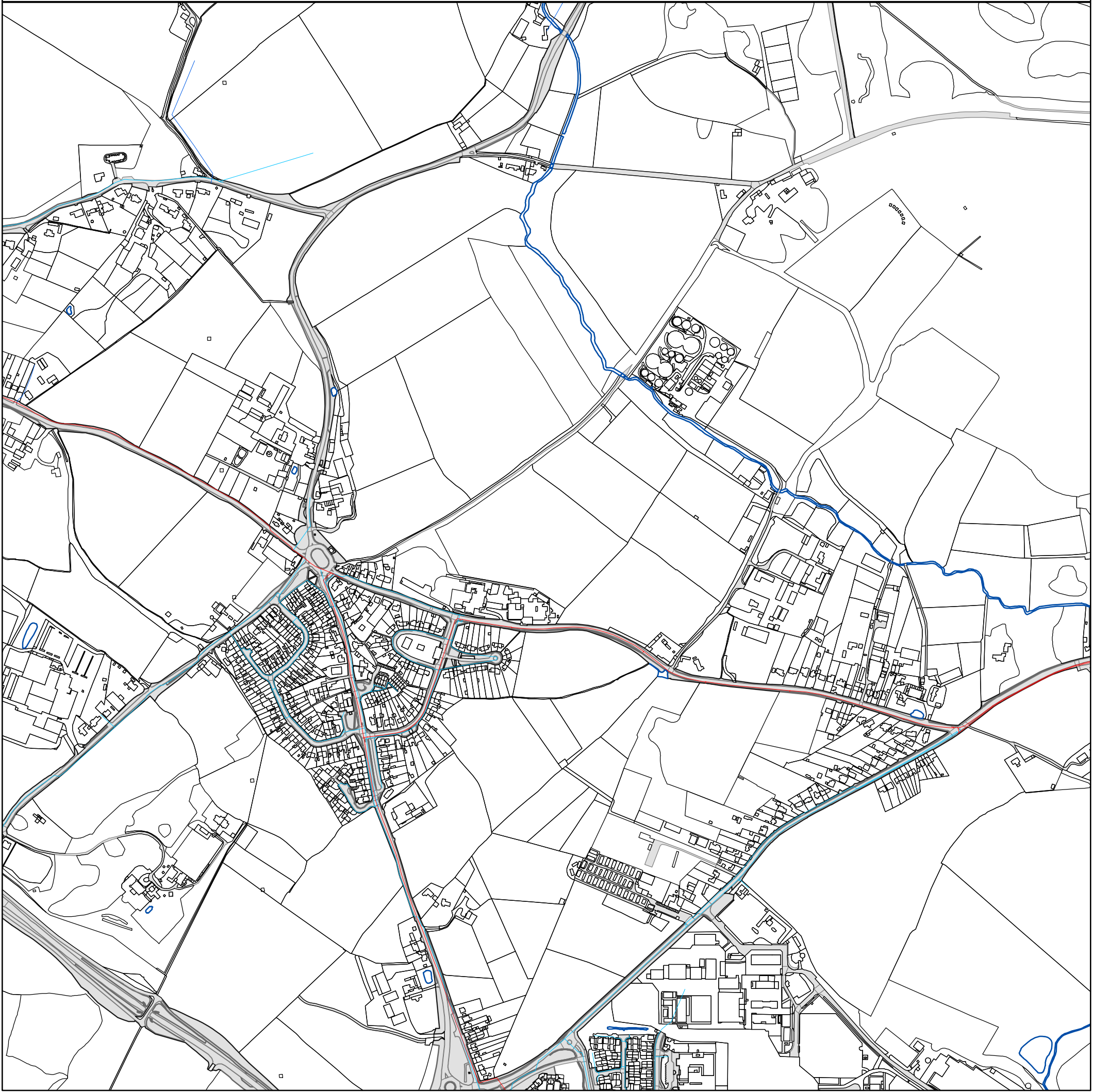
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The width of the displayed area is 500m and the centre of the map is located at OS coordinates 476250,167250

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Scale: 1:7161
Width: 2000m
Printed By: ASuji
Print Date: 13/05/2024
Map Centre: 476585,167101
Grid Reference: SU7667SE

Comments:



Asset Location Search - Water Key

Water Pipes (Operated & Maintained by Thames Water)

- Distribution Main:** The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.
- Trunk Main:** A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.
- Supply Main:** A supply main indicates that the water main is used as a supply for a single property or group of properties.
- Fire Main:** Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.
- Metered Pipe:** A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.
- Transmission Tunnel:** A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.
- Proposed Main:** A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger
- Casement:** Ducts may contain high voltage cables. Please check with Thames Water.

Other Water Pipes (Not Operated or Maintained by Thames Water)

- Other Water Company Main:** Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.
- Private Main:** Indicates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Payment Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment within 14 days of the date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service or will be held to be invalid.
4. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
5. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
6. A charge may be made at the discretion of the company for increased administration costs.

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If you are still dissatisfied with our final response, and in certain circumstances such as you are buying a residential property or commercial property within certain parameters, The Property Ombudsman will investigate your case and give an independent view. The Ombudsman can award compensation of up to £25,000 to you if he finds that you have suffered actual financial loss and/or aggravation, distress, or inconvenience because of your search not keeping to the Code. Further information can be obtained by visiting www.tpos.co.uk or by sending an email to admin@tpos.co.uk.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0300 034 2222 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	BACS Payment	Telephone Banking
Please Call 0800 009 4540 quoting your invoice number starting CBA or ADS	Account number 90478703 Sort code 60-00-01 A remittance advice must be sent to: Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW. or email ps.billing@thameswater.co.uk	By calling your bank and quoting: Account number 90478703 Sort code 60-00-01 and your invoice number

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.



Appendix B - LLFA Developer Checklist

Wokingham Borough Council Developer Checklist

Planning Application Drainage Checklists

Major Development Outline Applications

Outline planning applications for Major Developments must include the following information and details on the proposed drainage strategy and system(s).

Ref.	Documentation required	Requirement met/included
	The applicant shall submit a description of the proposed drainage system(s) with an explanation of key operating principles and design decisions including but not necessarily limited to: ■ Identification of the destination of discharge (in accordance with Building Regulation Part H hierarchy) with appropriate justification for the selection; ■ Identification of proposed points of connection(s) to water bodies, sewers, public surface water sewers or highway drains etc.; ■ Evidence of agreement in principal from key third parties whose systems the proposed drainage system will need to connect / impact (Environment Agency, Lead Local Flood Authority, Thames Water or adjacent landowner); ■ Identification of the SuDS techniques that will be applied at the site with appropriate justification for the selection; ■ A description of how water will be collected and dealt with across the site by the proposed SuDS techniques including what volumes are to be stored where; ■ A description of the water quality treatment measures applied to surface water as it drains the site; ■ Where necessary a description of how the proposed system(s) will deal with surface water overland flow flooding originating from off-site areas; ■ Where necessary, an explanation of why it is not reasonably practicable to achieve any of the non-statutory technical standards for sustainable drainage systems (March 2015); ■ Where proposing discharge to ground; evidence to support proposed infiltration rates used in initial calculations. This should include nearby borehole logs, geological mapping and if available any geotechnical investigations, infiltration tests and records of groundwater monitoring. Consideration shall also be given to the implications of any local Source Protection Zones; ■ Where necessary, identification of any mechanical or electrical features necessary for the effective operation of the drainage strategy; and; ■ Proposals for the adoption and maintenance of the entire drainage system(s), including a schedule, with written agreement in principal from the adopting/maintaining body.	Met Included To be Confirmed Met Included Included Included Included Included Met Included
	Plans & Drawings Required	

	The applicant shall submit plans defining the proposed drainage system including but not necessarily limited to: ■ Topographic survey of the site including local surface water drainage features; ■ Position of the site relative to surrounding flood sources, including where necessary identification of surface water/groundwater flows entering the development from adjacent land; ■ Where necessary definition of sub-catchments within the site; ■ A conceptual plan of the proposed drainage system(s) identifying the proposed point(s) of outfall, position of SuDS techniques / drainage features, the attenuation features, conveyance routes (including exceedance routes) comprising the drainage system(s); and ■ A thematic plan of the existing and proposed developments identifying land uses / coverings significant in informing discharge rates.	Included Included Included Included Included
	Calculations Required	
	Overview design calculations and design parameters to demonstrate conformity with the design criteria for the site. These should include: ■ Demonstration through calculation of the existing and proposed (unmitigated) development discharge rates for the 1, 30 and 100 year (including allowance for the effects of climate change) design storm events; ■ Demonstration through calculation(s) of the volumes of surface water storage required to attenuate site discharges to pre-development / agreed discharge rates; ■ Demonstration through calculation(s) that the proposed drainage system(s) will not result in flooding off site under the 100 year return period design storm including allowance for climate change; and ■ Demonstration through calculation(s) that provision is made to meet long term storage volumes required for the site, unless discharge rates have been restricted to QBar for all storm events up to and including the 1 in 100 year including allowance for climate change	Included Included Included Included

Additional requirements for a large site or multi-plot development (including Strategic Development Locations).

Ref.	Detail required	Requirement met/included
	■ Plans demonstrating the phasing of drainage infrastructure (in keeping with wider development phasing proposals, demonstrating how flood risks and drainage will be managed throughout and on completion of the development.	Not Applicable



Appendix C - Drainage Strategy

Greenfield Runoff Rates

Greenfield Volumes

Drainage Modelling with the use of Software

Drainage Strategy Plan

Calculated by:	GEORGIOS ROINAS
Site name:	HD083 School Road, Arborfield Cross
Site location:	School Road, Arborfield Cross

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

Site Details

Latitude:	51.39722° N
Longitude:	0.89968° W

Reference:	1141134777
Date:	Jul 29 2024 11:46

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	1
-----------------------	---

Methodology

Q _{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Notes

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

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

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

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

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

Hydrological characteristics

	Default	Edited
SAAR (mm):	651	651
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

(3) Is $\text{SPR/SPRHOST} \leq 0.3$?

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

Greenfield runoff rates

Default

Edited

Q_{BAR} (l/s):	1.67	1.67
1 in 1 year (l/s):	1.42	1.42
1 in 30 years (l/s):	3.85	3.85
1 in 100 year (l/s):	5.34	5.34
1 in 200 years (l/s):	6.26	6.26

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

GREENFIELD VOLUME - 50% AEP

Pre-development discharge

Site Makeup	Greenfield
Greenfield Method	FSR/FEH
Positively Drained Area (ha)	5.450
Soil Index	2
SPR	0.30
Catchment Wetness Index	95.820
Return Period (years)	2
Climate Change (%)	0
Storm Duration (mins)	360
Betterment (%)	0
	Calc
PR	0.227
Runoff Volume (m³)	307

GREENFIELD VOLUME – 3.3% AEP

Pre-development discharge

Site Makeup	Greenfield
Greenfield Method	FSR/FEH
Positively Drained Area (ha)	5.450
Soil Index	2
SPR	0.30
Catchment Wetness Index	95.820
Return Period (years)	30
Climate Change (%)	0
Storm Duration (mins)	360
Betterment (%)	0
	Calc
PR	0.257
Runoff Volume (m³)	767

GREENFIELD VOLUME - 1% AEP

Pre-development discharge

Site Makeup	Greenfield ▾
Greenfield Method	FSR/FEH ▾
Positively Drained Area (ha)	5.450
Soil Index	2 ▾
SPR	0.30
Catchment Wetness Index	95.820
Return Period (years)	100
Climate Change (%)	0
Storm Duration (mins)	360
Betterment (%)	0
	Calc
PR	0.274
Runoff Volume (m³)	1027

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	5	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	550.0		

Nodes

Name	Area (ha)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Basin	1.970	100.000	-14.438	76.404	1.500

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	1.000	Additional Storage (m³/ha)	0.0		

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
30	35	0	0
100	0	0	0
100	40	0	0

Node Basin Offline Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Loop to Node		Sump Available	✓
Invert Level (m)	98.500	Product Number	CTL-SHE-0084-3300-1200-3300
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.3	Min Node Diameter (mm)	1200

Node Basin Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	98.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1217.0	0.0	1.500	2796.0	0.0



Results for 2 year Critical Storm Duration. Lowest mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
960 minute winter	Basin	930	98.844	0.344	26.6	481.7071	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
960 minute winter	Basin	Hydro-Brake®	3.3	176.9

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Basin	1410	99.199	0.699	38.4	1108.5090	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
1440 minute winter	Basin	Hydro-Brake®	3.3	253.1



Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
2160 minute winter	Basin	2160	99.421	0.921	36.5	1566.8400	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
2160 minute winter	Basin	Hydro-Brake®	3.3	364.8



Results for 100 year Critical Storm Duration. Lowest mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
1440 minute winter	Basin	1440	99.349	0.849	47.2	1412.7740	0.0000	OK

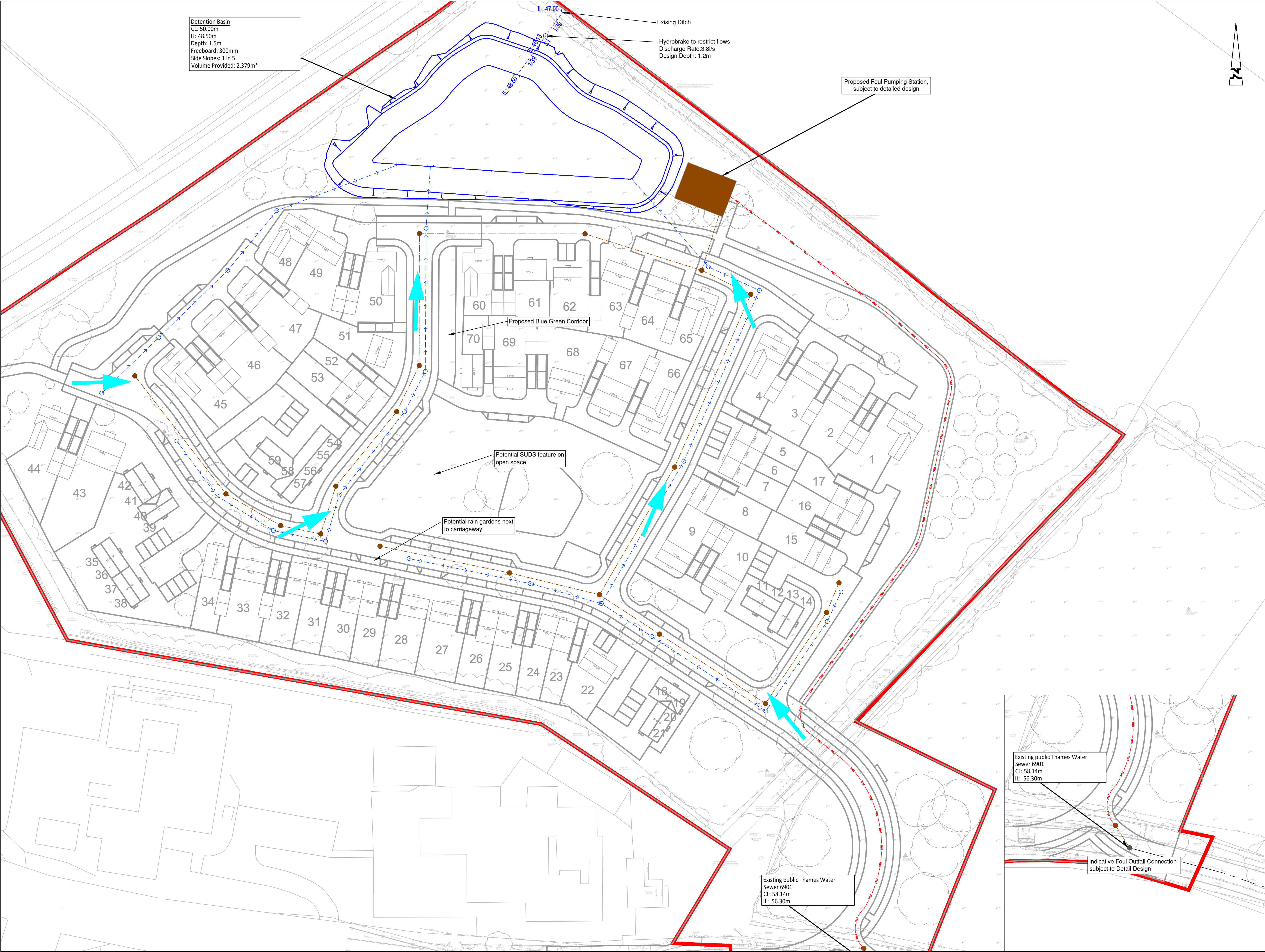
Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
1440 minute winter	Basin	Hydro-Brake®	3.3	252.0



Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
2160 minute winter	Basin	2160	99.630	1.130	46.1	2047.2060	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
2160 minute winter	Basin	Hydro-Brake®	3.3	390.8



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NOTES:

- The detention basin has been designed to drain 65% impermeable area(1.51ha) of the total developable area(2.33ha) and the total area of the basin(0.28ha) and of the roads(0.17ha).
- The ground model that was used to design the attenuation basin is based on a Topographical Survey that was produced in May 2024 by Encompass Surveys.

KEY

- Application Boundary
- Proposed adoptable surface water sewer & MH
- Indicative foul water sewer & MH
- Proposed adoptable surface water sewer & MH
- Proposed Rising Main
- Proposed Exceedance Flows

0 5 10 15 20 25m
Scale 1:500

P2	03/25	Updated design to suit new layout masterplan	LC	GR
P1	03/25	FIRST ISSUE	GR	EP
Rev	Date	Description	Drawn	Checked

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Client
CRUDACE HOMES,VORTAL HOMES LTD & FALCON DEVELOPMETS (SE) LTD

Project
LAND NORTH OF SCHOOL ROAD, ARBORFIELD CROSS

Title
DRAINAGE STRATEGY LAYOUT

Status
FOR INFORMATION

Scale 1:500 @ A1	Date MAR 2025	Drawn GR	Checked SI
Drawing No HD083-003			Revision P2