

FLOOD RISK ASSESSMENT & PRELIMINARY DRAINAGE STRATEGY

David Wilson Homes (Southern)

Land at Ducks Nest, Arborfield

November 2024 (V4)

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1 Introduction

Authorisation

- 1.1 Vectos (now SLR Consulting) has been appointed by David Wilson Homes (Southern) to prepare a Flood Risk Assessment (FRA) and preliminary drainage strategy to support the outline planning application for land at Duck's Nest, Arborfield.

Background

- 1.2 The site consists of agricultural land which is approximately 17.7 hectares (ha) in size and is located to the northwest of Arborfield (see Figure 1).
- 1.3 According to the Environment Agency (EA) Flood Map for Planning, the site is entirely located in Flood Zone 1. This is defined as land having a less than 1 in 1,000 annual probability of river or sea flooding and is therefore considered to be a low risk from these sources. However, the site exceeds 1 hectare (ha) in size and in accordance with the National Planning Policy Framework (NPPF) an FRA must support the planning application.
- 1.4 This FRA was originally prepared in August 2022 but has now been updated to reflect a revised scheme. The Lead Local Flood Authority (LLFA) were previously satisfied with the surface water drainage strategy outlined, therefore, all key principles have been retained.

Development Proposal

- 1.5 A hybrid application comprising:
- i) A full application for the change of use of land from agricultural land to provide an area of Suitable Alternative Natural Greenspace (SANG), including the details of associated landscaping, planting, drainage measures, parking, walking routes and other works associated with the creation of the SANG.
 - ii) An outline application with all matters reserved other than access into the site for a residential development of up to 135 dwellings, open space, internal accesses and parking, drainage measures, landscaping and all other associated works.
- 1.6 The Parameter Plan and Framework Masterplan are enclosed in Appendix A.

Aims and Objectives

- 1.7 The aim of this FRA is to demonstrate that the site can be developed safely for residential purposes, without exposing it to an unacceptable degree of flood risk and/or increasing the flood risk to third parties. The objectives of this FRA are to:
- i) Review the relevant planning policy documents to ensure that the development proposals are in accordance with this and other regional and local guidance.
 - ii) Summarise relevant stakeholder consultation used to inform this FRA.

- iii) Undertake a desk-based review of the available flood risk information to assess past, current and future flood risk issues, taking into consideration the anticipated impacts of climate change.
- iv) Identify flood mitigation requirements, if any, to ensure the development is safe from flooding, without impacting third parties.
- v) Assess whether the development will result in an increase of surface water runoff and how this can be mitigated through the incorporation of Sustainable Drainage Systems (SuDS) into the proposed development, which are informed through LLFA guidance and consultation.
- vi) Evaluate a conceptual foul water drainage solution.
- vii) Summarise the above into an FRA report including a plan showing the proposed SuDS features associated with the conceptual surface water drainage strategy.

Limitations

1.8 The general limitations of this assessment are that:

- i) A number of sources have been used to compile this document, whilst we believe them to be trustworthy; Vectos is unable to guarantee the accuracy of the information that has been provided by others.
- ii) This report is based on information available at the time of preparing the FRA. Consequently, there is potential for further information to become available or variations to the development proposals to be made. These changes may lead to future alteration to the conclusions or calculations in this report.

2 Site Description

Site Location and Description

- 2.1 The site is located on land to the northwest of Arborfield Garrison, Reading, and is centred at approximate grid reference of SU761662. The site comprises agricultural land, which split across a number of fields. The total site area is approximately 17.7 ha. The approximate red line boundary of the site is shown in Figure 1.

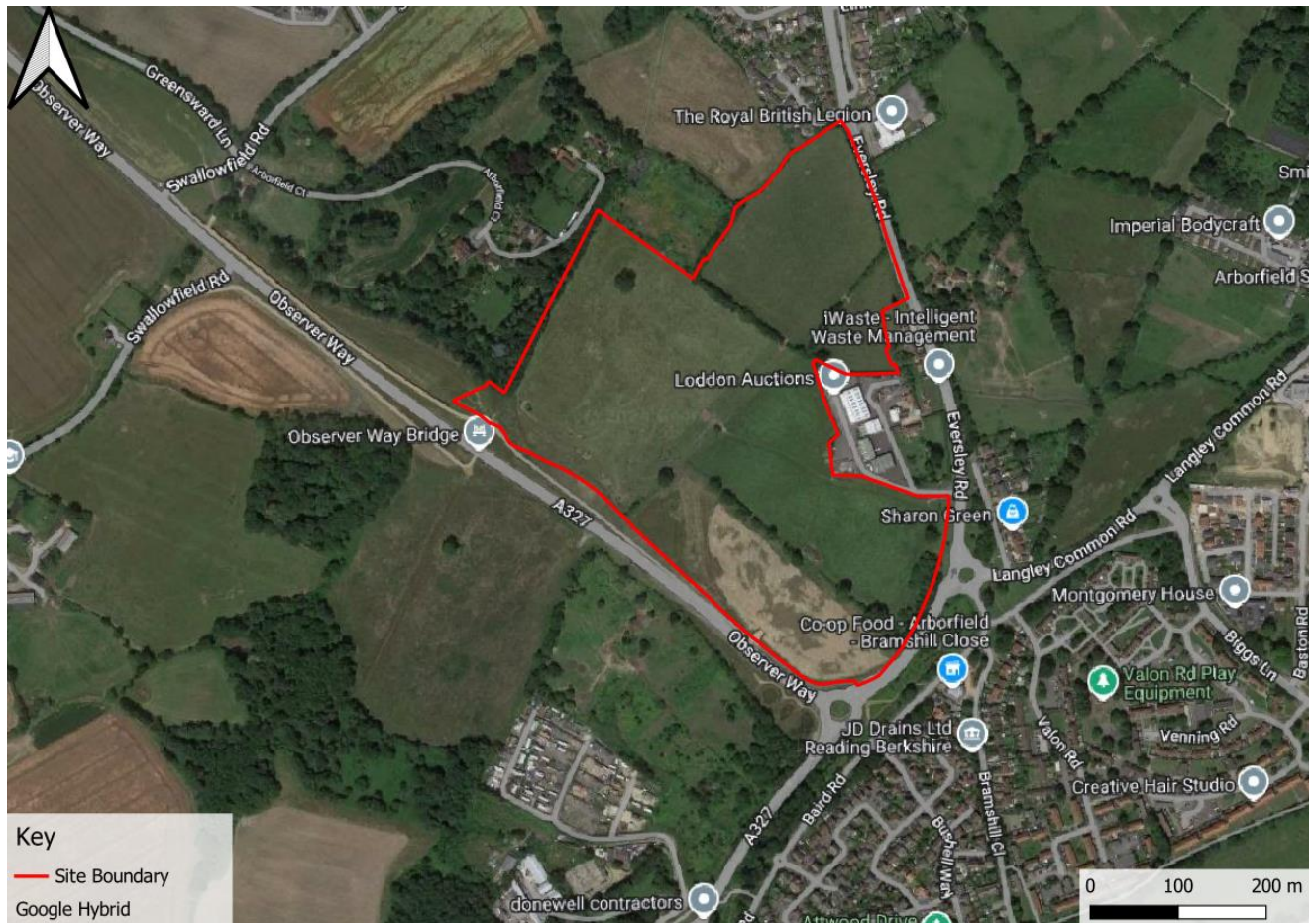


Figure 1: Site Location Plan

Site Topography

- 2.2 A topographical survey of the site is enclosed in Appendix B. It shows that ground levels typically fall in an easterly direction, with a maximum elevation of approximately 79 m above ordnance datum (AOD). This drops down to approximately 59 m AOD alongside the east site boundary.

Geology and Hydrogeology

- 2.3 The 1 in 50,000 scale British Geological Survey (BGS) online mapping indicates that the bedrock underlying most of site is London Clay. The west part of the site is underlain by the Bagshot Formation – Sandstone. Some limited superficial deposits are identified, which consist of Head - Gravel, Sand, Silt and Clay and are present in the west part of the site.

- 2.4 A Phase 1 Geo-Environmental Desk Study Report was completed by EMS Geotech in June 2022 (refer to Appendix C for details). No intrusive site works have been undertaken at this stage.
- 2.5 The London Clay is classified as Unproductive strata. Unproductive strata are largely unable to provide usable water supplies and are unlikely to have surface water and wetland ecosystems dependent on them. The small area of Bagshot Formation is classified a Secondary A aquifer, which comprise permeable layers that can support local water supplies, and may form an important source of base flow to rivers
- 2.6 The site is not located within a groundwater Source Protection Zone nor a drinking water safeguard zone for groundwater.

Hydrology and Existing Drainage

- 2.7 Two ditches are present within the site and are shown on the topographic survey and are also shown in Figure 2. The north ditch is present within a hedge and is culverted beneath the car park of the adjacent commercial area. It subsequently outfalls into a pond within the commercial area. The pond outfall is classified a public surface water sewer, which immediately downstream of Eversley Road outfalls into a stream.
- 2.8 The south ditch is present on a section of the east site boundary. It is also culverted and connects to the public surface water sewer upstream of the outfall into the stream.
- 2.9 The Thames Water sewer maps are enclosed in Appendix D, which show both surface and foul water sewers in Eversley Road adjacent to the site. A length of the surface water sewer is located within the site boundary and has a 300 mm diameter.



Figure 2: Waterbodies on Site

3 Planning Policy and Guidance

National Planning Policy Framework

- 3.1 The National Planning Policy Framework (NPPF) sets out the Government's national policies for flood risk management in a land use planning context within England and how these are expected to be applied. It states that developers and local authorities should try to locate development to land in zones with the lowest probability of flooding.
- 3.2 The aim is to steer new development into Flood Zone 1 (areas with a low probability of river or sea flooding). Where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2 (areas with a medium probability of river or sea flooding), applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zone 2 should Flood Zone 3 (areas with a high probability of river or sea flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.
- 3.3 This sequential risk-based approach to determining the suitability of land for development in flood risk areas is central to the policy statement and should be applied at all levels in the planning process.
- 3.4 The Planning Practice Guidance (PPG) outlines the approaches that should be taken to meet with the NPPF. In accordance with the PPG, the proposed development (i.e. residential) is classified as More Vulnerable.
- 3.5 Table 2 of the PPG sets out the 'incompatibility' of the vulnerability classification with the identified flood zones. The entire site is located in Flood Zone 1, which is compatible with More Vulnerable development, and application of the Sequential and Exception Test is therefore not required.

Wokingham Borough Local Plan

- 3.6 The local plan is a collection of planning documents, including the Wokingham Borough Adopted Core Strategy sets out the key elements of our vision for the development of our borough until March 2026. It includes policy CP1 (Sustainable Development), which identifies the need to avoid increasing (and where possible reduce) risks of or from all forms of flooding (including from groundwater).
- 3.7 Work is underway on a new local plan which will shape the future of Wokingham Borough. This new local plan will guide where and how growth will take place in the borough in the years up to 2040.
- 3.8 The emerging policy is more comprehensive and includes the following policies:
 - i) Policy FD1: Development and Flood Risk (from all sources)
 - ii) Policy FD2: Sustainable Drainage
 - iii) Policy FD3: River Corridors

3.9 The policies are largely consistent with national policy and guidance. However, some additional considerations include:

- i) Avoid the use of underground tanks, except when all other reasonable alternatives to provide a sustainable drainage solution have been exhausted.
- ii) Development encompassing a watercourse, wherever practicable and appropriate, should provide or retain a minimum undeveloped 10 metre buffer zone to create a corridor favourable to the enhancement of biodiversity.
- iii) The culverting of any watercourses should be avoided.

Wokingham Borough Council Level 1 Strategic Flood Risk Assessment (SFRA)

3.10 The SFRA was updated in 2020 and identifies the flood risk within the borough from rivers, surface water, groundwater, sewers and other artificial sources. Guidance for planners and developers is also included. The SFRA refers to the inclusion of SuDS within developments (with infiltration SuDS used where practicable).

LLFA SuDS Guidance

3.11 The LLFA are a statutory consultee to the planning process to assess major planning applications for their surface water drainage implications. The LLFA published their guidance for major developments in January 2017 with the document: Guidance on the use of Sustainable Drainage Systems, which is available online.

3.12 The guide is intended to assist developers in the design of surface water drainage systems, providing specific information on the planning, design and delivery of surface water drainage, designed to reduce the risk of flooding and maximise environmental gain, including water quality, water resources, biodiversity, landscape and amenity. The guide also aims to ensure that all new developments and redevelopments are designed to mitigate the effects of climate change.

3.13 The guide has informed the surface water drainage strategy discussed in Section 5.

The SuDS Manual (CIRIA C753) 2015

3.14 The CIRIA SuDS Manual provides comprehensive guidance for the design and incorporation of SuDS. The manual sets out the process by which appropriate SuDS options may be selected for a site.

3.15 The guidance within the CIRIA SuDS Manual (2015) will be used for the planning, design, operation and maintenance of the proposed SuDS.

Policy Conclusions

3.16 The development proposals are consistent with the policies within the NPPF, Local Plan and supporting national, regional and local guidance documents. This is because the site is located in

Flood Zone 1 and because surface water will be managed using SuDS. This is discussed in the following sections.

4 Assessment of Flood Risk

Historic Flooding

- 4.1 The EA Historic Flood Map dataset was consulted which shows no incidents in the proximity of the site.

Fluvial and Coastal/Tidal Flood Risk

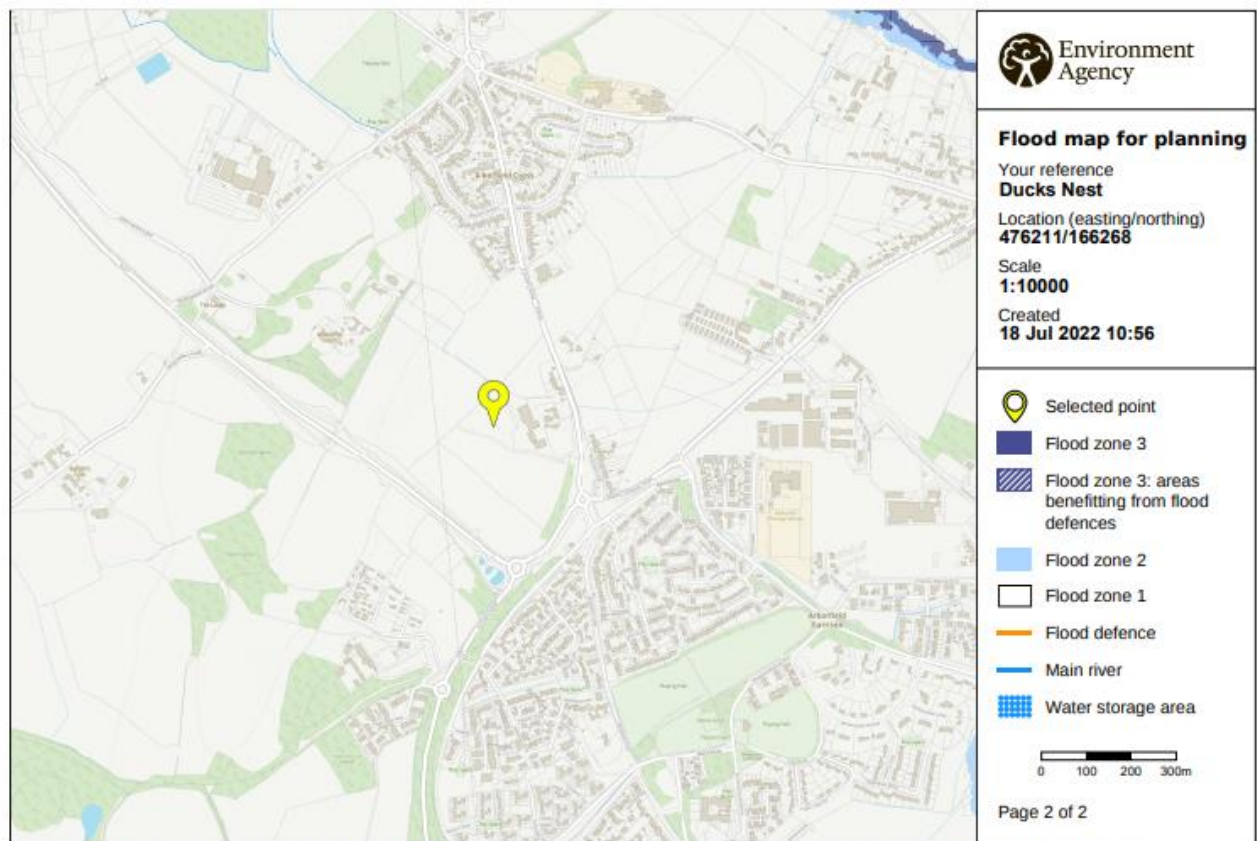
- 4.2 The EA Flood Map for Planning shows both the risk of flooding from rivers and the sea. It identifies that the entire site is in Flood Zone 1 (see Figure 3). Land in Flood Zone 1 is defined as land having a less than 1 in 1,000 annual probability of river or sea flooding.

Risk from Surface Water Flooding

- 4.3 Surface water flooding is a result of overland flow and ponding of water that can follow a rainfall event, from local catchment areas, hillsides and associated with minor ditches or streams. The Risk of Flooding from Surface Water map is available online. The flood extents were downloaded and are presented in Figure 4.
- 4.4 The Risk of Flooding from Surface Water map shows that most of site is at a very low risk of surface water flooding (defined as an area with less than 1 in 1,000 chance of flooding each year). However, three flow paths are present which introduce overland flow from hillside locations into the site.
- 4.5 There are three principal flows paths that impact the site, which are generated from the north, west and south. The flow path from the west introduces a small area of high risk (defined as an area with greater than 1 in 30 chance of flooding each year). However, the north and south flow paths are less significant and introduce a medium risk (defined as an area with between 1 in 100 and 1 in 30 chance of flooding each year) and low flood risk (defined as an area with between 1 in 1000 and 1 in 100 chance of flooding each year), respectively.
- 4.6 Built development has been steered outside of the larger west and north flow paths, but further flood mitigation is discussed later in this section.

Groundwater Flooding

- 4.7 Groundwater flooding typically occurs in low-lying areas, close to hills which are underlain by permeable rocks. This source of flooding generally only becomes a problem in these areas after long periods of extensive and significant rainfall, resulting in a rise in groundwater level.
- 4.8 The SFRA provides an extract of the BGS Susceptibility to Groundwater Map (see Appendix E). The site is located in an area with limited potential for groundwater flooding to occur and no potential for groundwater flooding to occur.



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Figure 3: EA Flood Map for Planning



Figure 4: Risk of Flooding from Surface Water Map

- 4.9 As outlined in Section 2, the site is predominately underlain by London Clay, which is defined as Unproductive strata. Ground conditions do not therefore represent a significant source of groundwater flooding and the associated flood risk is low.

Drainage and Infrastructure Flooding

- 4.10 Drainage and infrastructure flooding occurs when sewerage systems are overwhelmed and result in flooding, which may occur alone or be combined with other flood sources (e.g. fluvial or surface water).
- 4.11 Asset maps were obtained from Thames Water which are enclosed in Appendix D. As outlined in Section 2, there is a 300 mm diameter surface water sewer within the site alongside Eversley Road. There is also a 150 mm diameter foul sewer in Eversley Road.
- 4.12 These sewers are small and will not introduce a significant risk of flooding to the site. Furthermore, ground levels fall away from the proposed development and the preferential pathway will be towards the stream to the east of the site.
- 4.13 Given the above the risk of flooding from sewers is considered to be low.

Other Sources of Flooding

- 4.14 According to EA mapping, the site is not located in an area susceptible to reservoir flood risk. There are also no impounded canals within the vicinity of the site that could pose a potential flood risk.

Flood Mitigation

- 4.15 Parts of the site have been shown to be susceptible to surface water flooding. The most significant of these is from the west and north. However, residential development has located outside of these areas to allow shallow floodwater to pass through the site with little or no obstruction. This will provide an area of open space, which presents an opportunity to increase the volume of attenuation storage available. This could be achieved by excavating storage areas and providing space for water in a series of flood meadows. Whilst this is not considered necessary to facilitate development of the site, it could provide some betterment downstream through some simple engineering works.
- 4.16 A smaller flow path is generated from the south. The catchment area associated with the south pathway will be replaced with development and surface water will be managed through the introduction of SuDS. This area of surface water flooding is therefore unlikely to exist once the site has been developed.
- 4.17 In addition, finished floor levels (FFL) of all dwellings should be elevated above the surrounding ground levels by at least 150 mm in accordance with building regulations. This will protect against the possibility of shallow ponding of water which is inevitable following heavy or prolonged rainfall.

5 Surface Water Management

Overview

- 5.1 It is well understood that one of the effects of development is typically to reduce the permeability of a site and consequently change its response to rainfall. Therefore, a drainage strategy is required to ensure that the surface water runoff regime is managed appropriately and that the proposed development does not increase flood risk on the site and/or to surrounding areas.
- 5.2 The NPPF states that flood risk to land and property must not be increased as a result of development. The NPPF also states that flood risk should not increase for events up to and including a 1 in 100-year return period, including an appropriate allowance for climate change. These requirements have formed the basis of the surface water drainage strategy, which is described in this section.
- 5.3 The proposed surface water management strategy has been derived based upon the principles of SuDS, in accordance with NPPF and the LLFA SuDS guide. It has subsequently been used to inform the Parameter Plan and Framework Masterplan (Appendix A).

Proposed Surface Water Discharge Receptor

- 5.4 The LLFA SuDS guide refers to the drainage hierarchy (provided within The Building Regulations – Part H) for the discharge of surface water from the site, with this aiming to discharge surface water as high up the following hierarchy of options as practicable:
 - i) An adequate soakaway or some other adequate infiltration system; or, where not reasonably practicable;
 - ii) A watercourse; or where not reasonably practicable,
 - iii) A sewer.
- 5.5 Discharge options were investigated in the order of preference specified in the drainage hierarchy. An intrusive ground investigation is not available at this stage. However, the site is underlain by London Clay and the use of infiltration as a means of surface water management is not considered to be practical.
- 5.6 It is therefore proposed to use an attenuation-led surface water strategy with a restricted discharge to an appropriate receptor. Two ditches flow through, or on the boundary of, the site. The site currently drains into these ditches and therefore this proposed connectivity will mimic the existing drainage regime.

Existing Greenfield Runoff Rates

- 5.7 The FEH method has been used to determine greenfield runoff rates. The parameters utilised are detailed in Table 1, which shows the calculation was undertaken for 1.0 ha. The calculated rates are presented in Table 2. The calculation summary sheets are enclosed in Appendix G.
- 5.8 The QBAR rate for 1.0 ha was estimated to be 4.88 l/s. The proposed developable area is approximately 5.67 ha, therefore QBAR for this equates to 27.7 l/s.

Table 1: Calculation Parameters

Parameter	Value	Unit
Area	1.00	ha
SAAR	653	mm
Region	6	-
BFI HOST	0.253	-

Table 2: Greenfield Runoff Rates

Return Period	Peak Greenfield Discharge (l/s/ha)
QBAR	4.88
Q1	4.14
Q30	11.22
Q100	15.56

- 5.9 The LLFA SuDS guide states that “for greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.”
- 5.10 The estimated QBAR rate is 4.88 l/s/ha, which has been adopted for the restriction of surface water runoff from the site up to and including the 1 in 100 year plus climate change event. At a more detailed stage of design, restriction of the 1 in 1 year event to the corresponding greenfield event can be investigated. However, an alternative approach may be to use unlined shallow swales and wider source control SuDS to manage these smaller storms through interception, infiltration and evapotranspiration.
- 5.11 The QBAR rate has been adopted to ensure that the long-term storage volume has been accommodated, so that the volume of surface water that is discharged from the site (as well as the rate that it is discharged at) has been managed. Typically, the restriction of runoff from a development site to the QBAR rate can have a flood-risk benefit to catchments downstream.

Proposed Surface Water Drainage Strategy

- 5.12 The surface water management strategy proposed for the site has been derived based upon the principles of sustainable drainage as detailed in the CIRIA SuDS Manual (2015) and the LLFA SuDS guide.
- 5.13 SuDS will be utilised to manage surface water runoff from the entire site. This will include a series of detention basins and swales, as shown on the Preliminary Surface Water Drainage Strategy, enclosed in Appendix F.
- 5.14 The concept of sustainable drainage is that environmental and social factors such as the quantity and quality of runoff and amenity value of surface water in the urban or developed environment are considered when making decisions about drainage. SuDS can be used to compliment or replace conventional piped urban drainage to recreate the natural water cycle.

- 5.15 This process can be used in certain locations to reduce the existing problems associated with such conventional piped systems, which can include the risk of flooding, the potential of pollution or poor water quality and damage to the natural environment.
- 5.16 As discussed, the surface water drainage strategy has been based on the discharge of surface water runoff from the site into an adjacent ditch. This will be restricted to the total rate of 27.7 l/s. This restricted discharge rate from the site will be achieved using a hydrobrake (or similar approved) at each outfall.

Attenuation Volumes

- 5.17 The surface water drainage strategy has been based on providing attenuation up to and including the 1 in 100 year plus a 40% allowance climate change event, which is in accordance with the latest national planning policy.
- 5.18 Given the topographical characteristics etc of the site the development has been split into four catchments. Each catchment will allow for the natural drainage routes across the site, so that these are retained to ensure that runoff from the development continues to feed the existing riparian environment.
- 5.19 Table 3 includes a series of key parameters which have been used to estimate the attenuation storage requirements for the development.
- 5.20 The impermeable area has been calculated based upon a 60% impermeable ratio (i.e. that 60% of the developed residential area would have an impermeable cover), plus the addition of main road surface area. In accordance with the LLFA SuDS guidance, an additional 10% allowance has been made for the potential of urban creep.

Table 3: Attenuation Storage Parameters

Catchment	Residential Area (ha)	Road Area (ha)	Impermeable Area (ha)	Future Impermeable Area (ha)	Discharge Rate (l/s)
1	1.22	0.08	0.81	0.88	6.3
2	1.23	0.20	0.94	1.01	7.0
3	1.46	0.03	0.90	0.98	7.2

Basin Design – Sizing

- 5.21 A MicroDrainage source control calculation has been undertaken for each catchment using the values presented in Table 3. The purpose of this was to ensure that attenuation requirements could be accommodated, whilst offering the following:
- i) 1 in 100 year design event plus a 40% allowance climate change;
 - ii) Earthworks with average side slopes of 1:4;
 - iii) Approximately 0.3 m freeboard above the effective storage depth.

- 5.22 Table 4 presents evidence of how this has been achieved and is a summary of the MicroDrainage source control calculations. It shows the total area required for attenuation storage, at the top or crest of each feature, which is also reflected on the Preliminary Surface Water Drainage Strategy (Appendix F). The calculations are enclosed in Appendix G.

Table 4: Preliminary Basin Design Details

Catchment	Basin Area (m ²)	Total Basin Depth (m)	Attenuation Storage (m ³)
1	744	1.5	533
2	837	1.5	617
3	750	1.7	589

Wider SuDS Proposals

Swales

- 5.23 Swales are shallow (i.e. around 0.5 m deep) vegetated open channels designed to convey, treat and in certain circumstances attenuate surface water runoff. They enhance the natural landscape and provide aesthetic and biodiversity benefits. These can be ‘wet’ where water gathers above the surface, or ‘dry’ where water gathers in a gravel layer beneath.
- 5.24 It is proposed to incorporate an extensive network of swales across the site for the conveyance of surface water. Where positioned on slopes, check dams can be incorporated at appropriate distances across the width of the swales to store water in the swale, thereby providing some limited attenuation and reducing flow velocity.
- 5.25 The swales (and wider source control features) may be unlined to allow runoff from smaller storms to infiltrate and provide some localised management of rainfall. However, given the ground conditions, it is anticipated that this may only be practical for the smaller, more frequent rainfall events where limited infiltration was necessary.
- 5.26 The potential storage volume offered by swales has not been considered within the calculations at this stage. The indicative locations of swales across the proposed development are shown on the Preliminary Surface Water Drainage Strategy (Appendix F).

Other SuDS Features across each Development Parcel

- 5.27 Other more local, or source control, SuDS will be adopted to contribute to the management of surface water across the site. However, it is difficult to determine the detail of source control attenuation and conveyance features at the outline stage. However, this could consist of permeable paving, bio-retention or tree pits etc, used in parts of the site to supplement the detention basins and swales. These could also offer both water quality improvements and attenuation storage. However, these opportunities will be considered at a more detailed stage of design.
- 5.28 These wider SuDS features will be provided within each development parcel to ensure that surface water runoff is managed at source across the site.

SANG Car Park

- 5.29 The SANG car park will be constructed using permeable materials such as gravel, Grasscrete or permeable paving. This is self-draining and will not require a formal surface water drainage system.

Biodiversity and Landscape

- 5.30 In addition to their drainage function, SuDS can be designed to deliver significant community and environmental benefits. Detention basins and swales provide an opportunity to create high value habitat and contribute an important biodiversity, aesthetic and recreational function for the site.
- 5.31 The CIRIA SuDS Manual (2015) provides some useful insight into effective design of both basins and swales. These opportunities will be considered at a more detailed stage of design. However, for the basins, the following design principles will be taken forward:
- i) Average 1:4 side slopes will allow for variation and will help to ensure that they appear as natural as possible.
 - ii) Reed beds can be created at the outlet.
 - iii) The outlet can be set as far from the inlet as possible to maximise the benefits to water quality passing through.
 - iv) Sediment forebays.
 - v) Slightly deeper areas within the basin to allow retention of water all year round.
- 5.32 The CIRIA SuDS Manual (2015) provides an example of a typical plan view and profile of a detention basin illustrating how the feature could look on the site, as shown in Figure 5.

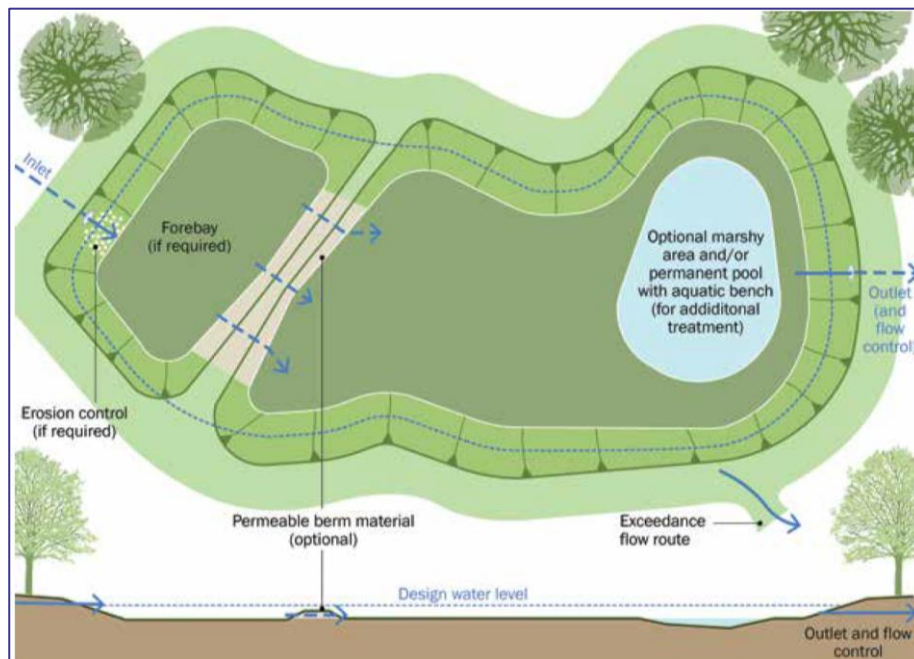


Figure 5: Plan of Detention Basin

- 5.33 Figure 6 presents a cross section of a dry swale extracted from the CIRIA SuDS Manual (2015). It identifies how these can be designed to offer biodiversity, landscape, and associated water quality benefits, through pre-treatment and planting.

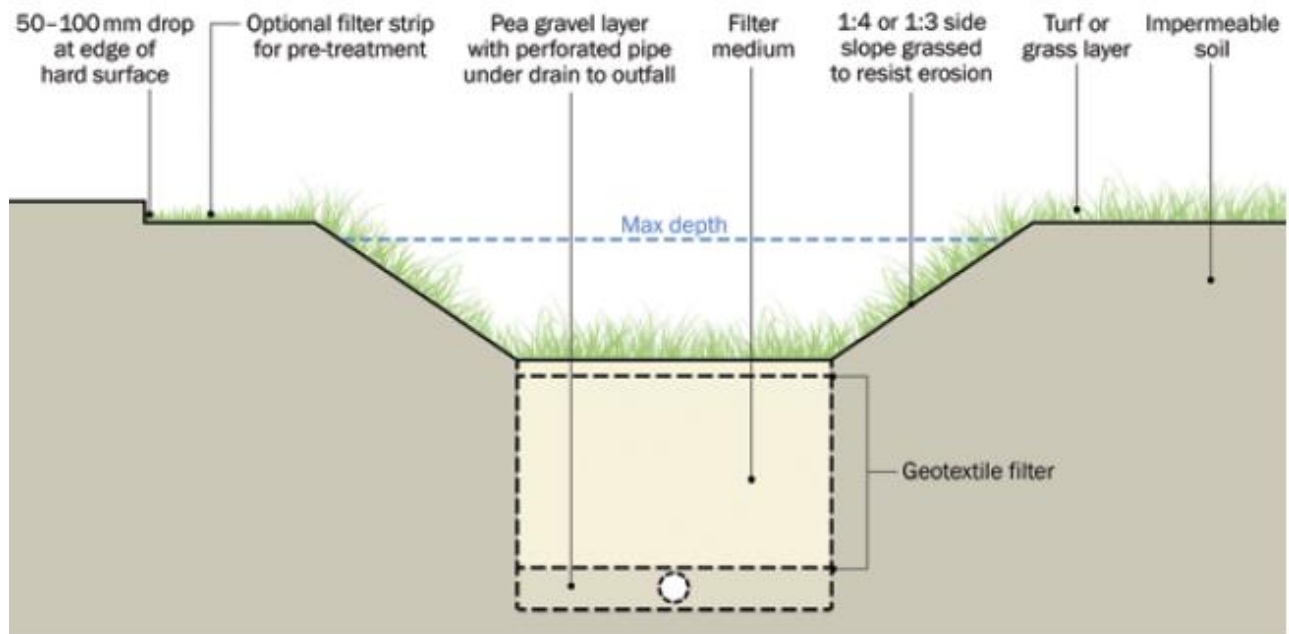


Figure 6: Typical Dry Swale Cross Section

Conveyance of Exceedance Surface Water Flooding

- 5.34 The surface water drainage strategy must consider an exceedance scenario, i.e. for flows in excess of the 1 in 100 year plus climate change rainfall event. Exceedance flows must be managed in conveyance routes across a site that minimise the risk to people and property.
- 5.35 The design for exceedance will be addressed at a more detailed stage. However, in an exceedance scenario, roads would be designed to convey any exceedance flows away from people and property using appropriate kerbing for channelling. Exceedance flow routes will ultimately be directed into the swales or basins located across the site. Exceedance routes are displayed on the Preliminary Surface Water Drainage Strategy in Appendix F.

Water Quality

- 5.36 In accordance with the CIRIA SuDS Manual (2015), SuDS components must have a total pollution index that equals or exceeds the pollution hazard index for different land use classifications. It is considered that the SuDS provided as part of the surface water drainage strategy would offer sufficient mitigation for the land use classification as demonstrated in Table 5 and Table 6 (as informed by Table 26.2 and 26.3 of the CIRIA SuDS Manual (2015), respectively).

Table 5: Pollution Hazard Indices

Land Use	Pollution Hazard Indices for Different Land Use Classifications			
	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads and non-residential car parking with infrequent change	Low	0.5	0.4	0.4
Total	Low	0.7	0.6	0.45

Table 6: SuDS Mitigation Indices (for discharges to surface water)

Type of SuDS	Mitigation Indices		
	TSS	Metals	Hydro-carbons
Swales	0.50	0.60	0.60
Detention basin ¹	0.25	0.25	0.30
Total	0.75	0.85	0.90

Operation and Maintenance

SuDS

- 5.37 Thames Water confirmed that they do not currently adopt SuDS and therefore the SuDS features proposed would be managed privately. Where privately maintained, the general maintenance requirements should be undertaken in accordance with the recommendations outlined in the CIRIA SuDS Manual (2015), as replicated in Figure 7 and 8.

Flow Control Device

- 5.38 A hydro-brake (or similar) will be used to control the flow leaving the each detention basin. Should a hydro-brake be fitted, limited maintenance is required as there are no moving parts. If blockages occur, they do so at the intake.
- 5.39 Access should be allowed for clearing debris from the chamber housing the flow control. In the event that the inlet to the unit becomes blocked, the pivoting bypass door may be operated by pulling the wire rope attached upwards to drain down the chamber and provide access for maintenance. The

¹ As per the CIRIA SuDS Manual (2015), where the mitigation index of an individual component is insufficient, two components (or more) will be required. However, a factor of 0.5 is used to account for the secondary or tertiary components associated with the already reduced inflow concentrations.

pivoting bypass door must be returned to the closed position following drain down of the chamber and clearance of the blockage.

- 5.40 Regular inspections should be carried out to ensure that debris that may obstruct the inlet to the flow control is not present in the chamber. Following installation, it is essential that any extraneous material i.e. building materials are removed from the unit and the chamber. Once in operation, it should be inspected monthly for three months and thereafter at six monthly intervals with hose down if required. The units can be jetted from downstream, in accordance with standard sewer jetting procedures without affecting the hydraulic performance of the system.
- 5.41 Should another manufacturer be used it is recommended that their maintenance guidance is reviewed and adopted.

Other Assets

- 5.42 Various other smaller assets of the surface water drainage strategy consist of gutters, down water pipes, manholes, pipes and drainage channels. These assets should be checked annually and after large storm events, in order to remove debris and inspect the condition.
- 5.43 Jet washing may be required on occasion to remove any blockages within the pipe network. If the condition is found to be poor, replacement or repairs may be required.

TABLE 17.1 Operation and maintenance requirements for swales		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseed	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

Figure 7: Operation and Maintenance Requirements for Swales

TABLE 22.1 Operation and maintenance requirements for detention basins		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Figure 8: Operation and Maintenance Requirements for Detention Basins

Summary

- 5.44 The surface water drainage strategy has been prepared to demonstrate that the proposed development of the site can meet national and local requirements for the management of surface water runoff. This will be achieved through the principles of SuDS but is subject to more detailed design considerations once outline planning permission has been approved.
- 5.45 The SuDS will offer wider benefits including biodiversity and recreational opportunities, as well as aesthetic improvements.

6 Foul Drainage

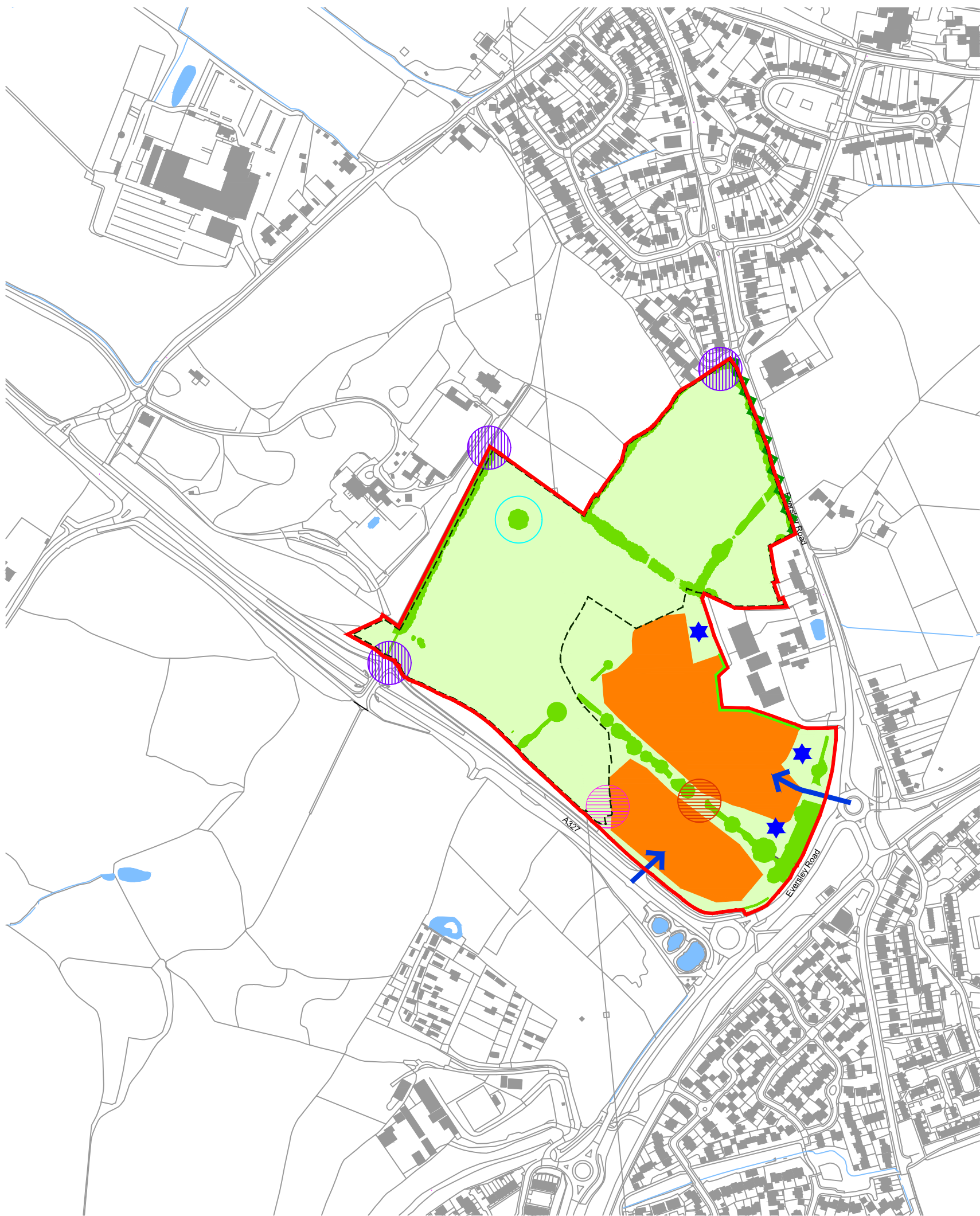
- 6.1 In April 2018 Ofwat changed the rules with respect to new sewer connections. Developers may now connect to the nearest public sewer on a size for size basis at their cost and, in this case, Thames Water will provide capacity in the network to accommodate domestic type flows from granted development which is funded by infrastructure charging arrangements.
- 6.2 A 150 mm Thames Water foul sewer is located to the east of the site in Eversley Road (see Appendix D). Based on the size for size rules, this sewer has sufficient capacity to accommodate the proposed development. However, Thames Water have indicated an inability of the wider foul water infrastructure to accommodate foul water flows from the proposed development. Once outline planning permission has been obtained, Thames Water, at their cost, will need to undertake hydraulic modelling to understand what infrastructure upgrades are likely to be required to accommodate the proposed development. Further details are enclosed in Appendix D.

7 Conclusions

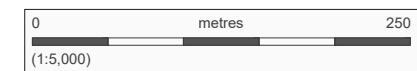
- 7.1 This Flood Risk Assessment (FRA) and surface water drainage strategy has been undertaken to accompany the outline planning application for the proposed residential development on land at Duck's Nest, Arborfield.
- 7.2 This report has been prepared by Vectos (now SLR Consulting) on behalf of David Wilson Homes (Southern) in accordance with the guidelines set out in National Planning Policy Framework, regional and local guidance documents.
- 7.3 The site lies in Flood Zone 1 (i.e. land having a less than 1 in 1,000 annual probability of river or sea flooding, with this considered to be low risk). Surface water flooding impacts part of the site. Residential development has been steered out of the main flow path to allow this to pass through the site without obstruction. Other potential sources of flood risk have not been identified to be significant.
- 7.4 An attenuation led conceptual surface water drainage strategy has been proposed to manage the surface water runoff from the site. Attenuation will be provided in a series of detention basins, which will restrict runoff to greenfield rates before discharging into an adjacent ditch. The basins will be supplemented with a series of swales, whilst wider SuDS will be considered at a more detailed stage of design.
- 7.5 Foul water is to be disposed to a Thames Water foul network, but further assessment is required by Thames Water once planning permission has been obtained.

Appendix A

Parameter Plan and Framework Masterplan



- Application boundary
- Residential (C3) to consist of predominantly 2 storey development with occasional 2.5 storey (up to 10m). To include areas of multi-functional open space, play, SuDS (including permeable paving, swales and attenuation basins), infrastructure and access
- Enhancement of existing vegetation in line with Policy CC03 (area is identified as a Green Route Enhancement Area)
- SANG boundary subject to full application
- Indicative location of attenuation basin
- Vehicular, pedestrian and cycle access point
- Vehicular access to SANG car park
- Emergency vehicular access, pedestrian and cycle connection zone
- Pedestrian connection zone
- Landscape strip
- Multi-functional green space. To include SuDS (basins and swales), paths, play spaces, community growing spaces, hedge/buffer/tree planting.
- Retained vegetation
- Veteren tree/ancient woodland buffer zone
- Note: Heights are measured from finished ground level to the ridge of the building. In residential areas incidental elements such as chimneys may exceed the ridge by up to 1.5 metres. Some re-modelling of the existing ground levels will be necessary to achieve appropriate development platforms. Finished floor levels may vary by +/-2 metres



Project
Land at Ducks Nest, Arborfield

Drawing Title
Parameter Plan

Date	Scale	Drawn by	Check by
03/09/2024	1:5,000 at A3	MR/JB	LA
Project No	Drawing No	Revision	
1309	007	M	

Mosaic



- Key
- Site Boundary
 - 01 Eversley Road/Langley Common Road/Baird Road roundabout access point
 - 02 Sustainable Drainage System (SuDS)
 - 03 Potential Swale
 - 04 Retained and enhanced vegetation
 - 05 Arborfield Cross Relief Road access point
 - 06 Proposed SANG car park
 - 07 Proposed enhancement planting
 - 08 Emergency access point
 - 09 Proposed dog pond
 - 10 Pedestrian access point

- Existing high voltage powerline including 30m no development zone
- Proposed LAPs
- Proposed LEAP & LAP
- Edible landscapes
- Proposed pedestrian crossing points
- Pedestrian/cycle bridge
- Existing Public Rights of Way
- Proposed SANG path
- Informal pedestrian routes
- Informal open space
- Potential development area
- Proposed planting
- Existing planting
- Proposed SANG

CLIENT:
David Wilson Homes

PROJECT:
Land at Ducks Nest, Arborfield

DRAWING:
Illustrative Masterplan

PROJECT NUMBER:
1309

DRAWING NUMBER: 003
CHECKED BY: JB/LA

REVISION: V21
STATUS: Draft

DATE: 03/09/2024
SCALE: 1:5000 @ A3



Appendix B

Topographical Survey



Tree:

Great 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 grid are obtained using industry standard guidelines and can vary according to the quality of the GPS network at the time of survey. GPS data is stored electronically and can be downloaded. Horizontal and Vertical Datums are established from a central site fix and baseline information sent utilising GNS3 connection 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. It is difficult to survey from dry restricted access, lines of trees or dense vegetation. Critical dimensions and positions should be verified following suitable clearance.

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

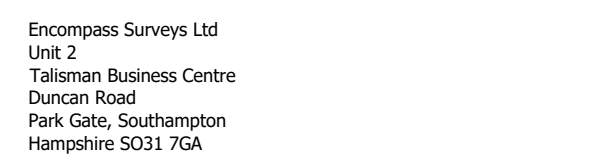
Copyright:

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A 4x3 grid of squares. The top row has three squares, with the middle square highlighted in red. The second row has three squares. The third row has three squares. The bottom row has two squares, starting from the left.

Northpoint:



Client:	David Wilson Homes
Survey Location:	Duck's Nest Farm NR Aborfield Garrison Reading

Drawing ref:	ENC/270422/9VV8/T	Date:	May 2022
Drawn/QA:	RMF,SE,MH/GL	Revision:	-

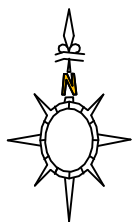
NOTES:
Drawings:
 The plan covers are filled where possible and all drainage input information has been obtained through visual inspection only, with no entry into manholes. Therefore the complete accuracy cannot be guaranteed. The user assumes all responsibility and agrees the services of a specialist engineer expert be used.

Every effort has been made to identify and detail all trees on site but where there are of critical importance we suggest the use of a specialist arborist to carry out a detailed assessment of trees. GPS:

Latitude 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. The accuracy of the GPS is dependent on the quality of the GPS and Vertical Datum are established from a central site fix and the datum elevation station using GNS3 correction data.

Survey notes:
 Survey specification is limited to the original purpose of the survey as stated in the title and is to be used for this purpose only. Survey is accurate within limitations of site conditions at the time of survey. The user assumes all responsibility and agrees the services of a specialist engineer expert be used. The user assumes all responsibility and agrees the services of a specialist engineer expert be used. The user assumes all responsibility and agrees the services of a specialist engineer expert be used.

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LEGEND

TREE SPECIES INFORMATION

ALDER	ALD	LOOUST	LOC
ASH	ASH	LONDON PLANE	LPL
ASPEN	ASP	ASP MAGNOLIA	MAG
BEECH	BOH	MAPLE	MPL
CEDAR	CED	DAK.	DAK
CHERRY	CH	POME	POM
CYPRESS	CYP	POPULAR	POP
ELM	ELM	PRUNUS	PRU
FLR	FLR	RHODODENDRONUS	RDN
FUZZ	FRT	ROMAN	RBN
HAWTHORN	HAW	SILVER BIRCH	SBR
HAZEL	HAT	SORBUS	SOR
HOLLY	HOL	SWEET CHESTNUT	SCH
HORSE CHESTNUT	HCH	SYCAMORE	SYC
HORNBEAM	HBM	WALNUT	WNT
LABURNUM	LBN	YEW	YEW
LARCH	LAR		
LIME	LIM	SPECIES UNKNOWN	SUN
		COFFICE	COF

TREE ANNOTATION:

FENCE INFORMATION		LEVEL INFORMATION	
BARRIED WIRE FENCE	BWF	BASEMENT LEVEL	BTL
CORRUGATED IRON FENCE	CIF	RED LEVEL	RL
CORR BOARD FENCE	CBF	CORNER LEVEL	CL
CHAIN LINK FENCE	CLF	DAMP PROOF COURSE	DP
CHESTNUT PAILING	CPE	FLOOR LEVEL	FL
CRASH BARRIER	CBR	INVERT LEVEL	IL
HANDRAIL	HDL	OUTFALL LEVEL	OL
IRON RAILINGS	IRF	THRESHOLD LEVEL	TL
LAMIN LAP FENCE	LLF	ROCK WATER	FW
MISCELLANEOUS FENCE	MFP	SURFACE WATER	SW
PALISADE FENCE	PSF	UNABLE TO LIFT	UTL

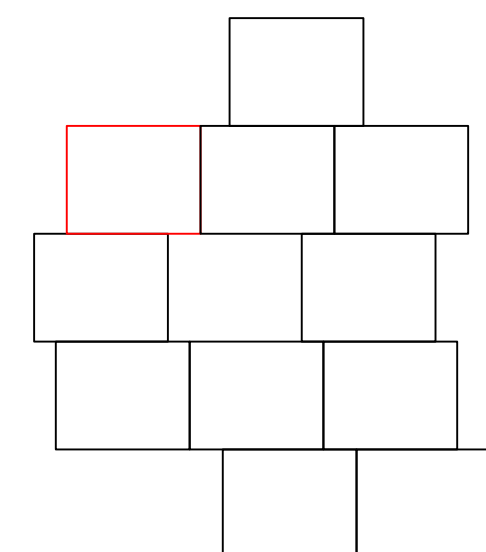
POST AND RAIL FENCE

POST AND WIRE FENCE	PWF	SURFACE INFORMATION	
STOCK WIRE FENCE	SWF	CONCRETE	Conc
TRELLIS FENCING	TLF	BRICK PAVERS	BP
		FLOWERBED	FB
		PAVING SLABS	PS
		RETAINING WALL	RtWall

FEATURE INFORMATION

BOLLARD	BO	NOTICE BOARD	NB
BRITISH TELECOM BOX	BTB	POST	P
BRITISH TELECOM IC	BTIC	RAIN WATER PIPE	RWP
BUS STOP	BS	RAISED FLOWBERED	RFB
CABLE TELEVISION BOX	CATB	ROADSIDE EYE	RE
CABLE TELEVISION IC	CATC	ROADSIDE TELEVISION	RT
EARTHING ROD	ERD	SERVICE HANDBOOK STOP	SHS
ELECTRICITY CABLE PIT	ECP	SOIL VENT PIPE	SNP
ELECTRICITY CONTROL BOX	ECB	STOCK	SC
ELECTRICITY POLE	EP	STOP VALVE	SV
EXHAUST	EX	TELEGRAPHIC BOX	TB
INSPECTION CHAMBER	IC	TELEPHONE CALL TAP	CTC
LAMP POST	LP	TRAFFIC SIGNAL	TS
LETTER BOX	LB	TRAFFIC SIGNALS IC	TSC
LETTER BIN	LB	WATER METER	WM
KEY BOX OUTLET	KBO	WATER TAP	WT
NAME PLATE	NB		

Key Plan



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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Unit 2
Talisman Business Centre
Duncom Road
Park Gate, Southampton
Hampshire SO31 7GA

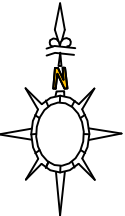
Tel: 023 80692002 Email: info@encompass-surveys.co.uk

Client:	David Wilson Homes
---------	--------------------

Survey Location:	Duck's Nest Farm NR Aberfeld Garrison Reading
------------------	---

Survey type:	Topographical	Scale:	1:200@A0
Drawing ref:	ENC/270422/9VV8/T	Date:	May 2022

Drawn/QA: RMF,SE,MH/GL	Revision: -
------------------------	-------------

[illegible]

LEGEND

TREE SPECIES INFORMATION

ALDER	ALD	LOQUIST	LOC
ASH	ASH	LONDON PLANE	LPM
ASPEN	ASP	MAGNOLIA	MAG
BEECH	BOH	MAPLE	MPL
CEDAR	CED	OAK	OAK
CHERRY	CHY	PINE	PNE
CYPRESS	CYP	POPULAR	POP
ELM	ELM	PRUNUS	PMS
FR	FR	RHODODENDRONS	RDN
FRUIT	FRU	ROSE	RSE
HAZEL	HAZ	SILVER BIRCH	SBS
HOLY	HLY	SPRUE	SPR
HORSE CHESTNUT	HCH	SWEET CHESTNUT	SCH
HORNBEAM	HBM	SYCAMORE	SYC
LARIX	LAR	WALNUT	WNT
LABURNUM	LBN	WILLOW	WIL
LARCH	LAR	YEW	YEW
LIME	LIM	SPECIES UNKNOWN	SU
		UNIDENTIFIED	UNID

TREE ANNOTATIONS

Tree Species / Tree Boli Size / No. of Trees

FENCE INFORMATICS

LEVEL INFORMATION

BARRER WIRE FENCE	BNW	BASEMENT LEVEL	BTL
CORRUGATED IRON FENCE	CBF	RED LEVEL	REL
CLOSE BOARD FENCE	CBF	COVER LEVEL	CL
CHAIN LINK FENCE	CLF	DAMP PROOF COURSE	DPC
CHESTNUT PALING	CPF	FLOOR LEVEL	FL
CRASH BARRIER	CBR	INVERT LEVEL	IL
HARDWOOD PALING	HWP	OUTFALL LEVEL	OL
IRON RAILINGS	IRF	THRESHOLD LEVEL	THL
LARCH LAP FENCE	LLF	POOL WATER	PW
MISCELLANEOUS FENCE	MSF	SURFACE WATER	SW
PALISADE FENCE	PSF	UNABLE TO LIFT	UTL
PROTECT FENCE	PTF	WATER LEVEL	WL
POST AND CHAIN FENCE	PCF		

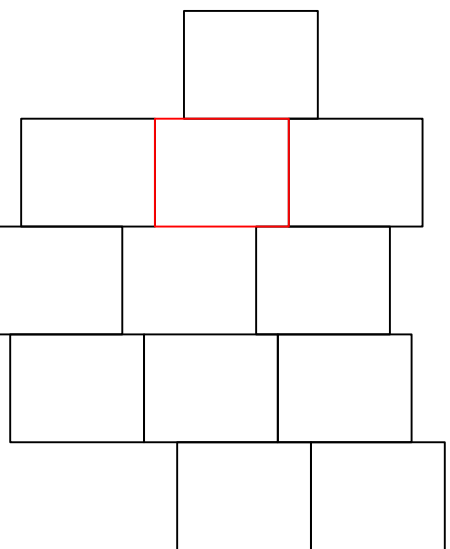
CE PWF SURFACE
ONE

TRELLIS FENCING	TLP	CONCRETE	CONE
		BRICK PAVING	BP
		FLOWERBED	FB
		PAVING SLABS	PS
		RETAINING WALL	RWALL
		TACTILE PAVING	Tac

FEATURE INFORMATION

BOLLARD	BO	NOTICE BOARD	NB
BRITISH TELECOM BOX	BTB	POST	P
BRITISH TELECOM JC	BTJC	RAIN WATER PUMP	RWP
BUS STOP	BS	RASSED FLOWERSHED	RFB
CABLE TELEVISION BOX	CABT	ROAD SIGN	RS
CABLE TELEVISION JC	CABTJC	ROOM NUMBER	RN
EARTHING ROD	ER	SERVICE MARKER POST	SMP
ELECTRICITY CABLE PVT	ELCP	SOIL VENT	SV
ELECTRICITY CONTROL BOX	ECB	STOCK COOK	SC
ELECTRICITY POLE	EP	STOCK VALVE	SV
FIRE INSURGENT	FI	TELEGRAPH POLE	TP
INSPECTION COVER	IC	TELEPHONE CABLE BOX	TCB
LAMP POST	LP	TRAFFIC SIGNAL	TS
LETTER BOX	LB	TRAFFIC SIGNALS IC	TSIC
LETTER BEN	LBEN	WATER METER	WM
KEROSE OUTLET	KO	WATER TAP	WT
NAMES PLATE	NP		

Key Plan



Level Datum:
Levels are related to OSGR15 derived from the GRS network.

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

Northpoint



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Fax: 023 80697125 Website: encompass-surveys.co.uk

Client:	David Wilson Home
---------	-------------------

Survey Location	Duck's Nest Farm MD, Maryland, Coon
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Location:	NR Abolished Garrison Reading

Survey type: Topographical	Scale: 1:200@A0

Drawing ref:	ENC/270422/9VV8/T	Date:	May 2022

DRAINAGE:

The drainage covers are installed where possible and all drainage inlet openings have been obtained through visual inspection only, with no entry into manholes. Therefore the complete accuracy cannot be guaranteed. The importance we attach to the importance we suggest the services of a specialist drainage expert be used.

Every effort has been made to identify and detail all trees on site but where there are any trees of importance we suggest you consult your local authority arborist. Some trees may be listed as indicative GPS:

Indicative relative to the time survey was taken, 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. All horizontal coordinates are based on the datum of the Ordnance Survey Vertical Datums are established from a certain site fix and the orientation station utilizing GNSS correction data.

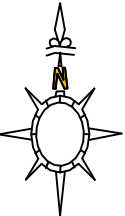
Survey notes:

Survey specification is limited to the original purpose of the survey and does not include source and is to be used for this purpose only. Survey is accurate within limitations of site conditions at the time of survey. It is not intended to be used for legal purposes or to show slight or dense vegetation, critical dimensions and positions should be verified following suitable clearance.

All details shown and shown is reference to the plotting scale.

Coverprint:

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LEGEND

TREE SPECIES INFORMATION

ALDER	ALD	LOOUST	LOC
ASH	ASH	LONDON PLANE	LPH
ASPEN	ASP	MAGNOLIA	NAG
BEECH	BCH	MAPLE	MAP
CEDAR	CED	OAK	OAK
CHERRY	CHT	PINE	PNE
CYPRESS	CYP	POPLAR	POP
ELM	ELM	PRUNUS	PMS
FIR	FIR	RHODOENDRONS	RDN
HAZEL	HZT	ROSE	RSE
HAWTHORN	HWN	SILVER BIRCH	SBN
HUSET	HUZ	SORBUS	SOR
HOLLY	HLY	SWEET CHESTNUT	SCH
HORSE CHESTNUT	HCH	SYCAMORE	SYC
HORNBEAM	HBM	WALNUT	WNT
LAR-SPRUE	LSP	WILLOW	WYL
LARCH	LAR	YEW	YEW
LIME	LIM	SPECIES UNKNOWN	SPU
		COPPOD	COP

TREE ANNOTATIONS

Tree Species / Tree Boli Size / No. of Trees

FENCE INFORMATICS

LEVEL INFORMATION

BARRIED WIRE FENCE	BBF	BASEMENT LEVEL	BTL
CORRUGATED IRON FENCE	CBF	RED LEVEL	BL
CLOSE ROMEO FENCE	CBF	COVER LEVEL	CL
CHAIN LINK FENCE	CLF	DAMP PROOF COURSE	CPC
CHESTNUT PALING	CPA	FLOOR LEVEL	FL
CRASH BARRIER	CBR	INVERT LEVEL	IL
HANDRAIL	HDL	OUTFALL LEVEL	OL
IRON RAILINGS	IRF	THRESHOLD LEVEL	TL
LARCH LAP FENCE	LSF	FOIL WATER	FW
MISCELLANEOUS FENCE	MSF	SURFACE WATER	SW
PALISADE FENCE	PSF	UNABLE TO LIFT	UTL
POCKET FENCE	PWF	WATER LEVEL	WL

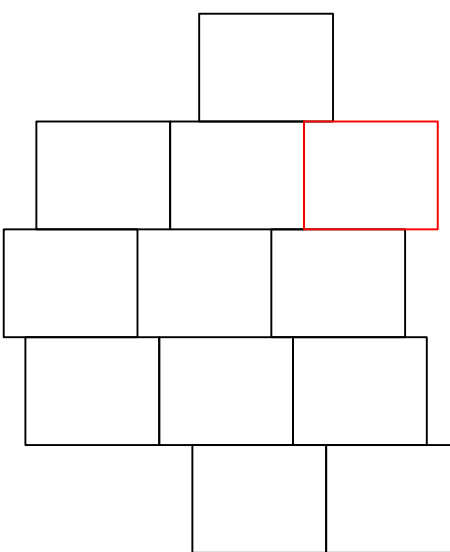
WCE PWF SURFACE
NCE PWF

TRELLIS FENCING	SHF	CONCRETE	Conc
	TUF	BRICK PAVERS	BP
		FLOWERBED	FB
		PAVING SLABS	PS
		RETAINING WALL	RWall
		TACTILE PAVING	Tac

FEATURE INFORMATION

BOLLARD	BO	NOTICE BOARD	NB
BRITISH TELECOM BOX	BTB	POST	P
BRITISH TELECOM IC	BTIC	RAIN WATER PIPE	RWP
BUS STOP	BS	RAISED FLOUREDBED	RFP
CABLE TELEVISION IC	CATV	ROAD SIGN	RS
CABLE TELEVISION BOX	CATB	ROOFTOP EYE	RE
CANTHROW BOX	CB	SURFACE MANHOLE POST	SM
ELECTRICITY CABLE PIT	ECP	SOIL VENT PIPE	SNV
ELECTRICITY CONTROL BOX	ECB	STOP COKE	SC
ELECTRICITY POLE	EP	STOP VALVE	SV
FIREF HYDRANT	FH	TELEGRAPH HOLE	TH
INCINERATION COVER	IC	TELEGRAPH SIGNAL BOX	TGB
LAMP POST	LP	TRAFFIC SIGNAL	TS
LETTER BOX	LB	TRAFFIC SIGNALS IC	TSC
LITTER BIN	LBIN	WATER METER	WM
NEAR OUTLET	NO	WATER TAP	WT
NEW PLATE	NP		

Key Plan



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

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

Northpoint:



Encompass Surveys Ltd
Unit 2
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Hampshire SO31 7GA

Tel: 023 80692002 Email: info@encompass-surveys.co.uk
Fax: 023 80607126 Website: encompass-surveys.co.uk

Client:	David Wilson Home
---------	-------------------

Survey Location:	Duck's Nest Farm NR Aborfield Garrison Reading
------------------	--

Survey type: Topographical	Scale: 1:200@A0
----------------------------	-----------------

Drawing ref: ENC/270422/9VV8/T	Date: May 2022
--------------------------------	----------------

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

GPS detail: 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 otherwise stated, all heights are Scale factor 1.0 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 accuracy: Survey is accurate within limitations of site conditions at the time of survey. The accuracy of the survey is affected by the density 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.



FENCE INFORMATION		LEVEL INFORMATION	
BARRIED WIRE FENCE	BNF	BASEMENT LEVEL	BTLL
CORRUGATED IRON FENCE	CSF	BEV. LEVEL	BEV
CLAD BOARD FENCE	CBF	COVER LEVEL	CLC
CHAIN LINK FENCE	CLF	DAMP PROOF COURSE	DPC
CHESTNUT PALING	CPF	FLOOR LEVEL	FLL
CHAIN HARDER	CHN	INVERT LEVEL	INTL
WARRIOR	WDF	OUTSIDE LEVEL	OUTL
IRON RAILINGS	IRF	THRESHOLD LEVEL	THL
LARCH PLAF FENCE	LPF	TOE LEVEL	TOE
WISCONSIN FENCE	WDF	SURFACE WATER	SW
PAULSIE FENCE	PSF	UNABLE TO LIFT	UNL
POCKET FENCE	POF	WATER LEVEL	WAL
POST AND CHAIN FENCE	PCF		
POST AND RAIL FENCE	PRF		
POST AND IRON FENCE	PIF		
STOCK WIRE FENCE	SWF		
TRELLIS FENCING	TLF		

SURFACE INFORMATION	
CONCRETE	CONC
BRICK PAVING	BRP
FLORAMBER	FLM
PAVING SLABS	PAS
RETAINING WALL	RWBL
PAVING TRAILING	PTC

FEATURE INFORMATION			
ROLLAND	BO	NOTICE BOARD	NOB
BUTTERFLY TELECOM BOX	BTB		BPB
BUTTERFLY TELECOM JC	BTJC	RAIN WATER PIPE	RPW
BUS STOP	BS	ROAD FLOWERS	RFB
CABLE TELEVISION BOX	CATB	ROAD SIGN	RSB
CABLE TELEVISION JC	CATJC	SCALPING FEE	SE
EARTHING ROD	ER	SEVICE PARKER POST	SPP
ELECTRICITY CABLE PIT	ELCP	SOOL VENT PIPE	SVMP
ELECTRICITY CABLE BOX	ELCB	STOCK CUBE	SC
ELECTRICITY POLE	EP	STOP VALVE	SV
FIRE HYDRANT	HR	TELEGRAM POLE	TP
INSPECTION CHUCK	IC	TELEPHONE CALL BOX	TCB
LAMP POST	LP	TRAPING SIGN	TS
LETTER BOX	LB	TRAPING SIGNALS JC	TJCS
LETTER BEN	BBN	WATER METER	WM
REAR OUTLET	RO		
NAME PLATE	NP	WATER TAP	TAP

A 5x5 grid of squares. The square at row 3, column 1 is highlighted with a red border. The grid is as follows:

Level Datum: Levels are related to OSGB15 derived from the GPS network.
Grid: Grid is related to OSGB15 derived from the GPS network.
Northpoint:



Encompass Surveys Ltd Unit 2 Tallerman Business Centre Dunoon Road Park Gate, Southampton Hamphors SO31 7GA Tel: 013 80662002 Fax: 023 80697125 Email: info@encompass-surveys.co.uk Website: encompass-surveys.co.uk	
Client: David Wilson Homes	
Survey Location: Duck's Nest Farm NR Axfordfield Garrison Reading	
Survey type: Topographical	Scale: 1:200@A0
Drawing ref: ENC/270422/JNVB/T	Date: May 2022
Drawn/QA: RMF_SE/MH/GL	Revision: -

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TREE ANNOTATIONS: Tree Species / Tree Bolt Size / No of Bolts
Tree Height / Tree Canopy Spread

POST AND RAIL FENCE	PPF	SURFACE INFORMATION	
POST AND WIRE FENCE	PWF		
STOCK WIRE FENCE	SWF		
TRILLS FENCING	TUF		
		CONCRETE	Conc
		BRICK PAVERS	BP
		FLOWERBED	FB
		PAVING SLABS	PS
		RETAINING WALL	RW/Ret
		TACTILE PAVING	Tac

ROLLARD	BO	NOTICE BOARD	NB
BRITISH TELECOM BOX	BTB	POST	P
BRITISH TELECOM IC	BTIC	RAIN WATER PIPE	RWP
BUS STOP	BS	RAISED FLOWERS	RFB
CABLE TELEVISION BOX	CB	ROAD SIGN	RS
CABLE TELEVISION IC	CBIC	ROCKING EYE	RE
EARTHING ROD	ER	SERVICE MANAGER POST	SMP
ELECTRICITY CABLE PIT	ECP	SOIL VENT PIPE	SVP
ELECTRICITY CONTROL BOX	ECB	STOP COOK	SC
ELECTRICITY POLE	ELP	STOP VALVE	SV
FIRE HYDRANT	FH	TELEPHONE POLE	TP
INSPECTION COVER	IC	TELEPHONE CALL BOX	TCB
LAND POST	LP	TRAFFIC SIGNAL	TS
LETTER BOX	LB	TRAFFIC SIGNALS	TSC
LITTER BIN	LBN	WATER METER	WM
KERS OUTLET	KO	WATER TAP	WTB
NAME PLATE	NP		

A net of a cube consisting of six squares. The squares are arranged in a cross shape: a central square, four squares attached to its top, bottom, left, and right sides, and one square attached to the right side of the rightmost square. The central square is highlighted with a red border.

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

Northpoint:



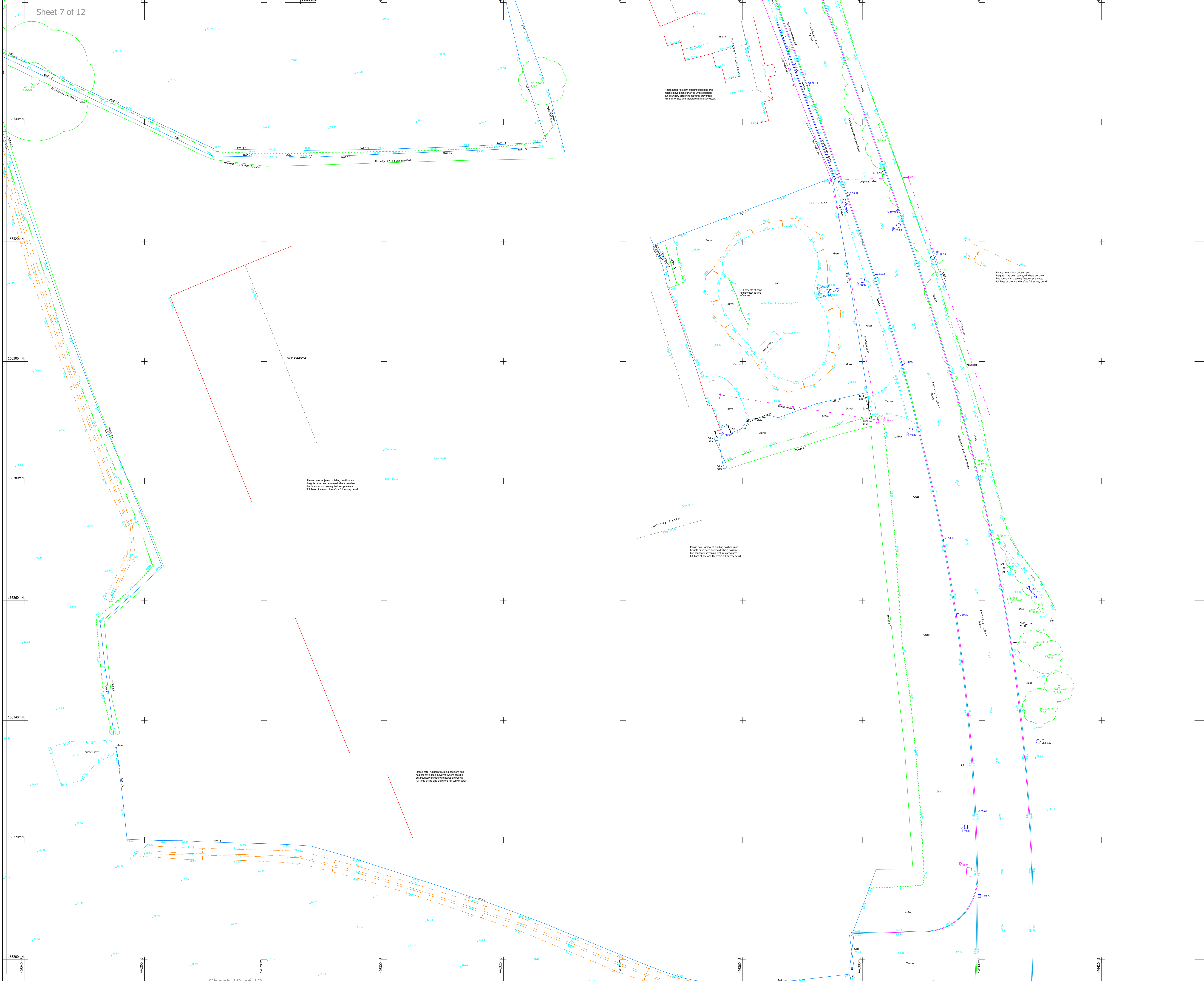
Tel: 023 80692002 Email: info@encompass-surveys.co.uk
Fax: 023 80697125 Website: encompass-surveys.co.uk

Client:	David Wilson Homes
---------	--------------------

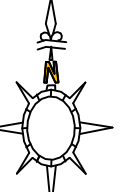
Survey Location: Duck's Nest Farm
NR Aborfield Garrison
Reading

Survey type: Topographical	Scale: 1:200 @ A0
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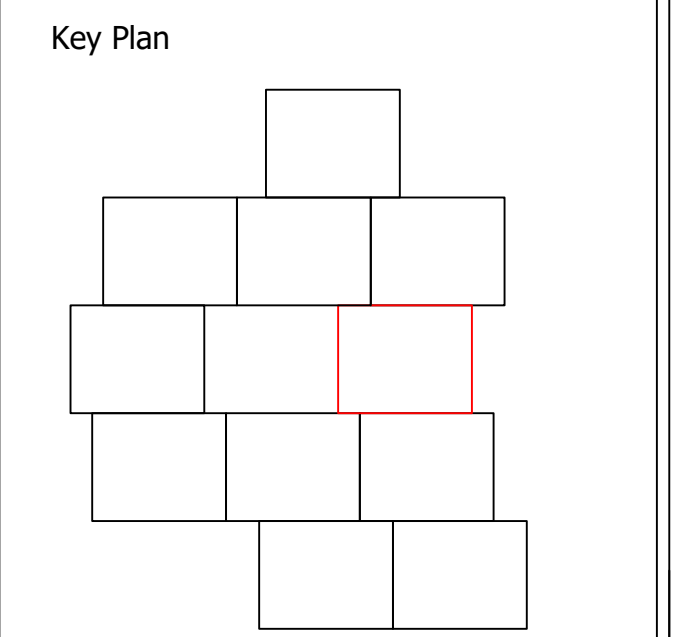
Drawing ref:	ENC/270422/9VV8/T	Date:	May 2022
Drawn (CA):	RME SE MH/GI	Revised:	



NOTES:
Drainage:
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Copyright:
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LEGEND		
TREE SPECIES INFORMATION		
ALDER	ALD	LOCUST
ASH	ASH	LONDON PLANE
ASPEN	ASP	PRUNELLA
BEECH	BCH	MAPLE
CEDAR	CDZ	CANE
CHERRY	CHT	PINE
CORSE	COP	CORUSK
ELM	ELM	PRUNUS
FIR	FIR	ROODOLANDER
HAZEL	HAZ	ROWAN
HAWTHORN	HAW	SILVER BEECH
HOLLY	HOL	SORBUS
HORNBEAM	HOB	SWEET CHESTNUT
LABURNUM	LBN	WALNUT
LARCH	LAR	YEW
LIME	LIM	SPICE UNKNOWN
		COPYRIGHT
TREE ANNOTATIONS:		
Tree Species / Tree Height / Tree Butt Size / No. of Bulbs		
FENCE INFORMATION		
BARBED WIRE FENCE	BWF	BASEMENT LEVEL
CONCRETE BLOCK FENCE	CBF	BEI LEVEL
CLOSE BOARD FENCE	CBF	COVER LEVEL
CHAIN LINK FENCE	CLF	DAWN PROOF COURSE
CHESTNUT FENCING	CHF	FLOOR LEVEL
CHICKEN WIRE FENCE	CWF	INSET LEVEL
IRON RAILINGS	IRF	OUTRILL LEVEL
LANCH LAF FENCE	LLF	THRESHOLD LEVEL
MODULAR WIRE FENCE	MWF	POOL WATER
PAVING FENCE	PAF	SURFACE WATER
POST AND RAIL FENCE	PAR	UNABLE TO LIFT
POST AND WIRE FENCE	PWF	WATER LEVEL
STOCK WIRE FENCE	SWF	
THICK FENCING	TF	
SURFACE INFORMATION		
CONCRETE	CON	
BRICK PAVING	BP	
FLAMEBERRIES	FB	
PRIVACY SLABS	PS	
RETAINING WALL	RW	
TACTILE PAVING	TP	
FEATURE INFORMATION		
BOLLARD	BO	NOTICE BOARD
BRITISH TELECOM BOX	BTB	POST
BUTTER TELECOM BOX	BTB	RAIN WATER PIPE
CABLE TELECOM BOX	CTB	RADIO FLOWMETER
CABLE TELECOM BOX	CTB	RADIO SIGN
CABLE TELECOM BOX	CTB	ROCKING EYE
EMERGENCY BOX	EB	SERVICE MANHOLE POST
ELECTRICITY CABLE PIT	ECP	SOIL VENT PIPE
ELECTRICITY CONTROL BOX	ECB	STOP COCK
ELECTRICITY POLE	EP	STOP VALVE
FIRE HYDRANT	FH	TELEGRAPH POLE
INSPECTION COVER	IC	TELEPHONE CALL BOX
LAMP POST	LP	TRAFFIC SIGNAL
LETTER BOX	LB	TRAFFIC SIGNAL IC
LETTER BOX	LB	WATER METER
WATER OUTLET	WO	WATER TAP
WATER PLATE	WP	



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

ENCOMPASS SURVEYS

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Hampshire SO31 7GA

Tel: 013 8056202 Email: info@encompass-surveys.co.uk
Fax: 013 8057125 Website: encompass-surveys.co.uk

Client: David Wilson Homes

Survey Location: Duck's Nest Farm
NE, Axford Garrison
Reading

Survey type: Topographical **Scale:** 1:200@AD

Drawing ref: ENC/270422/PAV/UT **Date:** May 2022

Drawn/QA: RHF/SE/MVGL **Revision:** -

166180mN

166160mN

166140mN

166120mN

166100mN

166080mN

166060mN

166040mN

475200mE

475200mE

475200mE

475200mE

475200mE

475200mE

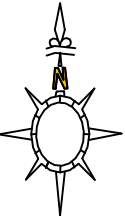
475200mE

475200mE

475200mE

475200mE

NOTES:
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LEGEND

TREE SPECIES INFORMATION

ALDER	ALD	LOCUST	LOC
ASH	ASH	LONDON PLANE	LPL
ASPEN	ASP	MAGNOLIA	MAG
BEECH	BCH	MAPLE	MPL
BIRCH	BIR	ORCHARD	ORCH
CHERRY	CHT	PINE	PNE
CHESTNUT	CHP	PLANE	PLN
ELM	ELM	PRUNUS	PRS
FIR	FIR	ROSEHEDGE	RSE
GALF	GAL	ROWAN	ROW
HAWTHORN	HAW	SILVER BEECH	SBB
HAZEL	HAZ	SORBUS	SOR
HOLLY	HOL	SWEET CHESTNUT	SCN
HORNBEAM	HOB	WALNUT	WNT
LAVENDER	LAV	WILLOW	WIL
LARCH	LAR	YEW	YEW
LYNCH	LYN	SPICE UNKNOWN	SPU
		COPPER	COP

TREE ANNOTATIONS:

Tree Species / Tree Bulb Size / No. of Bulbs / Tree Height / Tree Canopy Spread

FENCE INFORMATION

BARBED WIRE FENCE	BWF	BASEMENT LEVEL	RTL
CORRUGATED IRON FENCE	CIF	BE D LEVEL	BL
CLOSE BOARD FENCE	CBF	COVER LEVEL	CL
CHAIN LINK FENCE	CLF	DAMP PROOF COURSE	DPC
CHESTNUT PALING	CHF	FLOOR LEVEL	FL
CRASH BARRIER	CBR	INVERT LEVEL	IL
HANDRAIL	HDL	OUTFALL LEVEL	OL
IRON RAILINGS	IRF	THRESHOLD LEVEL	THL
LARCH LAMP FENCE	LLF	POOL WATER	FW
MISCELLANEOUS FENCE	MF	SURFACE WATER	SW
PAVING FENCE	PAF	UNRAIL TO LEFT	UTL
PIEDMONT FENCE	PF	WATER LEVEL	WL
POST AND CHAIN FENCE	PCF		

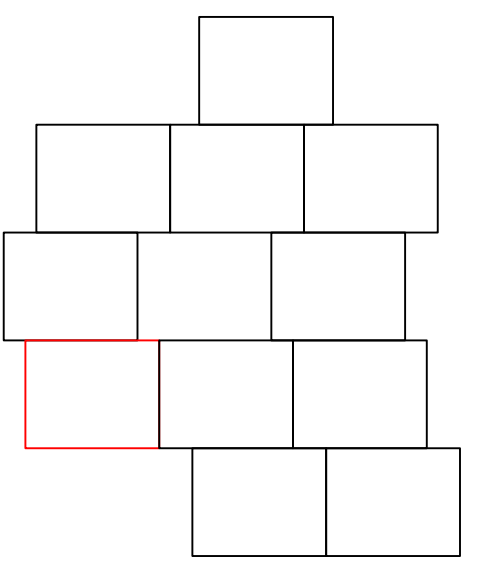
SURFACE INFORMATION

POST AND WIRE FENCE		PWF		SURFACE INFORMATION	
STOCK WIRE FENCE		SWF			
TRELLIS FENCING		TLF			
		CONCRETE	Conc		
		BRICK PAVING	BP		
		FLOWERBED	FB		
		PAVING SLABS	PS		
		RETAINING WALL	RW		
		TACTILE PAVING	TP		

FEATURE INFORMATION

BOLLARD	BO	NOTICE BOARD	NB
BRITISH TELECOM BOX	BTB	POST	P
BRITISH TELECOM IC	BTIC	RAIN WATER PIPE	RWP
BUS STOP	BS	RAISED FLOWERS	RFB
CABLE TELEVISION BOX	CTB	ROAD SIGN	RS
CABLE TELEVISION IC	CTIC	ROCKING EYE	RE
EARTHING ROD	ERV	SOIL VENT PIPER/POST	SVP
ELECTRICITY CABLE PIT	ECP	SOIL VENT PIPE	SVP
ELECTRICITY CONTROL BOX	ECB	STOP COCK	SC
ELECTRICITY POLE	EP	STOP VALVE	SV
FIRE HYDRANT	FH	TELEGRAPH POLE	TP
INSPECTION COVER	IC	TELEPHONE CALL BOX	TCB
LETTER BOX	LB	TRAFFIC SIGNAL	TS
LETTER BOX	LB	TRAFFIC SIGNALS IC	TSC
LETTER BOX	LB	WATER METER	WM
KERB OUTLET	KO	WATER TAP	Tap
NAME PLATE	NP		

Key Plan



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

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

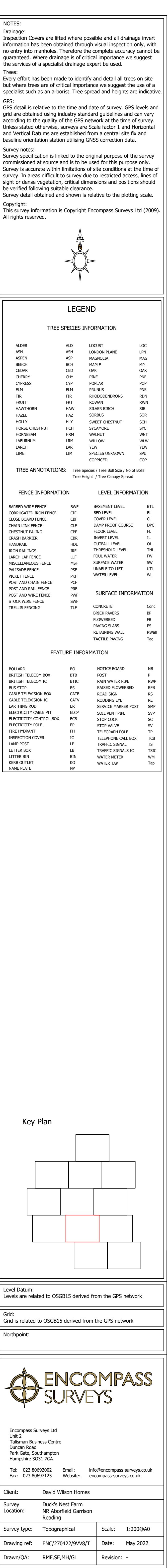
Northpoint:



Encompass Surveys Ltd
Unit 2
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Hampshire SO31 7GA
Tel: 012 8056202 Email: info@encompass-surveys.co.uk
Fax: 012 8057125 Website: encompass-surveys.co.uk

Client: David Wilson Homes
Survey Location: Duck's Nest Farm
Reading: N1, Aorfield Garrison

Survey type: Topographical Scale: 1:200@AD
Drawing ref: ENC/270422/9/VV/UT Date: May 2022
Drawn/QA: RHF, SE, MV/LG Revision: -



Drawing ref:	ENC/270422/9VV8/T	Date:	May 2022
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NOTES:
Drainage:
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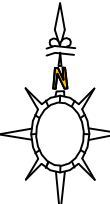
Trees:
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GPS:
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Survey notes:
Survey specification is linked to the original purpose of the survey
commissioned at source and is to be used for this purpose only.

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

TREE SPECIES INFORMATION

ALDER	ALD	LOCUST	LDC
ASH	ASH	LONDON PLANE	LPM
ASPEN	ASP	MAGNOLIA	MAG
BEECH	BOH	MAPLE	MAP
CEDAR	CED	OAK	OAK
CYPRESS	CYP	PINE	PIN
ELM	ELM	PORLAR	POK
FR	FR	PRUNES	PMS
FRUIT	FR	RHODODENDRONS	RDS
HAWTHORN	HAW	RICE	ROWN
HAZEL	HAZ	SILVER BIRCH	SBR
HOLLY	HAZ	SORBUS	SOR
HOLLY	HOLY	STEEPLE CHESTNUT	STC
HORSE CHESTNUT	HCH	SYCAMORE	SYH
HORNBEAM	HBM	WALNUT	WNT
LABURNUM	LBN	WILLOW	WIL
LARCH	LAR	YEW	YEW
LYME	LYM	SPECIES UNKNOWN	SPU
		DIFFERED	DIFF

TREE ANNOTATIONS

FENCE INFORMATION		LAMP INFORMATION	
BARBED WIRE FENCE	BWF	BASEMENT LEVEL	BTL
CORRUGATED IRON FENCE	CIF	RD LEVEL	RL
CLOSE BOARD FENCE	CBF	COVER LEVEL	CL
CHAIN LINK FENCE	CLF	DAMP PROOF COURSE	DPC
CHESTNUT PALING	CPE	FLOOR LEVEL	FL
CORR BARBER	CBR	INLET LEVEL	IL
HANDRAIL	HDL	OUTFALL LEVEL	OL
RON RAILINGS	RFL	THRESHOLD LEVEL	THL
LARCH LAMP FENCE	LLF	TOA WATER	TW
MISCELLANEOUS FENCE	MSF	SURFACE WATER	SW
PALISADE FENCE	PSF	UNABLE TO LIST	UTL
POST AND RAIL	PRF	WATER LEVEL	WL

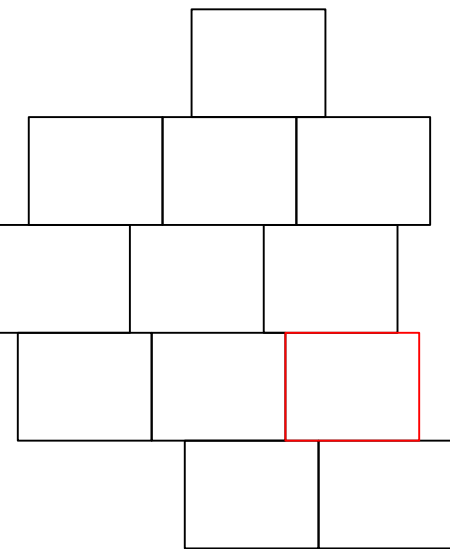
POST AND RAIL FENCE	PPF	SURFACE INFORMATION
POST AND RAIL FENCE	ONE	

TRELLIS FENCING	TLF	CONCRETE	Conc
		BRICK PAVERS	BP
		FLOWERBED	FB
		PAVING SLABS	PS
		RETAINING WALL	RWall
		TACTILE PAVING	Tac

FEATURE INFORMATION

BOLLARD	BO	NOTICE BOARD	NB
BRITISH TELECOM BOX	BTB	POST	P
BRITISH TELEPHONE IC	BTIC	RAIN WATER PIPE	RWP
RUS STOP	BS	RAISED FLOWERS	FRB
CABLE TELEVISION BOX	CATB	ROAD SIGN	RS
CABLE TELEVISION IC	CATV	ROOFTOP EYE	RE
CHINESE STOP	CS	SURFACE DRAIN POST	SDP
ELECTRICITY CABLE PT	ELCP	SOIL VENT PIPE	SVP
ELECTRICITY CONTROL BOX	ECB	SOOT COOK	SC
ELECTRICITY POLE	EP	SOOT VALVE	SV
FIRE HYDRANT	FH	TELEGRAPH POLE	TP
INSPECTION COVER	IC	TELEPHONE CALL BOX	TCB
LETTER POST	LP	TRAFFIC SIGNAL	TS
LETTER BOX	LB	TRAFFIC SIGNALS IC	TSIC
WATER OUTLET	WO	WATER METER	WM
WATER OUTLET	WO	WATER TAP	WT

Key Plan



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

Grid:
Grid is related to *OGC11E* derived from the *CPC* national

Northpoint:



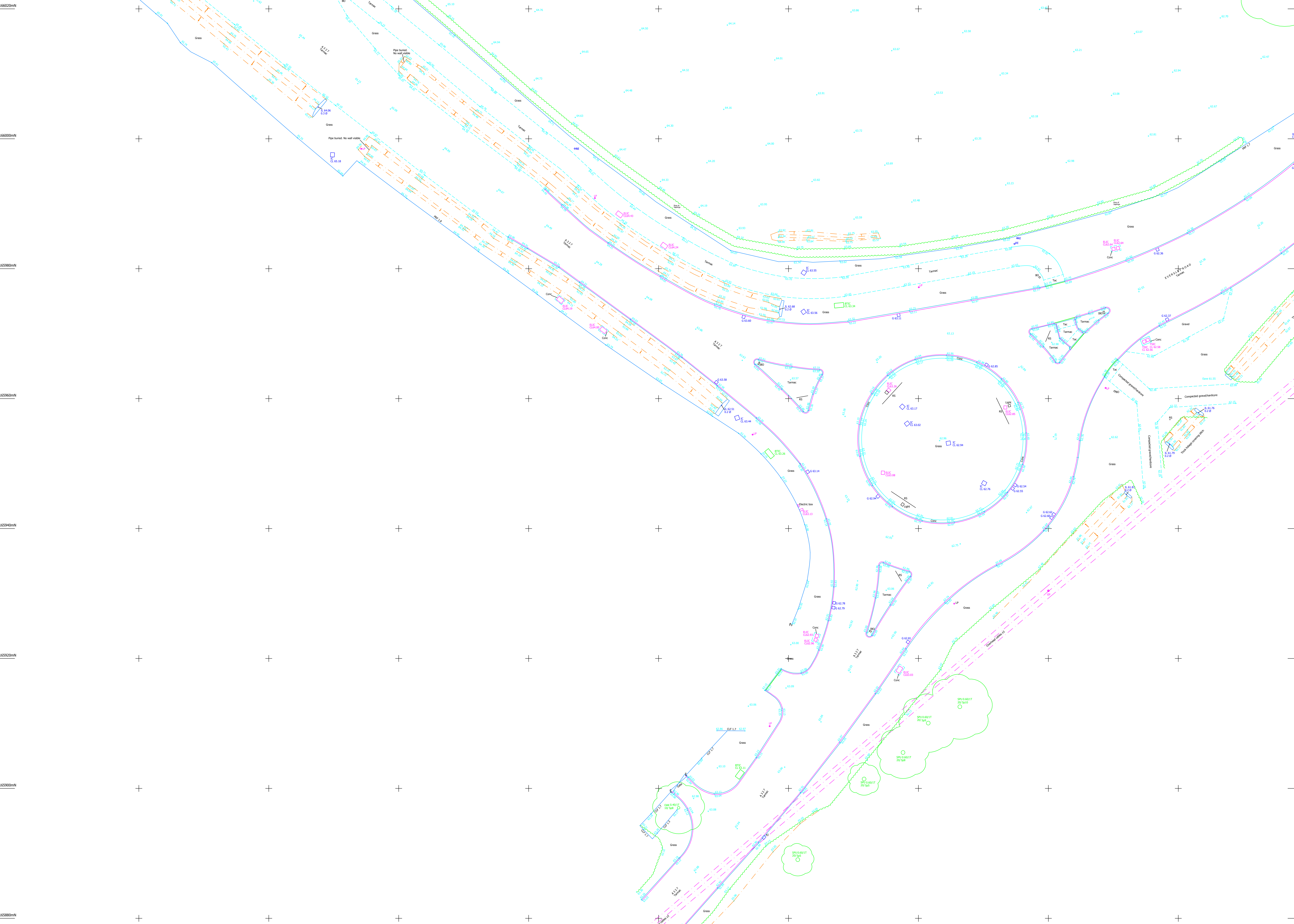
Encompass Surveys Ltd
Unit 2
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Tel: 023 80692002 Email: info@encompass-surveys.co.uk
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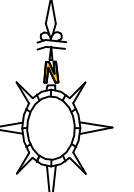
Client: David Wilson Homes

Survey Location:	Duck's Nest Farm NR Aberfeldy Garrison Reading
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Survey type:	Topographical	Scale:	1:200@A0
Drawing ref:	ENC/270422/9VV8/T	Date:	May 2022
Drawn/CA:	RME SE MH/GI	Revision:	-



NOTES:
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Copyright:
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LEGEND

TREE SPECIES INFORMATION

ALDER	ALD	LOCUST	LOC
ASH	ASH	LONDON PLANE	LPL
ASPEN	ASP	MANGROVE	MNG
BEECH	BCH	MAPLE	MPL
BIRCH	BIR	PALE	PAE
CHERRY	CHT	PINE	PNE
CORNUC	COR	POPLAR	POP
ELM	ELM	PRUNUS	PRS
FIR	FIR	ROSEHEDGE	RSE
GALF	GAL	ROWAN	ROW
HAWTHORN	HAW	SILVER BEECH	SBE
HAZEL	HAZ	SORBUS	SOR
HOLLY	HOL	SWEET CHESTNUT	SCN
HORNBEAM	HOB	WALNUT	WNT
LAVENDER	LAV	WILLOW	WIL
LARCH	LAR	YEW	YEW
LIME	LIM	SPECIES UNKNOWN	SUW
		COPYRIGHT	COP

TREE ANNOTATIONS:

Tree Species / Tree Butt Size / No. of Butts / Tree Height / Tree Canopy Spread

FENCE INFORMATION

BARBED WIRE FENCE	BWF	BASEMENT LEVEL	RTL
CONCRETE BLOCK FENCE	CBF	BEEL LEVEL	BL
CLOSE BOARD FENCE	CBF	COVER LEVEL	CL
CHALK LINE FENCE	CLF	DAMP PROOF COURSE	DPC
CHESTNUT FENCING	CHF	FLOOR LEVEL	FL
CHALK BARRIERS	CB	INVERT LEVEL	IL
HANDRAIL	HDL	OUTRILL LEVEL	OL
IRON RAILINGS	IRL	THRESHOLD LEVEL	THL
LARCH LIFT FENCE	LLF	POOL WATER	FW
WOODLAND FENCE	WLF	SURFACE WATER	SW
PALISADE FENCE	PAF	UNABLE TO LEFT	UTL
POST FENCE	POF	WATER LEVEL	WL
POST AND CHAIN FENCE	PCF		
POST AND RAIL FENCE	PRF		
POST AND WIRE FENCE	PWF		
STOCK WIRE FENCE	SWF		
TRUSS FENCING	TUF		

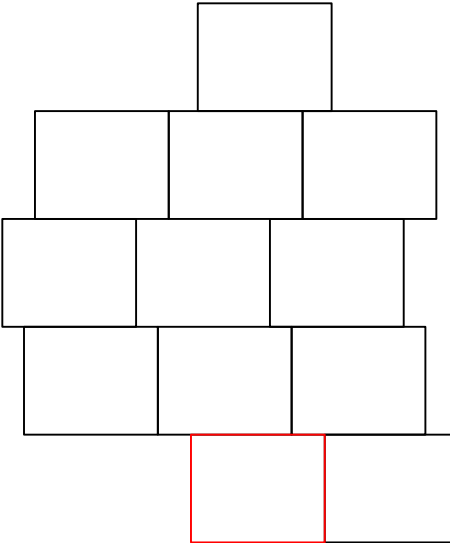
SURFACE INFORMATION

CONCRETE	CON
BRICK PAVING	BP
FLORBERIES	FB
PAVING SLABS	PS
RETAINING WALL	RW
TACTILE PAVING	TAC

FEATURE INFORMATION

BOLLARD	BO	NOTICE BOARD	NB
BRITISH TELECOM BOX	BTB	POST	P
CABLE TELEVISION IC	CTIC	RAIN WATER PIPE	RWP
CABLE TELEVISION BOX	CTB	RASSED FLOWBERIED	RFS
CABLE TELEVISION IC	CTV	RADIO SIGN	RS
DATAING BOX	DB	ROCKING EYE	RE
ELECTRICITY CABLE PIT	ECP	SOIL VENT PIPE	SVP
ELECTRICITY CONTROL BOX	ECB	STOP COCK	SC
ELECTRICITY POLE	EP	STOP VALVE	SV
FIRE HYDRANT	FH	TELEGRAPH POLE	TP
INSPECTION COVER	IC	TELEPHONE CALL BOX	TCB
LAMP POST	LP	TRAFFIC SIGNAL	TS
LETTER BOX	LB	TRAFFIC SIGNAL IC	TSC
LETTER BOX	LB	WATER METER	WM
WATER OUTLET	WO	WATER TAP	WT
WATER PLATE	WP		

Key Plan



Level Datum:
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Grid:
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Northpoint:



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Tel: 012 8056202 Email: info@encompass-surveys.co.uk
Fax: 012 8057125 Website: encompass-surveys.co.uk

Client: David Wilson Homes

Survey Location: Duck's Nest Farm
W. Aorfield Garrison
Reading

Survey type: Topographical Scale: 1:200@AD

Drawing ref: ENC/270422/9/VV/UT Date: May 2022

Drawn/QA: RHF/SE/MV/LG Revision: -

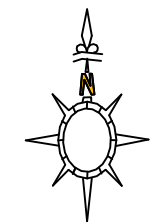
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Survey notes:
Survey specification is linked to the original purpose of the survey commissioned at source and is to be used for this purpose only.
Survey is accurate within limitations of site conditions at the time of survey. In areas difficult to 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.
Copyright:
This survey information is Copyright Encompass Surveys Ltd (2009).
All rights reserved.



LEGEND

TREE SPECIES INFORMATION

ALDER	ALD	LODUST	LOC
ASH	ASH	LONDON PLANE	LPL
ASPEN	ASP	MAGNOLIA	MAG
BEECH	BCH	MAPLE	MPL
CEDAR	CED	OAK	OK
CHERRY	CHP	PINE	PK
CYPRESS	CYP	POPULAR	POP
ELM	ELM	PRUNUS	PMS
FR	FR	RHODOCENDRONS	RDN
FRUIT	FRU	ROMAN	RWN
HAWTHORN	HWT	SILVER BIRCH	SB
HAZEL	HZN	SORBUS	SCR
HOLLY	HOL	SWEET CHESTNUT	SCN
HORSE CHESTNUT	HCH	SYCAMORE	SYC
HORNBEAM	HBN	WALNUT	WNT
LARBARUM	LBM	WILLOW	WIL
LARCH	LAR	YEW	YEW
LINE	LN	SPECIES UNKNOWN	UNK
		COFFICE	COF

TREE ANNOTATIONS: Tree Species / Tree Bolt Size / No of Bolts

FENCE INFORMATION		LEVEL INFORMATION	
BARRIED WIRE FENCE	BWF	BASEMENT LEVEL	RTL
CORRUGATED IRON FENCE	CIF	RD LEVEL	RL
CLOSE BOARD FENCE	CBF	CEMENT LEVEL	CL
CHAIN LINK FENCE	CLF	DAMP PROOF COURSE	DCP
CHESTNUT PALING	CPF	FLOOR LEVEL	FL
CRASH BARRIER	CBA	SHOULT LEVEL	SL
HANDRAIL	HDL	OUTTILL LEVEL	OL
IRON RAILINGS	IRF	THRESHOLD LEVEL	THL
LARCH LAF FENCE	LFF	ROLL WATER	FW
MISCELLANEOUS FENCE	MPF	SURFACE WATER	SW
MALAISIA FENCE	MFP	UNABLE TO LIFT	UTL
		WATER FUTE	WF

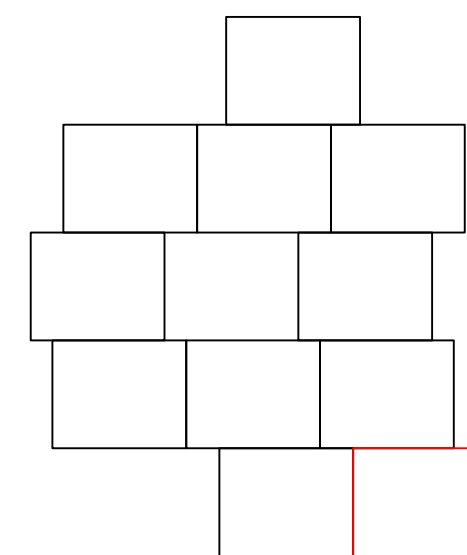
POST AND RAIL FENCE	PRF	SURFACE INFORMATION
POST AND WIRE FENCE	PWF	

BRICK PAVING	BP
FLOWERBED	FB
PAVING SLABS	PS
RETAINING WALL	RtWall
TACTILE PAVING	Tac

FEATURE INFORMATION

ROLLARD	NO	NOTICE BOARD	NB
BRITISH TELECOM BOX	STB	POST	P
BRITISH TELECOM IC	STIC	RAIN WATER PIPE	RWP
RUG STOP	BTS	RATED FLOWBERED	RFB
CABLE TELEVISION BOX	CATB	ROAD SIGN	RS
CABLE TELEVISION IC	CATIC	ROCKING EYE	RE
EARTHING CORD	EC	SERVICE MANAGER POST	SMP
ELECTRICITY CABLE PT	ELCP	SOIL VENT PIPE	SVP
ELECTRICITY CONTROL BOX	ECB	STOP COOK	SC
ELECTRICITY POLE	EP	STOP VALVE	SV
FINISH	FI	TELEGRAM POLE PT	TP
INSPECTION COVER	IC	TELEPHONE LAMP	TEL
LAMP POST	LP	TRAFFIC SIGNAL	TS
LETTER BOX	LB	TRAFFIC SIGNALS IC	TSC
KEB	KB	WATER METER	WM
KEB OUTLET	KOB	WATER TAP	Tap

Key Plan



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

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

Northpoint:



Encompass Surveys Ltd
Unit 2
Talisman Business Centre
Duncon Road
Park Gate, Southampton
Hampshire SO31 7GA

Tel: 023 80692302
Fax: 023 80697125

Email: info@encompass-surveys.co.uk
Website: encompass-surveys.co.uk

Client:	David Wilson Homes
---------	--------------------

Survey	Duck's Nest Farm
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Location:	NR Aberfield Garrison Reading
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Survey type: Topographical	Scale: 1:200@A0
----------------------------	-----------------

Drawing ref:	ENC/270422/5VV8/T	Date:	May 2022
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Appendix C

Ground Investigation Extracts

Phase 1 Geo-Environmental Desk Study Report
Ducks Nest Farm, Arborfield, Berkshire RG2 9PJ
David Wilson Homes Southern



Environmental Management Solutions – EMS Geotech

Report Number: E28112-DS

Revision: 0

Date: 23rd June 2022

Status: Final

SUMMARY REPORT

SUBJECT	COMMENTS
CURRENT USE & DESCRIPTION	Irregular in plan, the site covers approximately 18 hectares, is relatively flat and includes four large grass covered/ cropped fields (Fields 1 to 4) that are separated with hedgerows, trees and post and wire fencing. The site generally slopes towards the southeast. Ducks Nest Farm Industrial Estate sits on the eastern boundary between Fields 1 and 2. A drainage ditch, or stream, flows along the boundaries between Fields 1, 2, 4 and the Ducks Nest Farm Industrial Estate. Hedgerows, trees and wooden post and rail fencing generally delineates the site on all sides. Arborfield Court, open fields and the residential outskirts to Arborfield Cross bound the site to the north. Eversley Road bounds the site to the east, beyond which are open fields, Targetts Farm, Langley Common and a residential and commercial/light industrial estate. Observer Way (A327) and open fields bound the site to the southwest.
PROPOSED USE	It is proposed to develop the eastern half of the site for residential purposes with associated access roads, parking areas, gardens and open space.
HISTORICAL SUMMARY	The site has remained undeveloped green fields with Ducks Nest Farm and the existing Eversley Road in their existing locations since at least 1876. Brick kilns were present at Targetts Farm to the east of the site up to 1900. From 1911, land to the east that includes Targetts Farm, Langley Common and the former Arborfield Garrison was developed. Arborfield Court, to the northwest was also constructed around this time. Ducks Nest Farm was developed into the existing industrial estate around 1968 and Observer Way (A327) to the south, was constructed around 2020.
PUBLISHED GEOLOGY	It is anticipated that Head Deposits are present on high ground forming the northwest site periphery. The higher ground to the northwest is underlain with granular strata belonging to the Bagshot Formation. The lower two thirds of the site are underlain with clay rich strata belonging to the London Clay Formation.
COAL MINING AND MINERAL EXTRACTION	The site is not situated within an area of coal mining or mineral extraction.
GROUND STABILITY	The site is unlikely to be affected by ground instability hazards.
RADON GAS	The site is not within an area where radon protection measures are required in new dwellings.

HYDROGEOLOGY	The underlying Head Deposits and Bagshot Formation are designated a Secondary A Aquifer and the London Clay Formation as Unproductive Strata. The site is not located within a groundwater Source Protection Zone.
HYDROLOGY	The closest water feature to the site is the existing stream/ drainage ditch running along the boundaries between Fields 1, 2, 4 and the Ducks Nest Farm Industrial Estate. The site is not in an area indicated to be at risk from flooding.
PREVIOUS GROUND REPORTS	EMS is not aware of any previous ground investigations having been conducted at the site.

PRELIMINARY CONTAMINATION RISK ASSESSMENT

No significant potential contaminative sources have been identified for the site from this assessment. Therefore, the risk posed human health and groundwater is low and that for surface water courses and buildings, buried structures and services is very low.

PRELIMINARY GEOTECHNICAL ASSESSMENT

The site should be suitable for employing traditional shallow footings, founded within the London Clay Formation strata. Clay rich soils can be susceptible to volume changes with fluctuating moisture contents, particularly in the vicinity of existing or proposed trees, which may complicate foundation design and drive them deeper. Aggressive ground conditions could lead to attack of buried concrete structures.

The London Clay Formation strata is likely to be clay rich in nature and expected to exhibit low permeability. Therefore, it is considered unlikely that soakaways will be feasible at the site.

RECOMMENDATIONS

Phase 2 Contamination Assessment	it would be prudent to collect general shallow soil samples, during future geotechnical intrusive investigation works, to confirm that contamination is absent on-site.
Geotechnical Ground Investigation	It is recommended that intrusive geotechnical investigation works are undertaken to characterise the underlying ground conditions and to aid with foundation design.

It is recommended that this desk study report is passed to the relevant Environmental Health Department for comment as soon as possible.

Appendix D

Thames Water Information

Nick Bosanko

To: Hamza El-Adnany
Subject: RE: PPLA DS6096142: Land West of Swallowfield, Arborfield (Our Ref. 184395)

From: DEVELOPER.SERVICES@THAMESWATER.CO.U <DEVELOPER.SERVICES@THAMESWATER.CO.UK>
Sent: 15 July 2022 09:11
To: Hamza El-Adnany <Hamza.ElAdnany@vectos.co.uk>
Subject: RE: RE: RE: PPLA DS6096142: Land West of Swallowfield, Arborfield (Our Ref. 184395)

Good morning Hamza,

Thank you for your email.

We do not carry out any modelling unless we are confident that the development will proceed. We consider having ownership of the land and outline or full planning approval satisfies this criteria, therefore, if the development does not meet both of these points, we will not look to progress with the site at this time.

When both of these points have been met, please resubmit your email to us with all four points completed (please provide the planning reference number).

Kind regards,
Leigh

Leigh Khan
Developer Services – Adoptions Engineer
Office: 0800 009 3921
Mobile: 07747 642978
developer.services@thameswater.co.uk

Clearwater Court, Vastern Road, Reading, RG1 8DB
Find us online at developers.thameswater.co.uk

Get advice on making your sewer connection correctly at connectright.org.uk



Original Text

From: Hamza El-Adnany <Hamza.ElAdnany@vectos.co.uk>
To: Developer Services <developer.services@thameswater.co.uk>
CC:
Sent: 08.07.22 17:25:20
Subject: RE: RE: RE: PPLA DS6096142: Land West of Swallowfield, Arborfield (Our Ref. 184395)

Good afternoon Leigh,

Please see responses to your queries below.

1. Outline Planning.
2. David Wilson Homes are our client and we are undertaking a feasibility study on their behalf. They have an option agreement for the land and are not currently the landowner.
3. Construction is expected to start in January 2024 and end in October 2028 (timescale is indicative and based on the outline application being approved locally)
4. Date of first occupancy is expected to be in October 2024.

Further to the above, the proposed number of dwellings has been revised to 200 homes. As such the total foul discharge rate from the site is calculated to be 9.3l/s. Based on the current indicative developable areas, the split is a total foul discharge of 3l/s (approx. 64 houses) to chamber 3401 and 6.3l/s (approx. 136 houses) to chamber 4202.

With the new revision the total surface water discharge to manhole 3352 will now be 27.4l/s (15.1l/s & 12.3l/s).

Kind regards,

Hamza

Hamza El-Adnany
Senior Flood Risk Consultant

-

0117 203 5240

-

3rd Floor, Brew House, Jacob Street
Bristol, BS2 0EQ

vectos. | PART OF **SLR** 

 Consider the environment. Do you really need to print this email?

From: DEVELOPER.SERVICES@THAMESWATER.CO.UK <DEVELOPER.SERVICES@THAMESWATER.CO.UK>

Sent: 29 June 2022 09:46

To: Hamza El-Adnany <Hamza.ElAdnany@vectos.co.uk>

Subject: RE: RE: RE: PPLA DS6096142: Land West of Swallowfield, Arborfield (Our Ref. 184395)

Good morning Hamza,

Following your pre-planning enquiry for the above site, please see attached our formal response letter.

We have identified an inability of the existing foul water infrastructure to accommodate foul water flows from your proposed development and request to provide a build programme and further information describing a confidence of the delivery of this scheme.

To enable us to proceed, please provide all of the following information:

1. Please provide either outline or full planning permission
2. Please provide evidence of site ownership
3. When is construction of the development expected to start and be completed?
4. When is the first occupancy expected?

Kind regards,
Leigh

Leigh Khan

Developer Services – Adoptions Engineer
Office: 0800 009 3921
Mobile: 07747 642978
developer.services@thameswater.co.uk

Clearwater Court, Vastern Road, Reading, RG1 8DB
Find us online at developers.thameswater.co.uk

Get advice on making your sewer connection correctly at connectright.org.uk



Original Text

From: "[DEVELOPER.SERVICES@THAMESWATER.CO.U](mailto:DEVELOPER.SERVICES@THAMESWATER.CO.UK)" <DEVELOPER.SERVICES@THAMESWATER.CO.UK>
To: hamza.eladnany@vectos.co.uk
CC:
Sent: 21.06.22 11:47:40
Subject: RE: RE: PPLA DS6096142: Land West of Swallowfield, Arborfield (Our Ref. 184395)

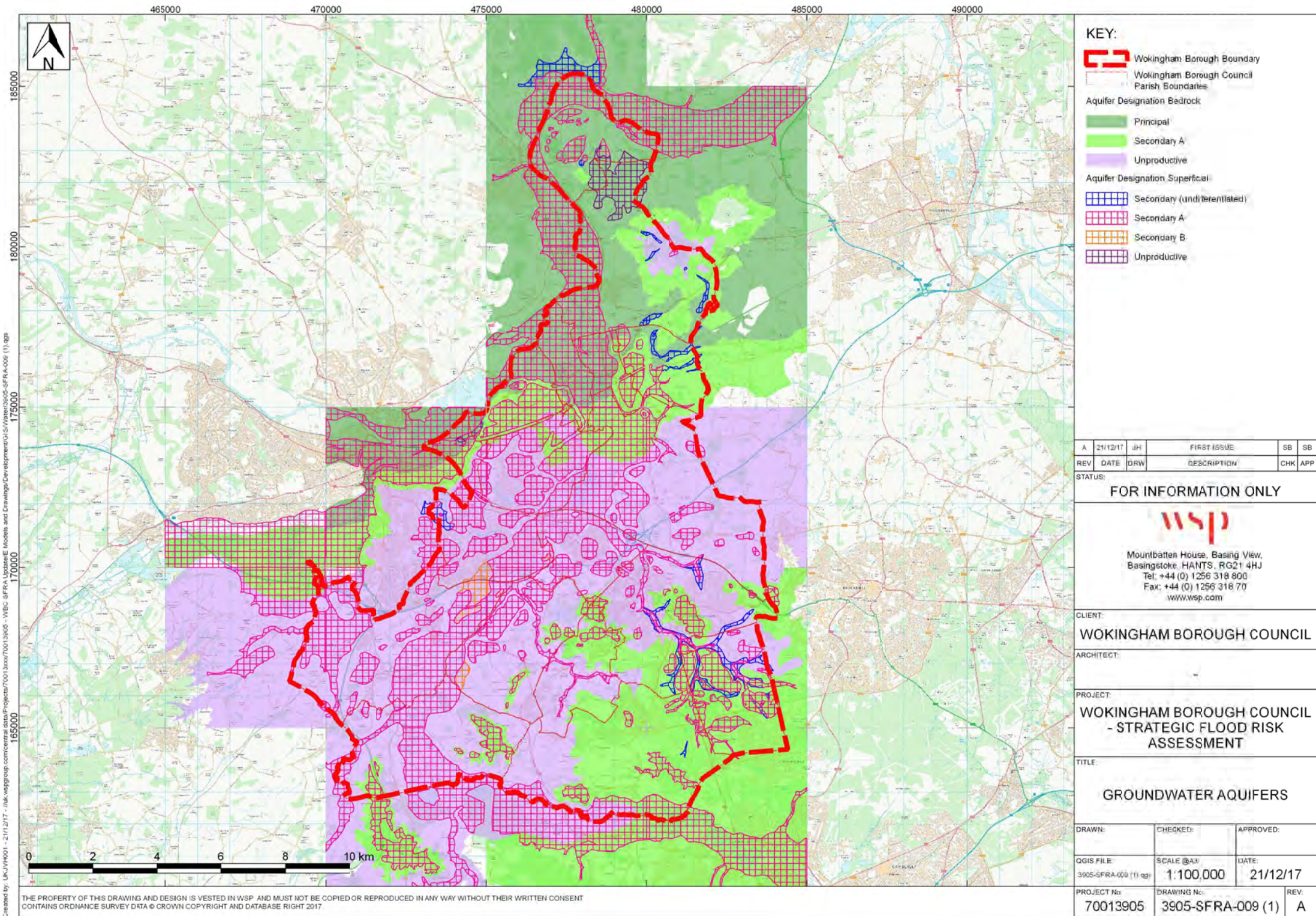
Appendix E

SFRA Mapping

Appendix A.9

GROUNDWATER MAPPING





KEY:



Wokingham Borough Boundary



Wokingham Borough Council
Parish Boundaries

Aquifer Designation Bedrock



Principal



Secondary A



Unproductive

Aquifer Designation Superficial



Secondary (undifferentiated)



Secondary A



Secondary B



Unproductive

A	21/12/17	JH	FIRST ISSUE	SB	SB
REV	DATE	DRW	DESCRIPTION	CHK	APP

STATUS:

FOR INFORMATION ONLY



Mountbatten House, Basing View,
Basingstoke, HANTS, RG21 4HJ
Tel: +44 (0) 1256 318 800
Fax: +44 (0) 1256 318 70
www.wsp.com

CLIENT:

WOKINGHAM BOROUGH COUNCIL

ARCHITECT:

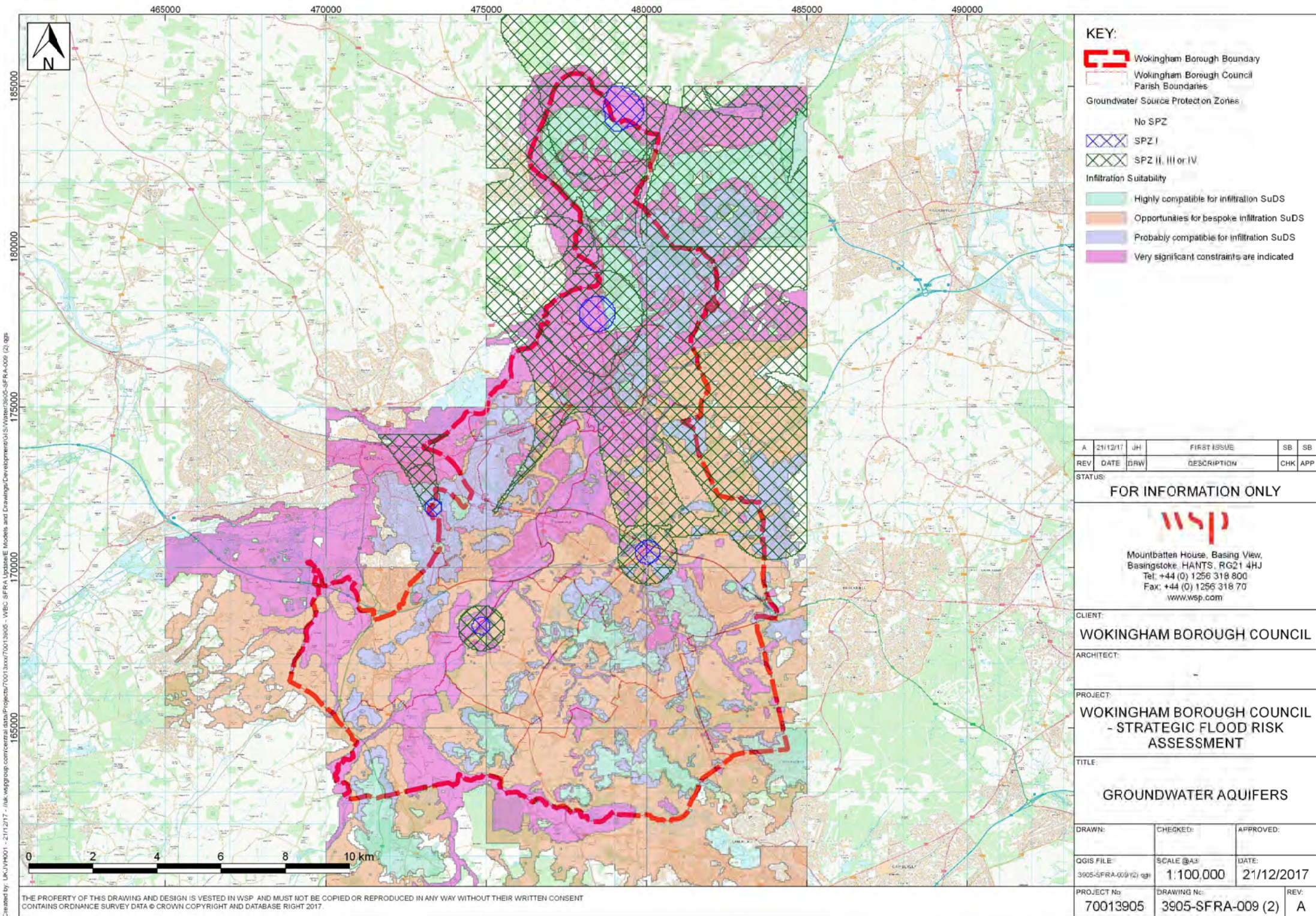
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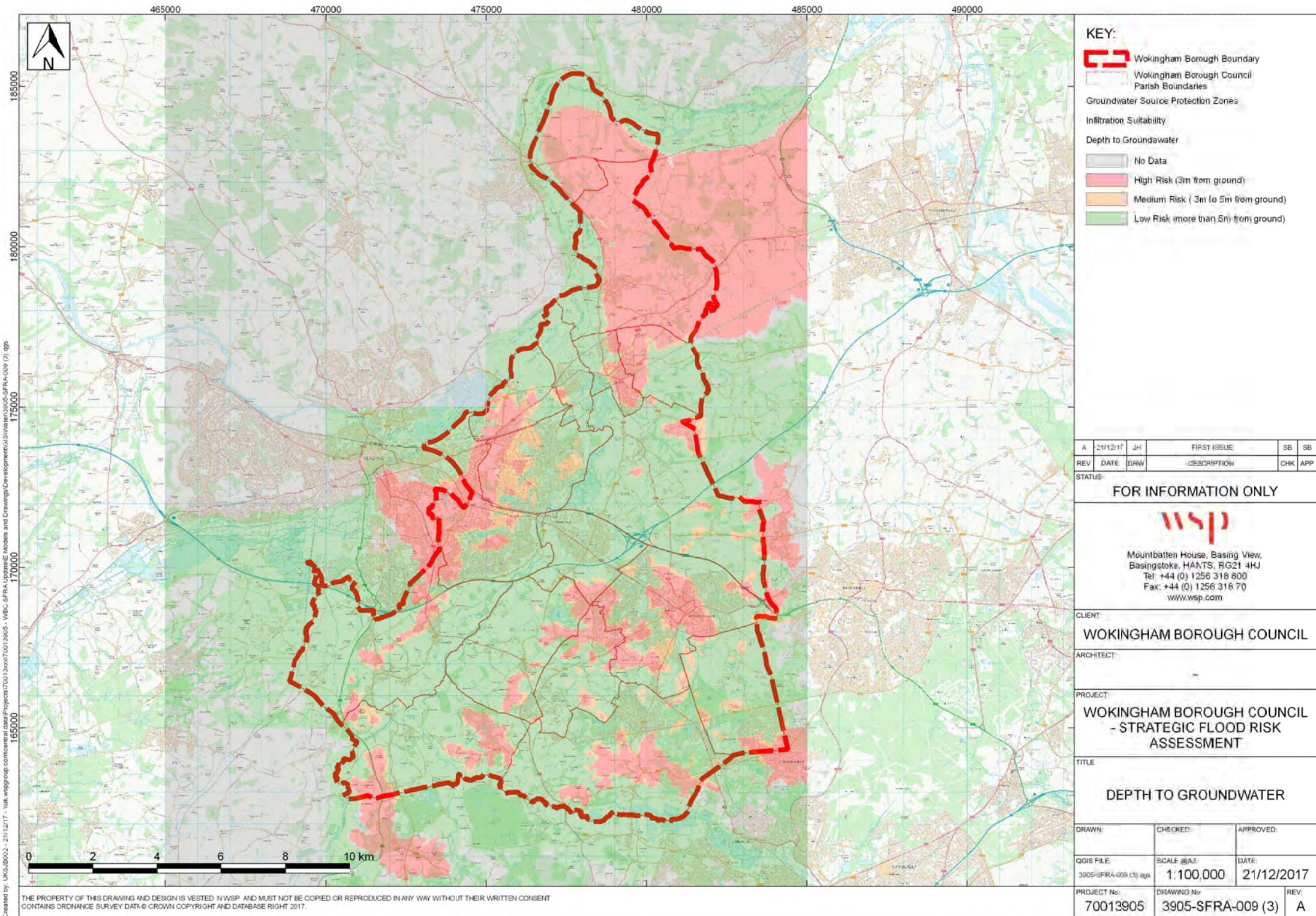
WOKINGHAM BOROUGH COUNCIL
- STRATEGIC FLOOD RISK
ASSESSMENT

TITLE:

GROUNDWATER AQUIFERS

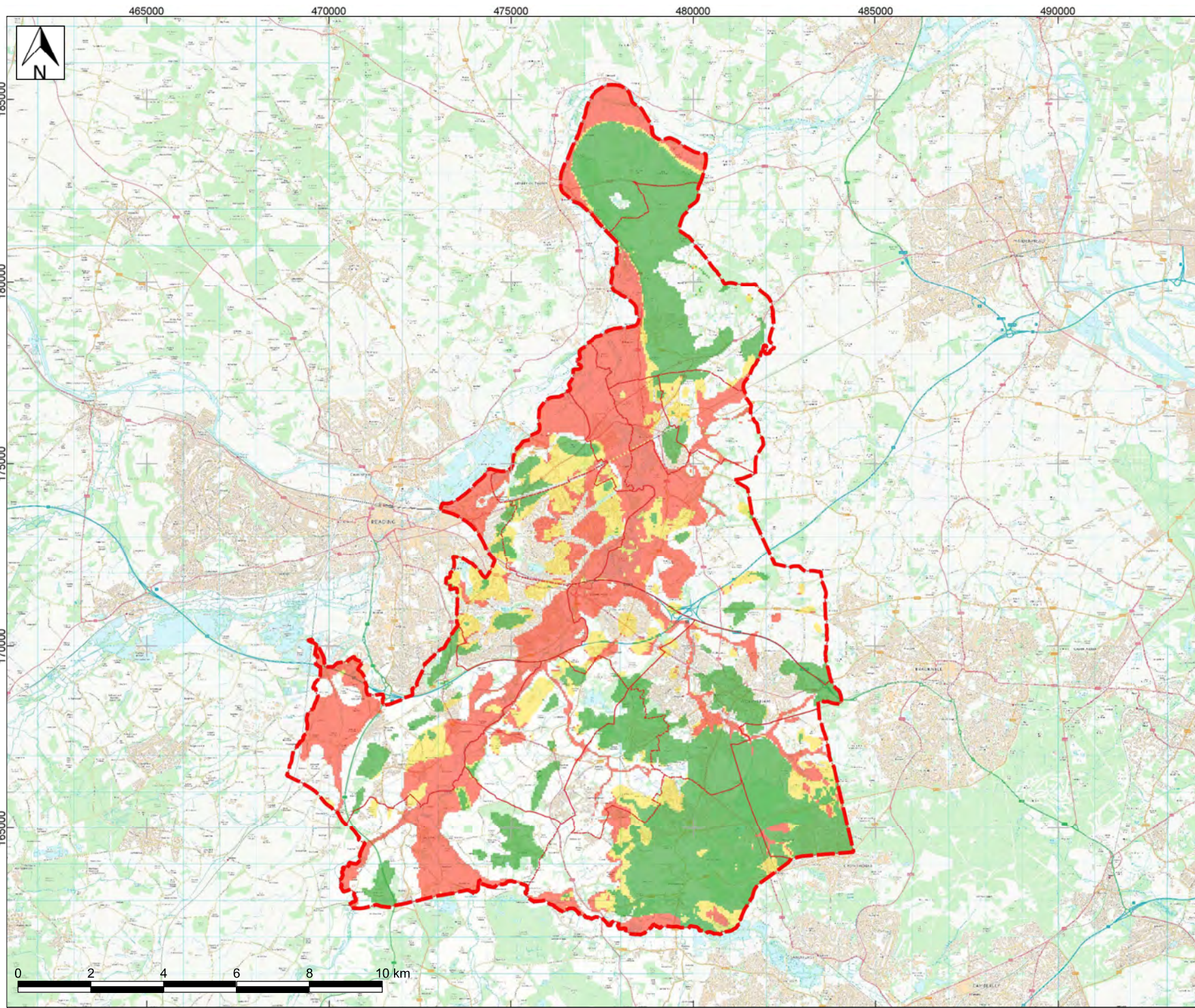
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PROJECT No: 70013905	DRAWING No: 3905-SFRA-009 (1)	REV: A





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\\uk.wspgroup.com\central_data\Projects\70013905-SFRA\094.qgz



KEY:

Parish Boundaries

Wokingham Borough Administrative Boundary

Groundwater Flood Risk

Limited potential for groundwater flooding to occur

Potential for groundwater flooding of property situated below ground level

Not considered to be prone to groundwater flooding

A	05/11/19	GL	FIRST ISSUE	OB	MQ
REV	DATE	DRW	DESCRIPTION	CHK	APP
STATUS:					
FOR INFORMATION ONLY					
 Mountbatten House, Basing View, Basingstoke, HANTS, RG21 4HJ Tel: +44 (0) 1256 318 800 Fax: +44 (0) 1256 318 70 www.wsp.com					
CLIENT: WOKINGHAM BOROUGH COUNCIL					
ARCHITECT: -					
PROJECT: WOKINGHAM BOROUGH COUNCIL - STRATEGIC FLOOD RISK ASSESSMENT					
TITLE: BGS SUSCEPTIBILITY TO GROUNDWATER FLOODING					
DRAWN:		CHECKED:		APPROVED:	
QGIS FILE: 3905-SFRA-094.qgz		SCALE @A3: 1:100000		DATE: 05/11/19	
PROJECT No: 70013905		DRAWING No: 3905-SFRA-009(4)			REV: A

Appendix F

Preliminary Surface Water Drainage Strategy

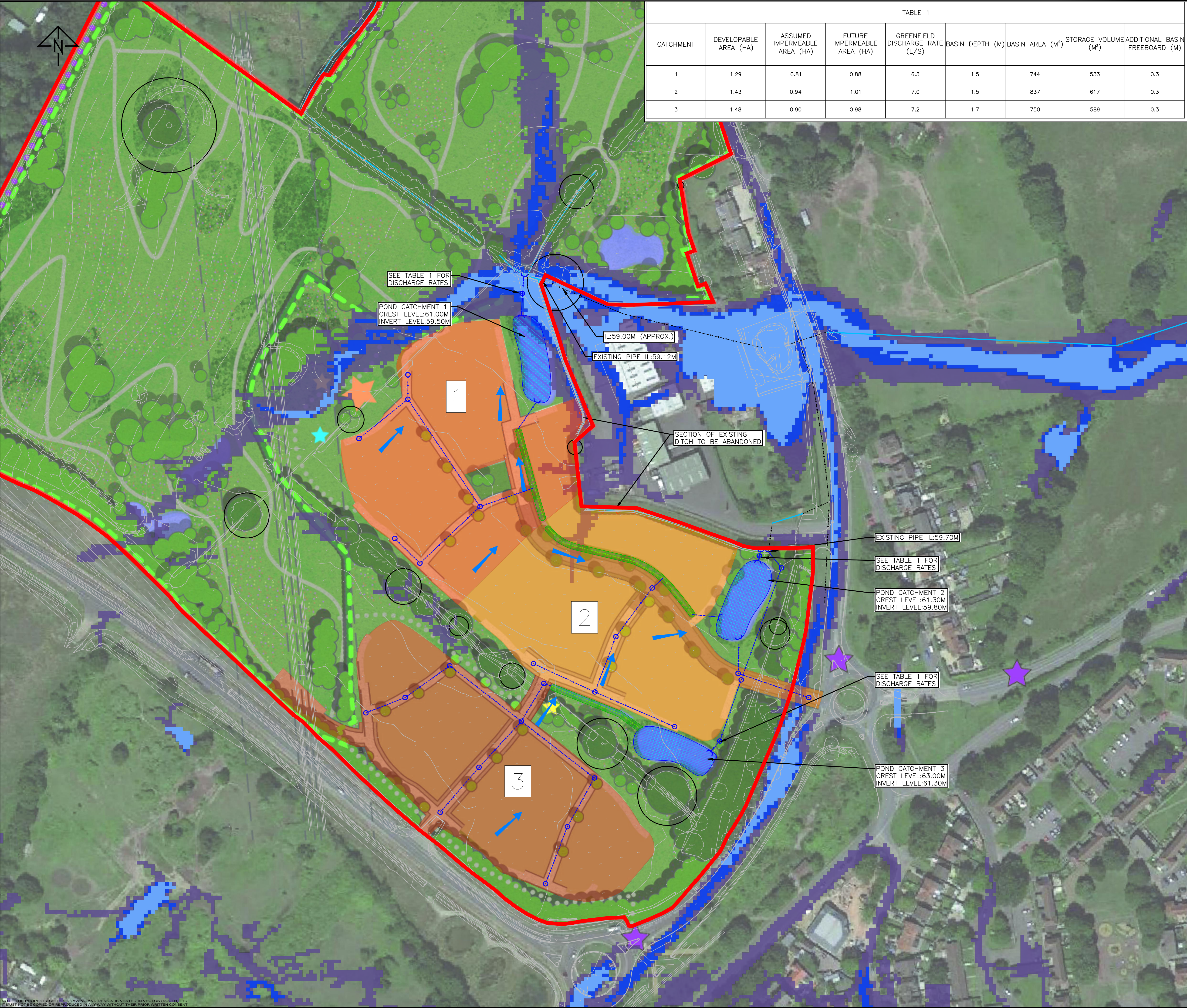


TABLE 1								
CATCHMENT	DEVELOPABLE AREA (HA)	ASSUMED IMPERMEABLE AREA (HA)	FUTURE IMPERMEABLE AREA (HA)	GREENFIELD DISCHARGE RATE (L/S)	BASIN DEPTH (M)	BASIN AREA (M²)	STORAGE VOLUME (M³)	ADDITIONAL BASIN FREEBOARD (M)
1	1.29	0.81	0.88	6.3	1.5	744	533	0.3
2	1.43	0.94	1.01	7.0	1.5	837	617	0.3
3	1.48	0.90	0.98	7.2	1.7	750	589	0.3

KEY

RED LINE BOUNDARY

EXISTING SURFACE WATER DRAIN (INDICATIVE)

EXISTING DITCH

INDICATIVE INTERCEPTOR DITCH

PROPOSED SURFACE WATER SYSTEM

PROPOSED HEADWALL

PROPOSED UNDERLYING FILTER DRAIN

PROPOSED SURFACE WATER ATTENUATION POND

PROPOSED SWALE

1 IN 30 SURFACE WATER FLOOD EXTENTS

1 IN 100 SURFACE WATER FLOOD EXTENTS

1 IN 1000 SURFACE WATER FLOOD EXTENTS

PROPOSED FLOOD EXCEEDANCE ROUTE

PROPOSED CATCHMENT

ROOT PROTECTION ZONES

NOTES

1. DRAWING TO BE READ IN CONJUNCTION WITH THE VECTOS FLOOD RISK ASSESSMENT.

2. PROPOSED LEVELS BASED ON EXISTING LEVELS AND ARE APPROXIMATE SUBJECT TO DETAILED DESIGN.

3. LOCALISED GROUND RAISING LIKELY IN SOME AREAS TO HELP FACILITATE GRAVITY DRAINAGE ARRANGEMENT.

P11	VIEWPORT UPDATED.	HE	NB	29.11.2024
P10	ARCHITECT LAYOUT UPDATED, DRAINAGE STRATEGY AMENDED TO SUIT.	HE	NB	06.09.2024
P09	CATCHMENT 1 REMOVED, CATCHMENT 2 UPDATED TO 1 ETC.	HE	NB	03.08.2023
P08	CONTOURS SHOWN ON TOPOGRAPHICAL SURVEY.	HE	NB	20.12.2022
P07	DRAWING UPDATED TO DISPLAY SURFACE WATER FLOOD EXTENTS.	HE	NB	16.12.2022
P06	ARCHITECT LAYOUT UPDATED.	HE	NB	21.10.2022
P05	ARCHITECT LAYOUT UPDATED, FLOW EXCEEDANCE ADDED. DRAINAGE STRATEGY UPDATED TO SUIT.	HE	NB	26.08.2022
P04	ARCHITECT LAYOUT UPDATED, DRAINAGE STRATEGY AMENDED TO SUIT.	HE	NB	04.08.2022
P03	ARCHITECT LAYOUT UPDATED, DRAINAGE STRATEGY AMENDED TO SUIT.	HE	NB	24.06.2022
P02	ARCHITECT LAYOUT UPDATED, DRAINAGE STRATEGY AMENDED TO SUIT.	HE	NB	23.06.2022
REV	DETAILS	DRAWN	CHECKED	DATE

STATUS:

INFORMATION ONLY

CLIENT:

DAVID WILSON HOMES

PROJECT:

DUCKS NEST, SWALLOWFIELD

DRAWING TITLE:

PRELIMINARY SURFACE WATER DRAINAGE LAYOUT

SCALES:

1:1000 @ A1

DRAWN: HE

CHECKED: NB

DATE: JUNE 2022

vector. | PART OF **SLR**

5th Floor, 4 Colston Avenue, Bristol, BS1 4ST
t: 0117 203 5240 e: enquiries@vectos.co.uk

DRAWING NUMBER:

184395_PDL_01

REVISION:

P11

Appendix G

Surface Water Drainage Calculations

Vectos South Ltd (London)				Page 1	
97 Tottenham Court Road London W1T 4TP		Ducks Nest, Swallowfield Residential - C1 Attenuation Pond - V7			
Date 06/09/2024 11:44 File 184395_ATTENUATIONPOND_...		Designed by HE Checked by NB			
Innovyze		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.141	0.641	6.3	230.3	O K
30 min Summer	99.291	0.791	6.3	301.2	O K
60 min Summer	99.428	0.928	6.3	372.0	O K
120 min Summer	99.520	1.020	6.3	423.1	O K
180 min Summer	99.562	1.062	6.3	447.2	O K
240 min Summer	99.582	1.082	6.3	459.3	O K
360 min Summer	99.592	1.092	6.3	465.0	O K
480 min Summer	99.582	1.082	6.3	459.4	O K
600 min Summer	99.562	1.062	6.3	447.5	O K
720 min Summer	99.540	1.040	6.3	434.8	O K
960 min Summer	99.496	0.996	6.3	409.7	O K
1440 min Summer	99.419	0.919	6.3	367.4	O K
2160 min Summer	99.318	0.818	6.3	314.6	O K
2880 min Summer	99.213	0.713	6.3	263.4	O K
4320 min Summer	99.030	0.530	6.3	182.6	O K
5760 min Summer	98.895	0.395	6.3	128.8	O K
7200 min Summer	98.801	0.301	6.3	94.5	O K
8640 min Summer	98.737	0.237	6.1	72.6	O K
10080 min Summer	98.694	0.194	5.9	58.3	O K
15 min Winter	99.203	0.703	6.3	258.9	O K
30 min Winter	99.364	0.864	6.3	338.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	143.782	0.0	234.8	26	
30 min Summer	94.386	0.0	308.2	41	
60 min Summer	59.233	0.0	389.8	70	
120 min Summer	34.869	0.0	459.0	128	
180 min Summer	25.400	0.0	501.5	188	
240 min Summer	20.209	0.0	532.0	246	
360 min Summer	14.546	0.0	574.4	364	
480 min Summer	11.486	0.0	604.7	482	
600 min Summer	9.540	0.0	627.7	582	
720 min Summer	8.182	0.0	645.9	626	
960 min Summer	6.393	0.0	672.7	750	
1440 min Summer	4.509	0.0	710.9	1010	
2160 min Summer	3.184	0.0	755.8	1424	
2880 min Summer	2.495	0.0	789.8	1820	
4320 min Summer	1.786	0.0	847.3	2548	
5760 min Summer	1.421	0.0	900.3	3232	
7200 min Summer	1.203	0.0	952.3	3896	
8640 min Summer	1.056	0.0	1003.1	4584	
10080 min Summer	0.951	0.0	1053.1	5248	
15 min Winter	143.782	0.0	263.1	26	
30 min Winter	94.386	0.0	344.9	40	
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Vectos South Ltd (London)				Page 2	
97 Tottenham Court Road London W1T 4TP		Ducks Nest, Swallowfield Residential - C1 Attenuation Pond - V7			
Date 06/09/2024 11:44 File 184395_ATTENUATIONPOND_...		Designed by HE Checked by NB			
Innovyze		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	99.512	1.012	6.3	418.5	O K
120 min Winter	99.614	1.114	6.3	478.0	O K
180 min Winter	99.662	1.162	6.3	507.2	O K
240 min Winter	99.687	1.187	6.3	522.8	O K
360 min Winter	99.703	1.203	6.3	533.2	Flood Risk
480 min Winter	99.699	1.199	6.3	530.7	O K
600 min Winter	99.684	1.184	6.3	521.0	O K
720 min Winter	99.662	1.162	6.3	507.3	O K
960 min Winter	99.608	1.108	6.3	474.8	O K
1440 min Winter	99.517	1.017	6.3	421.2	O K
2160 min Winter	99.382	0.882	6.3	347.8	O K
2880 min Winter	99.236	0.736	6.3	274.5	O K
4320 min Winter	98.956	0.456	6.3	152.5	O K
5760 min Winter	98.775	0.275	6.2	85.3	O K
7200 min Winter	98.679	0.179	5.8	53.5	O K
8640 min Winter	98.634	0.134	5.4	39.4	O K
10080 min Winter	98.621	0.121	4.9	35.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.233	0.0	436.6	70	
120 min Winter	34.869	0.0	514.1	126	
180 min Winter	25.400	0.0	561.7	184	
240 min Winter	20.209	0.0	595.8	242	
360 min Winter	14.546	0.0	643.2	356	
480 min Winter	11.486	0.0	677.1	470	
600 min Winter	9.540	0.0	702.8	580	
720 min Winter	8.182	0.0	723.2	684	
960 min Winter	6.393	0.0	753.1	786	
1440 min Winter	4.509	0.0	795.3	1086	
2160 min Winter	3.184	0.0	846.5	1540	
2880 min Winter	2.495	0.0	884.6	1988	
4320 min Winter	1.786	0.0	949.2	2644	
5760 min Winter	1.421	0.0	1008.4	3288	
7200 min Winter	1.203	0.0	1066.6	3896	
8640 min Winter	1.056	0.0	1123.6	4416	
10080 min Winter	0.951	0.0	1179.7	5144	
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Vectos South Ltd (London)		Page 3
97 Tottenham Court Road London W1T 4TP	Ducks Nest, Swallowfield Residential - C1 Attenuation Pond - V7	
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Model Details Storage is Online Cover Level (m) 100.000 Tank or Pond Structure Invert Level (m) 98.500 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>277.0</td><td>1.500</td><td>744.1</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0115-6300-1200-6300 Design Head (m) 1.200 Design Flow (l/s) 6.3 Flush-Flo™ Calculated Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 115 Invert Level (m) 98.500 Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>1.200</td><td>6.3</td></tr><tr><td>Flush-Flo™</td><td>0.355</td><td>6.3</td></tr><tr><td>Kick-Flo®</td><td>0.754</td><td>5.1</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>5.5</td></tr></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>4.0</td><td>1.200</td><td>6.3</td><td>3.000</td><td>9.7</td><td>7.000</td><td>14.5</td></tr><tr><td>0.200</td><td>6.0</td><td>1.400</td><td>6.8</td><td>3.500</td><td>10.4</td><td>7.500</td><td>15.0</td></tr><tr><td>0.300</td><td>6.3</td><td>1.600</td><td>7.2</td><td>4.000</td><td>11.1</td><td>8.000</td><td>15.5</td></tr><tr><td>0.400</td><td>6.3</td><td>1.800</td><td>7.6</td><td>4.500</td><td>11.7</td><td>8.500</td><td>15.9</td></tr><tr><td>0.500</td><td>6.2</td><td>2.000</td><td>8.0</td><td>5.000</td><td>12.3</td><td>9.000</td><td>16.4</td></tr><tr><td>0.600</td><td>6.0</td><td>2.200</td><td>8.4</td><td>5.500</td><td>12.9</td><td>9.500</td><td>16.8</td></tr><tr><td>0.800</td><td>5.2</td><td>2.400</td><td>8.7</td><td>6.000</td><td>13.5</td><td></td><td></td></tr><tr><td>1.000</td><td>5.8</td><td>2.600</td><td>9.1</td><td>6.500</td><td>14.0</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	277.0	1.500	744.1	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.200	6.3	Flush-Flo™	0.355	6.3	Kick-Flo®	0.754	5.1	Mean Flow over Head Range	-	5.5	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.0	1.200	6.3	3.000	9.7	7.000	14.5	0.200	6.0	1.400	6.8	3.500	10.4	7.500	15.0	0.300	6.3	1.600	7.2	4.000	11.1	8.000	15.5	0.400	6.3	1.800	7.6	4.500	11.7	8.500	15.9	0.500	6.2	2.000	8.0	5.000	12.3	9.000	16.4	0.600	6.0	2.200	8.4	5.500	12.9	9.500	16.8	0.800	5.2	2.400	8.7	6.000	13.5			1.000	5.8	2.600	9.1	6.500	14.0		
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97 Tottenham Court Road London W1T 4TP		Ducks Nest, Swallowfield Residential - C2 Attenuation Pond - V7			
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Innovyze		Source Control 2019.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.126	0.626	7.0	264.7	O K
30 min Summer	99.276	0.776	7.0	346.1	O K
60 min Summer	99.415	0.915	7.0	427.9	O K
120 min Summer	99.509	1.009	7.0	487.5	O K
180 min Summer	99.553	1.053	7.0	516.1	O K
240 min Summer	99.575	1.075	7.0	530.8	O K
360 min Summer	99.587	1.087	7.0	539.0	O K
480 min Summer	99.580	1.080	7.0	534.1	O K
600 min Summer	99.561	1.061	7.0	521.7	O K
720 min Summer	99.540	1.040	7.0	507.4	O K
960 min Summer	99.497	0.997	7.0	479.4	O K
1440 min Summer	99.421	0.921	7.0	431.7	O K
2160 min Summer	99.322	0.822	7.0	372.1	O K
2880 min Summer	99.220	0.720	7.0	315.0	O K
4320 min Summer	99.043	0.543	7.0	223.0	O K
5760 min Summer	98.910	0.410	7.0	160.3	O K
7200 min Summer	98.816	0.316	7.0	119.2	O K
8640 min Summer	98.751	0.251	6.9	92.5	O K
10080 min Summer	98.706	0.206	6.7	74.7	O K
15 min Winter	99.188	0.688	7.0	297.4	O K
30 min Winter	99.350	0.850	7.0	388.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	143.782	0.0	268.8	26	
30 min Summer	94.386	0.0	352.8	41	
60 min Summer	59.233	0.0	447.0	70	
120 min Summer	34.869	0.0	526.4	128	
180 min Summer	25.400	0.0	575.2	188	
240 min Summer	20.209	0.0	610.1	246	
360 min Summer	14.546	0.0	658.7	364	
480 min Summer	11.486	0.0	693.4	482	
600 min Summer	9.540	0.0	719.7	594	
720 min Summer	8.182	0.0	740.6	638	
960 min Summer	6.393	0.0	771.2	760	
1440 min Summer	4.509	0.0	814.6	1016	
2160 min Summer	3.184	0.0	867.2	1432	
2880 min Summer	2.495	0.0	906.2	1824	
4320 min Summer	1.786	0.0	972.1	2556	
5760 min Summer	1.421	0.0	1033.2	3240	
7200 min Summer	1.203	0.0	1092.8	3904	
8640 min Summer	1.056	0.0	1151.2	4592	
10080 min Summer	0.951	0.0	1208.4	5256	
15 min Winter	143.782	0.0	301.1	26	
30 min Winter	94.386	0.0	394.6	40	
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	99.500	1.000	7.0	481.3	O K
120 min Winter	99.604	1.104	7.0	550.4	O K
180 min Winter	99.653	1.153	7.0	584.8	O K
240 min Winter	99.680	1.180	7.0	603.5	O K
360 min Winter	99.699	1.199	7.0	617.0	O K
480 min Winter	99.697	1.197	7.0	615.7	O K
600 min Winter	99.683	1.183	7.0	606.0	O K
720 min Winter	99.663	1.163	7.0	591.4	O K
960 min Winter	99.611	1.111	7.0	555.1	O K
1440 min Winter	99.521	1.021	7.0	495.3	O K
2160 min Winter	99.391	0.891	7.0	413.2	O K
2880 min Winter	99.254	0.754	7.0	333.3	O K
4320 min Winter	98.978	0.478	7.0	191.8	O K
5760 min Winter	98.795	0.295	7.0	110.5	O K
7200 min Winter	98.694	0.194	6.6	70.0	O K
8640 min Winter	98.644	0.144	6.2	50.9	O K
10080 min Winter	98.628	0.128	5.6	45.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.233	0.0	500.7	70	
120 min Winter	34.869	0.0	589.6	126	
180 min Winter	25.400	0.0	644.2	184	
240 min Winter	20.209	0.0	683.3	242	
360 min Winter	14.546	0.0	737.6	356	
480 min Winter	11.486	0.0	776.4	470	
600 min Winter	9.540	0.0	805.8	580	
720 min Winter	8.182	0.0	829.1	686	
960 min Winter	6.393	0.0	863.1	806	
1440 min Winter	4.509	0.0	910.4	1090	
2160 min Winter	3.184	0.0	971.4	1556	
2880 min Winter	2.495	0.0	1015.0	2000	
4320 min Winter	1.786	0.0	1089.0	2684	
5760 min Winter	1.421	0.0	1157.2	3296	
7200 min Winter	1.203	0.0	1224.0	3904	
8640 min Winter	1.056	0.0	1289.4	4496	
10080 min Winter	0.951	0.0	1353.7	5152	
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.077	0.777	7.2	256.2	O K
30 min Summer	99.248	0.948	7.2	334.8	O K
60 min Summer	99.402	1.102	7.2	413.1	O K
120 min Summer	99.503	1.203	7.2	469.1	O K
180 min Summer	99.548	1.248	7.2	495.0	O K
240 min Summer	99.569	1.269	7.2	507.5	O K
360 min Summer	99.577	1.277	7.2	512.1	O K
480 min Summer	99.563	1.263	7.2	504.2	O K
600 min Summer	99.539	1.239	7.2	489.8	O K
720 min Summer	99.513	1.213	7.2	475.0	O K
960 min Summer	99.462	1.162	7.2	446.1	O K
1440 min Summer	99.374	1.074	7.2	398.4	O K
2160 min Summer	99.257	0.957	7.2	339.2	O K
2880 min Summer	99.137	0.837	7.2	282.5	O K
4320 min Summer	98.916	0.616	7.2	190.1	O K
5760 min Summer	98.753	0.453	7.2	130.3	O K
7200 min Summer	98.641	0.341	7.2	93.3	O K
8640 min Summer	98.565	0.265	7.0	70.1	O K
10080 min Summer	98.515	0.215	6.7	55.6	O K
15 min Winter	99.149	0.849	7.2	288.1	O K
30 min Winter	99.331	1.031	7.2	376.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	143.782	0.0	262.5	26	
30 min Summer	94.386	0.0	344.5	41	
60 min Summer	59.233	0.0	434.6	70	
120 min Summer	34.869	0.0	511.7	128	
180 min Summer	25.400	0.0	559.1	188	
240 min Summer	20.209	0.0	593.1	246	
360 min Summer	14.546	0.0	640.3	364	
480 min Summer	11.486	0.0	674.2	482	
600 min Summer	9.540	0.0	699.8	572	
720 min Summer	8.182	0.0	720.2	620	
960 min Summer	6.393	0.0	750.2	742	
1440 min Summer	4.509	0.0	793.2	1002	
2160 min Summer	3.184	0.0	842.0	1412	
2880 min Summer	2.495	0.0	879.8	1820	
4320 min Summer	1.786	0.0	944.1	2516	
5760 min Summer	1.421	0.0	1002.8	3224	
7200 min Summer	1.203	0.0	1060.7	3896	
8640 min Summer	1.056	0.0	1117.4	4576	
10080 min Summer	0.951	0.0	1173.3	5248	
15 min Winter	143.782	0.0	294.0	26	
30 min Winter	94.386	0.0	385.6	40	
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97 Tottenham Court Road London W1T 4TP		Ducks Nest, Swallowfield Residential - C3 Attenuation Pond - V7			
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<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	99.496	1.196	7.2	465.0	O K
120 min Winter	99.607	1.307	7.2	530.4	O K
180 min Winter	99.659	1.359	7.2	562.1	O K
240 min Winter	99.685	1.385	7.2	578.6	O K
360 min Winter	99.701	1.401	7.2	588.6	Flood Risk
480 min Winter	99.694	1.394	7.2	584.3	O K
600 min Winter	99.675	1.375	7.2	572.1	O K
720 min Winter	99.648	1.348	7.2	555.5	O K
960 min Winter	99.587	1.287	7.2	518.3	O K
1440 min Winter	99.481	1.181	7.2	456.9	O K
2160 min Winter	99.327	1.027	7.2	373.9	O K
2880 min Winter	99.157	0.857	7.2	292.0	O K
4320 min Winter	98.819	0.519	7.2	153.6	O K
5760 min Winter	98.604	0.304	7.1	82.0	O K
7200 min Winter	98.495	0.195	6.6	50.0	O K
8640 min Winter	98.442	0.142	6.0	35.7	O K
10080 min Winter	98.427	0.127	5.5	31.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	59.233	0.0	486.7	70	
120 min Winter	34.869	0.0	573.1	126	
180 min Winter	25.400	0.0	626.2	184	
240 min Winter	20.209	0.0	664.3	242	
360 min Winter	14.546	0.0	717.1	356	
480 min Winter	11.486	0.0	755.0	468	
600 min Winter	9.540	0.0	783.7	578	
720 min Winter	8.182	0.0	806.5	682	
960 min Winter	6.393	0.0	840.0	778	
1440 min Winter	4.509	0.0	887.8	1082	
2160 min Winter	3.184	0.0	943.0	1540	
2880 min Winter	2.495	0.0	985.4	1984	
4320 min Winter	1.786	0.0	1057.5	2640	
5760 min Winter	1.421	0.0	1123.1	3240	
7200 min Winter	1.203	0.0	1188.0	3888	
8640 min Winter	1.056	0.0	1251.6	4424	
10080 min Winter	0.951	0.0	1314.3	5144	
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97 Tottenham Court Road London W1T 4TP	Ducks Nest, Swallowfield Residential - C3 Attenuation Pond - V7	
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Model Details Storage is Online Cover Level (m) 100.000 Tank or Pond Structure Invert Level (m) 98.300 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>235.0</td><td>1.700</td><td>749.8</td></tr></tbody></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SHE-0119-7200-1400-7200 Design Head (m)1.400 Design Flow (l/s)7.2 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)119 Invert Level (m)98.300 Minimum Outlet Pipe Diameter (mm)150 Suggested Manhole Diameter (mm)1200 <table><thead><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td>Design Point (Calculated)</td><td>1.400</td><td>7.2</td></tr><tr><td>Flush-Flo™</td><td>0.414</td><td>7.2</td></tr><tr><td>Kick-Flo®</td><td>0.869</td><td>5.8</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>6.3</td></tr></tbody></table> The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated <table><thead><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td>0.100</td><td>4.2</td><td>1.200</td><td>6.7</td><td>3.000</td><td>10.3</td><td>7.000</td><td>15.4</td></tr><tr><td>0.200</td><td>6.6</td><td>1.400</td><td>7.2</td><td>3.500</td><td>11.1</td><td>7.500</td><td>15.9</td></tr><tr><td>0.300</td><td>7.1</td><td>1.600</td><td>7.7</td><td>4.000</td><td>11.8</td><td>8.000</td><td>16.4</td></tr><tr><td>0.400</td><td>7.2</td><td>1.800</td><td>8.1</td><td>4.500</td><td>12.5</td><td>8.500</td><td>16.9</td></tr><tr><td>0.500</td><td>7.2</td><td>2.000</td><td>8.5</td><td>5.000</td><td>13.1</td><td>9.000</td><td>17.4</td></tr><tr><td>0.600</td><td>7.0</td><td>2.200</td><td>8.9</td><td>5.500</td><td>13.7</td><td>9.500</td><td>17.8</td></tr><tr><td>0.800</td><td>6.3</td><td>2.400</td><td>9.3</td><td>6.000</td><td>14.3</td><td></td><td></td></tr><tr><td>1.000</td><td>6.1</td><td>2.600</td><td>9.6</td><td>6.500</td><td>14.9</td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	235.0	1.700	749.8	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.400	7.2	Flush-Flo™	0.414	7.2	Kick-Flo®	0.869	5.8	Mean Flow over Head Range	-	6.3	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.2	1.200	6.7	3.000	10.3	7.000	15.4	0.200	6.6	1.400	7.2	3.500	11.1	7.500	15.9	0.300	7.1	1.600	7.7	4.000	11.8	8.000	16.4	0.400	7.2	1.800	8.1	4.500	12.5	8.500	16.9	0.500	7.2	2.000	8.5	5.000	13.1	9.000	17.4	0.600	7.0	2.200	8.9	5.500	13.7	9.500	17.8	0.800	6.3	2.400	9.3	6.000	14.3			1.000	6.1	2.600	9.6	6.500	14.9		
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