FLOOD RISK ASSESSMENT
FOR
PROPOSED RESIDENTIAL DEVELOPMENT
25 ORCHARD WAY, HARWELL, OXFORDSHIRE
ON BEHALF OF
FELTHAM PROPERTIES

FEBRUARY 2021

[ISSUE 2]

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COLE EASDON CONSULTANTS (CEC)

DOCUMENT ISSUE RECORD

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Description / Status	Draft for Client Comment	Planning Issue		
Prepared	Z. Bell BSc (Hons)	Z. Bell BSc (Hons)		
Technical Check	A. Dixon BSc (Hons)	A. Dixon BSc (Hons)		
Authorised	A. Dixon BSc (Hons)	A. Dixon BSc (Hons)		
Document Check	S. Seed BA (Hons)	S. Seed BA (Hons)		

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APPENDICES

1.0 INTRODUCTION

1.1 This *Flood Risk Assessment* (*FRA*) has been prepared by Cole Easdon Consultants Limited (CEC) on behalf of Feltham Properties in support of a planning application for a residential development at 25 Orchard Way, Harwell, Oxfordshire, OX11 0LQ. Refer to CEC Figure 6997/500 Figure 1 [*Site Location Plan*] in Appendix 1.

Development Proposals

1.2 The development proposals include the construction of 5 dwellings with associated parking and landscaping and demolition of an existing house (No. 25 Orchard Way).

1.3 This study is based on Drawing No. P18-020-FPL-150 HS [*5 Dwellings @ Orchard Way*] (by Feltham Properties) provided to CEC in February 2021. Refer to Appendix 6.

Need for Study

1.4 The purpose of this assessment is to demonstrate that the development proposal outlined above can be satisfactorily accommodated without worsening flood risk for the area and without placing the development itself at risk of flooding, as per National guidance provided within the National Planning Policy Framework document (NPPF).

1.5 Accordingly, this study has been prepared to:

i) assess flood risk to the development from fluvial sources;
ii) assess flood risk to the development from other potential sources, including ditches, sewers, groundwater and overland flows;
iii) ensure that the proposed development will fully comply with the requirements of the Environment Agency's (EA's) policy on the safeguarding of floodplains; and
iv) assess a surface water drainage strategy for the proposed development.

Local Policy

1.6 This assessment also demonstrates that the proposals meet the requirements of Vale of White Horse District Council Core Strategy Policy 42 (Flood risk). The policy seeks to ensure that development provides appropriate measures for the management of surface water as an essential element of reducing future flood risk to both the site and its surroundings. Sustainable drainage methods, such as green roofs, ponds and permeable surfaces, will be encouraged, where technically possible. The drainage elements of new development must

be designed to the principles set out in the Flood and Water Management Act and associated relevant design standards.

Scope of Study

1.7 In Section 2.0, we describe the characteristics of the proposed development site and surrounding area. In Section 3.0, we assess flood risk issues and outline the proposed surface water drainage strategy and finally, conclusions are presented in Section 4.0.

1.8 The following resources have been used for this study:

- *Flood Map for Surface Water – Environment Agency (EA, accessed February 2021);*
- *Flood Zone Map – Environment Agency (EA, accessed February 2021);*
- *Geological Map - British Geological Survey (BGS, Accessed February 2021);*
- *Groundwater Source Protection Zones Map - Environment Agency (EA, accessed February 2021);*
- *Revised Climate Change Allowances (EA, March 2016);* and
- *Thames Water Utilities Sewer Records (July 2019).*

1.9 The following publicly available documents have also been reviewed as part of this assessment:

- *Building Regulations 2010 – Approved Document H (Drainage and Waste Disposal);*
- *C753 The SuDS Manual (CIRIA, November 2015);*
- *Vale of White Horse Local Plan 2031 (adopted December 2016);*
- *Vale of White Horse District Council SFRA Level 1 (July 2013);*
- *Non-Statutory Technical Standards for Sustainable Drainage Systems (Defra, March 2015);*
- *National Planning Policy Framework (NPPF) (2019);*
- *Planning Practice Guidance (PPG) (March 2014);*
- *Rainfall Runoff Management for Developments (R&D Technical Report W5-074/A/TR/1 Revision E, Defra, June 2012);* and
- *Sewerage Sector Guidance – Design and Construction Guidance (March 2020).*

1.10 The following abbreviations are used in this Report:

- AOD – Above Ordnance Datum;
- BGS – British Geological Society;
- EA – Environment Agency;
- FZM – Flood Zone Map prepared by the EA;

- NPPF – National Planning Policy Framework;
- QBAR - Annual flood flow (return period of approximately 1:2.3 years);
- SFRA – Strategic Flood Risk Assessment;
- SuDS – Sustainable Urban Drainage Systems;
- TWU –Thames Water Utilities; and
- VWHDC – Vale of White Horse District Council.

2.0 THE EXISTING SITE

Refer to CEC Plan 6997/500 [*Existing Site Plan*] in Appendix 7.

2.1 The proposed development site comprises 0.237 ha area of greenfield land located to the rear of 25 Orchard Way, Harwell, Oxfordshire. The site is bounded to the north by the gardens of existing residential dwellings; to the west by agricultural land; to the south by a recreational ground and to the east by Orchard Way.

2.2 Land use within the vicinity of the site is predominantly Agricultural with larger residential areas located to the east such as the village of Harwell and the town of Didcot.

Existing Topography

2.3 The topographical survey shows the site to be relatively flat, with an area of slightly lower lying ground in the centre. Existing ground levels vary from 82.95mAOD in the north western corner of the site, to 82.51mAOD within the low-lying area.

Nearby Watercourses/Drainage Features

2.4 An unnamed drainage channel is located 400m to the east of the site and another is located 600m to the west of the site. The River Thames, classed by the EA as a main river, is located 5.3km to the north of the site. The unnamed drainage channels flow in a northerly direction and feed into the River Thames.

Existing Drainage

2.5 Asset records provided by Thames Water Utilities show a 150mm diameter public surface water sewer located to the north of the site within Orchard Way. Multiple 150mm diameter public foul sewers are located within the rear gardens of the residential dwellings to the north east of the site. A small section of combined sewer is located within 23 Orchard way to the east of the site.

2.6 An approved residential development is proposed by the same developer (Feltham Properties) within a parcel of land to the rear of Nos. 29 to 35 Orchard Way, approximately 10m to the north of the site. The proposals include laying a new off-site sewer in Orchard Way to provide a connection to the existing public surface water sewer to the north. Refer to Drawing No. 3573-102(P2) [*Engineering Layout – Sheet 1 of 2*] (by DOA Consulting Structural Engineers) in Appendix 6.

2.7 The site is greenfield. It is assumed that surface water currently either infiltrates to ground or follows the natural topography as overland flow. Greenfield runoff rates for the proposed hard areas on the site (0.128ha) have been calculated as 0.6l/s for the mean annual runoff event (QBAR), 1.3l/s for the 1:30-year event and 1.8l/s for the 1:100-year event. Refer to Appendix 5 for greenfield runoff calculations.

Existing Ground Conditions

2.8 Records acquired from the British Geological Survey (BGS) indicate the site is underlain by Upper Greensand Formation - Calcareous Sandstone and Siltstone with no superficial deposits recorded.

2.9 The EA's mapping aquifer destination map shows that the bedrock geology is classed as a Principle Aquifer and the superficial deposits are classed as unproductive. The EA groundwater vulnerability map designates the site as High with a soluble rock risk.

2.10 EA mapping shows the site to not be in a groundwater source protection zone.

2.11 An intrusive site investigation has not been undertaken because the development site is currently inaccessible to large plant. The findings of a site investigation undertaken on the adjacent site to the rear of Nos. 29-35 Orchard Way has therefore been used to assess existing ground conditions at the site. Refer to Appendix 3 for report excerpts.

2.12 The report for the adjacent site recorded made ground to a depth of 0.4mbgl, underlain by clay to a depth of 2.0mbgl. Thin bands of gravel were also found within the clay.

2.13 Groundwater was not encountered during the works.

2.14 Following discussion with the Lead Local Flood Authority (LLFA) regarding the proposed drainage strategy for No. 25 Orchard Way, a deeper test pit was excavated on the adjacent site to a depth of 3m BGL. Groundwater was not encountered.

2.15 Infiltration testing has been carried out on the adjacent site. Water levels within the test pits did not fall sufficiently over approximately 24 hours to allow calculation of an infiltration rate. The LLFA confirm that, on the basis of the test results, drainage by infiltration is not considered feasible at the site. Refer to Appendix 3 for infiltration test results. Refer to Appendix 4 for LLFA correspondence.

3.0 FLOOD RISK ISSUES

Refer to CEC Plans 6997/500 [*Existing Site Plan*] and 6997/502 [*Proposed Site Layout*], both located in Appendix 7.

3.1 This Section presents an assessment of flood risk to the development from:

a) external sources; and

b) surface water discharge from the proposed development.

3.2 Recommended flood risk mitigation measures appropriate to the level of perceived risk are included in the assessment. The mitigation measures are summarised in Table 3.1 below.

A) Assessment of Flood Risk to the Development Site from External Sources

Ai) Assessment of Flood Risk from Fluvial Sources

3.3 The Flood Zone Map (FZM) for the locality as produced by the EA is shown on CEC Figure 6997/500/Figure 2 [*EA Flood Zone Map*] within Appendix 1. According to the FZM it can be seen that the site lies within flood zone 1 (Low risk).

3.4 *NPPF Practice Guidance (Table 2: Flood Risk Vulnerability Classification)* classifies the proposed site usage 'residential' as 'More vulnerable' development. In accordance with the *NPPF Practice Guidance (Table 3: Flood Risk Vulnerability and Flood Zone* Compatibility), More Vulnerable Development is appropriate within Flood Zone 1.

3.5 The level 1 SFRA for VWHDC does not state any fluvial flooding to have occurred within Harwell or within the vicinity of the site. Therefore, flood risk from fluvial sources can be considered low.

Fluvial/Tidal Flood Risk Mitigation Measures

3.6 No mitigation required.

Aii) Assessment of Flood Risk from Existing Ditches

3.7 A review of the topographical survey and OS mapping indicates that no drainage ditches are present in the vicinity of the site. Flood risk from this source is therefore low.

Ditch Flood Risk Mitigation Measures

3.8 No mitigation required.

Aiii) Assessment of Flood Risk from Existing Sewers/ Drains

3.9 The asset records show a small section of combined sewer directly to the east of the site. The remainder of the foul sewer network is located within the rear gardens of the houses to the north east of the site. If the sewers were to surcharge the site would be unaffected as flows would be directed away by the existing dwellings and highway corridor. Flood risk from sewers can therefore be considered low.

Sewer/ Drain Flood Risk Mitigation Measures

3.10 No mitigation required.

Aiv) Assessment of Flood Risk from Overland Flow (Pluvial)

3.11 The Surface Water Flood Zone Map for the locality as produced by the EA is shown on CEC Figure 6997/500/Figure 3 [*EA Surface Water Flood Zone Map*] within Appendix 1. The mapping indicates the site to be at very low- high risk from surface water flooding.

3.12 The mapping shows the east of the site to be at very low risk from surface water flooding. The west of the site is shown to be at low-high risk of surface water flooding. For the high-risk scenario, the flood depth is predicted to be below 300mm. The surface water flooding is localised within the site and not an overland flow route. As a result, surface waters will not be obstructed by any development and the proposed development is not at risk from surface water flows from adjacent land.

3.13 The Level 1 SFRA mapping for VWHDC also indicates the site to be at risk from surface water flooding. However, it does not record any historic incidents of flooding within the vicinity of the site. Flood risk from overland flow can be considered low.

Overland Flow Flood Risk Mitigation Measures

3.14 The area of low ground below 82.60mAOD within the centre of the site shall be filled in and raised so that no surface water can collect and pose a risk to the proposed development. The LLFA has verbally agreed that the proposed mitigation measures are appropriate. Refer to Drawing No 6997/500 [Existing Site Plan].

Av) Assessment of Flood Risk from Groundwater

3.15 The level 1 SFRA for VWHDC does not highlight any areas on the site to be at risk from groundwater flooding.

3.16 On site testing to the rear of 29-35 Orchard Way has not encountered any groundwater within the trial pit dug to a depth of 3.0mbgl. Flood risk from groundwater can therefore be considered low.

Groundwater Flood Risk Mitigation Measures

3.17 No mitigation required.

Avi) Assessment of Flood Risk from Artificial sources

3.18 The EA Risk of Flooding from Reservoirs Map shows the site is not at risk of flooding from reservoirs. Therefore, the risk from artificial sources can be considered very low.

Reservoir Flood Risk Mitigation Measures

3.19 No mitigation required.

Table 3.1: Assessment of Flood Risk to the Development Site Arising from External Sources

Source of Potential Flooding to the Development Site	Flood Risk	Mitigation/Comments
Overland Flow	Very Low - High	Existing low lying area to be filled
Groundwater	Low	No mitigation required
Fluvial/ Tidal	Low	
Public Sewer / Drains	Low	
Ditches	Very Low	
Artificial sources	Very Low	

B) Assessment of Flood Risk Arising from Surface Water Discharge from the Proposed Development

Refer to CEC Plan 6997/502 [*Proposed Site Layout*] in Appendix 7.

3.20 In order to mitigate flood risk posed by post development runoff, adequate control measures will need to be provided within the site, including Sustainable Urban Drainage Systems (SuDS).

Bi) Surface Water Runoff Control

3.21 The proposed development will comprise 1305.5m^2 of impermeable surfaces in the form of access roads, parking and roof areas.

Bii) Infiltration Potential

3.22 As discussed in Section 2.0, infiltration testing has been undertaken on the adjacent site at 29 – 35 Orchard Way. The results of the testing were unsatisfactory for infiltration-based SuDS, as agreed with the LLFA. Refer to Appendix 3 for infiltration test results. Refer to Appendix 4 for LLFA correspondence. The underlying geology of the development site is likely to be the same, and as a result, an attenuation-based strategy is proposed.

Biii) Proposed Surface Water Drainage Strategy

Discharge location

3.23 It is proposed to discharge surface water from the site to the proposed off site sewer connection from the adjacent site at 29 – 35 Orchard Way, which is also being developed by Feltham Properties. The connection point will be in Orchard Way, at the junction of the proposed site access for the adjacent site. Refer to Drawing No. 3573-102(P2) [*Engineering Layout – Sheet 1 of 2*] (by DOA Consulting Structural Engineers), in Appendix 6 for details of the drainage proposals for the adjacent site.

3.24 Enquires have been sent to Thames Water previously in relation to a 7-plot development on this site as the proposed connection from the adjacent site will enter the public surface water sewer network. Thames Water confirmed that capacity existed within the existing public surface water sewer network. Refer to TWU correspondence from July 2019, in Appendix 4. Updated enquiries have been sent to Thames Water for the reduced plot scheme who have agreed the proposals are still acceptable. Refer to the updated correspondence with Appendix 4.

3.25 **Discharge rate**

It is proposed to restrict all post development surface water discharge to the QBAR greenfield runoff rate of 0.6l/s.

Attenuation Calculations

3.26 The proposed development comprises 1305m^2 of impermeable surfacing (roofs, parking and driveways). Preliminary calculations indicate that 91.7m^3 of storage will be required to attenuate and dispose of runoff from the proposed impermeable areas arising from the

critical 1:100 year + 40% climate change storm event. Sufficient storage can be provided within a tanked permeable paving SuDS to be located within the access road and the proposed parking spaces. The paving will cover an area of 587m^2 with an effective depth of 0.57m and a minimum construction depth of 0.78m.

Table 3.2: Summary of Existing & Proposed Surface Water Discharge Rates

Area (ha)		Discharge Point	Calculation Method	Discharge Rate (l/s)				Attenuation Volume Required (m^3)
				1:2 yr	1:30 yr	1:100 yr	1:100 yr +40%	
Greenfield	0.13	To ground	ICP SuDS	0.6	1.3	1.8	-	-
Proposed	0.13	Attenuated to sewer	Micro Drainage	0.6	0.6	0.6	0.6	91.7

3.27 All attenuation facilities have been designed to accommodate and dispose of runoff from storms up to the 1:100 year + 40% climate change event, without flooding, in accordance with NPPF guidance.

3.28 All drainage design calculations are preliminary and have been undertaken using Windes Microdrainage software. Refer to Appendix 5.

Design Exceedance

3.29 Should the on-site drainage system fail under extreme rainfall events or blockage, flooding may occur within the site. Any resultant floodwater will be routed in a southerly direction onto the recreational ground and away from the proposed development.

Water Quality

3.30 Water quality has been assessed in line with the Simple Index approach from Chapter 26 of CIRIA *C753 The SuDS Manual:*

1. Step 1 – Allocate suitable pollution hazard indices for the proposed land use.
2. Step 2 – Select SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index.

3.31 The highest pollution hazard level for the proposed land use is Low (residential car parks and low trafficked roads). The pollution hazard indices for this land use are shown in Table 3.3 below.

Table 3.3: Pollution Hazard Indices for the Proposed Site (from Table 26.2 of CIRIA C753 The SuDS Manual)

Total suspended solids (TSS)	Metals	Hydrocarbons
0.5	0.4	0.4

3.32 All SuDS components to be used in the development have been assessed for their effectiveness in pollutant removal prior to discharge to surface waters in Table 26.3 in CIRIA *C753 The SuDS Manual*. The pollution mitigation indices are show in Table 3.4 below.

Table 3.4: Pollution Mitigation Indices for Permeable Pavement (from Table 26.3 of CIRIA C753 The SuDS Manual)

Attenuation Device	Total suspended solids (TSS)	Metals	Hydrocarbons
Tanked Permeable Paving	0.7	0.6	0.7

3.33 The Pollution Mitigation Indices for permeable pavement are greater than the Pollution Hazard Indices for car parks and low trafficked roads. The proposed facilities will therefore provide sufficient water quality treatment prior to discharge.

Adoption & Maintenance

3.34 All on-site drainage features will be maintained by the site owner. A Maintenance Schedule is discussed below and outlined in Table 3.5.

3.35 The off-site sewer connection within Orchard Way will be offered for adoption by Thames Water.

Permeable Paving

3.36 Permeable paving will either be maintained by a private management company acting on behalf of the end users/occupants of the site.

3.37 Permeable surfaces need to be regularly cleaned of silt and other sediments to preserve their infiltration capability. A brush and suction cleaner, which can be a lorry-mounted device or a smaller precinct sweeper, should be used and the sweeping regime should be as follows:

1. End of winter (April) – to collect winter debris.
2. Mid-summer (July/August) – to collect dust, flower and grass-type deposits.
3. After autumn leaf fall (November).

3.38 If reconstruction is necessary, the following procedure should be followed:

1. Lift surface layer and laying course.
2. Remove any geotextile filter layer.
3. Inspect sub-base and remove, wash and replace if required.
4. Renew any geotextile layer.
5. Renew laying course, jointing material and concrete block paving.

3.39 Materials removed from the voids or the layers below the surface of the paving may contain hazardous substances such as heavy metals and hydrocarbons which may need to be disposed of as controlled waste.

Pipework and Catchpits

3.40 It is not envisaged that silt build up within the pipework systems will require a rigorous maintenance regime so long as silt is removed from upstream catch pits on a regular basis. Notwithstanding this, a suitable maintenance regime for the systems will comprise of routine inspection (every six months) and silt removal (as necessary).

Flow Controls

3.41 Flow controls should be inspected regularly for blockages and silt/ debris removed as necessary.

Table 3.5: Suggested Maintenance Regime for Elements of the Drainage Infrastructure

Drainage Element	Schedule	Maintenance Requirement	Frequency
Tanked Permeable Paving	Regular	Brushing and vacuuming over whole surface	Once a year, after autumn leaf fall
	Occasional	Removal of weeds	As required
	Remedial	Remedial work to any depressions or cracked or broken blocks considered a hazard to end users or detrimental to performance	As required
		Rehabilitation of surface and upper sub-structure by remedial sweeping	Every 10 – 15 years, or as required
	Monitoring	Initial inspection	Monthly for 3 months after installation
		Inspect for evidence of weed growth or poor operation	Three monthly, 48 hours after large storms in first six months
		▪ Inspect silt accumulation rates ▪ Monitor inspection chambers	Annually

Drainage Element	Schedule	Maintenance Requirement	Frequency
Pipework, Catchpits & Flow Control	Regular	▪ Inspect for accumulation of silt ▪ Inspect inlets, outlets and overflows for blockages ▪ Inspect for debris and litter	Every six months
	Occasional	▪ Remove debris and litter ▪ Remove silt	As required

Note: In addition to the above maintenance requirements, it is recommended that all drainage elements are inspected:

- Following the first storm event
- Monthly for the first 3 months following commissioning

4.0 DISCUSSION AND CONCLUSIONS

Assessment of Flood Risk from External Sources

4.1 Flood risk to the proposed development from various sources, including rivers, sewers, groundwater, ditches and overland flow has been considered in this study.

4.2 According to the Surface Water Flood Map, flood risk from surface water varies from very low to high. Review of the topographical survey confirms that a slightly lower lying area is present in the centre of the site. Surface water could accumulate in this area, as identified by the mapping.

4.3 Raising ground levels within the low-lying area will ensure there is no build-up of surface water, and therefore reduce the risk of surface water flooding across the site to very low. The LLFA has verbally confirmed that this is an acceptable mitigation measure.

Assessment of Flood Risk Arising from Surface Water Discharge from the Proposed Development

4.4 The development site is on greenfield land. The proposed development will introduce impermeable surfaces in the form of car parking area and roof areas. Surface water runoff from the development site will be managed on site for storms up to the 1:100 year + 40% climate change event, without flooding.

4.5 Post development runoff will be discharged at the existing QBAR runoff rate, via attenuation SuDS comprising tanked permeable paving.

4.6 Preliminary calculations indicate that some 91.7m^3 of storage is required for the proposed development.

4.7 Should the on-site drainage system fail under extreme rainfall events or due to blockage, flooding may occur within the site. Any resultant floodwater will be routed away from the proposed development onto the recreational ground to the south of the site.

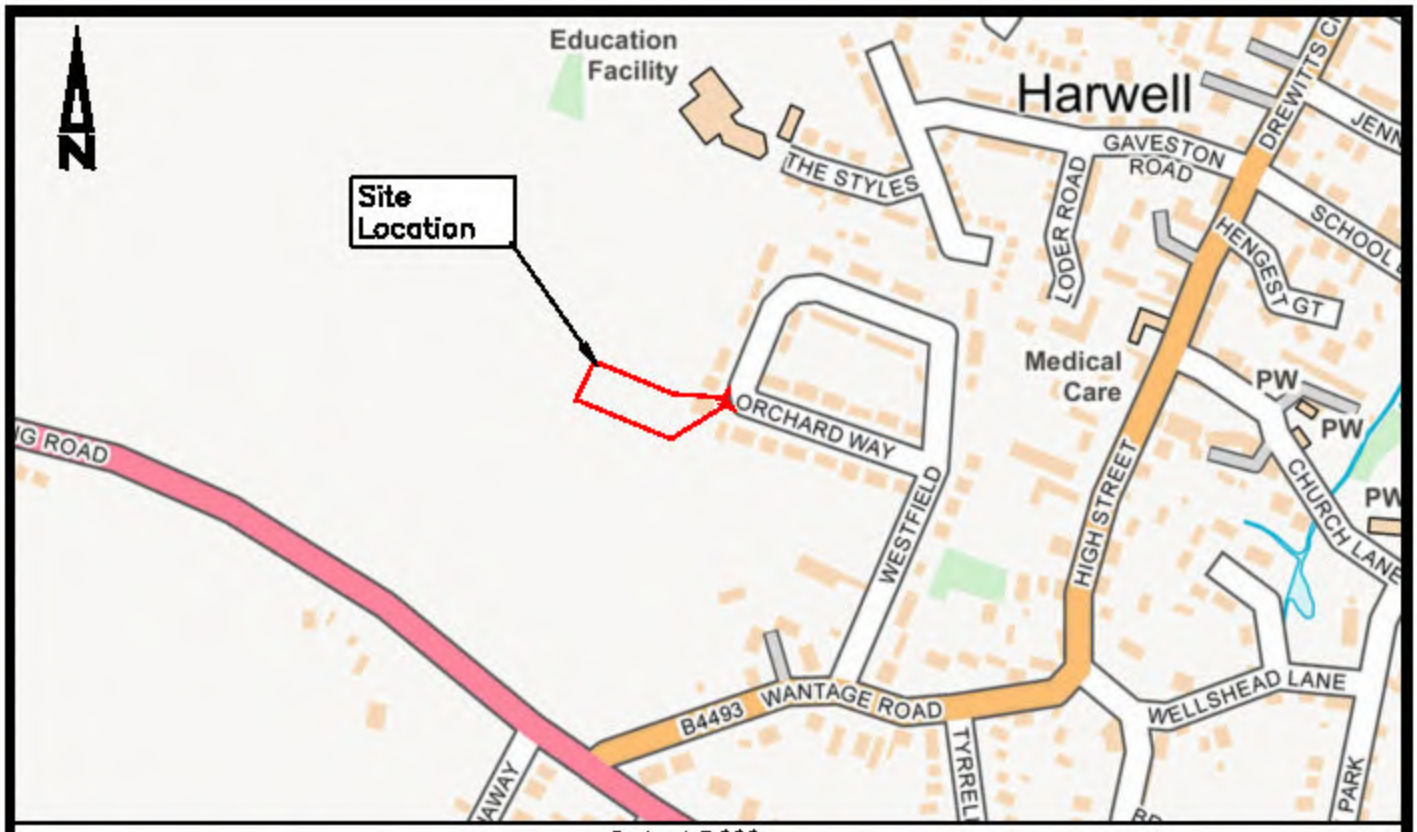
4.8 Water quality has been assessed in line with the Simple Index approach from Chapter 26 of CIRIA *C753 The SuDS Manual*. The proposed SuDS devices provide adequate mitigation for the pollution generated by the development.

4.9 The proposed SuDS features will be maintained by the site owner.

4.10 This study has been undertaken in accordance with the principles set out in NPPF. We can conclude that providing the development adheres to the conditions advised in this Report, the said development proposals can be accommodated without increasing flood risk within the locality in accordance with objectives set by Central Government and the EA.

Cole Easdon Consultants Limited
February 2021

Appendix 1



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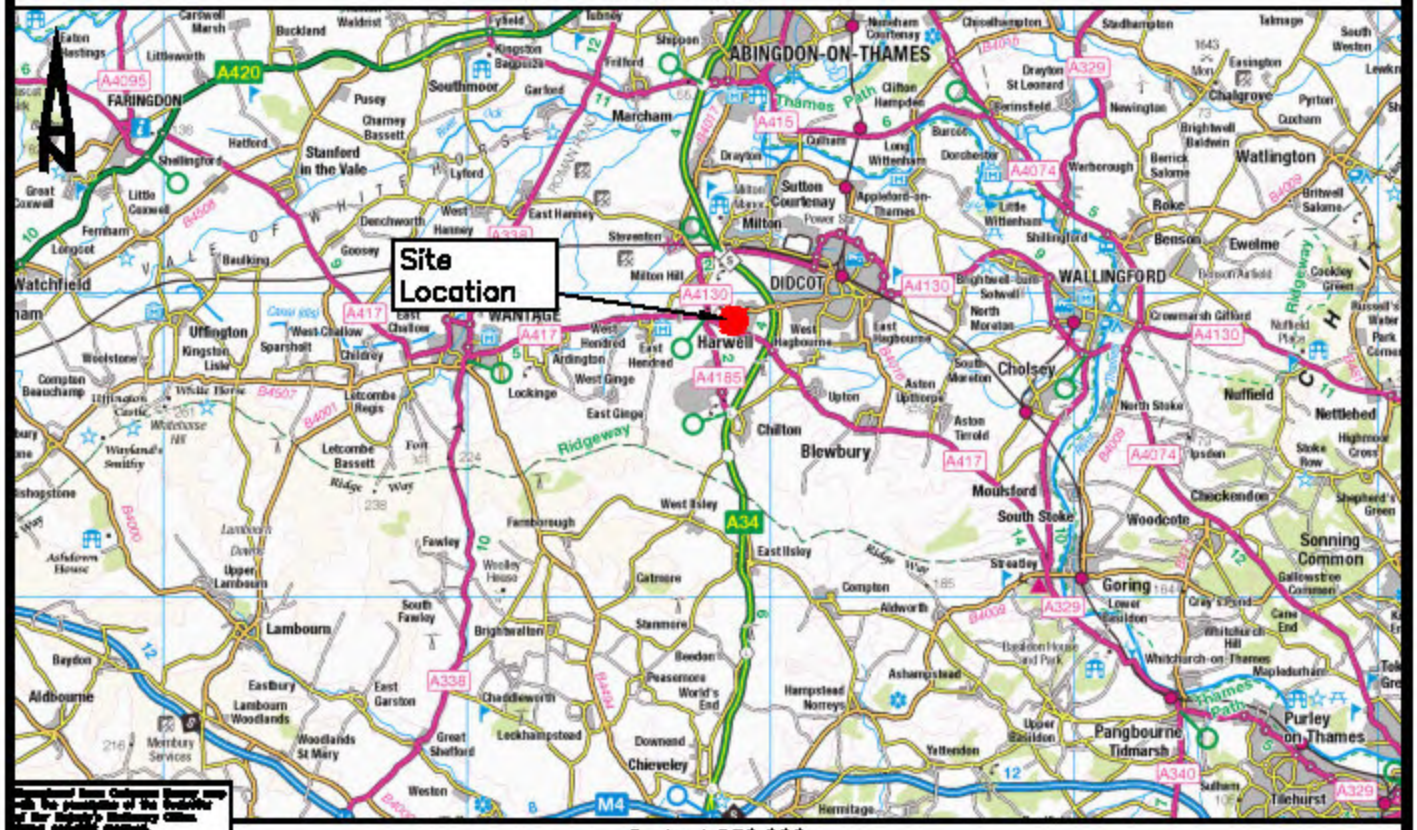

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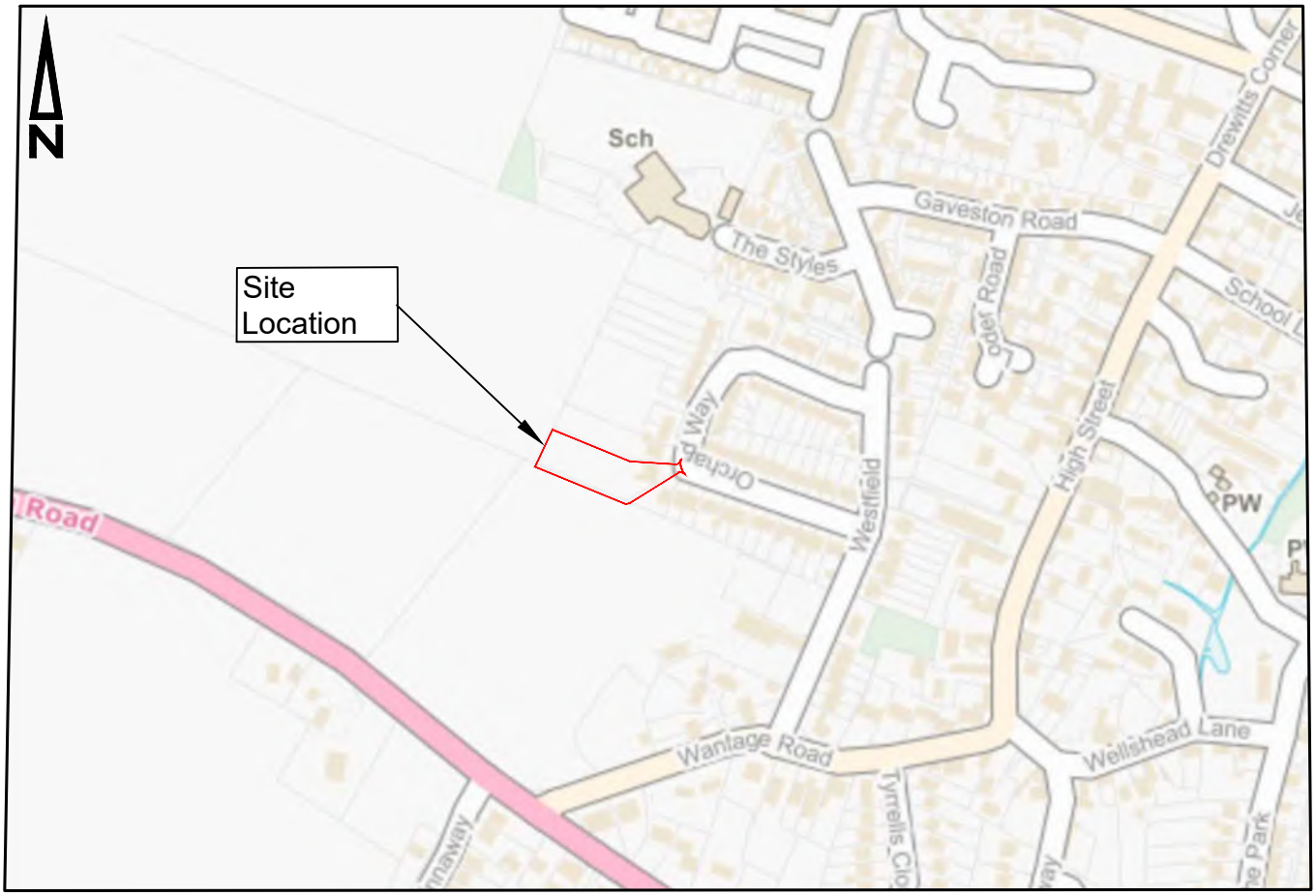
Job Title	Proposed Residential Development 25 Orchard Way Harwell Oxfordshire
Client	Feltham Properties
Drawing Title	Site Location Plan
Drawn By	ZB
Date Drawn	February 2021
Scale	As shown (A4)
Checked By	DF
Drawing No	8997/500 Figure 1
Revision	



Flood Zone 1 - Low Risk

Flood Zone 2 - Medium Risk

Flood Zone 3 - High Risk

Main Rivers

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Job Title:
Propsoed Residential Development
25 Orchard Way
Harwell
Oxfordshire

Client:
Feltham Propoerties

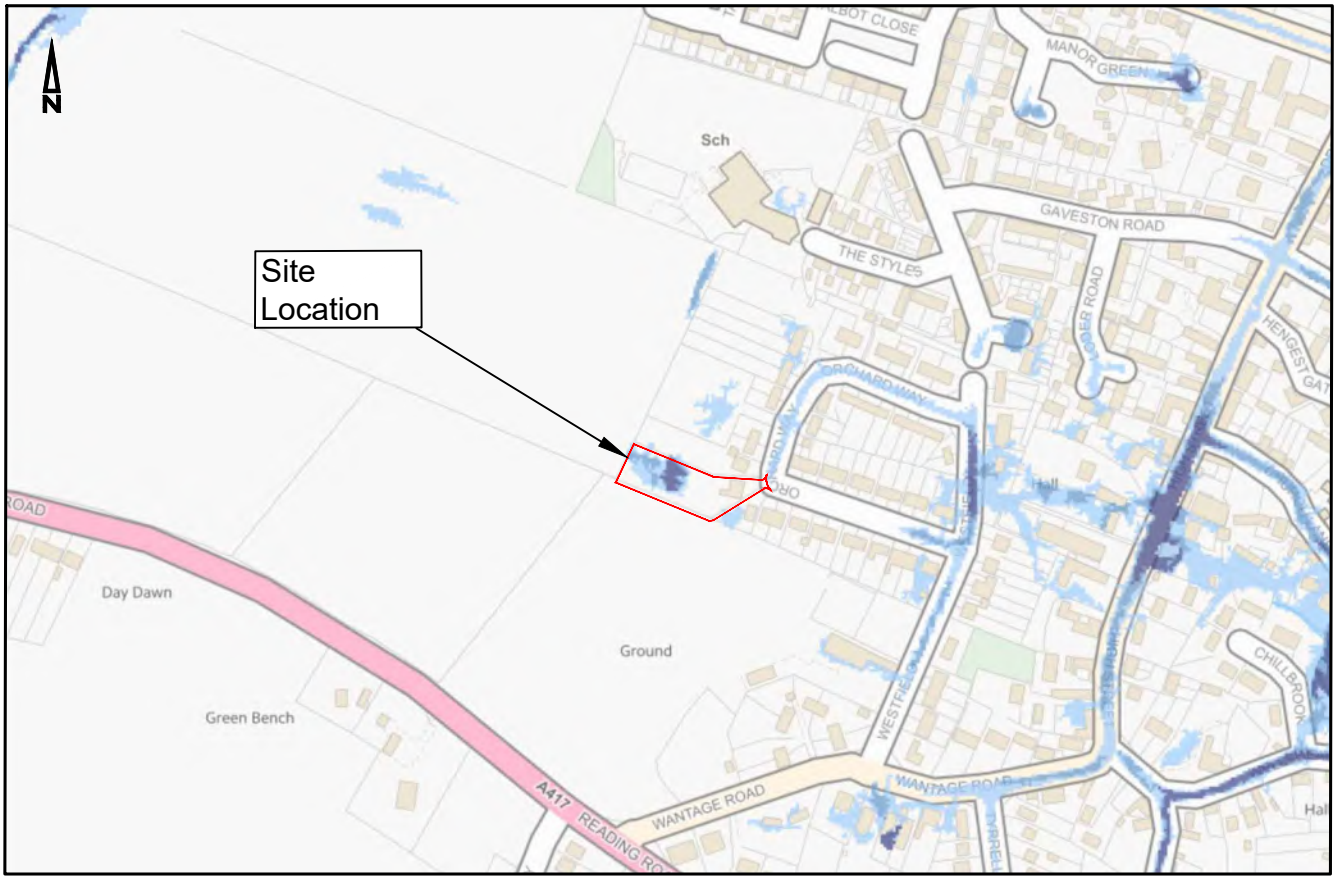
Drawing Status:

CONSTRUCTION AT CLIENT AND/OR CONTRACTOR RISK		
	FOR COMMENT	
	FOR PLANNING	X
	FOR TENDER	
	FOR APPROVAL	
	FOR CONSTRUCTION	
	AS BUILT	

Drawing Title:
EA Flood Zone Map

Drawn By	Date Drawn	Scale
ZB	February 2021	1:5,000 @ A4

Checked By	Drawing No.	Revision
DF	7013/500 Figure 2	



Surface Water Flooding - Very Low Risk

Surface Water Flooding - Low Risk

Surface Water Flooding - Medium Risk

Surface Water Flooding - High Risk

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Proposed Residential Development
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Client:
Feltham Properties

Drawing Status:

CONSTRUCTION AT CLIENT AND/OR CONTRACTOR RISK		
	FOR COMMENT	
	FOR PLANNING	X
	FOR TENDER	
	FOR APPROVAL	
	FOR CONSTRUCTION	
	AS BUILT	

Drawing Title:
EA Surface Water Flood Zone Map

Drawn By	Date Drawn	Scale
ZB	February 2021	1:5,000 @ A4

Checked By	Drawing No.	Revision
DF	6997/500 Figure 3	

Appendix 2

Asset location search

Property Searches

Cole Easdon Consultants Limited
Unit 2 York House
Edison Park
SWINDON
SN3 3RB

Search address supplied

25
Orchard Way
Harwell
Didcot
OX11 0LQ

Your reference (6997) 25 Orchard Way Harwell Oxfordshire

Our reference ALS/ALS Standard/2019_4037092

Search date 10 July 2019

Keeping you up-to-date

Notification of Price Changes

From 1 September 2018 Thames Water Property Searches will be increasing the price of its Asset Location Search in line with RPI at 3.23%.

For further details on the price increase please visit our website: www.thameswater-propertysearches.co.uk
Please note that any orders received with a higher payment prior to the 1 September 2018 will be non-refundable.

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0845 070 9148

searchcode

Asset location search

Property Searches

Search address supplied: 25, Orchard Way, Harwell, Didcot, OX11 0LQ

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

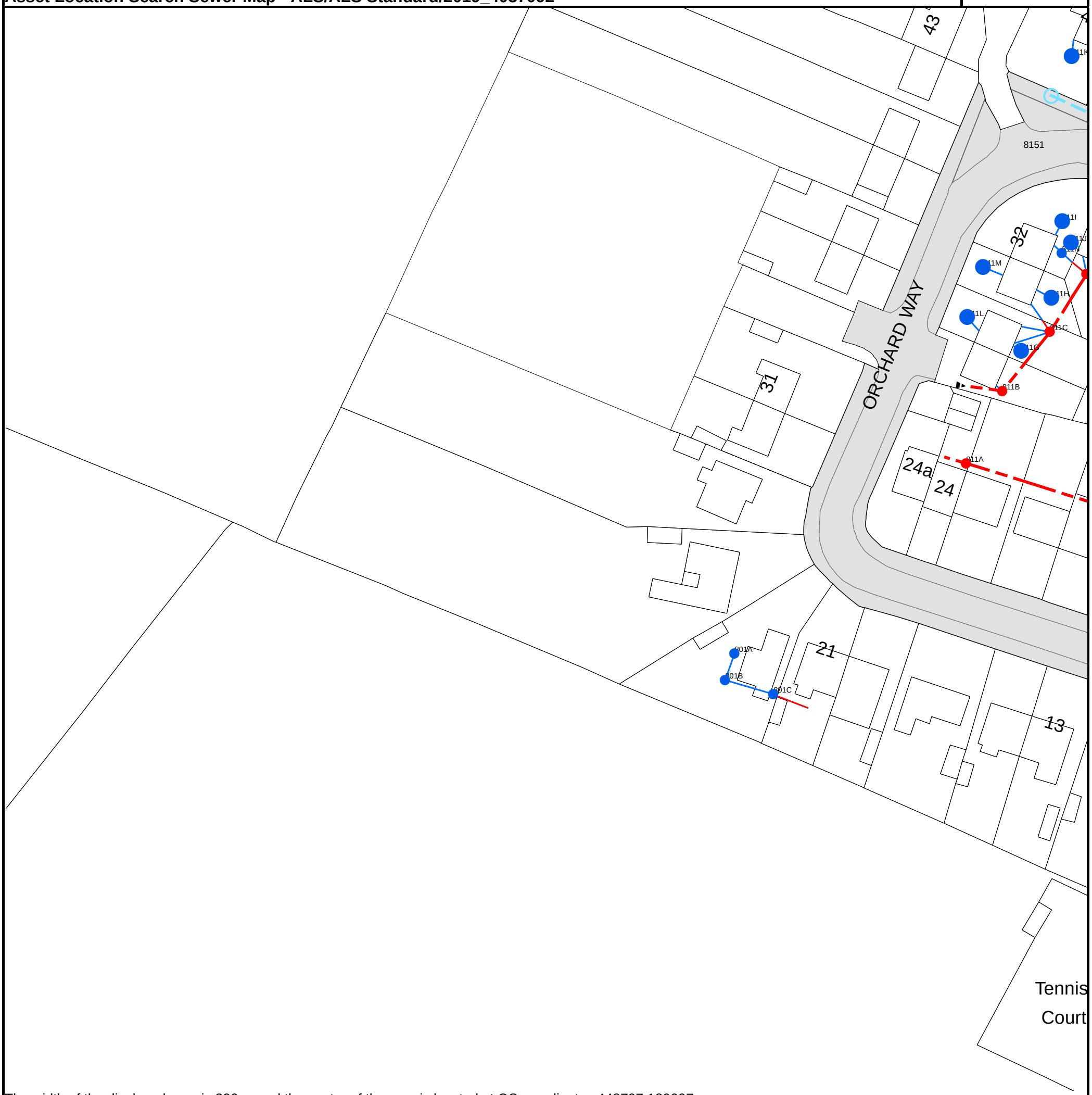
Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2019_4037092



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 448797,189097

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
811A	n/a	n/a
811B	n/a	n/a
811G	n/a	n/a
811C	n/a	n/a
811L	n/a	n/a
811H	n/a	n/a
811E	n/a	n/a
811M	n/a	n/a
811N	n/a	n/a
811J	n/a	n/a
811I	n/a	n/a
8151	81.9	80.54
811K	n/a	n/a
801B	n/a	n/a
801A	n/a	n/a
801C	n/a	n/a

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

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

ALS/ALS Standard/2019_4037092

0 10 20 40 60 80 Meters

Scale:	1:1792
Width:	500m
Printed By:	G1KANAGA
Print Date:	10/07/2019
Map Centre:	448796,189097
Grid Reference:	SU4889SE

Comments:

ALS/ALS Standard/2019_4037092

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
9055		78.78
9003	80.5	78.69
7855	91.21	90.2
7854	90.69	89.98
7852	88.95	87.59
9801	82.58	80.77
9152	80.83	79.56
9051	80.65	79.6
9851	81.72	81.1
9054	80.36	78.89
8901	84.2	82.49
8951	84.28	83.37
9951	82.11	80.83
6901	91.65	89.89
7802	89.76	87.6
0852	81.25	80.59
8801	86.03	84.36
921B		
911B		
011A		
011C		
081B		
031B		
031B		
9002	80.49	78.99
901B		
901D		
901E		
801B		
021A		
981B		
021G		
021F		
021D		
881B		
881E		
912B		
912C		
912F		
912I		
912K		
912P		
011J		
011L		
011N		
0101		
8202	81.99	80.7
9101	81.05	79.59
9103	80.54	78.95
811E		
911F		
811C		
811H		
811J		
911H		
911J		
911L		
911N		
911Q		
911S		
911T		
811K		
911W		
911Y		
821A		
911E		
811M		
912E		
912M		
912N		
011E		
011G		
011H		

REFERENCE	COVER LEVEL	INVERT LEVEL
0002	80.19	78.47
0904		
7803	90.87	89.26
7853	89.99	89.02
9902		
9052	80.64	79.67
9001	80.63	79.2
9903		
9151	80.51	79.18
8902		
8151	81.9	80.54
9153	81.4	79.59
5901	91.85	90.46
7801	89.83	87.79
9053	80.39	79
9901	81.02	79.63
921A		
911A		
921C		
011B		
081A		
031A		
081C		
901A		
901C		
811A		
801A		
801C		
021B		
021E		
021I		
021H		
881A		
881C		
912A		
811N		
811O		
912H		
912J		
912L		
011I		
011K		
011M		
011O		
8201	82.22	80.87
8203		
9102	80.87	79.46
811B		
811F		
911C		
811G		
811I		
911G		
911I		
911K		
911M		
911P		
911R		
911O		
911U		
911V		
911X		
911Z		
911D		
811L		
912D		
912G		
011D		
912O		
011F		
912Q		

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

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

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

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

Control Valve

Drop Pipe

Ancillary

Weir

End Items

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

Outfall

Undefined End

Inlet

Other Symbols

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

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plans are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole level indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Asset Location Search Water Map - ALS/ALS Standard/2019_4037092

The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 448797, 189097.

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

ALS/ALS Standard/2019_4037092

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

Scale:	1:1792
Width:	500m
Printed By:	G1KANAGA
Print Date:	10/07/2019
Map Centre:	448796,189097
Grid Reference:	SU4889SE

Comments:

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

Valves

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

Hydrants

- Single Hydrant

Meters

- Meter

End Items

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

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

Operational Sites

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

Other Symbols

- Data Logger

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

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

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

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

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0845 070 9148** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

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

Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if the Ombudsman finds that you have suffered actual loss and/or aggravation, distress or inconvenience as a result of your search provider failing to keep to the code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Web site: www.tpos.co.uk
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

Appendix 3

Intégrale
Understanding Ground Conditions

Suite 7, Westway Farm Business Park
Wick Road, Bishop Sutton,
Somerset BS39 5XP United Kingdom

Tel: 01275 333036
www.integrale.uk.com

Proposed Residential Development
Land to the Rear of 25-35 Orchard Way
Harwell
Didcot
Oxfordshire
OX11 0LH

GEOTECHNICAL AND PHASE 11 CONTAMINATION REPORT

REPORT NO. 19058, July 2019

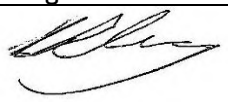
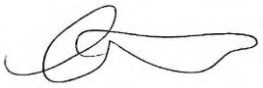
GEOLOGICAL • GEOTECHNICAL • ENVIRONMENTAL • ENGINEERING

Intégrale is a trading name of Integrale Limited
Registered Office: The Granary, Chewton Fields, Ston Easton,
Somerset, BA3 4BX, United Kingdom
Company Registration No. 2855366 England VAT Reg. No. 609 7402 37

Geotechnical and Phase II Contamination Report
Proposed Residential Development
Land to the Rear of 25-35 Orchard Way
Harwell
Didcot
Oxfordshire
OX11 0LH

Client: Feltham Construction Limited

Intégrale Report No. 19058, July 2019

		Signature/Date
Project Co-ordinator & Report Preparation:	Isabel Lees	
Mentor Consultant, Advice & Report Approved by:	Chris Whale	
Final Check by:	Dr Kay Boreland	

CONFIDENTIALITY STATEMENT

This report is addressed to and may be relied upon by the following:

Feltham Construction Ltd
42 London Road
Newbury
Berkshire
RG14 1LA

Integrale Limited has prepared this report solely for the use of the client named above. Should any other parties wish to use or rely upon the contents of this report, written approval must be sought from Integrale Limited. An assignment fee may then be charged.

Integrale Limited, Suite 7, Westway Farm Business Park, Wick Road, Bishop Sutton, Somerset, BS39 5XP, United Kingdom
Tel: 01275 333036 www.integrale.uk.com

Registered Office: The Granary, Chewton Fields, Ston Easton, Somerset, BA3 4BX, United Kingdom Company Registration No. 2855366 England

LIST OF CONTENTS

- EXECUTIVE SUMMARY –

Intégrale
Understanding Ground Conditions

Suite 7, Westway Farm Business Park
Wick Road, Bishop Sutton, Somerset,
BS39 5XP, United Kingdom

Tel: 01275 333036
www.integrale.uk.com

EXECUTIVE SUMMARY

19058 Land to the Rear of 25 – 35 Orchard Way, Harwell, OX11 0LH – Geotechnical and Phase 11 Contamination Report

Feltham Construction Ltd propose to develop this site by constructing 16 No. detached properties over two plots with associated private gardens, car parking and detached garage/ bike storage.

The geology map reports the Upper Greensand Formation over the entire site. Old maps show that the area had a predominantly agricultural usage until the late 1960's when the surrounding area became residential and Orchard Way was first constructed.

Intrusive investigation has established a veneer of Topsoil, a very localised mantle (c.0.5m) of Made Ground, and a continuous stratum of variably weathered, firm becoming stiff silty Clay (with bands of medium dense clayey gravel) to depths of about 1-2m below existing ground level. From c.1-2m depth, weak to moderately strong sandstone was proven to 2.5m depth.

The variably Weathered Upper Greensand can provide an adequate bearing stratum for reinforced strip footings with design bearing pressures of 150kN/m^2 at approximately 1m depth increasing to 250kN/m^2 at c.2m depth. A 'flexible' foundation raft or short bored piles are other alternative foundation solutions. It seems unlikely that vibro ground improvement will have any significant advantage on this site. Where new structures are very close to existing or proposed trees, consideration should be given to the inclusion of compressible material such as clayboard to accommodate ground heave at critical locations. Ground floor slabs may be designed as ground bearing assuming a 'weak' formation on clayey soils or 'normal' on granular soils. Design CBR values of at least 3-4% should adopted for clayey Weathered Greensand at 0.5m depth, increasing to 5+% for gravelly Weathered Greensand.

Design Sulphate Class of DS-1 and ACEC Class of AC–1d are appropriate for buried concrete, however, may require upgrading.

Based on the desk study and ground investigations completed to date, the risk posed to the development and the future user from a contaminated land viewpoint would appear to be low and no further investigations are recommended.

1.0 INTRODUCTION

Feltham Construction Ltd are proposing to develop this site by constructing 16 No. detached properties over two plots with associated private gardens, car parking and detached garage/ bike storage. The project architects are Feltham Properties Ltd.

Integrale Limited (Intégrale) are commissioned to undertake a ground investigation and complete a Geotechnical and Phase II Contamination report. The investigation scope was determined by Feltham Construction in liaison with Intégrale.

This interpretative report summarises desk studies, describes the scope of fieldworks, laboratory investigations and monitoring, discusses the ground and groundwater conditions encountered, and gives advice on foundations and other geotechnical aspects.

The results of contamination analyses and generic quantitative risk assessment are reported and used to establish a conceptual model of pollutant linkages. Potential implications for the development are discussed and recommendations for further investigation or potential remedial works or design measures given.

2.0 THE SITE

2.1 Location and Description

As shown in Appendix A, the site is located on the land to the rear of 25-35 Orchard Way, Harwell, Didcot. It has a central Ordnance Survey Grid Reference of 448800E, 189133N and postcode OX11 0LH.

The site consists of two plots; Plot 1 being directly adjacent to the gardens of No. 29-35 Orchard Way and Plot 2 being the building and garden of No. 25 Orchard Way. Notes describing the site were prepared during the site visit and are included as Appendix B, together with typical photographs. The main features and pertinent aspects on the site and immediately adjacent land are summarised below, and annotated on Figure 1:

Plot 1: Square plot behind 29 – 35 Orchard Way

Current Use	Public open green space.
Site Area & Plan Shape	c.0.23 hectares. Square plan shape.
Maximum Dimensions	c.45m SW – NE x c.50m NW – SE.
Ground Slopes & Topography	c.82 - 83m AOD with a slightly higher elevation on the NW side according the topographic survey.
Buildings & Condition	Not applicable.
Surfacings & Condition	100% soft landscaping.
Vegetation & Trees	Dense bramble scrub along the NW border. Sporadic mature trees along the NE border.
Water Courses	Not applicable.
Site Boundary Features	NE – Garden of No. 43 Orchard Way, NW – Agricultural Field, SE – Residential properties 29 - 35, SW – Garden of No. 27 Orchard Way.
Potential Contamination Issues	None identified.
Potential Geotechnical Issues	None identified.

Plot 2: Garden of No. 25 Orchard Way

Current Use	Garden, property and driveway No. 25 Orchard Way.
Site Area & Plan Shape	Rectangular garden = c.0.16 hectares. Triangular driveway area = c.0.04 hectares
Maximum Dimensions	c.65 x c.25m garden & c.30m x c.25m driveway area.
Ground Slopes & Topography	c.82 - 83m AOD according to the site survey. Relatively flat site.
Buildings & Condition	Single storey property. No signs of distress.
Surfacings & Condition	Soft landscaped garden and gravel driveway.
Vegetation & Trees	Fruit trees at the NW end of the plot. Large bush and mature tree on the SW boundary.
Water Courses	Not applicable.
Site Boundary Features	NW – Agricultural field, NE – Garden of No. 27 Orchard Way, SE – garden of No. 21 Orchard Way, SW – Field.
Potential Contamination Issues	None identified.
Potential Geotechnical Issues	None identified.

2.2 Published Geology

2.2.1 British Geological Survey (BGS) Mapping

BGS geological maps indicate the following strata beneath and adjacent to the site:

Map / Scale	Sheet 253 Abingdon (1971) at 1:63,360 scale.
Artificial Ground	On-Site – None recorded.
Superficial Deposits	On-Site – None recorded.
Solid Geology	On-Site – Upper Greensands Formation – Calcareous Sandstone and Siltstone (early Cretaceous)
Geological Features	None within 500m.

The BGS type description of the Upper Greensand Formation is as follows, '*Sand and sandstone, fine-grained, silt, glauconitic, shelly*'.

2.2.2 BGS Previous Investigation Records

Previous investigation records available on the BGS website under the Open Government Licence include trial pits and boreholes sunk to 4.5 m and situated c.600m northeast. This proved:

- GL to 0.25m – TOPSOIL
- 0.25 to 2.25m – MADE GROUND
- 2.25 to 4.5m – Dense clayey sandy SILT with inclusions of weak siltstone (UPPER GREENSAND)

Groundwater strikes were encountered at 1.4 and 1.9m depth.

2.3 Previous Investigations

No previous investigations within 500m of the site in the same anticipated geology were found.

2.4 Outline History

Historical maps obtained from a Groundsure report are included in Appendix C. These indicate the following pertinent information:

Map Date	Site Features/Land Use	Adjacent Features (distance from site)
1876	Site comprised of undeveloped agricultural fields.	Limetree House Farm situated c.240m E. Adjacent to agricultural fields in all directions.
1899	No significant changes.	Boundary of an orchard c.80m NE.
1933	No significant changes.	Orchard has expanded slightly.
1969	Two detached buildings with gardens were constructed in the SE corner.	Orchard Way was constructed, consisting of multiple semi-detached properties (immediately E). Recreation Ground directly S. Substation c.50m NE. Fields to the W.
1990-1994	No significant changes.	No significant change except an orchard has been established in the area to the W.

2.5 Geological Information

The following pertinent information on activities within 250m of the site has been extracted from the Groundsure report.

2.5.1 Ground Working and Mining

Historical Surface and Underground Working Features	None within 500m.
Current Ground Workings	None within 100m.
Mining, Extraction and Natural Cavities	110m SW – Potentially sporadic underground mining of chalk.

2.5.2 Natural Ground Subsidence

	Hazard Rating
Shrinking/Swelling Clay Ground Stability Hazard Potential	Negligible.
Landslide Ground Stability Hazard Potential	Very Low.
Ground Dissolution Stability Hazard Potential	Negligible.
Compressible Deposits Ground Stability Hazard Potential	Negligible.
Collapsible Deposits Ground Stability Hazard Potential	Very Low.
Running Sands Ground Stability Hazard Potential	Very Low.

2.6 Background Soils Chemistry

The Groundsure report includes BGS estimated background soil chemistry for 5 metals within shallow soils. This indicates that naturally occurring arsenic (As), cadmium (Cd), chromium (Cr), nickel (Ni) and lead (Pb) are not raised in this area. Interpretation suggests that at these levels, such metals would be unlikely to exceed generic assessment criteria for residential. Current National Planning Policy guidance does not consider naturally occurring metals as evidence of contamination.

2.7 Environmental Information

The following pertinent information on activities within 250m of the site has been extracted from the Groundsure report.

2.7.1 Historical Industrial Sites

Potentially Contaminative Uses	Electricity Substation	40m NE (1969-1990)
Potentially Infilled Land	None within 250m	

2.7.2 Environmental Permits, Incidents and Registers

	Details	Distance/ Direction
Historic IPC Authorised sites	-	-
Records of Part A (1) and IPPC Authorised Activities	-	-
Records of Red List Discharge Consents	-	-
Records of List 1 Dangerous Inventory Sites	-	-
Records of List 2 Dangerous Substance Inventory Sites	-	-
Records of Part A (2) & Part B Activities and Enforcements	-	-
Records of Category 3 or 4 Radioactive Substances Authorisations	-	-
Records of Licenced Discharge Consents	-	-
Water Industry Referrals (discharges to public sewer)	-	-
Planning Hazardous Substance Consents & Enforcements	-	-
COMAH & NIHHS Sites	-	-
National Incident Recording System List 1 & 2	-	-
Contaminated Sites under Part 2A EPA 1990	-	-

2.7.3 Landfill and Other Waste Sites

	Details	Distance/ Direction
Historic and Current Landfill Sites	-	-
Waste Treatment/Transfer/Disposal Sites	-	-

2.7.4 Current Land Uses

	Details	Distance/ Direction
Current Industrial Sites	Electricity Substation	44m NE
Petrol and Fuel Sites	-	-
NG High Voltage Underground Electricity Transmission cables and High-Pressure Gas Transmission Pipelines	-	-

2.8 Hydrogeology & Hydrology

2.8.1 Aquifers

Aquifer within Superficial Deposits	Not applicable.
Aquifer within Bedrock Deposits	Principal Aquifer.

Aquifer Definitions	
Principal Aquifers	**Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale**

2.8.2 Surface and Groundwater Abstraction Licences

	Number	Distance/ Direction
Surface Water Abstraction licences	None within 250m.	
Groundwater Abstraction licences		
Potable Water Abstraction Licences		

2.8.3 Source Protection Zones

	Number	Distance/ Direction
Source Protection Zones	None within 250m.	
Source Protection Zones within Confined Aquifer		

2.8.4 Groundwater Vulnerability and Soil Leaching Potential

Soils Permeability	Intermediate leaching potential.
Anticipated Groundwater Table Depth	Between 5-10m depth.
Anticipated Groundwater Flow Direction	SW to NE.

2.8.5 Detailed River Network and River Quality

Surface Water Courses and Flow Direction	347m E and 427m NW.
Biological River Quality	None identified.
Chemical River Quality	None identified.
Environment Agency Soils Classification	None identified.
Surface Water Features	None identified.

2.8.6 Flood Risk

Zone 2 and Zone 3 River and Coastal Zone Flooding Areas	None identified.
Flood Rating (Risk of Flooding from Rivers and the Sea)	Very Low.
Flood Defences	None identified.
Areas benefiting from Flood Defences and Flood Storage	None identified.
Groundwater Flooding Susceptibility Areas	Clearwater Flooding – Associated with unconfined aquifers.

2.9 Environmentally Sensitive Sites

The Groundsure report highlights the following sites on or within influencing distance of the site, which could have an impact within the planning process for this site.

Identified designated environmentally sensitive sites	Area of Outstanding Beauty (AONB) - North Wessex Downs (195m SW).
Nitrate Vulnerable Zones	On-Site.

2.10 Groundsure Radon Risk Information

The Groundsure report (Appendix C) indicates that the specific site does not lie within a Radon Affected Area, as less than 1% of the properties are above the action level.

Where Groundsure conclude that no radon gas protection methods are needed, the local authority may have more conservative requirements, based on the indicative maps, and this aspect should be confirmed with their Building Control department.

2.11 Unexploded Ordnance (UXO)

A preliminary screening for the site was requested and completed by 1st Line Defence. A copy of the report is included in Appendix D. Overall 1st Line Defence stated that,

'*Given the findings of this preliminary report it is recommended that no further action be taken in regards to this site*'.

Consequently, this matter is not considered further.

3.0 CONCEPTUAL EXPOSURE MODEL

3.1 General

This section draws together desk study information, outlines an initial conceptual exposure model, and provides a qualitative assessment of potential contamination via a source-pathway-receptor framework for the proposed development.

3.2 Proposed Development

Details of the proposed development are shown on Appendix D and can be summarised as:

Buildings	16 detached properties over two plots with garage/ bike storage.
Car Parking	2 No. car park spaces per property (32 No. in total).
Access Roads	Access roads to be built from Orchard Way.
Landscaping	Traditional private gardens.
Anticipated Foundations and Floor Slabs Shown on Preliminary Drawings	Currently unknown.
Building Level	Presumed at existing grade.

3.3 Potential Sources of Contamination

The desk study has been used to identify the likely remnant contaminant sources and distribution. The potential current and historical on- and off-site sources and the contaminants associated with these, derived using CLR8 Potential Contaminants for the Assessment of Land, and through experience of industrial land use, are detailed below.

Potential Contaminants Associated with On-Site Sources			
Description	Metals, semi-metals, non-metals, inorganic chemicals and others	Organic chemicals	Ground Gases & Vapours
No on-site potential contamination.			

Potential Relevant Contaminants Associated with Off-Site Sources			
Description	Metals, semi-metals, non-metals, inorganic chemicals and others	Organic chemicals	Ground Gases & Vapours
Electricity substation (44m NE)	As, B, Cd, Cr, Cu, Pb, Hg, Ni, Zn, NO3-, SO42-, S2-, asbestos, pH	Aromatic hydrocarbons, chlorinated aliphatic hydrocarbons, PCBs	-

3.4 Potential Pathways

To understand the potential risks posed by the contaminants to human receptors, the possible contaminant pathways need identified. The CLEA model (DEFRA & EA 2002) indicates potential exposure routes for assessing risks to human health for a residential setting with home-grown produce uptake as follows:

- Dermal exposure;
- Inhalation of particulates;
- Inhalation of soil vapour (indoor and outdoor);
- Inhalation of groundwater vapour (indoor and outdoor);
- Direct ingestion of soil;
- Ingestion of home-grown produce and soil attached to vegetables.

The potential pathways with respect to Controlled Waters will include:

- Downward migration through Made Ground and to underlying Principal Aquifer;
- Lateral migration through Made Ground to surface water;
- Lateral migration through groundwater to surface water;
- Lateral migration via man-made pathways (e.g. services) to surface water.

3.5 Potential Receptors

For a residential end use and the known neighbouring land uses, the potential receptors to contamination (if present on site) are:

- Immediately adjacent residents – critical receptor female child;
- Construction workers – critical receptor female adult;
- Future site users – critical receptor female child.

The likely sensitive Controlled Waters receptors are considered to be:

- Principal Aquifer (On-Site);
- Tributary of the River Thames, (347m E);
- Tributary of the River Thames, (427m NW).

Due to the topography of the site and surroundings, continuity of geological strata and drainage pattern the Principal Aquifer is considered the most likely receptor.

3.6 Conceptual Site Model with Respect to Human Health

The conceptual site model has been developed based upon the source-pathway-receptor linkages.

SOURCE		PATHWAY		RECEPTOR
Contaminated soils	→	Dermal exposure	→	On-site female child
Contaminated soils	→	Inhalation of soil dust	→	On-site female child
Contaminated soils	→	Indoor/Outdoor inhalation of soil vapour	→	On-site female child
Contaminated groundwater	→	Inhalation of groundwater vapours	→	On-site female child
Combustible/toxic ground gases	→	Indoor inhalation	→	On-site female child
Contaminated Soils	→	Direct ingestions of soil	→	On-site female child
Contaminated soils	→	Ingestion of homegrown produce and soil attached to vegetables	→	On-site female child

3.7 Conceptual Site Model with Respect to Controlled Waters

The conceptual site model has been developed based upon the source-pathway-receptor linkages.

SOURCE		PATHWAY		RECEPTOR
Contaminated soils	→	Leaching from soils or migration of liquid contaminants through the unsaturated zone.	→	Aquifer
Contaminated soils	→	Leaching from soils or migration of liquid contaminants through service runs	→	Aquifer
Perched water contamination	→	Transport in groundwater	→	Aquifer
Groundwater contamination	→	Transport in groundwater	→	Aquifer

4.0 GROUND INVESTIGATION

In view of the anticipated ground conditions, current site layout and proposed development, the following scope of investigation was completed.

4.1 Trial Pitting

4 No. trial pits were mechanically excavated using a 4T excavator on 21st May, 2019. The trial pit locations, chosen by Intégrale, are shown on Figure 1 and were referenced as TP 1 - 4. The general procedures adopted during trial pitting, together with the detailed trial pit records are included in Appendix D.

Originally Feltham Construction requested trial pitting to be completed in Plot 2. However, due to access restriction this was not possible.

4.2 Soakaway Tests

A soakaway test was attempted in TP1. The trial pit was filled from a bowser and the water level measured over time. The general procedures adopted during soakaway testing together with the soakaway records are included in Appendix E and discussed in Section 6.

4.3 Lined Sampling Boreholes

5 No. small diameter boreholes were drilled with a tracked, open-drive percussive lined sampler rig on 21st May, 2019. These borehole locations, chosen by Intégrale, are shown on Figure 1 and were referenced as WS 1 - 5. Boreholes were sunk to 2m depth. The general procedures adopted during windowless sampling, together with the detailed borehole records are included in Appendix F.

4.4 Groundwater and Soils Gas Standpipe Installations and Monitoring

Standpipes were installed in 2 No. boreholes, one in each of the plots, typically to 2m depth, and details are given on the borehole records. Monitoring has been undertaken on 3 No. occasions and the results are included in Appendix G, together with the general procedures adopted for installing standpipes.

4.5 Geotechnical Laboratory Testing

A schedule of complementary soils testing was prepared by Intégrale and the tests by SW Geotechnical Ltd and I2 Analytical Ltd. The results are provided in Appendix H and I and the following shows the testing strategy:

Location	Depth (m)	Stratum	Testing	Criteria for test selection
WS5	0.7	WUG	BRE Reduced Suite	Concrete classification
WS1	0.8	"	"	"
WS3	1.3	"	"	"
WS4	0.5	"	"	"
TP1	0.5	"	Natural Moisture Content and Atterberg Limit	Strata classification and characteristics
TP3	0.9	"	"	"
WS2	1.00	"	"	"
TP4	0.4	"	Natural Moisture Content	Strata characteristic
WS3	0.7	"	"	"
WS7	1.3	"	"	"

*WUG - Weathered Upper Greensand

4.6 Contamination Analyses

In view of the desk study and fieldwork findings, a schedule of soils analyses was prepared. The analyses were completed by I2 Analytical Ltd and the results are provided in Appendix I. The following shows the testing strategy:

Location	Depth (m)	Stratum	Testing	Criteria for test selection
WS1	0.3	MG	WAC 2 Stage	Waste Classification
TP2	0.1	"	WAC 2 Stage	"
TP3	0.1	"	Generic Contamination Suite, Total TPH and Asbestos Screen.	Contamination classification and characterisation
WS2	0.2	"	"	"
WS3	0.05	"	"	"
TP1	0.1	TS	"	"

*MG – Made Ground
TS - Topsoil

4.7 Referencing

Locations of the exploratory positions were set out using taped offsets from existing features.

5.0 GROUND & GROUNDWATER CONDITIONS

5.1 Summary of Strata Encountered

The strata encountered across the site are broadly similar as shown on the tentative geological cross-section in Figure 2. They can be summarised as follows:

Depth (m)	Description
GL to 0.1/0.2	TOPSOIL
0.l/0.2 to 0.15/0.45	MADE GROUND: (Comprising firm slightly sandy slightly gravelly silty Clay)
0.15/0.4 to 1.1/2.0	Firm becoming stiff slightly gravelly silty sandy CLAY with occasional bands of sandstone gravel. (WEATHERED UPPER GREENSAND FORMATION)
1.1/2.0 – 1.45/2.5	Moderately weak to moderately strong SANDSTONE (UPPER GREENSAND FORMATION)
1.45/2.5+	Refusal on SANDSTONE (UPPER GREENSAND FORMATION)

No ground water was encountered to the depths investigated.

5.2 Strata Properties

5.2.1 Made Ground and Topsoil

Topsoil, typically 10 - 25mm thick, was proven in all the exploratory positions. Made Ground was proven in several of the exploratory positions and can be categorised as:

Made Ground Type/Location	Silty Clay
Min/Max. thickness (m)	0.1 - 0.4m proven.
Main Constituents	Brick, wood, charcoal and sandstone.
Properties	Soft to firm. SO4: 0.051 – 0.107%. pH: 7.3 – 7.6.
Visual Contamination/Odours	None.

5.2.2 Weathered Upper Greensand Formation

For the purposes of this report the uppermost horizons of the natural ground have been defined as weathered where firm becoming stiff silty clay is encountered and relatively un-weathered where weak to moderately strong sandstone is encountered. The properties can be summarised as

Stratum	Weathered Upper Greensand Formation (Clay)	Upper Greensand Formation (Sandstone)
Min / Max Thickness (m)	0.9 to 1.6m proven.	0.1 to 1.4m proven.
Soil Strength /Properties	Firm becoming stiff. SPT N = 10 – 25.	Weak to moderately strong. SPT N – refusal between 1.8 and 2.0m depth.
Occurrence	Proven across complete site.	Proven across complete site.
Sulphate /pH	SO4 0.025 – 0.064g/l, 7.7 – 8.4pH	-
Visual Contamination/ Odours	None.	None.

5.3 Groundwater

Groundwater was not proven in any of the exploratory positions during the site investigation or subsequent monitoring visits.

5.4 Ground Gas

The monitoring indicates slightly elevated carbon dioxide present in both boreholes. A maximum flow rate of 0.1 l/hr was recorded. Summary results are detailed below with full information provided in Appendix F.

Exploratory Location	WS1	WS5
Response Zone (m) / Strata	WUG	WUG
Evidence of Contamination	None.	None.
Monitoring Visits (No.)	3	3
Methane (%)	0.0-0.1	0.0-0.1
Carbon Dioxide (%)	2.3-2.6	2.2-6.3
Oxygen (%)	12.0-18.9	14.6-18.7
Gas Flow (litres/hr)	0.0-0.1	0.0-0.1
Water levels (m)	DRY	DRY
Atmospheric Pressure Range (mb)	994-1020	994-1020

*WUG -Weathered Upper Greensand

6.0 GEOTECHNICAL CONSIDERATIONS

6.1 Scheme Details & Structural Loadings

The proposed housing development will be constructed at, or close to, existing grade, locally on shallow (c.0.5m) upfilling. Intégrale understand that the development is to comprise sixteen 2-storey detached houses of load bearing masonry (and/or timber framed) construction with detached garages. Foundation line loads could be between 50 - 100kN/m run. Combined 'dead' and 'live' loading on the ground floor slabs will be less than 10kN/m^2. The development will also include new access roads, car parking, conventional gardens and perhaps limited, managed communal soft landscaping.

6.2 Site Preparation and Earthworks

Topsoil, typically 200mm thick, and any localised areas of particularly poor quality Made Ground, should be removed from beneath proposed building and hardstanding areas. Excavations to at least 1.5 - 2m depth are likely to be feasible with conventional soils excavating machinery. Pneumatic tools may be required to break out existing foundations, masonry obstructions, but more importantly sandstone bands in the bedrock.

Much of the spoil resulting from excavations in the existing Made Ground may prove be unsuitable for reuse as structural fill. At least 25 – 50% of spoil resulting from excavations in the Weathered Greensand should be suitable for reuse, except where invaded by roots and rootlets.

Whilst some excavations to 2m depth may well remain dry, others may encounter slight or moderate infiltration/ perched water seepage. Such excavations can be kept dry by intermittent pumping from a convenient sump, unless they simply soak away.

Temporary excavations in the existing Made Ground and variably weathered Greensand will probably stand unsupported in the short term at gradients of about 1 on 2 or a little steeper. Excavations below approximately 1m depth will require sheeting and shoring, particularly if personnel are to enter. Formations in the more clayey soils will be slightly susceptible to deterioration due to site traffic and weather and should be protected immediately on exposure with 150mm of granular material, or 75mm of lean mix concrete. All desiccated and root invaded (particularly) clayey soils should be excavated and made good with well compacted granular material.

6.3 Foundations and Ground Floor Slabs

6.3.1 Typical Ground Conditions

The investigation has proven a veneer of Topsoil, a very localised mantle (c.0.5m) of existing Made Ground, and a continuous stratum of variably weathered, firm becoming stiff silty Clay (with bands of medium dense clayey gravel) to depths of about 2m below existing ground level. At 1 - 2m depth is a weak becoming moderately strong sandstone, proven to 2.5m. The groundwater table appears to be below this depth and consequently the variably weathered Greensand can provide an adequate bearing stratum for strip footings.

6.3.2 Design Bearing Pressures for Strip Footings

The following design bearing pressures are given for guidance:

Depth (m) BEGL	Stratum (SPT 'N')	Design Bearing Pressure (kN/m^2)		
		1m*	2m*	3m*
c.1.0m	Firm to stiff/ medium dense WG. (N=15)	150	125	-
c.2.0m	Very weak Greensand Sandstone (N=50) (Only proven to shallow depth)	250	225	-

* WG = Weathered Greensand

All foundations must be in line with the recommendations and guidance given in NHBC Chapter 4.2 'Building near Trees'. The classification tests suggest that the founding strata will be of medium to high plasticity and shrinkage potential.

The bearing pressures given above, are inevitably 'conservative' because the deeper underlying strata have not been proven. At the intensities of loading given above, total settlements should not exceed 25mm, and angular rotation along a typical 10m long (mesh reinforced) strip footing of not worse than 1 in 750. There will be variations in formation compressibility (clay v sandstone) and consequently light gauge mesh reinforcement should probably be included in all footings to even out differential settlement.

Deeper strip footings may result in significant quantities of excavation spoil and if it is inconvenient to relocate surplus material safely on-site, consideration may be given to short bored piles.

Where new structure is very close to existing (or proposed) trees and roots are anticipated, consideration should be given to inclusion of compressible material (clayboard etc) to accommodate ground heave at 'critical' locations.

6.3.3 Other Shallow Reinforced Spread Foundations

Consideration may be given to the adoption of a 'flexible' foundation raft, where there is continuity of reinforcement, poured monolithically, and where the intensity of loading on the underside varies. This type of raft is relatively inexpensive. Intégrale can give further advice on flexible rafts, on request.

6.3.4 Ground Improvement

It seems unlikely that vibro ground improvement will have any significant advantage at this site. Indeed, it is unlikely that the minimum penetration of 2m depth, could be achieved in all areas.

6.3.5 Piles

Short bored piles are an alternative foundation solution and would have some advantages for construction close to trees of high-water demand. Intégrale can give further advice on request.

6.3.6 Ground Floor Slabs

Ground floor slabs may be designed as ground bearing (assuming a 'weak' formation on clayey soils, or 'normal' on granular soils). In line with NHBC guidelines, suspended ground floor slabs (e.g. 'beam and block' type or similar) should be adopted where the slab will be underlain by 600mm or more of 'non-engineered' Made Ground.

6.3.7 Inspection

All foundation, ground slab and other substructure formations should be checked and approved by a suitably qualified and experienced engineer or geotechnical specialist, who can also give guidance on the need for mesh reinforcement to even out formation compressibility as appropriate.

6.4 Pavement Design

The equivalent CBR strength of anticipated pavement formations has either been determined using a Mexecone Penetrometer or judged based on past experience in similar materials. The following (tentative) design values are given for guidance:

Stratum	Design CBR	Typical Depth (m) BEGL
Existing Made Ground	2%	0.5m
Clayey WG	3-4%	0.5m
Gravelly WG	5+%	0.5-1m

* WG = Weathered Greensand

It would be prudent to allow a contingency for treating 'soft-spots' equivalent to 25% of the proposed hardstanding area to a depth of typically 350mm. All soft spots should be excavated and replaced with suitable well compacted granular material. Where there could be rapid variations in formation strength, consideration should be given to a sandwiched geogrid construction which will help even out those variations to within acceptable limits. Intégrale can give further guidance on request.

6.5 Earth Pressures and Retaining Walls

Foundations for retaining walls can be based on the allowable design bearing pressures given in section 5.3.2. Earth pressures may be calculated assuming the following effective shear strength parameters:

Stratum	Effective Cohesion C' (kN/m²)	Effective Angle of Friction Ø' (degrees)	Bulk Density (Mg/m³)
Clayey WG	Zero	25°	1.85
Gravelly WG	Zero	30°	1.85
Sandstone	Zero	35°	2.00

6.6 Protection of Buried Concrete

In line with BRE Special Digest 1:2005 'Concrete in Aggressive Ground', 4 no. samples weathered Upper Greensand Formation were tested for water soluble sulphate, total acid soluble sulphate, total sulphur and pH.

The desk study and ground investigation indicate the site can be categorised as being:

- Natural ground unlikely to contain pyrites
- Mobile groundwater conditions, water will flow into excavations or percolate slowly through the ground.

The results show a highest water-soluble sulphate of 102mg/l. The lowest value for pH was 7.7. The results for total acid soluble sulphate (0.025% to 0.064%) and total sulphur (0.01% to 0.019%) indicate pyrite is not present. It is therefore recommended that a Design Sulphate Class of DS - 1 and an ACEC Class of AC-1d be adopted for budgeting purposes.

6.7 Drainage Considerations

The client requested soakaway trials in one investigation location. A water bowser and pump were therefore used to fill the trial pit to 1.0m depth. The drop in water level was recorded over time, and the results are included in Appendix D. Within approximately 170 minutes, the water level had only dropped by 95mm. Extrapolated results suggest an extrapolated infiltration rate in the order of 2.9x10-6m/s.

This correlates with the high silt content in the natural soils. Once the design layout is 'frozen', supplementary trials at specific locations and appropriate depths should be completed to confirm the above and Intégrale can give further assistance with this aspect if required.

6.8 Contamination Considerations

The trial pits and boreholes were completed primarily for geotechnical purposes. In addition, the client requested limited preliminary contamination analyses on soils.

Current guidance means that without completing a detailed environmental desk study, conceptual model and targeted investigation, it is not possible to make more than preliminary comments on the likelihood of remnant contamination at this site. However, as an initial stage of assessment, the soils results have been compared against:

- The AC adopted are the published LQM/CIEH Suitable For Use Levels (S4UL's), for a generic residential with plant uptake end-use, adopted under licence no. 3580. These provide a precautionary approach, based on the principle of minimal or tolerable risk, but relying on conservative values for soil type (sandy loam) and organic matter contents of 1, 2.5 or 6% as appropriate. Where no S4UL is published, e.g. lead, the alternative AC is the most recently published industry standard value.
- ICRCL 59/83 Phytotoxic thresholds.
- Water Regulation Advisory Scheme guidance on water supply pipes.

The results given in Appendix I highlights the following 'significant' values:

Location	Depth (m)	Stratum	Contaminants
WS3	0.05	MG	Chromium > WRAS Zinc > PHYTO

The three gas monitoring visits have proven elevated carbon dioxide in both boreholes. This suggests a near normal gas regime.

2 No. two stage WAC tests were completed on Made Ground samples from Plot 1 and Plot 2. The results confirmed that surplus spoil can be sent to an **inert** waste landfill site.

Based on the desk study and ground investigations completed to date, the risk posed to the development and the future user from a contaminated land viewpoint would appear to be low and no further investigations are recommended.

A watching brief should be kept at all times while groundworks are occurring. Should any signs of unforeseen contamination be found during groundworks, Intégrale should be contacted immediately to determine the best course of action.

Copies of this report should be provided to the local authority to confirm their agreement with the findings and recommendations.

Intégrale
Understanding Ground Conditions

Trial Pit Log

Trialpit No
TP1
Sheet 1 of 1

Project Name: Orchard Way	Project No. 19058	Co-ords: - Level:	Date
Location: Harwell, OX11 0LH		Dimensions (m): Depth	Scale 1:15
Client: Feltham Construction Limited			Logged

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.20			TOPSOIL: (Soft dark grey brown slightly sandy slightly gravelly silty Clay. Gravel is subangular fine to coarse sandstone. Large roots).
	0.50	D		1.20			Firm brown grey slightly gravelly silty sandy CLAY. Gravel is subangular fine to coarse sandstone.
	1.40	D		1.45			Moderately weak to moderately strong grey green SANDSTONE in a silty clay matrix.

1
2
3

Remarks: Mexicone at 0.6m - 4, 6, 6, refusal. Soakaway completed. Relatively hard digging at 1.2m depth. Stable walls.

Stability:

Intégrale
Understanding Ground Conditions

Trial Pit Log

Trialpit No
TP2
Sheet 1 of 1

Project Name: Orchard Way	Project No. 19058	Co-ords: - Level:	Date
Location: Harwell, OX11 0LH		Dimensions (m): Depth	Scale 1:15
Client: Feltham Construction Limited			Logged

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES					TOPSOIL: (Comprising soft grey slightly gravelly silty Clay. Gravel is subangular to subrounded fine to coarse brick, wood, flint and charcoal).
				0.25			Firm grey green mottled orange slightly sandy slightly gravelly silty CLAY. Gravel is subangular fine to coarse very weak sandstone.
	0.60	D					
							Becoming stiff at 1.0m depth.
	1.30	B					
				1.40			Grey green SANDSTONE recovered as gravel in a silt clay matrix.
				1.75			

1
2
3

Remarks: Refusal at 1.75m on sandstone bedrock. Relatively hard digging below 1.4m depth. Relatively stable walls.

Stability:

Intégrale
Understanding Ground Conditions

Trial Pit Log

Trialpit No
TP3
Sheet 1 of 1

Project Name:	Orchard Way	Project No. 19058	Co-ords: - Level:	Date
Location:	Harwell, OX11 0LH		Dimensions (m): Depth	Scale 1:15
Client:	Feltham Construction Limited			Logged

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES					TOPSOIL: (Comprising soft dark grey slightly gravelly silty Clay. Gravel is subangular fine to coarse brick, charcoal and woods).
				0.20			Firm grey slightly sandy slightly gravelly silty to very silty CLAY. Gravel is subangular fine to coarse sandstone.
	0.50	D					
				0.80			Stiff grey green mottled orange slightly sandy slightly gravelly silty CLAY. Gravel is subangular fine to coarse sandstone.
	0.90	D					
				1.10			Very thinly to thinly bedded weak to moderately strong SANDSTONE recovered as gravel in a silty sandy clay matrix. *Sandstone beds typically c.3cm thick.*
	2.30	D					
				2.50			

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Remarks: Refusal at 2.5m on sandstone bedrock. Relatively easy digging below 1.1m depth. Mexicone at 0.6m - 4, 3.5, 4, 4.5, refusal.

Stability:

Intégrale
Understanding Ground Conditions

Trial Pit Log

Trialpit No
TP4
Sheet 1 of 1

Project Name: Orchard Way	Project No. 19058	Co-ords: - Level:	Date
Location: Harwell, OX11 0LH		Dimensions (m): Depth	Scale 1:15
Client: Feltham Construction Limited			Logged

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.05	ES		0.10			TOPSOIL: (Comprising soft dark grey slightly sandy silty Clay. Rare gravel of charcoal).
	0.40	D					Firm grey slightly sandy slightly gravelly silty CLAY. Gravel is subangular fine to coarse sandstone).
	0.95	D					*Light grey at 0.95m depth.*
				1.10			Very thinly to thinly bedded grey green with streaks of orange weak to moderately strong SANDSTONE recovered as gravel and cobbles in a silty clay matrix. *Sandstone beds typically 2-3cm thick.*
							Sandstone beds typically 4-5cm thick.
				2.15			

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Remarks: Refusal at 2.15m on sandstone bedrock. Relatively hard digging below 1.1m depth. Mexicone at 0.45m - 3.5, 3.5, refusal.

Stability:

Intégrale
Understanding Ground Conditions

Borehole Log

Borehole No.
WS1
Sheet 1 of 1

Project Name: Orchard Way	Project No. 19058	Co-ords: -	Hole Type WLS
Location: Harwell, OX11 0LH		Level:	Scale 1:25
Client: Feltham Construction Limited		Dates: - 21/05/2019	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.05	ES		0.10			TOPSOIL: (Soft to firm dark grey slightly sandy slightly gravelly silty Clay. Gravel is subangular to angular fine to medium flint and sandstone. Occassional pieces of wood).
		0.30	ES		0.40			MADE GROUND: (Comprising soft slightly sandy slightly gravelly silty Clay. Gravel is subangular to angular fine to coarse brick, sandstone, wood and charcoal).
		0.80	D		1.00			Firm brown slightly sandy slightly gravelly silty CLAY. Gravel is subangular fine to coarse sandstone.
					1.25			Medium dense GRAVEL in a silty clay matrix. Gravel is subangular to angular fine to coarse sandstone.
					1.40			Firm grey green locally orange slightly sandy slightly gravelly to gravelly silty CLAY. Gravel is subangular fine to coarse sandstone.
					1.95			Stiff grey green with thin streaks of orange and white slightly sandy slightly gravelly silty CLAY. Gravel is subangular fine to coarse sandstone.
								Occassional orange old plant rootlet structures.

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Remarks
Refusal on sandstone.

Intégrale
Understanding Ground Conditions

Borehole Log

Borehole No.
WS2
Sheet 1 of 1

Project Name: Orchard Way	Project No. 19058	Co-ords: -	Hole Type WLS
Location: Harwell, OX11 0LH		Level:	Scale 1:25
Client: Feltham Construction Limited		Dates: - 21/05/2019	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.15			TOPSOIL: (Comprising soft ot firm dark grey brown slightly sandy slightly gravellly silty CLAY. Gravel is subangular fine to medium brick, flint and sandstone).
		0.20	ES		0.40			MADE GROUND: (Comprising firm grey slightly sandy slightly gravelly silty Clay. Gravel is subangular fine to medium brick, charcoal, brick, flint, wood and sandstone).
		1.00	ES		1.95			Stiff grey green slightly sandy slightly gravelly silty CLAY. Gravel is subangular fine to coarse sandstone.

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Remarks
Refusal on sandstone.

Intégrale
Understanding Ground Conditions

Borehole Log

Borehole No.
WS3
Sheet 1 of 1

Project Name: Orchard Way	Project No. 19058	Co-ords: -	Hole Type WLS
Location: Harwell, OX11 0LH		Level:	Scale 1:25
Client: Feltham Construction Limited		Dates: - 21/05/2019	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.05	ES		0.10			TOPSOIL: (Comprising soft dark grey brown slightly sandy slightly gravelly silty Clay. Gravel is subangular fine to medium charcoal, brick, tile, wood, flint and sandstone).
		0.25	ES		0.40			MADE GROUND: (Comprising firm grey slightly sandy slightly gravelly silty Clay. Gravel is subangular fine to medium brick, charcoal, brick, flint, wood and sandstone).
		0.70	D					Firm brown slightly sandy slightly gravelly silty CLAY. Gravel is subangular fine to coarse sandstone.
		1.30	D		1.00			Firm grey green speckled white and orange silty CLAY. Occassional plant rootlets.
					1.70			Dense grey green slightly clayey silty GRAVEL. Gravel is subangular to angular fine to coarse sandstone.
					1.80			Moderately strong fine to medium grained SANDSTONE.
					1.90			

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Remarks
Refusal on sandstone.

Intégrale
Understanding Ground Conditions

Borehole Log

Borehole No.
WS4
Sheet 1 of 1

Project Name: Orchard Way	Project No. 19058	Co-ords: -	Hole Type WLS
Location: Harwell, OX11 0LH		Level:	Scale 1:25
Client: Feltham Construction Limited		Dates: - 21/05/2019	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.50	D		0.20			TOPSOIL: (Soft dark brown grey slightly silty slightly sandy slightly gravelly Clay. Gravel is subangular fine to medium flint. Roots and rootlets).
					0.30			MADE GROUND: (Comprising firm grey brown slightly gravelly silty Clay. Gravel is subangular to subrounded fine to medium flint and charcoal).
					0.95			Firm light grey green silty CLAY.
					1.30			Dense grey green slightly silty clayey GRAVEL. Gravel is subangular fine to coarse sandstone.
					1.50			Firm grey green silty gravelly CLAY. Gravel is subangular fine to coarse sandstone.
					1.60			*Becoming slightly gravelly at 1.35m depth.*
					1.90			Dense grey green slightly clayey silty GRAVEL. Gravel is subangular to angular fine to coarse sandstone.
					2.00			Firm grey green slightly gravelly silty CLAY. Gravel is subangular fine to coarse weak sandstone. Occassional remnant plant root structures.
								Moderately weak to moderately strong medium grained SANDSTONE.

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Remarks
Refusal on sandstone.

Intégrale
Understanding Ground Conditions

Borehole Log

Borehole No.
WS5
Sheet 1 of 1

Project Name: Orchard Way	Project No. 19058	Co-ords: -	Hole Type WLS
Location: Harwell, OX11 0LH		Level:	Scale 1:25
Client: Feltham Construction Limited		Dates: - 21/05/2019	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.15			TOPSOIL: (Soft dark brown grey slightly gravelly silty Clay. Gravel is subrounded to subangular fine to medium flint. Roots and rootlets).
					0.40			MADE GROUND: (Comprising firm brown grey slightly gravelly silty Clay. Gravel is subangular to angular fine to medium sandstone, charcoal and flecks of brick).
		0.70	D					Firm grey slightly gravelly silty CLAY. Gravel is subrounded to subangular fine to coarse sandstone).
					1.00			*Becoming gravelly at 0.95m depth.*
					1.15			Dense silty clayey GRAVEL. Gravel is subangular fine to coarse sandstone.
		1.30	D					Grey green mottled orange slightly gravelly silty CLAY. Gravel is subangular fine to coarse weak sandstone.
					1.50			*Becoming gravelly at 1.45m depth.*
								Very weak to weak grey green fine to medium grained bands of SANDSTONE.
					1.90			
					1.95			Moderately weak white grey fine to medium grained SANDSTONE.

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Remarks
Refusal on sandstone.

Key:

- Window Sample borehole with installation
- Window Sample borehole
- Trial pit
- Trial pit with soakaway testing

Scale = 1:500 (approx.) @ A3

Figure 1
Site Plan
Orchard Way,
Harwell,
OX11 0LH

Job No: 19058
June 2019

Intégrale
Understanding Ground Conditions

Infiltation testing results Orchard Way

Pit 1

Time (mins)	Depth
0	920
60	910
120	880
180	840
240	815
300	790
360	775
1350	540

in 22 hours and 30 mins = 380mm

Pit 2

Time (Mins)	Depth
0	920
60	900
120	840
190	800
220	770
1210	720

in 20 hours and 10 mins = 200mm

Pit 3

Time (Mins)	Depth
0	860
60	850
105	840
135	835
1125	760

in 18 hours and 45 mins = 100mm