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GARAGES TO THE SOUTH OF 27a WEST END LANE, NW6 4QJ

SuDS Drainage Assessment with Outline FRA

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1.0 INTRODUCTION

Brief

1.1 Create Consulting Engineers Ltd was instructed by Streetplot Ltd to develop a drainage strategy and undertake a Drainage Assessment for the proposed development of 27a West End Lane, Camden, NW6 4QJ.

Project Context

1.2 It is understood that this Drainage Assessment Report will be used by Streetplot Ltd to support a planning application for the proposed demolition of the existing row of 8 garages and the removal of existing car parking space to the rear for the provision of three 3-storey terraced houses.

1.3 Plans showing the existing layout and proposed scheme are included on Drawings 1000-100E Rev A and 1000-110E Rev A, 1000-100 Rev A, 1000-300 Rev A, 1000-110 Rev A, 1000-111 Rev A, 1000-112 Rev A, 1000-114 Rev A, 1000-200 Rev A and 1000-201 Rev A

Objectives

1.4 To prepare a Foul and Surface Water Drainage Strategy and undertake a drainage assessment in accordance with the National Planning Policy Framework (NPPF)[1], Planning Practice Guidance (PPG)[2] and local policy documents.

National Planning Policy & Guidance

1.5 An assessment of surface water and drainage is required in order to demonstrate how flood risk to others will be managed following development and taking climate change into account.

1.6 The Planning Practice Guidance (substantially revised in March 2015 in relation to drainage) requires that sustainable drainage systems should be considered and included where practicable, in line with DEFRA Technical Standards[3].

1.7 The Technical Standards are therefore a key reference document and should be used in the formulation of the surface water drainage strategy for a scheme of this nature. The standards include the following requirements:

1 NPPF accessed online (September 2016)
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf
2 PPG accessed online (September 2016) http://planningguidance.planningportal.gov.uk/
3 Technical Standards Accessed Online (September 2016)
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf

"Flood risk outside the development

S1 *Where the drainage system discharges to a surface water body that can accommodate uncontrolled surface water discharges without any impact on flood risk from that surface water body (e.g. the sea or a large estuary) the peak flow control standards (**S2** and **S3** below) and volume control technical standards (**S4** and **S6** below) need not apply.*

Peak flow control

S2 *For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.*

S3 *For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.*

Volume control

S4 *Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.*

S5 *Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.*

S6 *Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with **S4** or **S5** above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.*

Flood risk within the development

S7 *The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.*

S8 *The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.*

S9 *The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.*

Structural Integrity

S10 *Components must be designed to ensure structural integrity of the drainage system and any adjacent structures or infrastructure under anticipated loading conditions over the design life of the development taking into account the requirements for reasonable levels of maintenance.*

S11 *The materials, including products, components, fittings or naturally occurring materials, which are specified by the designer must be of a suitable nature and quality for their intended use.*

Designing for Maintenance Considerations

S12 *Pumping should only be used to facilitate drainage for those parts of the site where it is not reasonably practicable to drain water by gravity.*

Construction

S13 *The mode of construction of any communication with an existing sewer or drainage system must be such that the making of the communication would not be prejudicial to the structural integrity and functionality of the sewerage or drainage system.*

S14 *Damage to the drainage system resulting from associated construction activities must be minimised and must be rectified before the drainage system is considered to be completed."*

Regional Planning Policy

1.8 The London Plan Sustainable Design and Construction Supplementary Planning Guidance (Mayor of London, 2014) includes important guidance on surface water drainage for all London Boroughs, most notably relating to greenfield runoff rates and the drainage hierarchy, as follows:

"Greenfield runoff rates

London Plan policy 5.13 states that developers should aim for a greenfield runoff rate from their developments. Greenfield runoff rates are defined as the runoff rates from a site, in its natural state, prior to any development. Typically this is between 2 and 8 litres per second per hectare. The CIRIA SuDS Manual generally recommends the institute of Hydrology Report 124 methodology for calculating greenfield runoff rates.

Achieving a greenfield runoff rate is of particular importance where the development is located in a catchment that contributes to combined sewers with known and/or modelled capacity or flooding issues. Information to determine whether capacity/flooding issues exist is available from borough SWMPs and Strategic Flood Risk Assessments (SFRAs) as well as other historic data.

If greenfield runoff rates are not proposed, developers will be expected to clearly demonstrate how all opportunities to minimise final site runoff, as close to greenfield rate as practical, have been taken. This should be done using calculations and drawings appropriate to the scale of the application. In order to achieve this, applicants should:

- *consider the permeability of all existing and proposed surfaces on the application site;*
- *assess the existing surface water and foul drainage networks and their discharges; and*
- *assess a range of return periods (the probability of a rainfall event of a particular size occurring and resulting in flooding) up to and including the 1 in 100 year plus climate change critical storms (an additional 20-30%)*.*

*It is to be noted that the Environment Agency's (EA) requirements for the assessment of increases in rainfall intensity resulting from climate change (40%) exceed that of the NPPF. The climate change requirements of the EA have been assessed as part of this assessment.

Most developments referred to the Mayor have been able to achieve at least 50% attenuation of the site's (prior to re-development) surface water runoff at peak times. This is the minimum expectation from development proposals.

There may be situations where it is not appropriate to discharge at greenfield runoff rates. These include, for example, sites where the calculated greenfield runoff rate is extremely low and the final outfall of a piped system required to achieve this would be prone to blockage. An appropriate minimum discharge rate would be 5 litres per second per outfall.

All developments on greenfield sites must maintain greenfield runoff rates. On previously developed sites, runoff rates should not be more than three times the calculated greenfield rate. The only exceptions to this, where greater discharge rates may be acceptable, are where a pumped discharge would be required to meet the standards or where surface water drainage is to tidal waters and therefore would be able to discharge at unrestricted rates provided unacceptable scour would not result.

The drainage hierarchy

The drainage hierarchy set out in London Plan policy 5.13 comprises two elements:

- *managing and storing surface water on-site before it is finally discharged, if required (Numbers 1 to 4); and*
- *disposal of surface water from a piped drainage system (Numbers 5, 6 and 7).*

The capture and storage of rainwater for later use is always the priority in order to also meet the objective of making efficient use of water resources. See section 2.5 for more details on water reuse. Where there are no opportunities to collect and reuse rainwater, the site, where practical should drain to the ground to recharge groundwater resources. Where infiltration is not possible, surface water should be stored on-site in open water features such as ponds and wetlands and then released at a controlled rate. The final option is to store surface water in tanks or cellular storage before it is released at a controlled rate. This is the least referable storage option as it does not provide wider sustainability benefits such as habitat provision or water quality improvements".

Local Planning Policy

1.9 The Development Plan for the site is the London Borough of Camden Local Development Framework (London Borough of Camden, 2010).

1.10 The most relevant policy from the Local Development Framework in relation to drainage is 'Policy DP23 – Water' which states that:

> *"The Council will require developments to reduce their water consumption, the pressure on the combined sewer network and the risk of flooding by:*
>
> *a) incorporating water efficient features and equipment and capturing, retaining and re-using surface water and grey water on-site;*
> *b) limiting the amount and rate of run-off and waste water entering the combined storm water and sewer network through the methods outlined in part a) and other sustainable urban drainage methods to reduce the risk of flooding;*
> *c) reducing the pressure placed on the combined storm water and sewer network from foul water and surface water run-off and ensuring developments in the areas identified by the North London Strategic Flood Risk Assessment and shown on Map 23 as being at risk of surface water flooding are designed to cope with the potential flooding;*
> *d) ensuring that developments are assessed for upstream and downstream groundwater flood risks in areas where historic underground streams are known to have been present; and*

e) encouraging the provision of attractive and efficient water features."

1.11 Although not adopted yet, the Camden Draft Local Plan (London Borough of Camden, 2015) has been submitted for examination.

1.12 The most relevant policies from the Draft Local Plan are listed below.

"Policy CC2 - Adapting to climate change

a) The Council will require development to be resilient to climate change. We will ensure that schemes include appropriate climate change adaptation measures, such as:
b) protecting existing green spaces and promoting new appropriate green infrastructure;
c) not increasing and wherever possible reducing surface water run-off;
d) incorporate green roofs, combination green and blue roofs and green walls where appropriate; and
e) measures to reduce the impact of urban and dwelling overheating."

"Policy CC3 Water and flooding
The Council will require developments to mitigate against flooding, be adaptable and reduce their water consumption. We will ensure that development:

a) considers the impact of development on Local Flood Risk Zones (including drainage);
b) does not locate vulnerable development (such as basements dwellings) in flood-prone areas;
c) achieves a greenfield run-off rate or, where this is not possible, achieve runoff rates that do not exceed those predevelopment;
d) incorporates water efficiency measures; and
e) avoids harm to the water environment and water quality.

Development should not increase flood risk and should reduce the risk of flooding where possible. Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable."

1.13 The Strategic Flood Risk Assessment (SFRA) for Camden (URS, 2014), the SFRA for North London (Mouchel, 2008) and the Preliminary Flood Risk Assessment (PFRA) for Camden (Drain and Halcrow, 2011) provides a summary of the flood risks for the local area.

Constraints and Limitations

1.14 The copyright of this report is vested in Create Consulting Engineers Ltd and the Client, Streetplot Ltd. The Client, or his appointed representatives, may copy the report for purposes in connection with the development described herein. It shall not be copied by any other party or used for any other purposes without the written consent of Create Consulting Engineers Ltd or the Client.

1.15 Create Consulting Engineers Ltd accepts no responsibility whatsoever to other parties to whom this report, or any part thereof, is made known. Any such other parties rely upon the report at their own risk.

1.16 Create Consulting Engineers Ltd has endeavoured to assess all information provided to them during this appraisal. Should additional information become available which may affect the opinions expressed in this report, Create Consulting reserves the right to review this information and, if warranted, to modify the opinions presented in the report accordingly.

1.17 This Drainage Assessment reviews the proposed drainage strategy associated with the development as shown on the attached plans.

1.18 The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the site.

2.0 SOURCES OF INFORMATION

2.1 The information contained in this report is based on a review of readily available information pertinent to the site and consultation with interested parties.

Records Review

2.2 Key reports, drawings and websites pertinent to this assessment are detailed below in Table 2.1.

Document/Website	Author/Publisher	Date
Flood Maps, Groundwater Mapping, Reservoir Flood Maps, Surface Water Flood Maps www.environment-agency.gov.uk	Environment Agency (EA)	Accessed September 2016
BGS GeoIndex – Geology and borehole records - www.bgs.ac.uk/geoindex	British Geological Survey	Accessed September 2016
London Borough of Camden Strategic Flood Risk Assessment	Camden	July 2014
North London SFRA	Mouchel	2008
London Borough of Camden SFRA	URS	2014
London Borough of Camden PFRA	Drain/Halcrow	2011
London Borough of Camden Surface Water Management Plan (SWMP)	Drain/Halcrow	2013
The Lost Rivers of London	Nicholas Barton	1992
Existing Architects Plans (Drawings 1000-100E Rev A and 1000-110E Rev A)	Street Plot	September 2015
Proposed Floor Plans (Drawings 1000-100 Rev A, 1000-300 Rev A, 1000-110 Rev A, 1000-111 Rev A, 1000-112 Rev A, 1000-114 Rev A, 1000-200 and 1000-201 Rev A)	Street Plot	September 2015
Thames Water Sewer Flooding History Enquiry (Appendix A)	Thames Water	August 2016
Thames Water Asset Plans (Appendix B)	Thames Water	August 2016

Table 2.1: Key Information Sources

Consultation

2.3 The parties consulted as part of this Flood Risk Assessment are detailed in Table 2.2.

Consultee	Form of Consultation	Topics Discussed and Actions Agreed
Thames Water Developer Services Team	Obtain asset records and Sewer Flooding History Enquiry	Thames Water asset plans were obtained to inform the surface water drainage strategy for the scheme. These are included in Appendix B. A sewer flooding history enquiry was submitted to Thames Water. The response (Appendix A) confirmed that the flooding records held by Thames Water do not contain any reports of flooding in the requested area as a result of surcharging public sewers.

Table 2.2: List of Parties Consulted

3.0 SITE SETTING

Site Location

3.1 The Site is located at 27a West End Lane within the London Borough of Camden, at grid reference 525487E 183841N and Postcode NW6 4QJ. The area of the site is 297 m^2.

Description of Site and Surroundings

3.2 The site comprises a series of 8 garages along the southern boundary with a hardstanding car-parking area forming the remainder of the site. The site is bounded by residential gardens to the north west and north of the site, a block of residential dwellings to the north east, a car park (associated with the residential block) to the east and West End Lane to the south. The surrounding land use is predominantly residential, however Kilburn High Street is located 190 m to the south west and Kilburn High Road Station is located 240 m south of the site.

3.3 Relative to ordnance datum the site falls from approximately 36.8 mAOD in the northern corner to approximately 35.0 mAOD in the south.

Hydrological Setting

Surface Watercourses

3.4 The nearest watercourse to the site is Regents Canal located approximately 1.97 km south east of the site.

3.5 The River Thames is located approximately 6.2 km south of the site.

Estuaries and Coastal Watercourses

3.6 The River Thames is tidal at this location, as it is downstream of the tidal limit at Teddington Lock.

Culverted Watercourses

3.7 According to the Lost Rivers of London Map (Barton, 1992) the site is located approximately 80 m south west of the site to the culverted River Westbourne which now forms part of the Ranelagh Sewer.

Ground Conditions

3.8 British Geological Survey (BGS) mapping shows bedrock geology at the site to be comprised of the London Clay Formation (Clay and Silt). There are no superficial deposits noted at the site.

3.9 Local BGS borehole records confirm this geological sequence. A borehole located at the site encounters made ground to a depth of 0.45 m bgl. The London Clay Formation was found directly below the made ground.

Groundwater

3.10 The site does not lie within any Groundwater Source Protection Zones, as identified by the Environment Agency mapping (EA website, accessed September 2016). The mapping also designates the London Clay bedrock at the site as unproductive.

3.11 BGS borehole records in the vicinity of the site do not record the presence of groundwater.

Artificial Waterbodies

3.12 There are no artificial waterbodies in the vicinity of the site. The nearest is a boating lake within Regents Park 2.34 km south east of the site.

Public Sewers

3.13 Thames Water Asset records (Appendix A) show a combined sewer, 1143 x 763 mm in size, passing in a south western direction along West End Lane adjacent to the site. This adjoins with a series of combined sewers along Bransdale Close and Mutrix Road (unknown sizes) and enters into the Ranelagh Sewer (1245 x 864 mm) located 80 m south west of the site. All of the sewers in the local area appear to drain towards the Ranelagh sewer, which drains in a south easterly direction.

3.14 There are no individual foul and surface water sewers in the vicinity of the site.

Site Drainage

3.15 The roof tops of the garages are profiled towards the car parking area to ensure any surface water drains from the roof towards the grid and channel drain located in the centre of the site. The channel drain runs parallel to the garages (from the south western edge to north eastern edge of the site) with a gully beside in the central part of the site. The car park topography falls towards the channel drain resulting in surface water run off from the car park draining towards it. It is assumed that the surface water subsequently will drain to the south west and enter the combined sewer along West End Lane.

3.16 A manhole is located along the western edge of the site. It is unclear whether this man hole connects to the sites surface water system or is a part of a separate system.

3.17 There are no foul services located on the site.

3.18 Existing brownfield flows for the site (which is understood to be currently wholly impermeable) are summarised in Table 4.1 with calculations shown in Appendix C.

Storm Event	Existing Brownfield Flow Rate (l/s)
1 year (15 minute)	3.5
30 year (15 minute)	8.57
100 year (15 minute)	11.05

Table 4.1. Existing Critical Brownfield Flow rates

Water Mains

3.19 Thames Water potable water supply records (included in Appendix B) show a number of water mains within the vicinity of the site. A 180 mm distribution main is located adjacent to the site and supplies West End Lane. This main adjoins with several other mains including two 500 mm trunk mains located along Kilburn High Street 180 m south west of the site. None of these mains are shown to lie within the site boundary.

Flood Zones

3.20 The site lies within the Environment Agency's (EA) Flood Zone 1, which is described within the NPPF Technical Guidance as having a less than 1 in 1000 annual probability of river or tidal flooding (<0.1%) in any one year.

3.21 With regard to reservoir flooding, the Environment Agency reservoir flood maps (accessed online, September 2016) indicate that the site lies outside of the area that may be flooded in the event of a breach of any reservoirs.

3.22 The EA Surface Water Flood Maps indicate that the site area has a 'very low' risk of flooding from surface water (i.e. a less than 1 in 1000 (<0.1%) annual probability of flooding from extreme rainfall). Part of West End Lane adjacent to the site has a 'low' risk of surface water flooding (i.e. an associated risk of between 1 in 100 and 1 in 1000 (1-0.1 %) annual probability of flooding from extreme rainfall). Flood depths are however estimated to be <300 mm.

3.23 According to the Surface Water Management Plan (SWMP) for the London Borough of Camden, the site is located within a critical drainage area (CDA). The area has been designated as a CDA in the SWMP due to surface water flooding and sewer capacity problems. The site however, is located on the edge of this CDA and flood water will likely flow past the site in a

south westerly direction (rather than ponding) due to the topography in the immediate vicinity of the site.

Flood History

3.24 The SWMP identifies West End Lane as an area that was affected during the 2002 flood event as a result of the main sewer reaching capacity during an excessive rainfall event. It is unclear where exactly on West End Lane this flooding occurred. Figure 5a within the SFRA identifies the site, as part of a larger area (approximately 9.0km^2 in size), as having two sewer flooding incidents. Due to the low resolution of the mapping it is unclear whether these events effected the site or immediate vicinity.

3.25 A Thames Water Sewer Flooding History Enquiry (Appendix A) reported no historic records of any surcharging sewers in the vicinity of the site.

4.0 SCHEME DESCRIPTION AND PROPOSED DRAINAGE STRATEGY

The Scheme

4.1 Proposals for the Site include the demolition of the existing row of 8 garages and the removal of the car parking space to the rear for the provision of 3 two to three-storey terraced houses. The proposals include private gardens, 6 cycle stores, a refuse store and privacy landscaping. Access to the site is pedestrian only and via West End Lane.

4.2 Plans showing the proposed scheme are included on Drawings 1000-100 Rev A, 1000-300 Rev A, 1000-110 Rev A, 1000-111 Rev A, 1000-112 Rev A, 1000-114 Rev A, 1000-200 Rev A and 1000-201 Rev A appended with this report.

Proposed Drainage Strategy

Specific Planning Considerations Informing the Drainage Strategy

4.3 The London Plan Sustainable Design and Construction Supplementary Planning Guidance (Mayor of London, 2014) requires that equivalent site greenfield runoff rates should be targeted where possible, and where they are not included a full justification as to why they cannot be achieved, should be provided. In that case runoff rates should be reduced as low as possible.

4.4 However where greenfield rates for a particular site are restricted below 5.0 l/s, issues with orifice blockage may result, and therefore a discharge rate of 5.0 l/s per outfall is generally considered acceptable in line with best practice.

4.5 Policy DP23 from the Camden Local Development Framework (London Borough of Camden, 2010) and Policies CC2 and CC3 from Camden's Draft Local Plan (London Borough of Camden, 2015) requires development proposals to include SUDS to manage and reduce surface water run-off, unless it can be demonstrated that such measures are not feasible.

Potential for Infiltration Systems

4.6 The Building Regulations Part H state that no concentrated soakage device can be placed within 5.0 m of a building or adoptable road. Given the site has less than a 5 m easement from neighbouring buildings it is not possible to include soakaways in the scheme. Permeable paving will however be implemented.

Drainage Strategy - Overview

4.7 All new on site drainage will be separated until the point of connection to the existing public network in order to meet Thames Water requirements and best practice/building regulations. To inform the detailed design of the drainage, a full CCTV drainage survey will be carried out to determine fully the existing points of connection which are to be reused as part of the development and to confirm any necessary diversions or amendments to existing private drainage network.

Proposed Surface Water Drainage

4.8 In order to retain as much surface water on site as possible the following SUDS measures will be incorporated into the scheme:

- Green roofs will be incorporated on the roof of each of the 3 houses. These green roof areas will total 97 m^2;
- Planters will be incorporated along the southern edge of the site with a small area also along the northern edge; and
- The access pathway and private gardens will be formed of permeable surfacing. The area of permeable surfacing will total 142 m^2.

4.9 It is recommended that overflow pipes are included in the scheme to drain excess runoff from the private gardens and areas with permeable paving.

4.10 Based on the above proposals the majority of surface water will be retained on site and evaporated, infiltrated. However any surface water not retained on site will drain via the existing outfalls to the Thames Water network (subject to the aforementioned CCTV surveys confirming the condition and size of the existing connection being suitable). Should the connection not meet these requirements, or if the connection is in an unsuitable location a new connection will be made to the public sewer within West End Lane subject to the agreement of Thames Water.

4.11 In summary, SUDS measures have been implemented where possible within the bounds of the scheme producing a vast reduction in impermeable space. Overall there will be a significant reduction in peak runoff rates achieved compared to the existing scenario given that the site will be approximately 80% permeable post development. The remaining impermeable space will drain at a rate lower than 5.0 l/s therefore no formal attenuation storage and flow control devices are proposed.

4.12 A summary of the potential SUDS options which led to the above drainage strategy is included in Table 4.2.

SUDS Option	Suitability/Included in the Scheme?	Comments
Soakaways and porous paving	✓	All external areas and private gardens will be formed of permeable surfacing.
Porous paving (storage)	X	Not suitable for use given the constraints of the site.
Rainwater Harvesting	*	Not currently included in the scheme.
Swales	X	Not suitable for use given the constraints of the site.
Attenuation Ponds (above ground storage)	X	Not suitable for use given the constraints of the site.
Below ground storage in cellular systems	*	Not currently included in the scheme.
Green Roofs/Brown Roofs/Blue Roofs	✓	Six areas of green roof are included in the scheme, totalling approximately 97 m^2. Landscaped areas and a planter will be included along the southern and northern edge of the site.

Table 4.1: SUDS Options

Key:

✓ *Suitable for use and included in the scheme*

* *Possibly suitable for use – not included in the client and architect design proposal at present – should be considered further as part of the detailed design*

X Unlikely to be suitable for use

Maintenance

4.13 Regular inspection and maintenance of public and private drainage by Camden Council, Thames Water, and site management respectively, will be necessary minimise the residual risks associated with surface water/sewers.

4.14 Procedures for inspection and maintenance of the site drainage will be developed at the detailed design stage and incorporated into site operation and maintenance procedures.

5.0 ASSESSMENT OF DRAINAGE AND FLOOD RISK

5.1 The scope of this report was refined to meet the brief outlined in Chapter 1 and primarily considers potential for the design, construction and operation of the site to increase the risk of flooding to neighbouring properties. It also briefly assesses the flood risks posed to the site. Consideration is then given to any necessary mitigation measures to mitigate identified potential flood risks, climate change and residual flood risks.

5.2 The approach is consistent with the NPPF, PPG and the requirements of local planning policy.

Flood Risk to the Proposed Development

5.3 Based on our understanding of the scheme and the site setting, the potential sources of flooding have been identified and assessed in Table 5.1.

Potential Source	Pathway	Potential Linkage to Site	Justification
Fluvial/Tidal (River Thames)	Overtopping of banks and overland flow	No	The site is assessed as having a less than 1 in 1000 (<0.1%) probability of flooding from rivers and sea in any one year. Therefore the site is at a **negligible** risk of flooding from fluvial events and this source is not considered further in this report.
Groundwater (shallow)	Perched/shallow groundwater may be present	No	Groundwater is not anticipated to be shallow in the vicinity of the site.
Artificial water Bodies	Breach and overland flow	No	No significant sources identified in the immediate vicinity of the site therefore this source is not considered further within this report.
Infrastructure failure from water mains and internal water supply system	Failure of the Thames Water network and/or internal water supply and distribution system	Yes	Flood risk from this source is considered to be a residual risk with the main threat being from internal pipe work during any building works. Flooding from this source poses a **low** risk to the proposed development as a basement is not proposed however there are multiple water mains and hydrants located on Ewell Road.
Sewer flooding from Thames Water assets and private site drainage	Surcharge in site drainage and the public sewer network due to blockage or exceedance of capacity	Yes	Given records of historic flooding from this source reported in the vicinity of site the risk of sewer flooding is considered to be **high**. Sewer flooding from blockage of internal building drainage as well as the Thames Water network is also a residual risk managed by the design of the site drainage and regular inspection and maintenance of the public and private sewer network. The flood risk associated with this source

Potential Source	Pathway	Potential Linkage to Site	Justification
			may also increase over time due to the effects of climate change.
Surface water flooding as a result of extreme rainfall and runoff from overland flow	Flooding of the surrounding roads due to extreme rainfall	Yes	The site is located within Critical Drainage Area however the EA Surface Water Flood Maps show the site itself is at a **very low** risk from surface water flooding whilst part West End Lane adjacent to the property is at a **low** risk. Surface water flooding from this source is considered a residual flood risk and appropriate mitigation measures are discussed in Table 5.2

Table 5.1: Potential Sources of Flooding to the Development

5.4 In summary, the risk of flooding from surcharges in the site drainage and public sewer is considered to be high whereas all other sources are generally considered to be at low risk. A number of mitigation measures are recommended to address and manage the risk and residual risk from these forms of flooding in Table 5.2.

Drainage Assessment

Changes in runoff

5.5 The surface water drainage system will help attenuate increased flows as a result of climate change.

Impact on the public sewer network

5.6 The overall impact on the receiving sewer network is considered negligible when the potential decrease in peak surface flows is considered.

5.7 However, sewer flows (volumes) will increase overtime as a result of climate change.

Mitigation Measures

5.8 Table 5.2 sets out appropriate mitigation measures to minimise the identified flood risks.

Type of Flooding	Issue	Mitigation Measures	Justification	Residual Risk *
Flooding from surface and foul water – sewer blockage/surcharging and intense rainfall	Blockages or surcharges in the site drainage or the public sewer network within the site and in the site vicinity may result in flooding of the ground floor and mews.	• Appropriate design of the private drainage at the detailed design stage to include an allowance for Climate Change. • Routine inspection and maintenance of the site and public drainage systems by the site owner and Thames Water. • Monitor flood risk throughout the life of the development in order to confirm the risk posed to the scheme over time. • Consider opportunities for flood resilient design.	These measures will ensure flood risk from these sources is minimised.	Low
Flooding from Water mains (internal water supply system and Thames Water apparatus).	Flooding of the water supply and distribution system may result in flooding of the internal building.	• Routine inspection of the site and public water supply and distribution system by the site owner and Thames Water. • Consider the need and opportunities for raised thresholds as part of the detailed design.	Will ensure the risk of flooding is minimised.	Low
Flooding from Surface Water	Flooding to the ground floor may occur as a result of extreme rainfall and runoff from overland flow	• Consider opportunities for flood resilient design and/or for flood resistant design. • Consider the need and opportunities for raised thresholds as part of the detailed design. • Monitor flood risk throughout the life of the development in order to confirm the risk posed to the scheme over time.	Will ensure the risk of flooding is minimised	Low
Impact of the development on the public sewer network	The site has potential to change foul and surface water flows to the local public sewer network	• Undertake appropriate drainage surveys and refurbish/replace any retained drainage connections as appropriate. • Agree any modifications to the public sewer, the outfall location and flow rates with Thames Water. • Routine inspection and maintenance of the site and public drainage systems by the site owner and Thames Water.	Will ensure the risk of flooding is minimised.	Low

Table 5.2. Mitigation Measures

*Following adoption of the mitigation measures

Residual Flood Risks

5.9 A number of residual risks have been identified, associated with public sewers, site drainage, water supply pipes and intense rainfall.

5.10 As long as the public sewer networks and site drainage/water supply infrastructure are regularly inspected by maintained by Thames Water and site management respectively then the residual risk will be minimised.

Climate Change

5.11 Climate change has important implications for the assessment and management of flood risk. The NPPF requires that climate change is considered when making an assessment of flood risk posed to future development.

5.12 Climate change has the potential to affect all identified sources of flooding at the site. The likely impacts of climate change include increased severity of rainfall events as well as wetter winters leading to higher groundwater levels and increased frequency and severity of surface water flooding.

5.13 The influence of climate change on rainfall intensity has been taken into account by the surface water drainage strategy with the inclusion of a 40% increase in rainfall intensity to account for climate change for all rainfall events up to and including the 1 in 100 year event in accordance with NPPF requirements, and 'Flood Risk Assessments: Climate Change Allowances'[4].

4 Environment Agency (2016) *Flood Risk Assessments: Climate Change Allowances*.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 The surface water drainage strategy set out in this report demonstrates that the scheme can be constructed with adequate drainage to ensure flood risk to surrounding areas is not increased.

6.2 A full SUDS appraisal has been undertaken as part of the formulation of this strategy, and whilst soakaways are not appropriate, green roofs, planters, and permeable paving will be included within the scheme, providing a significant reduction in impermeable surfacing and therefore producing large reductions in surface water runoff.

6.3 The detailed design of the drainage should be informed by a full drainage survey of the public and private sewer network (where drainage/outfalls will be retained). The detailed design of the drainage will need to be submitted to the local planning authority and Thames Water and any other affected parties for approval.

6.4 As part of this assessment, a number of residual flood risk risks relating to water supply and drainage infrastructure in relation to surcharges and blockages in private or public sewer networks and surface water flooding from extreme rainfall in excess of the design of the site drainage and burst water/damaged water mains have been identified.

6.5 As long as the water supply infrastructure, public sewers and site drainage are routinely inspected and maintained by the site owners and Thames Water, then the residual risks to downstream properties will be minimised. The residual risks outlined here should be reviewed and considered as part of the detailed drainage design to ensure they are minimised as practicable.

7.0 REFERENCES

i. British Geological Survey GeoIndex. Available at: www.bgs.ac.uk/geoindex (Accessed online September 2016). BGS, Wallingford.

ii. Butler, D. Davies, J. W. (2011). *Urban Drainage 3rd Edition*. Spon Press, Abingdon.

iii. Environment Agency Fluvial Flood Maps, Surface Water Flood Maps, Groundwater Maps and Reservoir Flood Maps (2015) Available at: http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=514500.0&y=188500.0&topic=floodmap&ep=map&scale=8&location=Harrow,%20Harrow&lang=_e&layerGroups=default&textonly=off (Accessed September 2016).

iv. London Borough of Camden (2015) *London Borough of Camden Draft Local Plan.* London.

v. London Borough of Camden (2014) *London Borough of Camden Strategic Flood Risk Assessment.* URS.

vi. London Borough of Camden (2013) *London Borough of Camden Surface Water Management Plan.* Drain/Halcrow.

vii. London Borough of Camden (2011) *London Borough of Camden Preliminary Flood Risk Assessment.* Drain/Halcrow.

viii. London Borough of Camden (2010) *London Borough of Camden Local Development Framework.* London.

ix. North London (2008) *North London Strategic Flood Risk Assessment.* Mouchel.

x. Mayor of London (2014) *The London Plan Sustainable Design and Construction Supplementary Planning Guidance*. Mayor of London.

xi. Water UK/WRc plc (2012) *Sewers for Adoption – 7th Edition*. WRc plc, Swindon.

APPENDICES

APPENDIX A

Sewer Flooding

History Enquiry

Create Consulting Engineers Ltd

Princes Street

Search address supplied

Bransdale Close
West End Lane
London
NW6 4QJ

Your reference P16-1126

Our reference SFH/SFH Standard/2016_3397788

Received date **24 August 2016**

Search date **24 August 2016**

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Sewer Flooding

History Enquiry

Search address supplied: Bransdale Close,West End Lane,London,NW6 4QJ

This search is recommended to check for any sewer flooding in a specific address or area

TWUL, trading as Property Searches, are responsible in respect of the following:-

(i) any negligent or incorrect entry in the records searched;

(ii) any negligent or incorrect interpretation of the records searched;

(iii) and any negligent or incorrect recording of that interpretation in the search report

(iv) compensation payments

Thames Water Utilities Ltd

Property Searches
PO Box 3189
Slough SL1 4WW

DX 151280 Slough 13

T 0118 925 1504
E searches@thameswater.co.uk
I www.thameswater-propertysearches.co.uk

Registered in England and Wales
No. 2366661, Registered office
Clearwater Court, Vastern Road
Reading RG1 8DB

Sewer Flooding

History Enquiry

History of Sewer Flooding

Is the requested address or area at risk of flooding due to overloaded public sewers?

The flooding records held by Thames Water indicate that there have been no incidents of flooding in the requested area as a result of surcharging public sewers.

For your guidance:

- A sewer is “overloaded” when the flow from a storm is unable to pass through it due to a permanent problem (e.g. flat gradient, small diameter). Flooding as a result of temporary problems such as blockages, siltation, collapses and equipment or operational failures are excluded.
- “Internal flooding” from public sewers is defined as flooding, which enters a building or passes below a suspended floor. For reporting purposes, buildings are restricted to those normally occupied and used for residential, public, commercial, business or industrial purposes.
- “At Risk” properties are those that the water company is required to include in the Regulatory Register that is presented annually to the Director General of Water Services. These are defined as properties that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system more frequently than the relevant reference period (either once or twice in ten years) as determined by the Company’s reporting procedure.
- Flooding as a result of storm events proven to be exceptional and beyond the reference period of one in ten years are not included on the At Risk Register.
- Properties may be at risk of flooding but not included on the Register where flooding incidents have not been reported to the Company.
- Public Sewers are defined as those for which the Company holds statutory responsibility under the Water Industry Act 1991.
- It should be noted that flooding can occur from private sewers and drains which are not the responsibility of the Company. This report excludes flooding from private sewers and drains and the Company makes no comment upon this matter.
- For further information please contact Thames Water on Tel: 0800 316 9800 or website www.thameswater.co.uk

Thames Water Utilities Ltd

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I www.thameswater-propertysearches.co.uk

APPENDIX B

Asset Location Search

Create Consulting Engineers Ltd
15Princes Street
NORWICH
NR3 1AF

Search address supplied Bransdale Close
West End Lane
London
NW6 4QJ

Your reference P16-1126

Our reference ALS/ALS Standard/2016_3397787

Search date 24 August 2016

You are now able to order your Asset Location Search requests online by visiting
www.thameswater-propertysearches.co.uk

searchcode

Asset Location Search

Search address supplied: Bransdale Close, West End Lane, London, NW6 4QJ

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

Asset Location Search

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.

Asset Location Search

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: 0845 850 2777
Email: developer.services@thameswater.co.uk

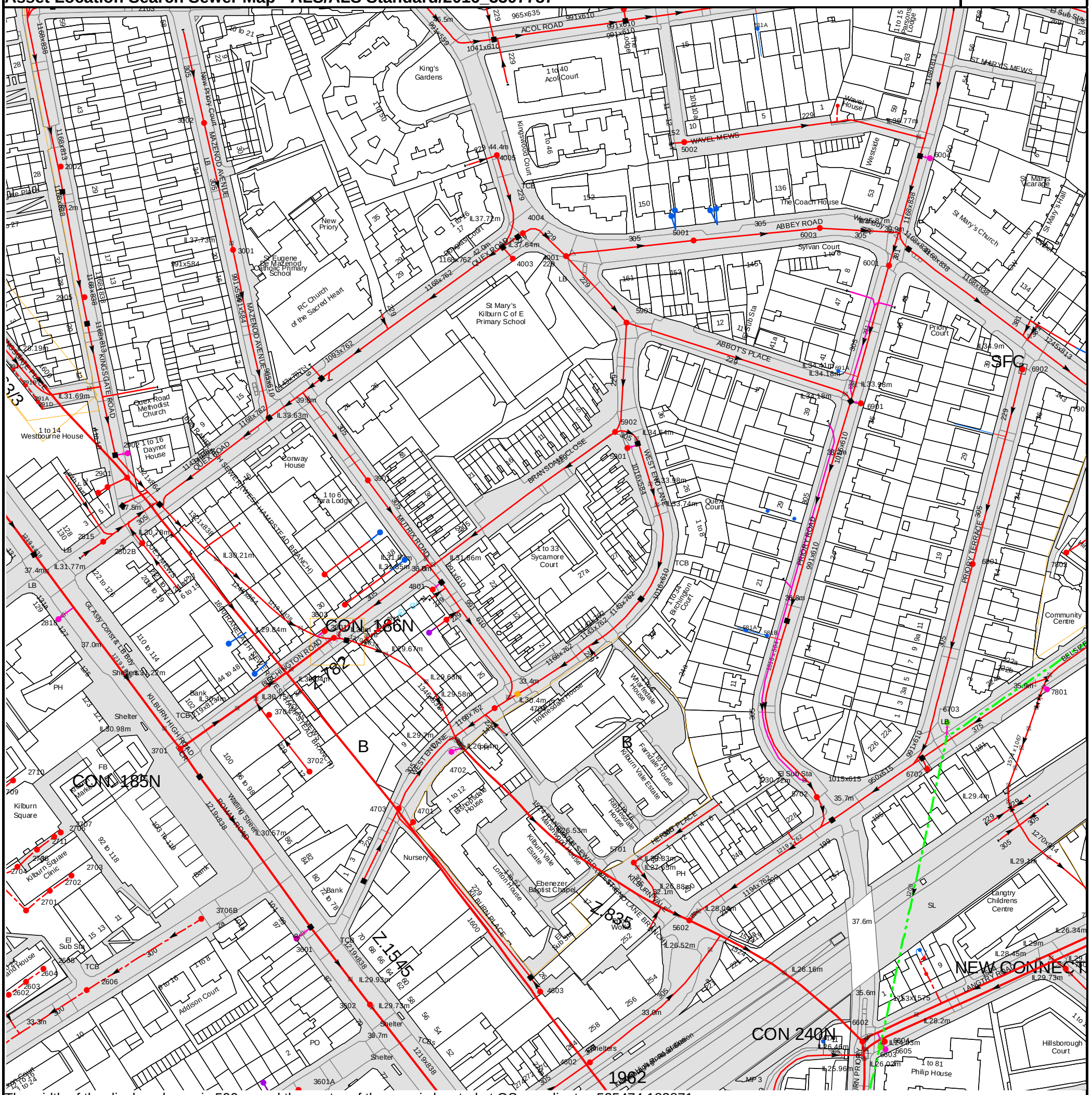
Clean Water queries

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: 0845 850 2777
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2016_3397787



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 525474,183871

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

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
4602	34.34	30.72
6605	34.67	31.04
6603	34.66	22.79
661A	n/a	n/a
6604	34.66	26.48
6602	34.96	n/a
661D	n/a	n/a
7604	34.06	n/a
661B	n/a	n/a
661C	n/a	n/a
5602	32.55	26.45
5701	32.53	27.65
5702	35.75	29.18
6702	35.51	31.45
6703	35.7	n/a
7801	36.03	32.37
581B	n/a	n/a
581A	n/a	n/a
6801	36.62	32.66
7802	36.8	34.48
581D	n/a	n/a
581C	n/a	n/a
5901	n/a	n/a
5902	38.91	35.03
6901	n/a	n/a
691A	n/a	n/a
6902	38.55	34.35
5903	40.41	37.27
6001	39.34	35.05
4001	n/a	38.82
5001	40.67	37.9
6003	40.11	n/a
50BD	n/a	n/a
50BC	n/a	n/a
50BB	n/a	n/a
50BA	n/a	n/a
6004	n/a	n/a
5002	41.76	40.42
601A	n/a	n/a
511A	n/a	n/a
5101	n/a	n/a
3601A	35.56	31.88
3602	36.73	n/a
4603	34.62	33.56
2901	37.55	27.93
2902	n/a	n/a
2802B	37.01	33.99
3701	37.05	30.92
38DE	n/a	n/a
38DI	n/a	n/a
3704	36.04	33.97
3702	36.34	33.41
3802	n/a	n/a
38DD	n/a	n/a
3801	35.83	29.71
38DJ	n/a	n/a
381B	n/a	n/a
3901	n/a	n/a
381A	n/a	n/a
38DB	n/a	n/a
481A	n/a	n/a
4703	33.77	31.55
4817	n/a	n/a
48CF	n/a	n/a
4818	n/a	n/a
4701	33.83	n/a
4819	n/a	n/a
4801	n/a	n/a
4820	n/a	n/a
4702	n/a	n/a
4704	n/a	n/a
291D	n/a	n/a
291A	n/a	n/a
291B	n/a	n/a
291C	n/a	n/a
2905	37.32	n/a
4003	n/a	n/a
3001	42.23	37.37
4004	42.32	39.15
2002	37.19	n/a
4005	44.05	41.61
3002	43.07	38.56
2710	36.59	35.45
2705	n/a	n/a
2711	n/a	n/a
2706	n/a	n/a
2818	37.08	n/a
2707	n/a	n/a
2816	n/a	n/a
2815	n/a	n/a
2817	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
2603	n/a	n/a
2701	n/a	n/a
2604	n/a	n/a
2605	n/a	n/a
2702	n/a	n/a
2703	n/a	n/a
2606	34.33	31.08
3706B	36.48	33.71
361A	n/a	n/a
3601	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.

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.

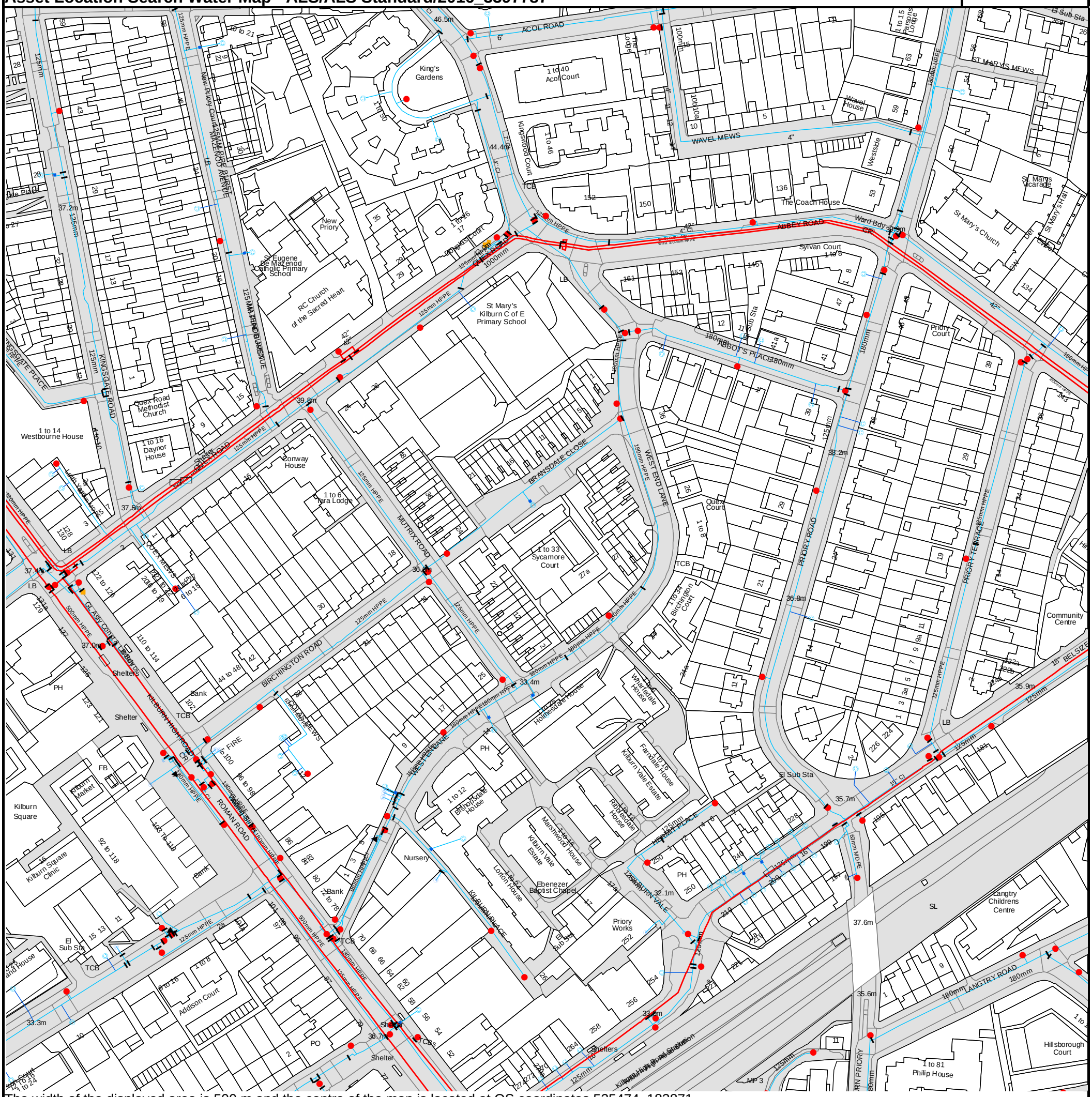
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

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/2016_3397787



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 525474, 183871.

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.

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 him 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.	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 he finds that you have suffered actual loss 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
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 C

Location : **27a West End Lane**

M5-60 : 20 mm

r : 0.425

Wallingford Method - maps

\\cre001-net01\company data\Reference\Technical Library\wallingford

For different durations,

From Table 1

Duration, D	Z1			
15 min	0.65	**M5-15:**	Z1 x M5-60	13.00 mm
30 min	0.82	**M5-30:**	Z1 x M5-60	16.40 mm
60 min	1	**M5-60:**	Z1 x M5-60	20.00 mm
6hr	1.51	**M5-360:**	Z1 x M5-60	30.20 mm

For different return intervals,

From Table 2*

		Z2	
Duration, D	M1	M30	M100
15 min	0.62	1.52	1.96
30 min	0.62	1.53	2.00
60 min	0.64	1.54	2.03
6 hr	0.68	1.51	1.97

Average point intensity, API = I/(D/60)

	D min	Calculation	I mm	API mm/hr
M 1-15	15	M5-15*Z2(M1)	8.06	32.24
M 1-30	30	M5-30*Z2(M1)	10.17	20.34
M 1-60	30	M5-360*Z2(M1)	12.80	25.60
M1-360	360	M5-360*Z2(M1)	20.54	3.42
M 30-15	15	M5-15*Z2(M30)	19.76	79.04
M 30-30	30	M5-30*Z2(M30)	25.09	50.18
M 30-60	60	M5-60*Z2(M30)	30.80	30.80
M30-360	360	M5-360*Z2(M30)	45.60	7.60
M 100-15	15	M5-15*Z2(M100)	25.48	101.92
M 100-30	30	M5-30*Z2(M100)	32.80	65.60
M100-60	60	M5-60*Z2(M100)	40.60	40.60
M100-360	360	M5-360*Z2(M100)	59.49	9.92

Peak Runoff

Q=2.78CiA Rational Method, SUDS Manual Section 4.3.3

where: (1) C = Cv Cr

Cv = 1 **

Cr = 1.3 constant value for design purposes

therefore , C = 1.3

(2) i = API, defined above

(3) A = areas measured for subcatchments

Q=2.78CiA

Table 1

Rainfall Duration D

Minutes					Hours					
r	5	10	15	30	1	2	4	6	10	24
0.12	0.22	0.34	0.45	0.67	1.00	1.48	2.17	2.75	3.70	6.00
0.15	0.25	0.38	0.48	0.69	1.00	1.42	2.02	2.46	3.32	4.90
0.18	0.27	0.41	0.51	0.71	1.00	1.36	1.86	2.25	2.86	4.30
0.21	0.29	0.43	0.54	0.73	1.00	1.33	1.77	2.12	2.62	3.60
0.24	0.31	0.46	0.56	0.75	1.00	1.30	1.71	2.00	2.40	3.35
0.27	0.33	0.48	0.58	0.76	1.00	1.27	1.64	1.88	2.24	3.10
0.30	0.34	0.49	0.59	0.77	1.00	1.25	1.57	1.78	2.12	2.84
0.33	0.35	0.50	0.61	0.78	1.00	1.23	1.53	1.73	2.04	2.60
0.36	0.36	0.51	0.62	0.79	1.00	1.22	1.48	1.67	1.90	2.42
0.39	0.37	0.52	0.63	0.80	1.00	1.21	1.46	1.62	1.82	2.28
0.42	0.38	0.53	0.64	0.81	1.00	1.20	1.42	1.57	1.74	2.16
0.45	0.39	0.54	0.65	0.82	1.00	1.19	1.38	1.51	1.68	2.03

Table 2 - England and Wales

Growth Factor Z2

M5 rainfall	M1	M2	M3	M4	M5	M10	M20	M50	M100	M30 interpolated
5.00	0.62	0.79	0.89	0.97	1.02	1.19	1.36	1.56	1.79	1.25
10.00	0.61	0.79	0.90	0.97	1.03	1.22	1.41	1.65	1.91	1.49
15.00	0.62	0.80	0.90	0.97	1.03	1.24	1.44	1.70	1.99	1.53
20.00	0.64	0.81	0.90	0.97	1.03	1.24	1.45	1.73	2.03	1.54
25.00	0.66	0.82	0.91	0.97	1.03	1.24	1.44	1.72	2.01	1.53
101.92 30.00	0.68	0.83	0.91	0.97	1.03	1.22	1.42	1.70	1.97	1.51
40.00	0.70	0.84	0.92	0.97	1.02	1.19	1.38	1.64	1.89	1.47
50.00	0.72	0.85	0.93	0.98	1.02	1.17	1.34	1.58	1.81	1.42
75.00	0.76	0.87	0.93	0.98	1.02	1.14	1.28	1.47	1.64	1.34
100.00	0.78	0.88	0.94	0.98	1.02	1.13	1.25	1.40	1.54	1.30
150.00	0.78	0.88	0.94	0.98	1.01	1.12	1.21	1.33	1.45	1.25
200.00	0.78	0.88	0.94	0.98	1.01	1.11	1.19	1.30	1.40	1.23

* The rainfall depths from cells E8-E11 are compared with the depths given in cells J29-J40 and Z2 interpolated accordingly for each return period

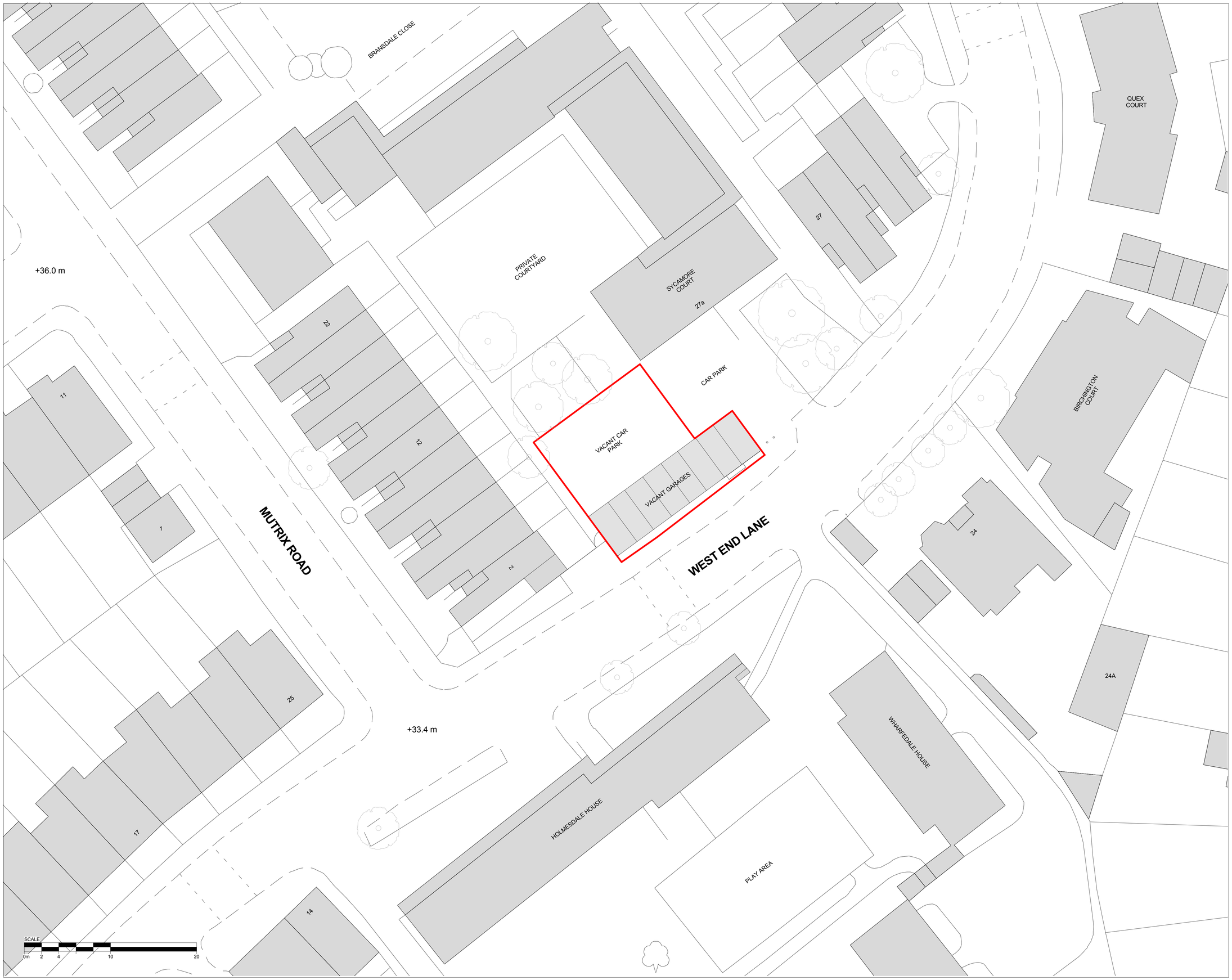
** Cv varies between 0.6 (rapidly draining soils) and 0.9 (heavy clay) with an average of 0.75 taken if ground conditions not known.

2.78*C= **3.614**

		Contributing Impermeable Area Ha	
	i	Site	Per hectare
	mm/hr	0.03	1
M 1-15	32.24	3.50	116.52
M 1-30	20.34	2.20	73.49
M 1-60	25.60	2.78	73.49
M1-360	3.42	0.37	12.37
M 30-15	79.04	**8.57**	285.65
M 30-30	50.18	5.44	181.36

		Contributing Impermeable Area Ha	
	i	Site	Per hectare
	mm/hr	0.03	1
M 30-60	30.80	3.34	181.36
M30-360	7.60	0.82	27.47
M 100-15	101.92	**11.05**	368.34
M 100-30	65.60	7.11	237.08
M 100-60	40.60	4.40	237.08
M100-360	9.92	1.08	35.84

PLANS



North

Do not scale dimensions. Dimensions govern.
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StreetPlot Ltd. shall be notified in writing of any discrepancies.

Key

Ownership Boundary

Rev	Date	Notes	Issued By	Insp By
A	100816	Planning	PB	PB

Garages to the south of 27a West End Lane

Status
PLANNING

Drawing Title
SITE PLAN EXISTING

Drawing Number
1000-100E

Revision
A

Scale
1 : 200

Sheet Size
A1

Creation Date
11.08.16

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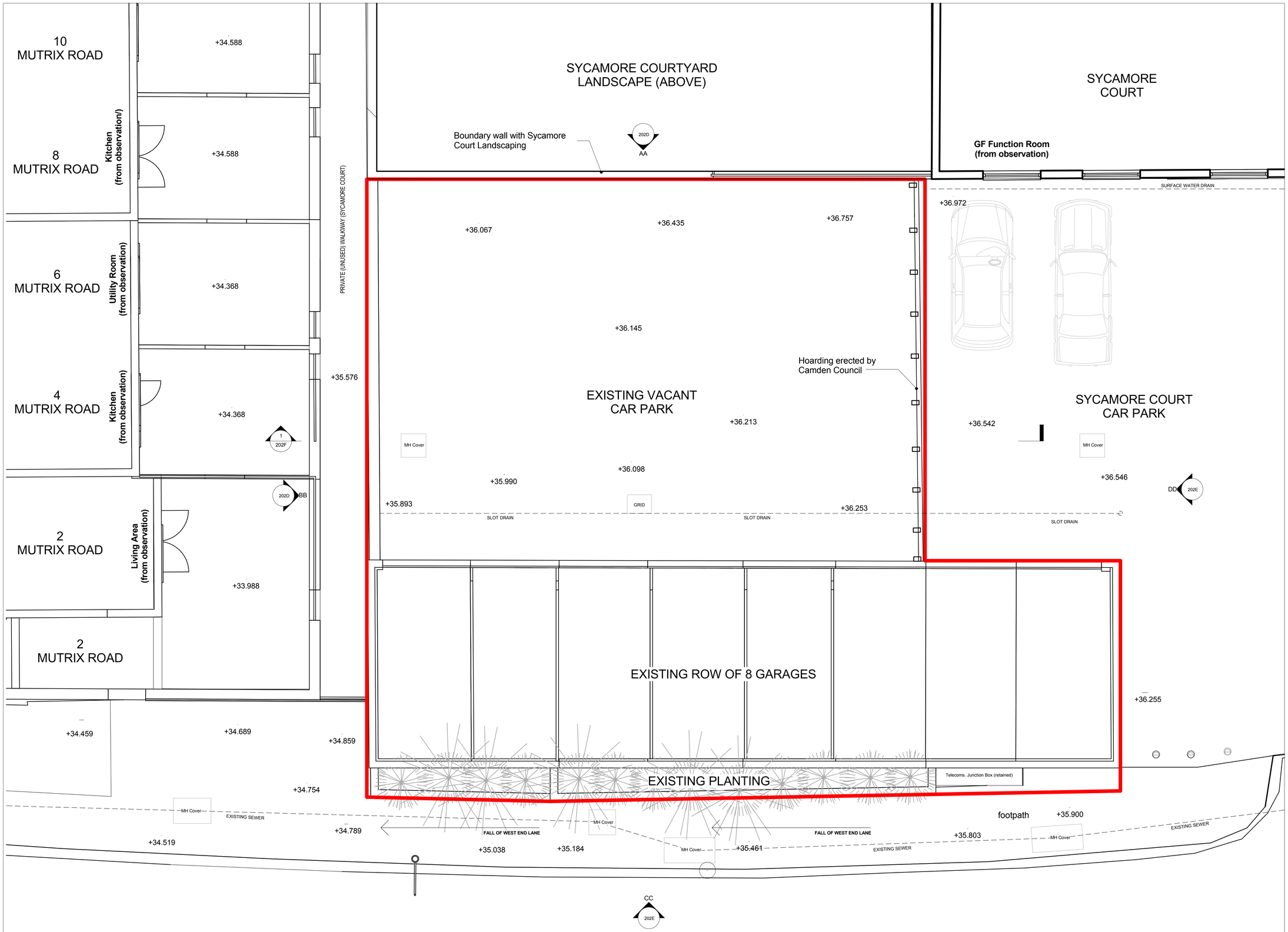
STREETPLOT



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Rev	Date	Notes	Issued By	Insp By
A	100816	Planning	PB	PB

Project
Garages to the south of 27a West End Lane

Status
PLANNING

Drawing Title
GROUND FLOOR EXISTING

Drawing Number
1000-110E

Revision
A

Scale
1:100 @ A3
1:50 @ A1

Creation Date
11.07.16

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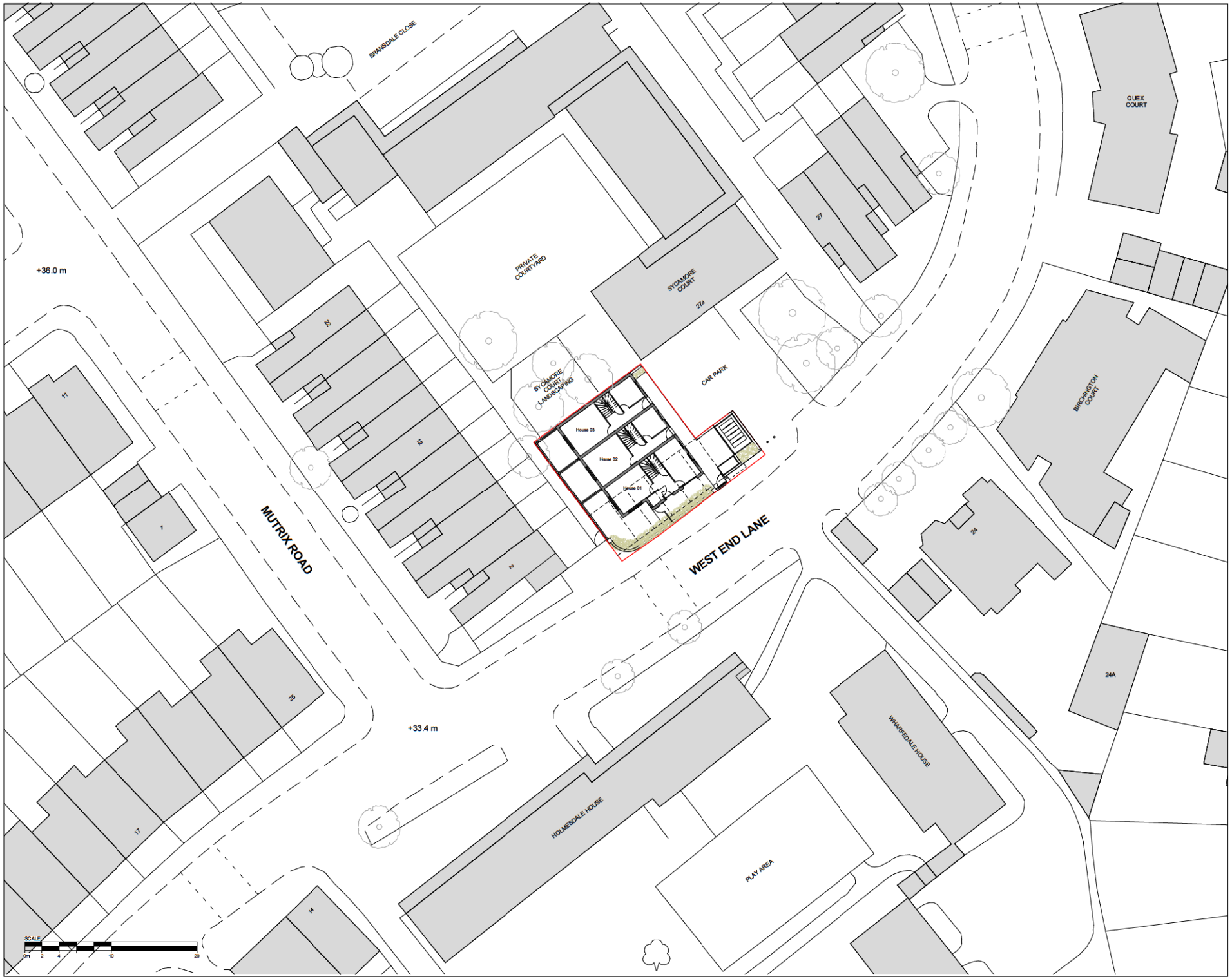

North

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Key

Ownership Boundary

Rev	Date	Notes	Issued By	Insp By
A	100816	Planning	PB	PB

Garages to the south of 27a West End Lane

Status: PLANNING

Drawing Title: SITE PLAN PROPOSED

Drawing Number: 1000-100

Revision: A

Scale: 1 : 200

Sheet Size: A1

Creation Date: 11.07.16

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STREETPLOT

AA // East Elevation (facing Sycamore Court Car Park)

BB // South Elevation (facing West End Lane)

CC // West Elevation (facing No. 2-12 Mutrix Road)

DD // North Elevation (facing Sycamore Court Landscaping)

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Rev	Date	Notes	Issued By	Insp By
A	07 09 2016	Planning	PB	PB

Garages to the south of 27a West End Lane

Status
PLANNING

Drawing Title
Proposed Elevations

Drawing Number
1000-300

Revision
A

Scale
1:100 @ A1

Creation Date
05.07.16

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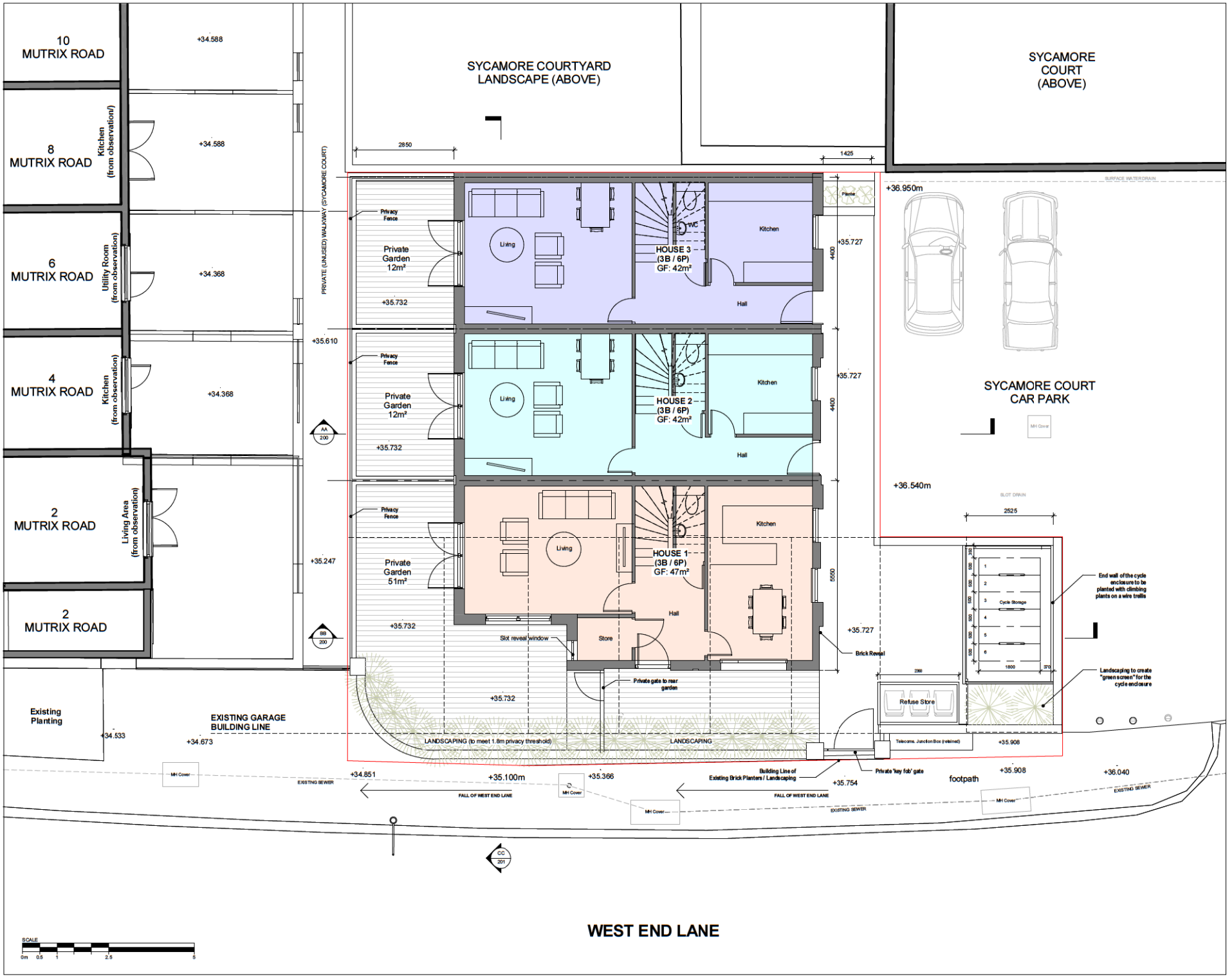

Do not scale dimensions.
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Ground Floor GIA

House 1:
47m²

House 2:
42m²

House 3:
42m²

Total GIA

House 1:
119m²

House 2:
110m²

House 3:
109m²

Rev	Date	Notes	Issued By	Insp By
A	100816	Planning	PB	PB

Project
Garages to the south of 27a West End Lane

Status
PLANNING

Drawing Title
GROUND FLOOR PLAN PROPOSED

Drawing Number: 1000-110
Revision: A

Scale: 1:100 @ A3, 1:50 @ A1
Creation Date: 11.07.16

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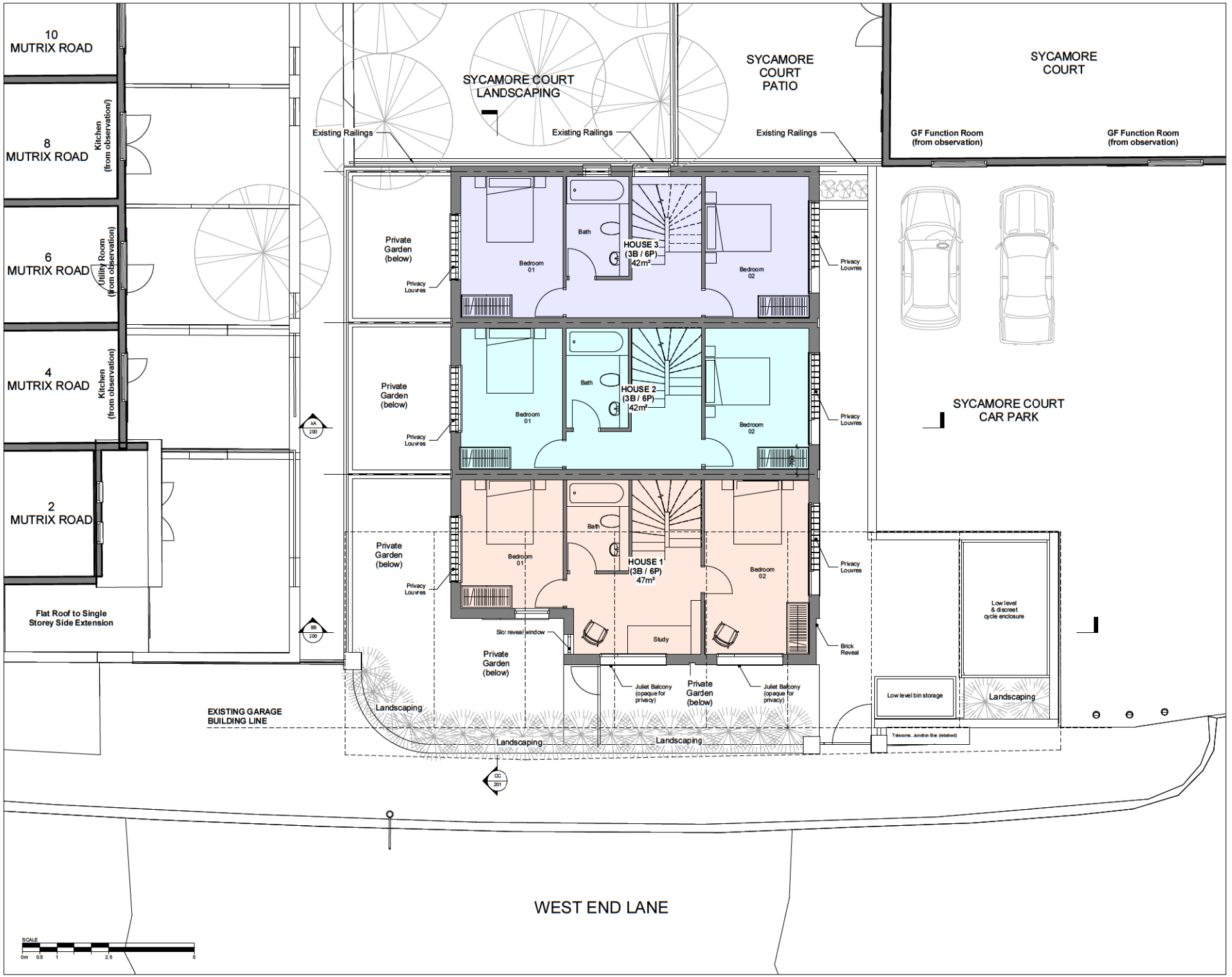

Do not scale dimensions.
All dimensions are in millimetres unless noted otherwise.
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First Floor GIA

House 1:
47m²

House 2:
42m²

House 3:
42m²

Total GIA

House 1:
119m²

House 2:
110m²

House 3:
109m²

Rev	Date	Notes	Issued By	Insp By
A	100816	Planning	PB	PB

Project
Garages to the south of 27a West End Lane

Status
PLANNING

Drawing Title
FIRST FLOOR PLAN PROPOSED

Drawing Number: 1000-111
Revision: A

Scale: 1:100 @ A3, 1:50 @ A1
Creation Date: 11.07.16

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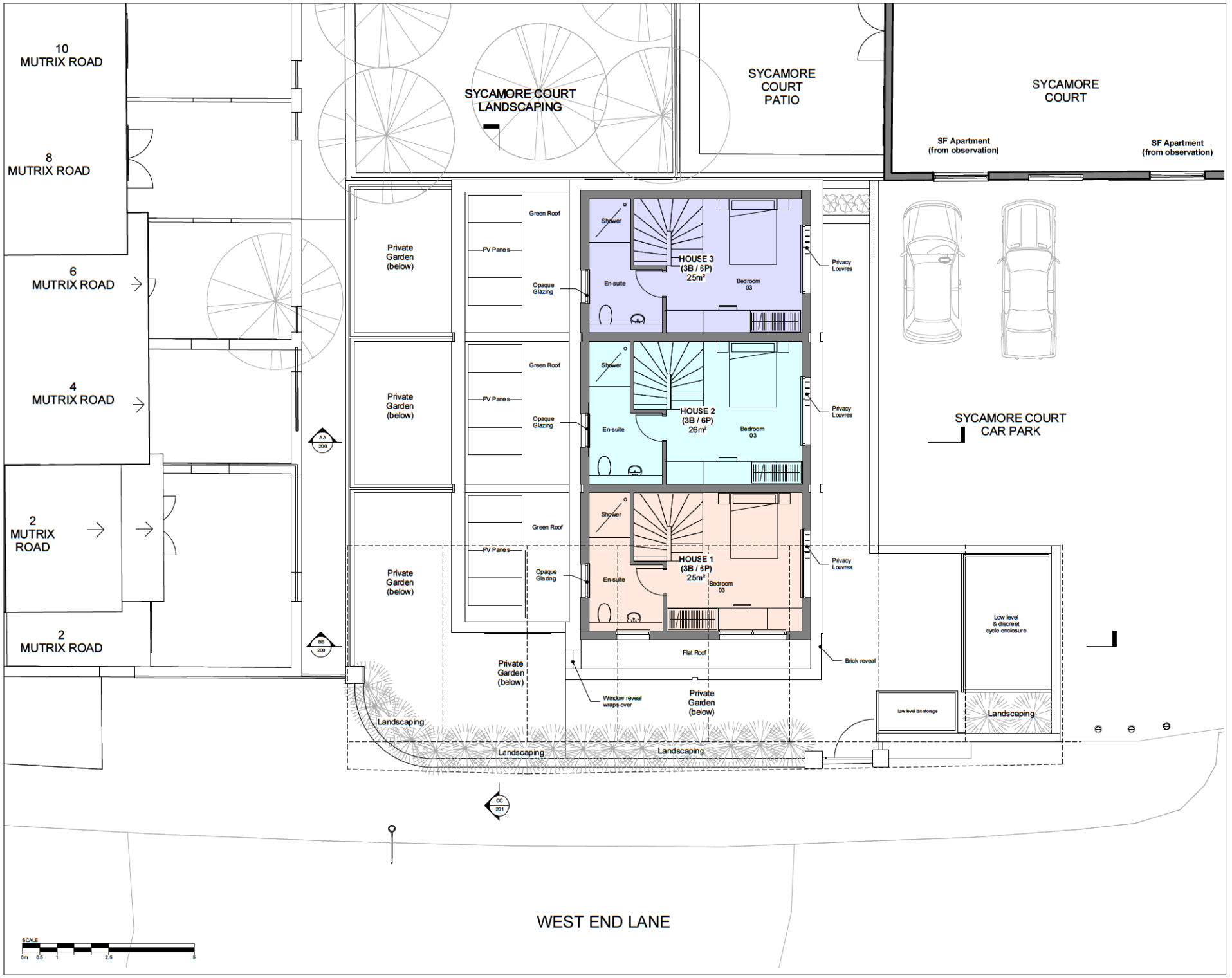

Do not scale dimensions.
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Second Floor GIA

House 1:
25m²

House 2:
26m²

House 3:
25m²

Total GIA

House 1:
119m²

House 2:
110m²

House 3:
109m²

Rev	Date	Notes	Issued By	Insp By
A	100816	Planning	PB	PB

Project
Garages to the south of 27a West End Lane

Status
PLANNING

Drawing Title
SECOND FLOOR PLAN PROPOSED

Drawing Number: 1000-112
Revision: A

Scale: 1:100 @ A3, 1:50 @ A1
Creation Date: 27.06.16

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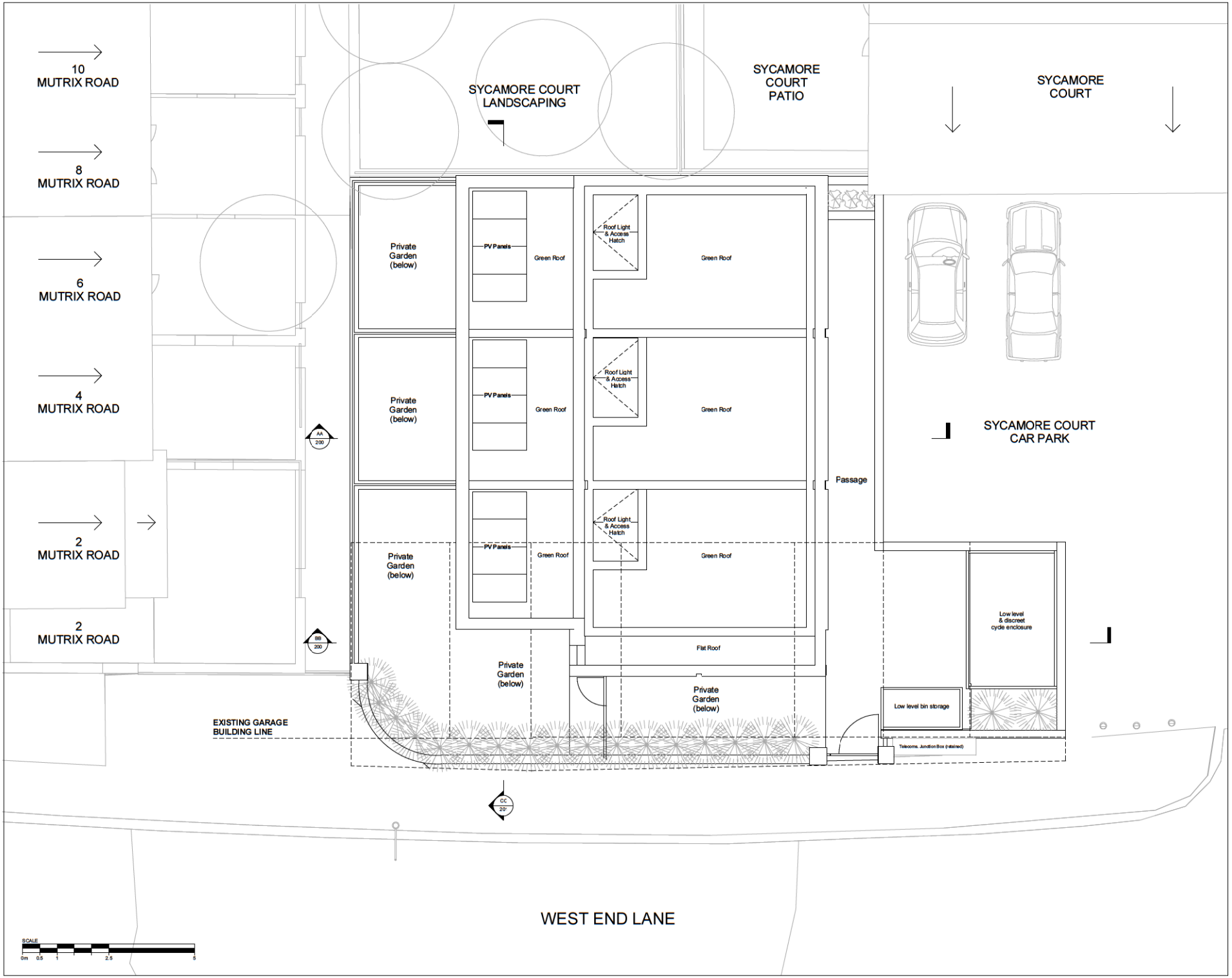

Do not scale dimensions.
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Green Roof
5 degree pitch

Extensive Green Roof, biodiverse
(inc. beneath PV panels)

Areas
Level 01: 39sqm
Level 02: 61sqm

Total: 90sqm
(to comply with CfSH Level 4)

Access
Note: Roof lights can be opened as used as an access hatch for servicing.

Rev	Date	Notes	Issued By	Insp By
A	100816	Planning	PB	PB

Project
Garages to the south of 27a West End Lane

Status
PLANNING

Drawing Title
ROOF PLAN PROPOSED

Drawing Number: 1000-114
Revision: A

Scale: 1:100 @ A3, 1:50 @ A1
Creation Date: 09.09.15

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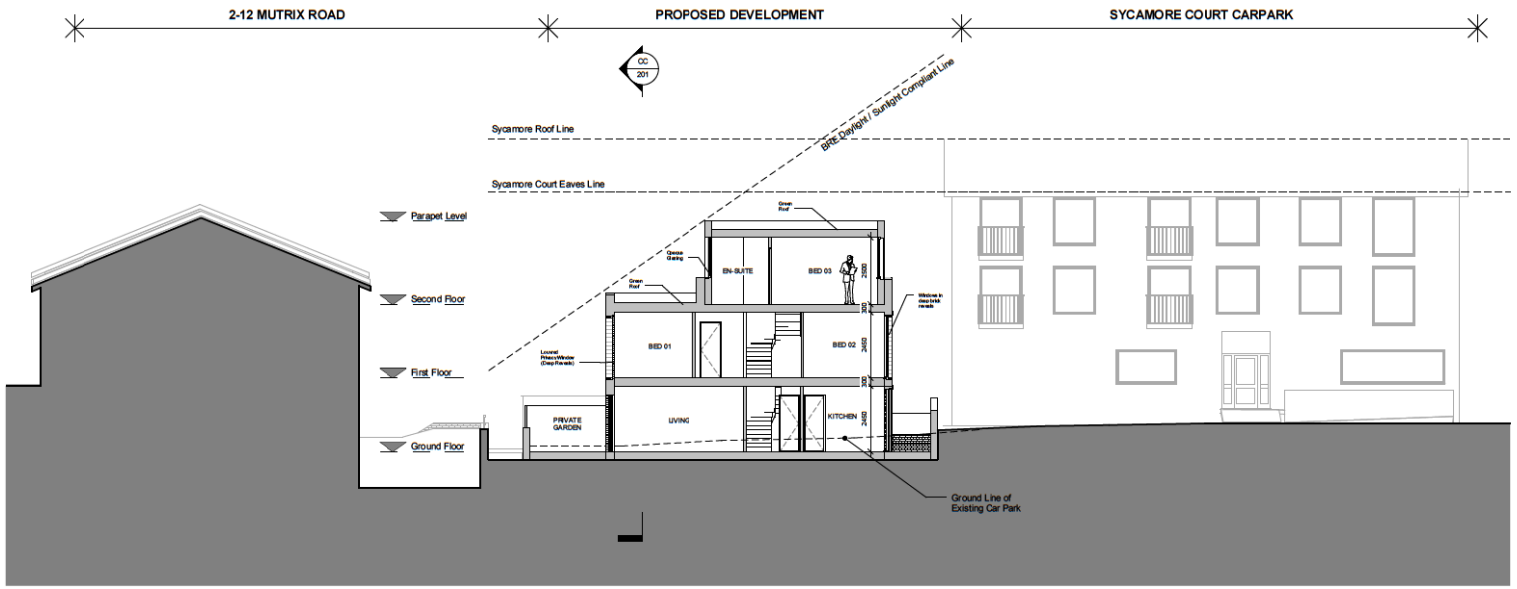
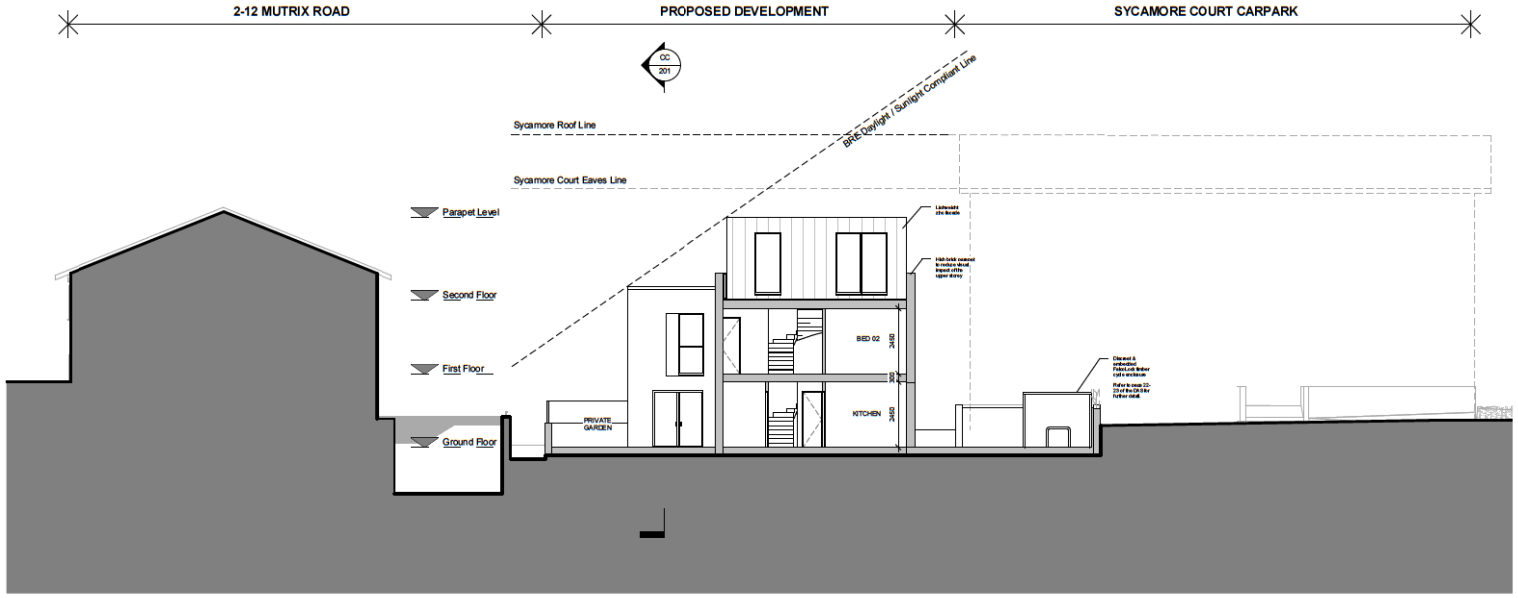
STREETPLOT



AA SECTION AA
1 : 100



BB Section BB
1 : 100

SCALE
0m 1 2 5 10

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Rev	Date	Notes	Issued By	Insp By
A	100816	Planning	PB	PB

Project
Garages to the south of 27a West End Lane

Status
PLANNING

Drawing Title
BLOCK SECTIONS 1

Drawing Number
1000-200

Revision
A

Scale
1:100 @ A1
1:200 @ A3

Creation Date
10.08.16

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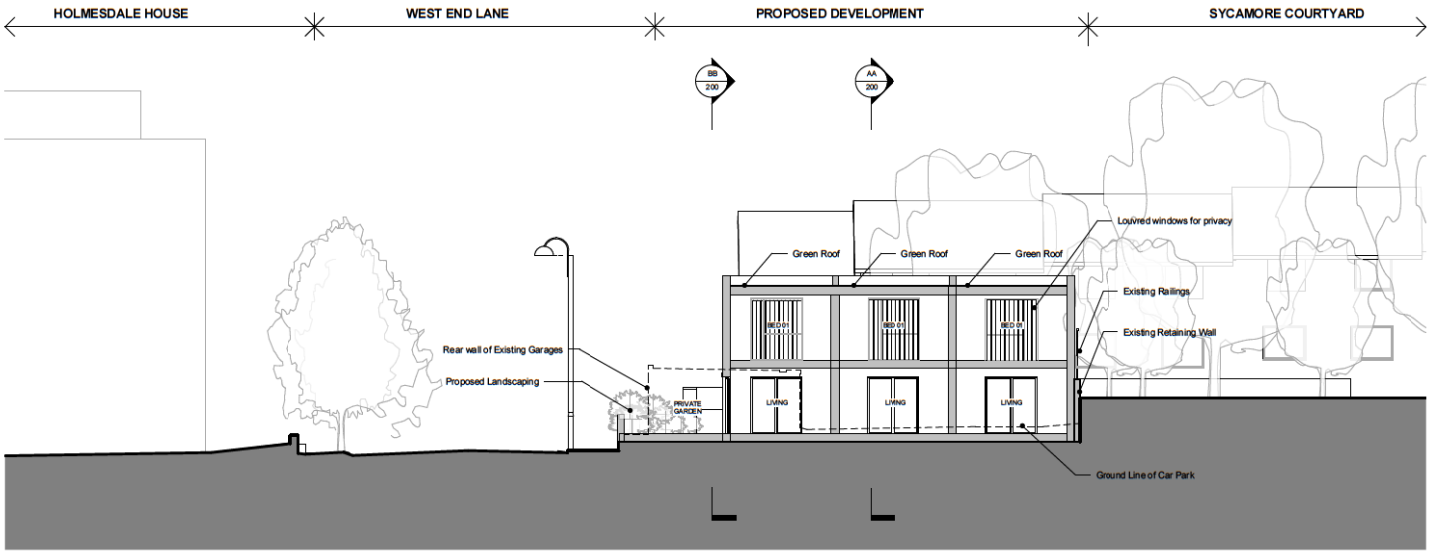
STREETPLOT



CC Section CC
1 : 100

SCALE
0m 1 2 5 10

Do not scale dimensions.
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Rev	Date	Notes	Issued By	Insp By
A	100816	Planning	PB	PB

Project
Garages to the south of 27a West End Lane

Status
PLANNING

Drawing Title
BLOCK SECTIONS 2

Drawing Number: 1000-201
Revision: A

Scale: 1:100 @ A1, 1:200 @ A3
Creation Date: 10.08.16

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