TECHNICAL NOTE

WATER | ENVIRONMENT

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PROJECT	34 Hollycroft Avenue London Borough of Camden	CLIENT	Truda and Daniel Agostino	
TITLE	SuDS Technical Note	REFERENCE	23003-SWD-TN-01	C01

AUTHOR	CHECKER	APPROVER
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REV	COMMENTS	DATE	AUTH	CHKR	APPR
P01	First issue	03/03/2023	CB	DM	GL
C01	Final Issue	23/03/2023	CB	DM	GL

1 Introduction

1.1 Water Environment Ltd were commissioned by Truda and Daniel Agostino to review the surface water drainage (SuDS) of a proposed development at 34 Hollycroft Avenue. The site is located within the London Borough of Camden (LBC)

1.2 The proposed development is not deemed to be "Major Development" and as such full details of the outline SuDS strategy is not required for planning permission. The lengthy and detailed requirements in relation to SuDS design at planning application stage for Major Development should not be imposed on a householder application in accordance with the National Planning Policy Framework (NPPF) [1], which states all requirements should be commensurate with the scale of the proposed development.

1.3 The proposal at the site is for a householder basement development and SuDS is required in accordance with the LBC planning policy. Furthermore, the site in located in a London Borough and as such the London Plan must also be adhered too, which contains surface water management policies for new developments (no matter of scale).

1.4 This outline SuDS design and report provides sufficient information for LBC to determine that surface water is to be managed safely for the site in relation to the proposed development.

1.5 This document has been prepared with due consideration of the revised NPPF and the local planning requirements.

[1] Ministry of Housing, Communities and Local Government, Revised National Planning Policy Framework, July 2021

2 DESCRIPTION OF DEVELOPMENT

2.1 The existing development is a single residential dwelling and is bounded by neighbouring residential dwellings.

2.2 The site area is 0.044 ha which contains the current residential property and gardens. The site has a rear garden which has artificial grass and front garden which includes an impermeable driveway.

2.3 The proposals for the site are to for a single storey basement level beneath the footprint of the existing house. The site has been granted permission for a rear extension under ref. 2022/0800/P. This basement application does not increase hard standing area post development. The planning application is solely for a basement with no changes above ground.

2.4 A topographical survey was completed for the site, by others, which showed ground levels to vary from approximately 103.3 m AOD to 104.4 m AOD. The ground levels within the survey correlate to the Thames Water manhole cover and invert levels which are provided in m AOD (included in the appendix for reference).

2.5 The topographical survey notes the current position of the rainwater downpipes and manholes on the site. It is not known if these manholes are associated to foul or surface water drainage, as this was disclosed on the survey, or an inspection undertaken on the site.

2.6 The location of the site in the context of local water features is shown in Figure 1.

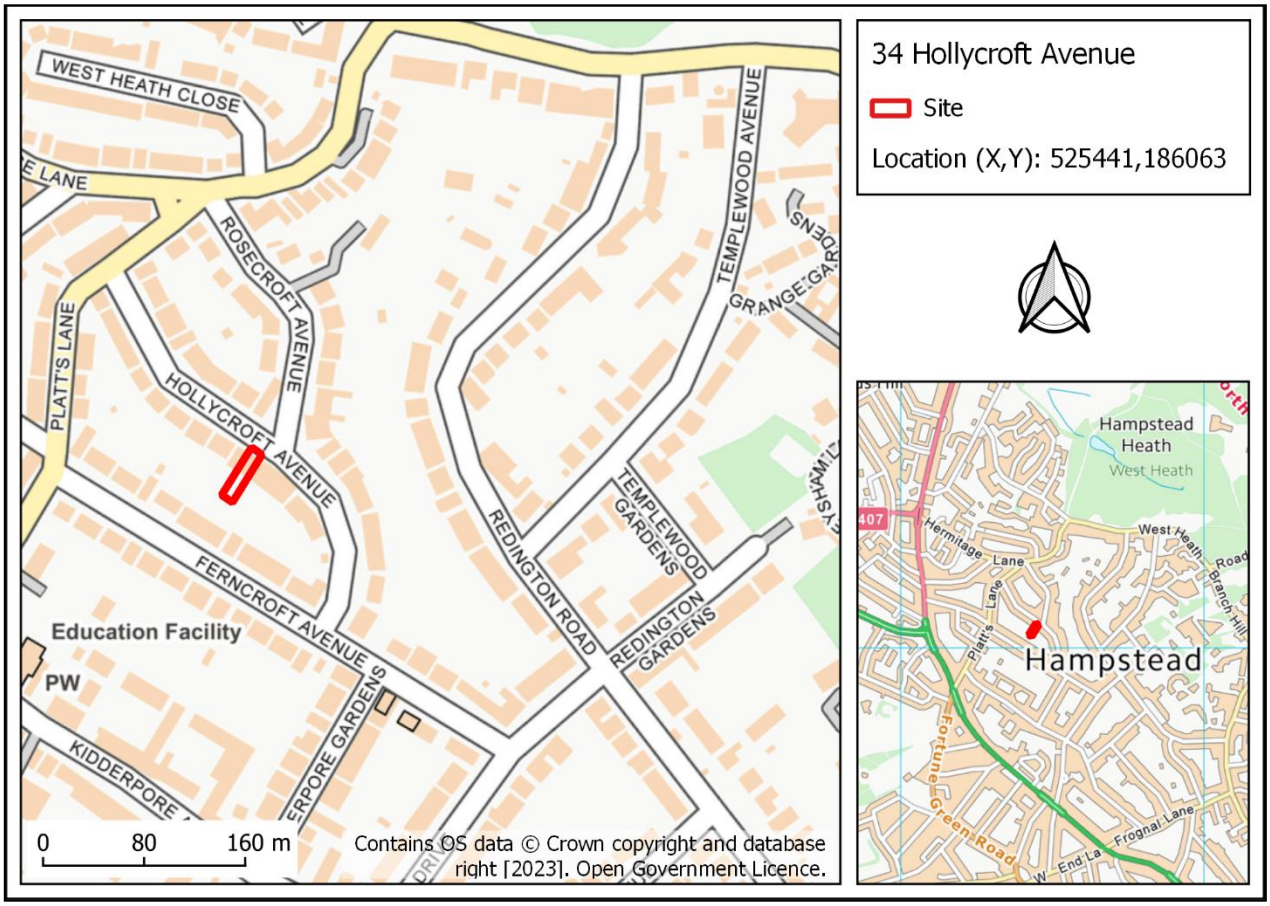


Figure 1- Location of the site

Geology and Ground Investigation

2.7 The British Geologic Survey (BGS) 1:50,000 scale mapping does not classify the superficial geology underlying the site. The bedrock geology is categorised as the permeable Claygate Member / London Clay.

2.8 The DEFRA Magic Map[2] shows that the site is not located in a groundwater Source Protection Zone, but and bedrock is classified as a 'Secondary A Aquifer'. The groundwater vulnerability is shown to have an 'unproductive' risk.

2.9 The BGS and DEFRA maps suggests that ground below the site could support groundwater at a local level but not a strategic level.

2.10 A site ground investigation was undertaken on 11th February 2022 by Ground and Water. The site investigation undertook a borehole to 8 m below ground level (bgl) and three trial pits. No BRE 365 testing was also undertaken as part of the site investigation.

2.11 The ground investigation confirmed that the geology at the site was made ground to 0.3 m below ground level underlain by the London Clay formation. The borehole did not encounter any groundwater during excavation, however a later groundwater reading at 3.3 m below ground level (100.2 m AOD) was recorded.

2.12 From the borehole on the site, it is considered unlikely that the site can infiltrate surface water due to the presence of London Clay. However, this should be confirmed with BRE 365 infiltration rates.

3 Sustainable Drainage Outline Strategy

3.1 An outline SuDS strategy has been prepared. The outline design has been undertaken in line with the SuDS and drainage hierarchy. Local policy forLBC, Policy CC3 requires development to:

> *"utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible;"*

3.2 LBC basement policy, A5 requires basement proposals (no matter of scale) to:

> *"avoid adversely affecting drainage and run-off or causing other damage to the water environment"*

3.3 The proposed development does not constitute "Major Development" and is a householder application for a basement extension. The lengthy and detailed requirements in relation to SuDS design at planning application stage for Major Development should not be imposed on a householder application in accordance with the NPPF, which states all requirements should be commensurate with the scale of the proposed development.

3.4 As permission has already been granted for the above ground rear extension in 2022, this is deemed built for the purposed this application / report.

Existing Site Runoff

3.5 The current state of the site is mostly hard paved (65%) and is assumed to discharge directly into the public sewer with no form of attenuation. There is some permeable landscaping on the current site, which constitutes 35% of the current site (154 m^2). The current runoff rates are 12.4 l/s for the 100-year event.

3.6 The rear garden is shown to be predominantly artificial grass (totals 119 m^2). Typically, artificial grass has a sand or gravel medium below the artificial grass to aid infiltration and as such is deemed permeable.

[2] https://magic.defra.gov.uk/MagicMap.aspx

The rate of infiltration, or storage available in the artificial grass in unknown. The artificial grass was deemed to be a permeable because it should mimic traditional permeable surfaces.

Proposed Site Runoff (No Mitigation)

3.7 There is no increase in hard standing post development, as part of this application. However, the NPPF requires all development to account for climate change. The current climate change allowance for 40% for this catchment (London Management Catchment). The 100 year + 40% climate change peak site runoff for the site post development is 17.3 l/s.

Discharge Strategy

3.8 The discharge hierarchy should be considered and the relevant Planning Practice Guidance states:

"Generally the aim should be discharge surface runoff as high up the following hierarchy of drainage options as reasonably practicable:

1. Into the ground (infiltration);

2. To a surface water body;

3. To a surface water sewer, highway drain or another drainage system;

4. To a combined sewer."

3.9 The desktop geological study and onsite boreholes indicate the geology below the site may not support formal infiltration devices such as soakaways because of the presence of London Clay. As such, formal soakaways are deemed not suitable for the site, but this should be formally confirmed with BRE 365 testing.

3.10 The site could accommodate shallow infiltration devices such as infiltration blankets, but rates of discharge would need to be also confirmed by BRE 365 testing or the system would need to lined (impermeable membrane) and have a controlled outfall.

3.11 There are no surface water bodies or watercourses which could receive runoff from the site.

3.12 Thames Water asset plans show the site is in the vicinity of a 305 mm diameter combined sewer within Hollycroft Avenue. There are no surface water sewers in the vicinity of the site. It is therefore assumed that the site discharges into the Thames Water combined network. The asset plans are appended to this document.

3.13 Connection to the Thames Water sewer is assumed and would need to be confirmed by a CCTV survey of existing drainage network at the site.

3.14 An application to Thames Water for a connection is not required as the proposal is to connect to the existing on-site private demarcation chamber. Since there is no increase in the number of properties on the development, and as there is an existing connection from the site the property has an assumed "existing right to discharge".

Sustainable Drainage Principles

3.15 The aim of SuDS is to emulate natural drainage processes such that watercourses and storage areas receive the hydrological profiles under which they evolved, and that water quality in local ecosystems is protected or improved. The best practice guide states that SuDS will:

- Reduce the impact of additional urbanisation on the frequency and size of floods;
- Protect or enhance river and groundwater quality;

- Be sympathetic to the needs of the local environment and community; and
- Encourage natural groundwater recharge.

3.16 Figure 2 shows the hierarchy of SuDS techniques. The SuDS techniques that are proposed to manage surface water for the development will be discussed in relation to this hierarchy.

	SUDS Technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife
Most Sustainable	**Green roofs**	✓	✓	✓
	Basins and ponds 1. Constructed wetlands 2. Balancing ponds 3. Detention basins 4. Retention ponds	✓	✓	✓
	Filter strips and swales	✓	✓	✓
	Infiltration devices 5. Soakaways 6. Infiltration trenches and basins	✓	✓	✓
	Permeable surfaces and filter drains 7. Gravelled areas 8. Solid paving blocks 9. Porous paviors	✓	✓	
Least Sustainable	**Tanked systems** 10. Over-sized pipes/tanks 11. Box storage systems	✓		

Figure 2: SuDS Hierarchy[3]

3.17 In accordance with the SuDS hierarchy, living roofs are the most sustainable option in terms of flood reduction, pollution reduction and landscape and wildlife benefit.

3.18 Living roofs are not feasible because of the pitched roof construction on the current property and the proposed extension.

3.19 Basins, ponds, filter strips and swales are not suitable for use within the development due to a lack of available space.

3.20 The ground investigation indicates that the sub-surface geology is made up of London Clay which is generally not suitable for infiltration devices (e.g. soakaways). This has not been confirmed with BRE 365 infiltration testing but typically London Clay is typically not considered suitable for infiltration type drainage.

3.21 Shallow infiltration such as an infiltration blanket may be a viable SuDS solution for the development to discharge surface water, as they can be installed next to the proposed building, provided the upstream connections to the subbase have catchpits prior to connecting to the subbase. This will be brought forward into the outline SuDS design.

3.22 The infiltration blanket also offers water quality benefits, improving the quality of water due to percolation through the gravel subbase.

[3] http://www.sustainabledrainagecentre.co.uk/suds-hierarchy_c2236.aspx Retrieved 02/11/2016

3.23 The development can also provide source control and retain rainwater on site for reuse. It is strongly recommended that any associated landscaped areas are designed as bioretention areas, tree pits and /or rain gardens to retain and utilise rainfall. Water butts could also be installed on rainwater downpipes.

3.24 Whilst implementing rainwater harvesting techniques such as rainwater butts (for watering gardens etc.) are encouraged, these are not included within any calculations as a cautious measure because it cannot be guaranteed these will be empty during a storm event.

3.25 The proposed outlined SuDS strategy has been determined in accordance with London Plan policy SI 13, which aims to achieve greenfield run-off rates (or as close as practicable) and ensure surface water is managed as close to its source as possible. The policy dictates that there should be a preference for green over grey features, in line with the following drainage hierarchy outlined in Table 1.

Table 1 - London Plan Drainage Hierarchy

Technique	Practicable	Proposed	Notes
Rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)	×	×	Can be suitable. Rainwater harvesting via water buts has been excluded in calculations in case these are full at the time of a storm event.
Rainwater infiltration to ground at or close to source	?	×	London Clay formation lies beneath the site which typically doesn't infiltrate water efficiently. However, shallow infiltration devices (infiltration blanket) may be suitable and can be laid closer to the building but may need to lined with a controlled outlet.
Rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)	×	×	No green roof proposed due to pitched nature of the roof. Rain gardens and bio-retention areas have been excluded from calculations as a cautionary measure as these areas are small.
Rainwater discharge direct to a watercourse (unless not appropriate)	×	×	No nearby watercourse.
Controlled rainwater discharge to a surface water sewer or drain	×	×	No surface water sewer within the vicinity of the site.
Controlled rainwater discharge to a combined sewer	✓	✓	Combined sewer is the only suitable discharge method.

Proposed Surface Water Drainage System

3.26 The design approach of integrating SuDS with the proposed development will be based on the SuDS and discharge hierarchies. However, the site is not located adjacent to a watercourse and infiltration is assumed not possible on the site due the presence of clay shown within the onsite borehole. Consequently, the discharge point will be via reuse of the existing connections to the Thames Water surface water sewer.

3.27 Following the SuDS hierarchy, the current and proposed development had a pitched roof, which is unable to support a living (green) roof. It is assumed that infiltration is not possible due to the underlying clay geology. The site and development are not suited to the use of above-ground attenuation.

3.28 The existing site drainage discharges is assumed to be directed into the 305 mm stormwater public sewer located in Hollycroft Avenue.

3.29 Given that there is an existing connection from the site, the property can be considered to have an "existing right to discharge".

3.30 The front half of the property is not changing. As the front garden and driveway are not to be changed, this means new drainage cannot be constructed within this area and as such, drainage in this area of the site should not be altered and continue to discharge as it does currently.

3.31 The previous approved application at the site is for a rear extension and this is planned to be undertaken at the same time at the basement works. Therefore, there is potential to include SuDS within this portion of the site as the works are to be all be undertaken at the same time.

3.32 The patio itself will be hard paved but, as per the findings of the ground investigation, runoff could be accommodated in the soft landscaping. This is in keeping with Building Regulations Part H – section 2.6:

> *"Paths, driveways and other narrow areas of paving should be free draining to a pervious area such as grassland, provided that:*
>
> *a. the water is not discharged adjacent to buildings where it could damage foundations; and*
>
> *b. the soakage capacity of the ground is not overloaded."*

3.33 However, the current site has artificial grass, and this may not be suitable to accommodate the surface water flows from the new patio. This is because it is not known on the depth or material of permeable substrate below the artificial grass. However, the subbase could be increased to accommodate the increase in flows due to climate change.

3.34 To ensure a feasible SuDS design, the following engineering decisions were made:

- Volumetric runoff coefficient (Cv) values were changed from the default (Cv=0.74 and 0.84) to ensure that all of the design storm event was captured in the drainage model. A Cv value of 1.0 ensures all of the storm is assessed i.e. 100% of the water. The default Cv values assume loss of water though natural infiltration etc.
- FEH (Flood Estimation Handbook) point data was also used for the storm event rather than FSR (Flood Studies Report). FEH is more up-to-date than FSR data and provides a more-reliable representation of the expected rainfall on the site.
- The precautionary assumptions and decision used (no bio retention, no water butts) within our SuDS calculations ensure there is adequate space in the network for the design storm event. This means there should be additional storage available within the proposed subbase for exceedance events, additional SuDS features are implemented (such as water butts).

3.35 To ensure there is no increase in surface water rates from the development the suggested outline SuDS proposals is:

- An infiltration blanket of 153 m^2 of 0.3 m deep and 30% void porosity underneath the artificial grass or patio.
- A flow control (ACO Q Brake) of 12.4 l/s is included in the Microdrainage calculations to mimic the current surface water flow rates from the site in the 100-year event.

- The infiltration blanket has been designed with no infiltration to ensure the increase in rates and be contained on the site with no flooding above ground.

3.36 Design of the infiltration blanket and details of the connection into the current network are all part of the detailed design stage of the development. This level of detail can be conditioned as part of the planning permission by the LLFA, if required.

3.37 The SuDS Manual provides some outline guidance on maintenance requirements, as presented in the appendix. These are generic and provide advice only. Management and maintenance of all drainage elements should be carried out in accordance with the guidance and specification provided by the relevant suppliers.

3.38 The LBC and London Plan policy states that development proposals should aim to achieve greenfield runoff rate. The restrictions and engineering design requirements on the site means that this is not achievable for a householder extension. Achieving greenfield runoff would result in large additional costs to the homeowner.

3.39 The development will be reducing the peak load to the local public sewer network, which will reduce the risk of sewer flooding to neighbouring properties.

3.40 Detail design of SuDS and details of the connections are all part of the detailed design stage of the development. This level of detail can be conditioned as part of the planning permission, if required.

3.41 For exceedance events, the surface water flows would initially be contained on the site. As the rear garden is lower than the ground floor of the property, exceedance event flows could be contained within the sunken rear garden. For the front of the site, any exceedance event would continue flow onto Hollycroft Avenue. The development with the SuDS proposals would not result in the exacerbation of the current situation and the exceedance routes are not altered as part of this development. The inclusion of SuDS would not increase the risk of surface water flooding but result in fewer overland flow routes from the site.

3.42 The proposed SuDS system will be the responsibility of the homeowner (typically the freeholder).

3.43 The SuDS Manual provides some outline guidance on maintenance requirements, as presented in the appendix. These are generic and provide advice only. Management and maintenance of all drainage elements should be carried out in accordance with the guidance and specification provided by the relevant suppliers. The flow control management and maintenance will be specified by the manufacturer.

3.44 The proposed SuDS solution and development ensures no increase in risk to other and decreases the surface water rates at the site.

4 Summary

4.1 A SuDS assessment has been prepared as part of the basement application at 34 Hollycroft Avenue. The proposed development within this planning application will not result in the change of areas post development however due to climate change there is an increase in surface water rates from the site. As such SuDS has been proposed to ensure no increase in surface water rates from the development.

4.2 The proposals are for a household basement extension and therefore the design of SuDS is to be reflective of the scale of work. As such the requirements of Major Development SuDS should not be imposed on the development or the site. The proposals for the site are to maintain surface water rates to ensure no increase in risk.

4.3 The proposed SuDS at the site to is the inclusion of a infiltration blanket under the artificial grass or the rear patio. Design of the infiltration blanket and details of the connection into the current network are all

part of the detailed design stage of the development. This level of detail can be conditioned as part of the planning permission by the LLFA, if required.

4.4 The calculations undertaken for this development have been precautionary. They have not included any potential water reuse in the form of water butts for irrigation in the garden.

4.5 The information provided in this report should be more than sufficient to demonstrate how surface water can be managed safely on the site for the design event. Any additional details which the LLFA would like to see demonstrated should be conditioned as this would be deemed detail design and would be disproportionate both in time and cost at this stage of the application process.

4.6 The property owner (typically the freeholder) will be responsible for the upkeep of the surface water network on the site.

4.7 The proposed SuDS measures for the development have been demonstrated to result in a reduction in surface water runoff rates and volumes from the site post-development and the proposals attempt to limit runoff, in so far as technically practicable, towards greenfield rates. This is compliant with the NPPF, the London Plan and local policy.

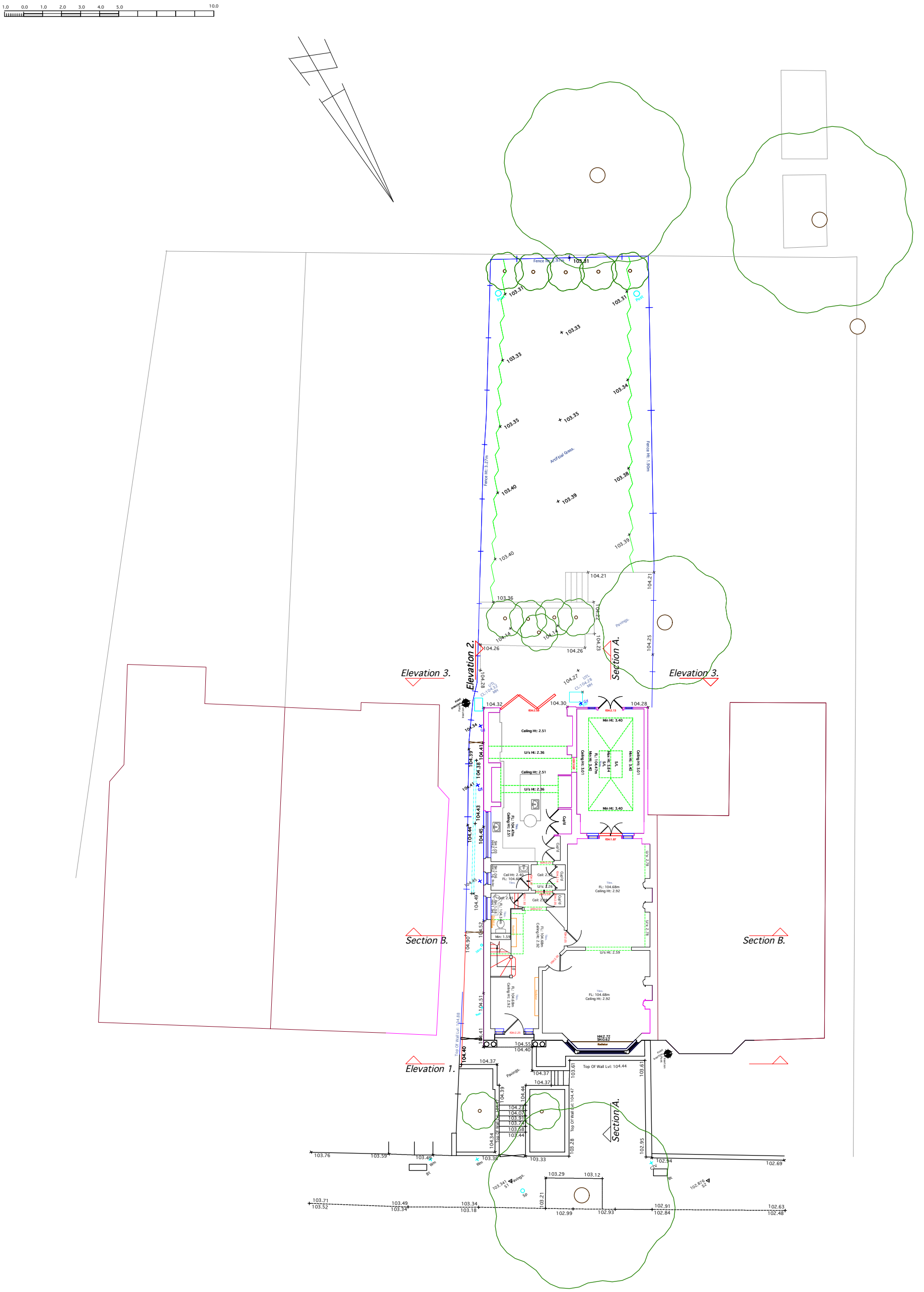
Appendix

- Topographic Survey
- Proposed Plans
- Thames Water Asset Plans
- Surface Water Calculations

Maintenance requirements for soakaway[4]

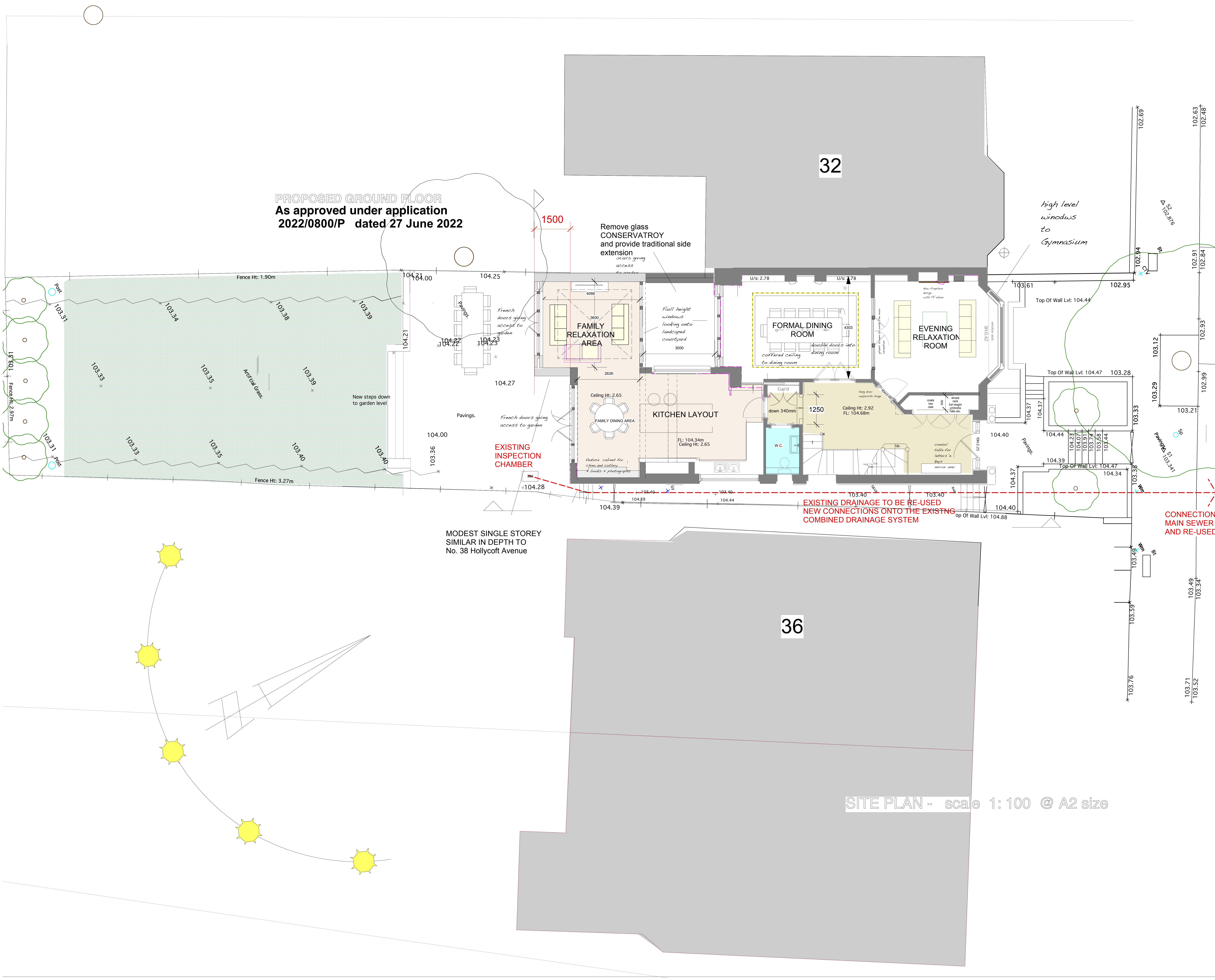
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages.	Annually, or as required
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required, based on inspections
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will requirere construction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

[4] Based on CIRIA C753 Table 20.15 – Operation and maintenance requirements for pervious pavements



TOPOGRAPHIC SURVEY OF EXISTING HOUSE WITHIN ITS GARDEN CURTILAGE

EXISTING SITE PLAN - scale 1:200 @ A2 size



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REVISIONS

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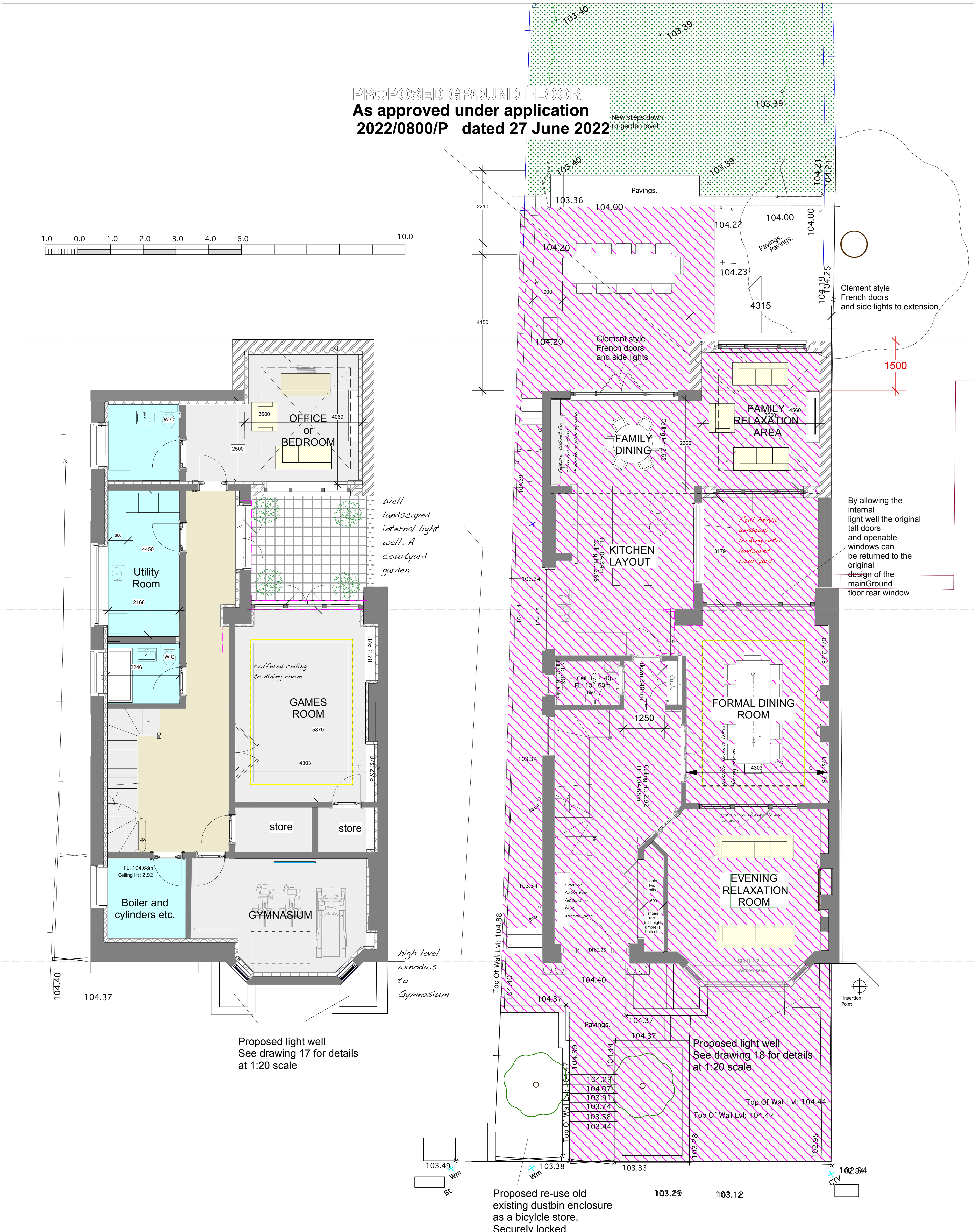
DRAWING TITLE
PROPOSED SITE PLAN at
SHOWING PROPOSED LEVELS

SCALE **1:100 @A2** DATE **June 2022**

DRAWING NUMBER
06.952.19

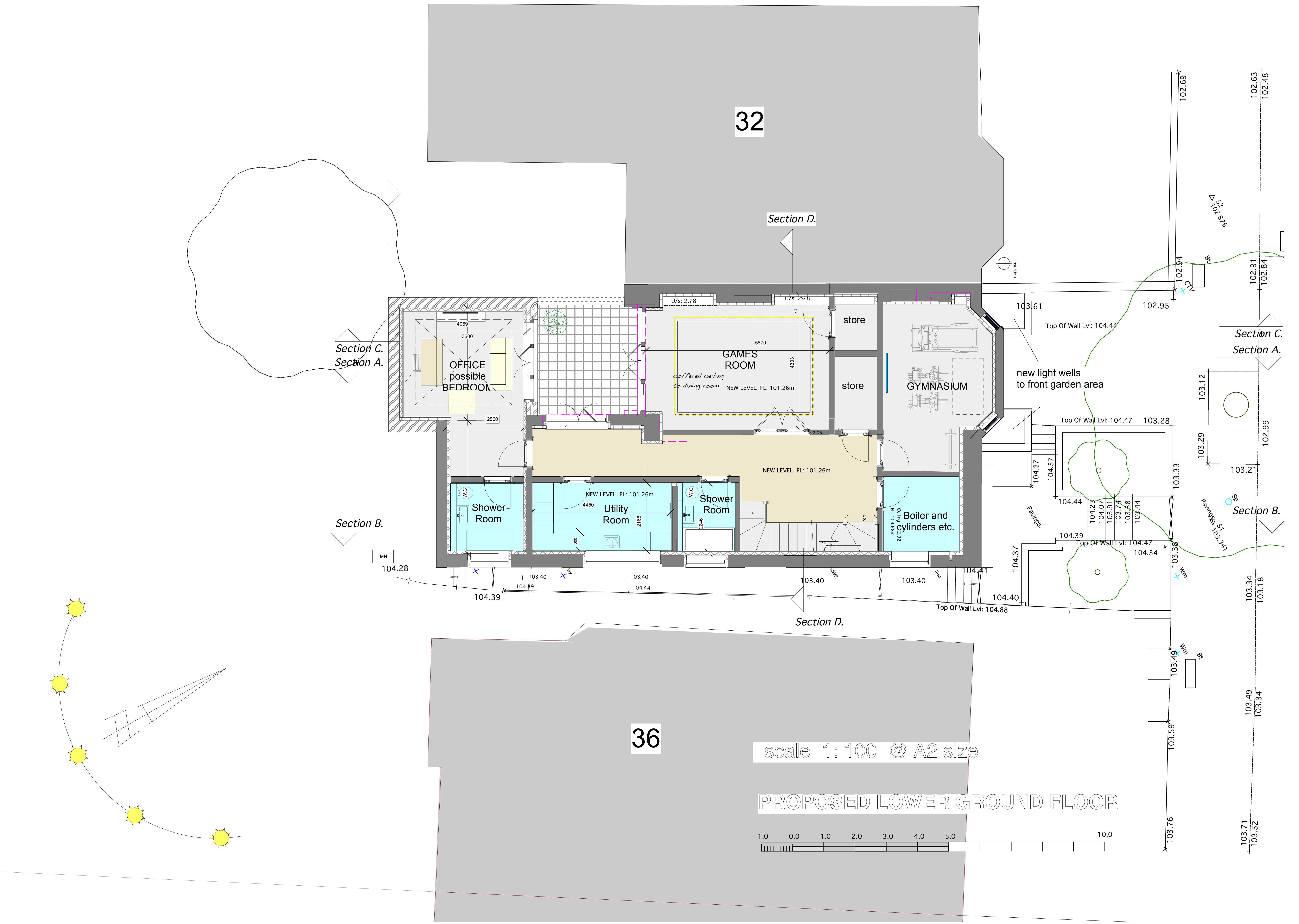


PROPOSED LOWER GROUND FOOR
120 m2 (1290 sq.ft)

LOWER GROUND FLOOR

PROPOSED LAYOUT SHOWING AREA IN PINK
REQUIRED TO CARRY OUT THE DEVELOPMENT

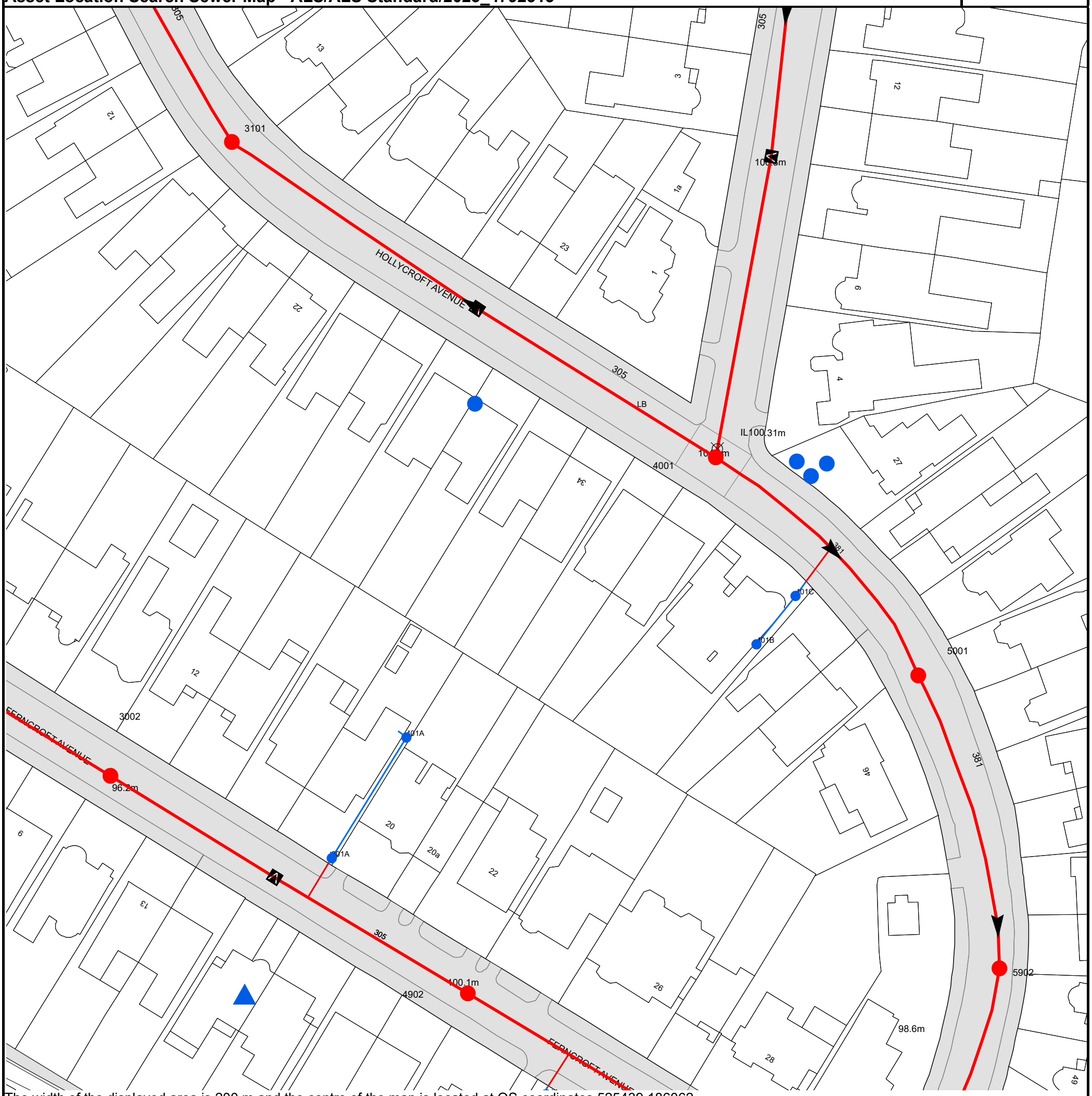
GROUND FLOOR



scale 1: 100 @ A2 size

PROPOSED LOWER GROUND FLOOR

Asset Location Search Sewer Map - ALS/ALS Standard/2023_4792313



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 525439,186062

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
3002	96.05	91.51
3101	99.21	95.31
301A	98.72	97.78
401A	100.57	99.6
4902	100.08	95.55
40BF	n/a	n/a
4001	103.98	100.27
401B	n/a	n/a
401C	n/a	n/a
40AE	n/a	n/a
40AG	n/a	n/a
40AF	n/a	n/a
5001	102.82	97.96
5902	98.97	95.43

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

Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

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

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

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

- Storm Sewer
- Sludge Sewer
- Foul Trunk Sewer
- Surface Trunk Sewer
- Combined Trunk Sewer
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Vacuum
- Thames Water Proposed
- Vent Pipe
- Gallery

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

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

Sewer Fittings

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

- Air Valve
- Meter
- Dam Chase
- Vent
- Fitting

Operational Controls

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

- Ancillary
- Drop Pipe
- Control Valve
- Weir

End Items

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

- Inlet
- Outfall
- Undefined End

Other Symbols

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

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

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Chamber
- Operational Site

Ducts or Crossings

- Casement

Ducts may contain high voltage cables. Please check with Thames Water.

- Conduit Bridge
- Subway
- Tunnel

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plan are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology, please contact Property Searches on 0800 009 4540.

Percussion Drilling Log

Project Name: 34 Hollycroft Avenue	Client: Vincent and Rymill	Date: 11/02/2022
Location: West Hampstead, London NW3 7QL	Contractor:	
Project No. : GWPR4636	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS01	WLS	103.50m AoD		1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20	103.30		SLAB WITH CONCRETE
					0.30	103.20		MADE GROUND: Greyish brown gravelly SAND. Sand was fine to coarse. Gravel was fine to coarse, angular to sub-angular brick (50%) and concrete (50%).
		1.00	SPT	N=8 (2,2/2,2,2,2)				Orangish brown silty CLAY with localised sand and silt bands. LONDON CLAY FORMATION.
		2.00	SPT	N=11 (2,2/3,2,3,3)				
		3.00	SPT	N=13 (3,3/3,3,3,4)				
					3.80	99.70		
		4.00	SPT	N=22 (3,3/4,4,6,8)				Orangish brown silty CLAY. LONDON CLAY FORMATION.
		5.00	SPT	N=36 (8,9/9,9,9,9)				
					5.90	97.60		
		6.00	SPT	N=34 (8,8/8,9,8,9)				Bluish grey silty CLAY. LONDON CLAY FORMATION.
		7.00	SPT	N=39 (8,8/8,9,11,11)				
		8.00	SPT	N=33 (10,10/8,8,8,9)	8.00	95.50		End of Borehole at 8.000m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

No fresh roots were noted. No groundwater was encountered.

Percussion Drilling Log

Project Name: 34 Hollycroft Avenue	Client: Vincent and Rymill	Date: 11/02/2022
Location: West Hampstead, London NW3 7QL	Contractor:	
Project No. : GWPR4636	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS02	WLS	103.40m AoD		1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.90	102.50		MADE GROUND: Brown gravelly clayey SAND. Sand was fine to coarse. Gravel was fine to coarse, angular to sub-rounded flint (40%), brick (30%) and concrete (30%).
								End of Borehole at 0.900m

1 2 3 4 5 6 7 8 9 10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Fresh roots were noted for the full depth (0.90m bgl). No groundwater was encountered.

Trial Pit Log

Project Name: 34 Hollycroft Avenue	Client: Vincent and Rymill	Date: 11/02/2022
Location: West Hampstead, London NW3 7QL	Contractor:	
Project No. : GWPR4636	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
FE01	TP	104.40m AoD		1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.38	104.02		MADE GROUND: Greyish brown gravelly SAND. Sand was fine to coarse. Gravel was fine to coarse, angular to sub-angular brick (50%) and concrete (50%).
								End of Borehole at 0.375m

1
2
3
4
5

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

Fresh roots were noted for the full depth (0.40m bgl). No groundwater was encountered.

Trial Pit Log

Project Name: 34 Hollycroft Avenue	Client: Vincent and Rymill	Date: 11/02/2022
Location: West Hampstead, London NW3 7QL	Contractor:	
Project No. : GWPR4636	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
FE02	TP	104.45m AoD		1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				

1
2
3
4
5

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

Access limited works and the trial hole was terminated.

Trial Pit Log

Project Name: 34 Hollycroft Avenue	Client: Vincent and Rymill	Date: 11/02/2022
Location: West Hampstead, London NW3 7QL	Contractor:	
Project No. : GWPR4636	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
FE03	TP	104.30m AoD		1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				

1
2
3
4
5

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

A cable was noted immediately below the slab and further excavation was terminated.

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RUNOFF CALCULATIONS | COVER SHEET

Job No.	23003	
Job Name	34 Hollycroft Avenue	
Engineer	Claire Burroughs	CB
Checked By	Dave Marden	DM
Date	23/03/2023	

Site Characteristics

Site Area (ha) 0.0444

	Overall		Discharging from site		
Existing Pervious Surfaces (ha)	0.0035	8%	0.0035	β	100%
Existing Impervious Surfaces (ha)	0.0409	92%	0.0409	α	100%
Total:	0.0444	Total:	0.0444		

	Overall		Discharging from site		
Proposed Pervious Surfaces (ha)	0.0035	8%	0.0035	β	100%
Proposed Impervious Surfaces (ha)	0.0409	92%	0.0409	α	100%
Proposed Green Roof	0	0%	0	γ	0%
Total:	0.0444	Total:	0.0444		

Peak Rate of Runoff

Existing Site	BROWNFIELD	
Detailed Modelling Used?		e.g. Microdrainage, HydroCAD, Multiple Catchments
Runoff Calculation Method (Existing)	Wallingford/Modified Rational	Calculation Sheets Attached
Runoff Calculation Method (Proposed)	Wallingford/Modified Rational	Calculation Sheets Attached
Allowance for Future Climate Change	To 2115 UE	40%
Surface Water Management Strategy	Attenuated on Site	

	1yr	30yr	100yr		
Existing Discharge Rate	**4.8**	**11.6**	**14.8**	l/s	
IoH Greenfield Discharge Rate (full site)	**0.2**	**0.5**	**0.6**	l/s	
Detailed modelling output/FEH:				l/s	
Limiting Discharge Rate	5.0	11.6	14.8	l/s	
Post-Development Discharge Rate	4.8	11.6	14.8	l/s	
Detailed modelling output:				l/s	
including allowance for climate change	**6.7**	**16.2**	**20.7**	l/s	
Proposed Discharge Rate	5.0	11.6	14.8	l/s	
Bespoke Limiting Discharge Rate					
Design discharge rate:	**4.8**	**11.6**	**14.8**	l/s	Existing Rates
Minimum Storage Required	**0.3**	**0.6**	**0.8**	m^3	

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IH124 : Greenfield Peak Runoff

23003	34 Hollycroft Avenue	
	Calculations By: CB	Checked By: DM	Date: 23/03/2023

Catchment Area	AREA	ha	0.0444
Standard average annual rainfall 1941 - 1970	SAAR	mm	660
Soil Index (from FSR or Wallingford Procedure WRAP maps)*	SOIL		0.47

*SOIL is the SPR for the soil type, and for larger sites is a weighted sum of the individual soil classes for the site, where:

$$SOIL = \frac{0.1A_{SOIL1} + 0.3A_{SOIL2} + 0.37A_{SOIL3} + 0.47A_{SOIL4} + 0.53A_{SOIL5}}{AREA}$$

For smaller sites, use the SPR for the local soil type, as follows:

SOIL TYPE	1	2	3	4	5	
AREA				0.0444		**SOIL:**
SPR	0.1	0.3	0.37	0.47	0.53	**0.47**

$QBAR = 0.00108 . (0.01AREA)^{0.89}. SAAR^{1.17}. SOIL^{2.17}$

$QBAR_{50ha}$	l/s	225.33
QBAR/ha	l/s/ha	4.51
$QBAR_{site}$	l/s	**0.20**

* The site area is less than 50ha. Since the IoH124 methodology is not calibrated for sites less than 50ha in area, the calculation should be undertaken based on a 50ha site area and proportionately adjusted based on the ratio of the site size to 50ha.

Hydrological Area	fig 4.2	6

Return Period (years)	Growth Factor (table 4.3)	Discharge rate l/s
1	0.85	**0.17**
2	0.88	0.18
10	1.62	0.32
30	2.3	**0.46**
50	2.62	0.52
100	3.19	**0.64**

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Wallingford Procedure : Existing Peak Runoff

23003	34 Hollycroft Avenue	
	Calculations By: CB	Checked By: DM	Date: 23/03/2023

Site Characteristics

Site Area	AREA	ha	0.0444
Drained Catchment Area	AREA	ha	0.0444
Approximate Longest Drainage Path	L	m	100
Difference in Ground Levels	ΔH	m	1
Slope	Slope (S)		1: 100
Permeable Surfaces (Rational Method runoff coefficient = 0.4)		ha	8%
Impermeable Surfaces (Rational Method runoff coefficient = 0.95)		ha	92%
Area Weighted Rational Method Runoff Coefficient			0.907

Site parameters from The Wallingford Procedure for Europe: Best Practice Guide to urban drainage modelling, HR Wallingford, July 2000 (CD)

60minute, 5 year return period rainfall	M5-60	mm	20
Ratio of M5-60 to 2day, 5 year return period rainfall	r	-	0.40

Time of Concentration

Recommended Tc Method: SCS: Sheet Flow
Tc Method Choice: SCS: Sheet Flow

Sheet Flow

Surface Description			Paving or Brick
Slope			Medium
Roughness Coefficient	(Manning's n)		0.015
Flow Length, L		m	100
M2-24hr		mm	37.70
Land Slope		m/m	0.01000
Tc		hr	0.13

Time of Concentration	T_c	min	7.8
Critical Storm Duration (minimum 5min)	T_{crit}	min	7.8

Critical Storm Rainfall and Runoff

$Z1_{TC}$	0.45	*Wallingford Procedure Figure 3.6
M5-T_{crit}	9.1	
C	0.907	

Discharge Rate
Q = 2.78CiA

Return Period (years)	Z2*	Depth (mm)	Intensity (mm/hr)	Discharge Rate l/s
1	0.61	5.6	42.8	**4.79**
2	0.79	7.2	55.3	6.19
10	1.21	11.0	84.9	9.51
30	1.48	13.4	103.4	**11.57**
50	1.63	14.8	114.2	12.78
100	1.89	17.1	132.0	**14.77**

*Wallingford Procedure Table 3.2

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Wallingford Procedure : Developed Peak Runoff

23003	34 Hollycroft Avenue	
Calculations By: CB	Checked By: DM	Date: 23/03/2023

Site Characteristics

Site Area	AREA	ha	0.0444
Drained Catchment Area	AREA	ha	0.0444
Approximate Longest Drainage Path	L	m	100
Difference in Ground Levels	ΔH	m	1
Slope	Slope (S)		1: 100
Permeable Surfaces (Rational Method runoff coefficient = 0.4)		ha	8%
Impermeable Surfaces (Rational Method runoff coefficient = 0.95)		ha	92%
Green Roof of gradient of up to 15°, and depth of 20-40mm , C=		0.7 *	0%
Area Weighted Rational Method Runoff Coefficient			0.91

*in line with Table 10.1 of CIRIA C644

Site parameters from The Wallingford Procedure for Europe: Best Practice Guide to urban drainage modelling, HR Wallingford, July 2000 (CD)

60minute, 5 year return period rainfall	M5-60	mm	20
Ratio of M5-60 to 2day, 5 year return period rainfall	r	-	0.40

Time of Concentration

Recommended Tc Method: SCS: Sheet Flow
Tc Method Choice: SCS: Sheet Flow

Sheet Flow

Surface Description			Paving or Brick
Slope			Medium
Roughness Coefficient	(Manning's n)		0.015
Flow Length, L		m	100
M2-24hr		mm	37.70
Land Slope		m/m	0.01000
Tc		hr	0.13

Time of Concentration	T_c	min	7.8
Critical Storm Duration (minimum 5min)	T_{crit}	min	7.8

Critical Storm Rainfall and Runoff

$Z1_{TC}$	0.45	*Wallingford Procedure Figure 3.6
$M5\text{-}T_{crit}$	9.1	
C	0.907	

Discharge Rate
$Q = 2.78CiA$

Return Period (years)	Z2*	Depth (mm)	Intensity (mm/hr)	Discharge Rate l/s	Future Rate l/s
1	0.61	5.6	42.8	**4.79**	**6.71**
2	0.79	7.2	55.3	**6.19**	8.66
10	1.21	11.0	84.9	**9.51**	13.31
30	1.48	13.4	103.4	**11.57**	**16.20**
50	1.63	14.8	114.2	**12.78**	17.89
100	1.89	17.1	132.0	**14.77**	**20.68**

*Wallingford Procedure Table 3.2

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 4 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	103.765	0.265	0.0	12.1	12.1	4.2	Flood Risk
30 min Summer	103.788	0.288	0.0	12.2	12.2	4.6	Flood Risk
60 min Summer	103.732	0.232	0.0	11.9	11.9	3.7	Flood Risk
120 min Summer	103.674	0.174	0.0	10.6	10.6	2.8	O K
180 min Summer	103.629	0.129	0.0	9.1	9.1	2.0	O K
240 min Summer	103.598	0.098	0.0	7.9	7.9	1.6	O K
360 min Summer	103.561	0.061	0.0	6.2	6.2	1.0	O K
480 min Summer	103.541	0.041	0.0	5.1	5.1	0.6	O K
600 min Summer	103.529	0.029	0.0	4.3	4.3	0.5	O K
720 min Summer	103.522	0.022	0.0	3.7	3.7	0.3	O K
960 min Summer	103.513	0.013	0.0	2.9	2.9	0.2	O K
1440 min Summer	103.507	0.007	0.0	2.1	2.1	0.1	O K
2160 min Summer	103.503	0.003	0.0	1.4	1.4	0.1	O K
2880 min Summer	103.502	0.002	0.0	1.2	1.2	0.0	O K
4320 min Summer	103.501	0.001	0.0	0.9	0.9	0.0	O K
5760 min Summer	103.501	0.001	0.0	0.9	0.9	0.0	O K
7200 min Summer	103.501	0.001	0.0	0.7	0.7	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	182.455	0.0	13.2	18
30 min Summer	117.135	0.0	17.0	26
60 min Summer	71.570	0.0	20.7	40
120 min Summer	46.081	0.0	26.7	70
180 min Summer	35.072	0.0	30.5	100
240 min Summer	28.612	0.0	33.2	130
360 min Summer	21.104	0.0	36.7	190
480 min Summer	16.732	0.0	38.9	250
600 min Summer	13.886	0.0	40.4	308
720 min Summer	11.883	0.0	41.5	368
960 min Summer	9.251	0.0	43.0	490
1440 min Summer	6.435	0.0	44.9	718
2160 min Summer	4.464	0.0	46.6	1080
2880 min Summer	3.448	0.0	48.0	1432
4320 min Summer	2.404	0.0	50.1	2336
5760 min Summer	1.871	0.0	51.7	2872
7200 min Summer	1.551	0.0	53.4	3464

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	103.500	0.000	0.0	0.4	0.4	0.0	O K
10080 min Summer	103.500	0.000	0.0	0.4	0.4	0.0	O K
15 min Winter	103.761	0.261	0.0	12.1	12.1	4.2	Flood Risk
30 min Winter	103.767	0.267	0.0	12.1	12.1	4.2	Flood Risk
60 min Winter	103.687	0.187	0.0	11.0	11.0	3.0	O K
120 min Winter	103.613	0.113	0.0	8.5	8.5	1.8	O K
180 min Winter	103.573	0.073	0.0	6.8	6.8	1.2	O K
240 min Winter	103.550	0.050	0.0	5.7	5.7	0.8	O K
360 min Winter	103.528	0.028	0.0	4.3	4.3	0.5	O K
480 min Winter	103.518	0.018	0.0	3.4	3.4	0.3	O K
600 min Winter	103.513	0.013	0.0	2.9	2.9	0.2	O K
720 min Winter	103.509	0.009	0.0	2.4	2.4	0.1	O K
960 min Winter	103.506	0.006	0.0	1.9	1.9	0.1	O K
1440 min Winter	103.503	0.003	0.0	1.3	1.3	0.0	O K
2160 min Winter	103.502	0.002	0.0	1.1	1.1	0.0	O K
2880 min Winter	103.501	0.001	0.0	0.9	0.9	0.0	O K
4320 min Winter	103.501	0.001	0.0	0.7	0.7	0.0	O K
5760 min Winter	103.500	0.000	0.0	0.4	0.4	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.336	0.0	55.7	4368
10080 min Summer	1.183	0.0	57.6	0
15 min Winter	182.455	0.0	13.2	18
30 min Winter	117.135	0.0	17.0	26
60 min Winter	71.570	0.0	20.7	42
120 min Winter	46.081	0.0	26.7	72
180 min Winter	35.072	0.0	30.5	100
240 min Winter	28.612	0.0	33.2	130
360 min Winter	21.104	0.0	36.7	190
480 min Winter	16.732	0.0	38.8	248
600 min Winter	13.886	0.0	40.3	308
720 min Winter	11.883	0.0	41.5	362
960 min Winter	9.251	0.0	43.0	492
1440 min Winter	6.435	0.0	44.8	720
2160 min Winter	4.464	0.0	46.6	1020
2880 min Winter	3.448	0.0	48.0	1480
4320 min Winter	2.404	0.0	49.6	2460
5760 min Winter	1.871	0.0	52.1	0

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
7200 min Winter	103.500	0.000	0.0	0.3	0.3	0.0	O K
8640 min Winter	103.500	0.000	0.0	0.3	0.3	0.0	O K
10080 min Winter	103.500	0.000	0.0	0.2	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
7200 min Winter	1.551	0.0	54.0	0
8640 min Winter	1.336	0.0	55.8	0
10080 min Winter	1.183	0.0	57.6	0

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 525475 186046 TQ 25475 86046
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.029

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.010	4	8	0.010	8	12	0.009

Model Details

Storage is Online Cover Level (m) 104.000

Complex Structure

Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Diameter/Width (m) 5.3
Safety Factor 2.0 Length (m) 10.0
Porosity 0.30 Cap Volume Depth (m) 0.300
Invert Level (m) 103.500

ACO Q-Brake Outflow Control

Design Head (m) 0.800 Diameter (mm) 152
Design Flow (l/s) 12.4 Invert Level (m) 103.500

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.0	1.200	15.3	3.000	24.1	7.000	36.9
0.200	11.3	1.400	16.5	3.500	26.1	7.500	38.2
0.300	12.3	1.600	17.6	4.000	27.9	8.000	39.4
0.400	12.4	1.800	18.7	4.500	29.6	8.500	40.6
0.500	12.0	2.000	19.7	5.000	31.2	9.000	41.8
0.600	11.1	2.200	20.7	5.500	32.7	9.500	43.0
0.800	12.5	2.400	21.6	6.000	34.1		
1.000	13.9	2.600	22.5	6.500	35.5		