herrington
CONSULTING LIMITED

Client: Joshua Faith

Flood Risk Assessment and SuDS Assessment for the Proposed Development at 20 Howitt Road, London

February 2023

Canterbury Office
Unit 6 & 7
Barham Business Park
Elham Valley Road
Barham
Canterbury
Kent
CT4 6DQ

London Office
Unit 52.11
Woolyard
52 Bermondsey Street
London
SE1 3UD

Tel 01227 833855
www.herringtonconsulting.co.uk

Project Reference: 3601

Client: Joshua Faith

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Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date
1	0	First issue of report sent by email	31 January 2023
2	1	SWMS included. Report issued by email	14 February 2023
3	2	Minor changes to scheme drawings. Report issued by email	21 February 2023
4	3	Minor changes to scheme drawings. Report issued by email	27 February 2023

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Document Verification

Issue	Revision	Date:	31 January 2023
1	0	Author(s):	LS
		First Check By:	TV
		Amendments Agreed:	LS
		Second Check by:	TV
Issue	**Revision**	**Date:**	**14 February 2023**
2	1	Author(s):	EC
		Check By:	SM-B
Issue	**Revision**	**Date:**	**21 February 2023**
3	2	Author(s):	NA
		Check By:	EC
Issue	**Revision**	**Date:**	**27 February 2023**
4	3	Author(s):	LS
		Check By:	EC

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1 Scope of Appraisal

Herrington Consulting has been commissioned by **Joshua Faith** to prepare a Flood Risk and Sustainable Drainage Assessment for the proposed development at **20 Howitt Road, London, NW3 4LL.**

A Flood Risk Assessment (FRA) appraises the risk of flooding to development at a site-specific scale and recommends appropriate mitigation measures to reduce the impact of flooding to both the site and the surrounding area. New development has the potential to increase the risk of flooding to neighbouring sites and properties through increased surface water runoff and as such, an assessment of the proposed site drainage can help to accurately quantify the runoff rates, flow pathways and the potential for infiltration at the site. This assessment considers the practicality of incorporating Sustainable Drainage Systems (SuDS) into the scheme design, with the aim of reducing the risk of flooding by actively managing surface water runoff.

This report has been prepared to supplement a full planning application and has been prepared in accordance with the requirements of both national and local planning policy. To ensure that due account is taken of industry best practice, reference has also been made to CIRIA Report C753 'The SuDS Manual' and any relevant local planning policy guidance. The surface water management strategy included within this report is not intended to constitute a detailed drainage design.

2 Background Information

2.1 Site Location and Existing Use

The site is located at Ordnance Survey (OS) coordinates 527303, 184987 off Howitt Road, London. The site covers an area of approximately 170m² and currently comprises a two-storey, terraced dwelling with associated garden area. The location of the site, in relation to the surrounding area, is shown in Figure 2.1 below.

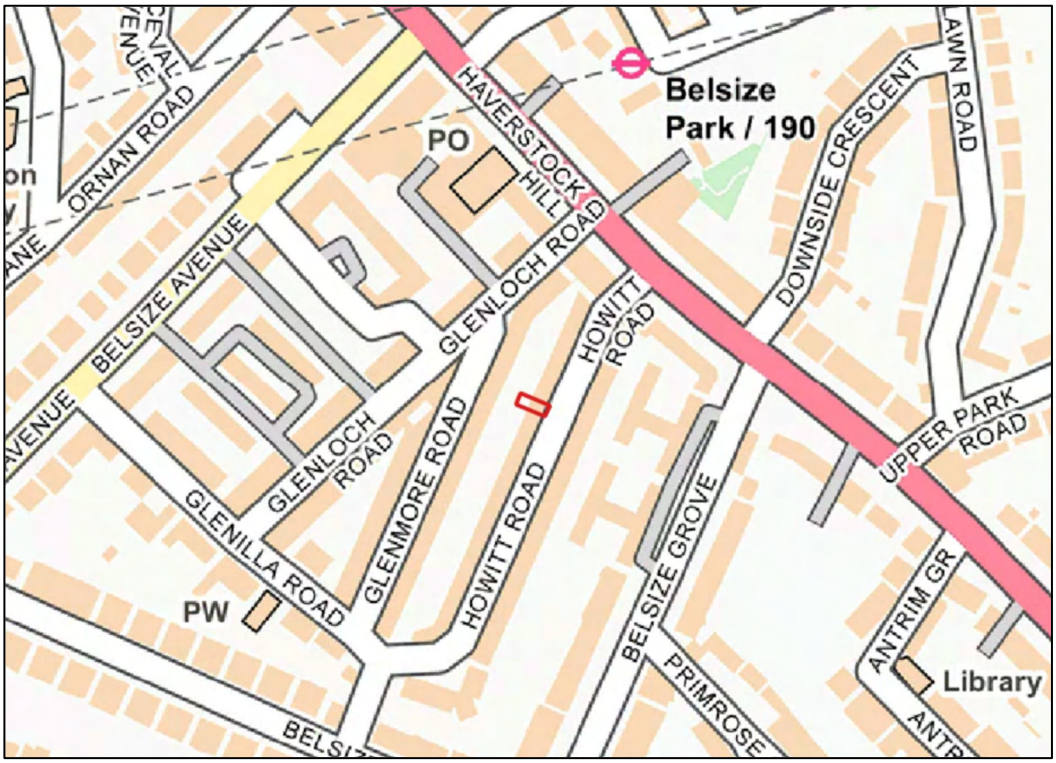


Figure 2.1 – Location map (contains Ordnance Survey data © Crown copyright and database right 2023).

2.2 Site Geology and Topography

Reference to the British Geological Survey (BGS) map shows that the underlying solid geology in the location of the subject site is London Clay Formation (clay and silt). There are no overlying superficial deposits.

Reference to aerial height data indicates that land levels at the site vary between 67.7m to 69.5m Above Ordnance Datum Newlyn (AODN), with the land falling towards the south.

2.3 Proposed Development

The development proposals comprise the extension of the existing basement, in addition to providing a new lightwell.

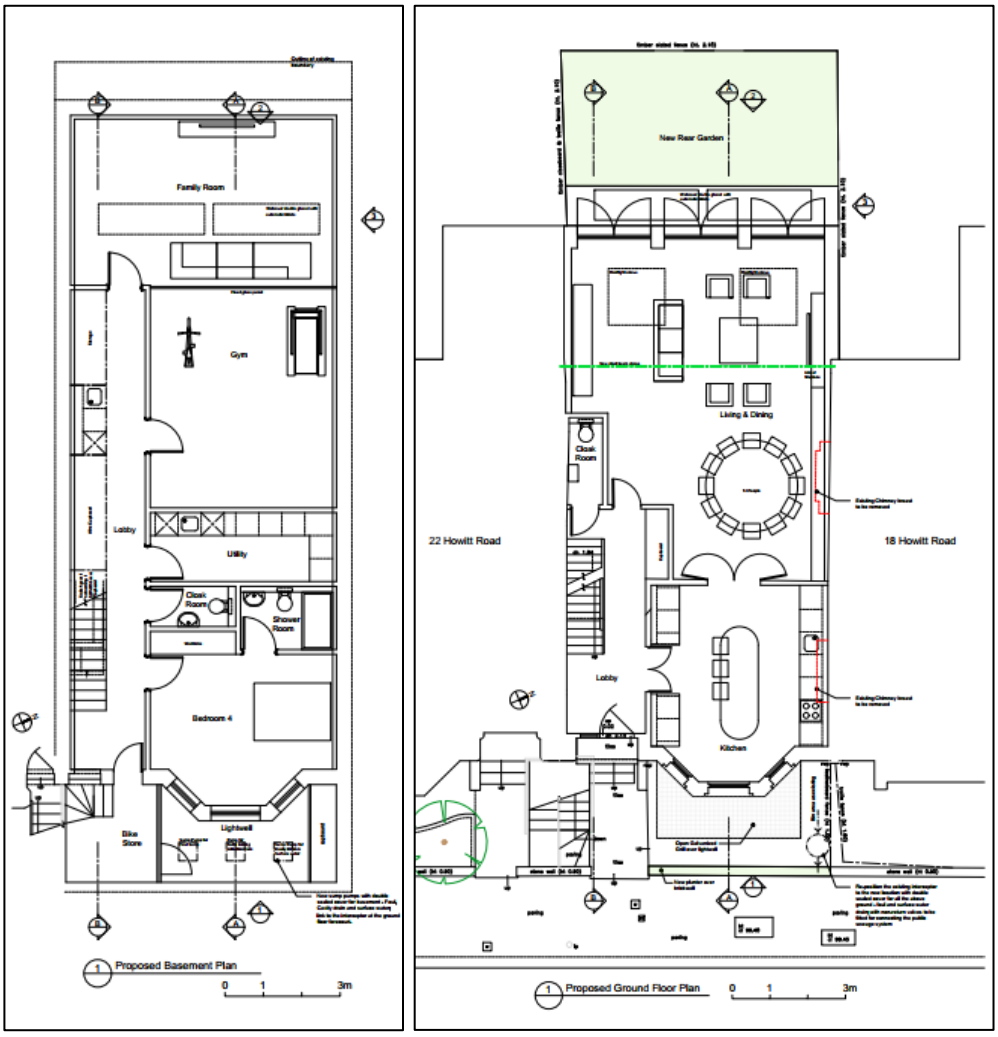


Figure 2.2 – Proposed basement (left) and ground floor (right)

Further drawings of the proposed scheme are included in Appendix A.1 of this report.

2.4 Planning Policy and Context

For any new development situated within Flood Zones 2 and 3 of a main river or the sea, or for sites greater than 1ha in size, the National Planning Policy Framework (NPPF) requires a detailed FRA to be undertaken. Inspection of the Environment Agency's (EA) 'Flood Map for Planning' shows that the site is located within Flood Zone 1 and is smaller than 1ha in size. Consequently, a FRA would not typically be required. However, it has been identified that the redline boundary for the proposed development site, is located within a Critical Drainage Area (CDA), therefore a Flood Risk Assessment is required.

In addition to the above, the general requirement for all new development is to ensure that the runoff is managed sustainably, and that the development does not increase the risk of flooding at the site, or within the surrounding area. In the case of brownfield sites, drainage proposals are typically measured against the existing performance of the site, although it is preferable (where practicable) to provide runoff characteristics that are similar to greenfield behaviour.

The Non-statutory Technical Standards for Sustainable Drainage Systems (NTSS) specify criteria to ensure sustainable drainage is included within developments classified as 'major' as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010). It is, however, recognised that SuDS should be designed to ensure that the maintenance and operation requirements are economically proportionate.

The proposed development is for the extension of the existing basement and the addition of a new lightwell, as a result, the proposals are classified as 'minor' development and therefore, the NTSS will not apply.

Notwithstanding this, Policy SI 13 of the London Plan states developments should incorporate SuDS wherever possible within schemes unless there is a practical reason for not doing so. Policy SI 13 of the London Plan also states that developers should follow the drainage hierarchy by prioritising the discharge of surface water runoff as close to source as possible. The London Plan Drainage Hierarchy is outlined below:

1. Rainwater use as a resource (for example: rainwater harvesting, blue roofs for irrigation).
2. Rainwater infiltration to ground at or close to source.
3. Rainwater attenuation in green infrastructure features for gradual release (for example: green roofs, rain gardens).
4. Rainwater discharge direct to a watercourse (unless not appropriate).
5. Controlled rainwater discharge to a surface water sewer or drain.
6. Controlled rainwater discharge to a combined sewer.

The proposed development must therefore attempt, where possible, to incorporate SuDS features in accordance with the requirements of the London Plan and any other adopted local planning policies pertaining to drainage. Consequently, the potential options for incorporating SuDS and their viability within the proposed scheme are discussed further in the following sections of this report.

2.5 Climate Change

The global climate is constantly changing but it is widely recognised that we are now entering a period of accelerating change. Over the last few decades there have been numerous studies into the impact of potential future changes in the climate and there is now an increasing body of scientific evidence which supports the fact that the global climate is changing as a result of human activity. Past, present and future emissions of greenhouse gases are expected to cause significant global climate change during this century.

The nature of climate change at a regional level will vary. For the UK, projections of future climate change indicate that more frequent short-duration, high-intensity rainfall, and more frequent periods of long-duration rainfall (of the type responsible for the recent UK flooding), could be expected.

These effects will tend to increase the size of flood zones associated with rivers and the amount of flooding experienced from other inland sources. Consequently, the following section of this report takes into consideration the impacts of climate change and references the most contemporary guidance that is applicable to the development site.

Planning Horizon

To ensure that any recommended mitigation measures are sustainable and effective throughout the lifetime of the development, it is necessary to base the appraisal on climate change predictions that are commensurate with the planning horizon for the proposed development. The NPPF and supporting Planning Practice Guidance Suite (August 2021) state that residential development should be considered for a minimum of 100 years, but that the lifetime of a non-residential development depends on the characteristics of the development. For commercial development, a 75-year design life is typically assumed. The development that is the subject of this assessment is classified as residential and therefore, a design life of 100 years has been assumed.

Potential Changes in Climate

Recognising that the impact of climate change will vary across the UK, the allowances were updated in May 2022 to show the anticipated changes to peak rainfall across a series of management catchments. The proposed development site is located in the **London Management Catchment**, as defined by the 'Peak Rainfall Allowance' maps, hosted by the Department for Environment, Food and Rural Affairs. Guidance provided by the EA states that this mapping should be used for site-scale applications (e.g. drainage design), in small catchments (less than 5km^2), or urbanised drainage catchments. For large rural catchments, the peak river flow allowances should be used.

The proposed development will include a surface water management strategy and the Peak Rainfall Allowances for the London Management Catchment should be applied to the hydraulic calculations undertaken as part of this SuDS Assessment.

For each Management Catchment, a range of climate change allowances are provided for two time epochs and for each epoch, there are two climate change allowances defined. These represent different levels of statistical confidence in the possible scenarios on which they are calculated. The two levels are as follows:

- Central: based on the 50th percentile
- Upper End: based on the 90th percentile

The EA has provided guidance regarding the application of the climate change allowances and how they should be applied in the planning process. The range of allowances for the Management Catchment in which the development site is located are shown in Table 2.1 below.

Management Catchment Name	Annual exceedance probability	Allowance Category	2050s	2070s
London	3.3 %	Central	20%	20%
		Upper End	35%	35%
	1 %	Central	20%	25%
		Upper End	40%	40%

Table 2.1 – Recommended peak rainfall intensity allowances for each epoch for the London Management Catchment.

For a development with a design life of 100 years the Upper End climate change allowance is recommended to assesses whether:

- there is no increase in flood risk elsewhere, and;
- the development will be safe from surface water flooding.

From Table 2.1 above, it can be seen that the recommended climate change allowance for this site is a 40% increase in peak rainfall. Therefore, this increase has been applied to the hydraulic drainage model constructed to inform the surface water management strategy. Where this allowance has been applied the abbreviation “+40%cc” has been used.

3 Potential Sources of Flooding

In determining whether the proposals for development are compliant with the NPPF, it is necessary to determine whether the development will be sustainable in terms of flood risk. Consequently, the main sources of flooding have been assessed and are discussed below.

3.1 Risk of Flooding from Rivers

The EA's 'Flood Map for Planning' shows the site is situated in Flood Zone 1 and is not in an area predicted to be at risk of flooding from a fluvial source. Consequently, the risk of flooding to the site from rivers is considered to be *low.*

3.2 Risk of Flooding from the Sea

The site is located a significant distance inland and is elevated above predicted extreme tide levels. Consequently, the risk of flooding from this source is considered to be *low.*

3.3 Risk of Flooding from Ordinary or Man-Made Watercourses

Natural watercourses that have not been enmained and man-made drainage systems such as irrigation drains, sewers or ditches could potentially cause flooding.

Inspection of OS mapping of the site and surrounding area reveals that there are no non-main rivers or artificial watercourses within close proximity to the site and therefore, the risk of flooding from this source is considered to be *low.*

3.4 Risk of Flooding from Surface Water

Surface water, or overland flooding, typically occurs in natural valley bottoms as normally dry areas become covered in flowing water and in low spots where water may pond. This mechanism of flooding can occur almost anywhere but is likely to be of particular concern in any topographical low spot, or where the pathway for runoff is restricted by terrain or man-made obstructions.

Inspection of the EA's 'Flood Risk from Surface Water' mapping (Figure 3.1) identifies that the site is at 'very low' risk of flooding from surface water. Aerial height data also reveals that there are no topographic depressions within the site that would encourage surface water to pond. Consequently, the risk of flooding from this source is considered to be *low.*

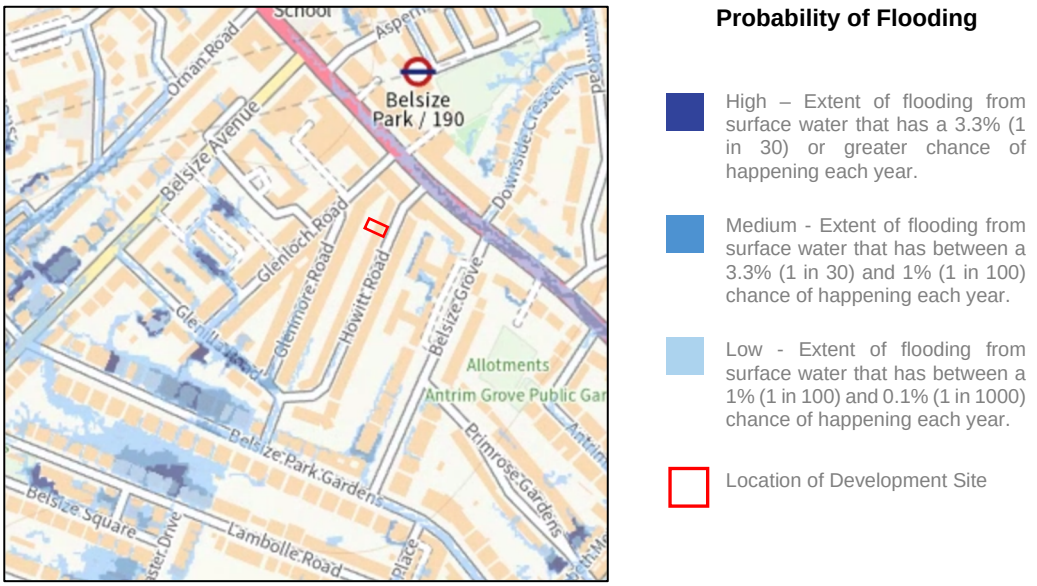


Figure 3.1 – EA's 'Flood Risk from Surface Water' map (© Environment Agency).

3.5 Risk of Flooding from Groundwater

Water levels below the ground rise during wet winter months, and fall again in the summer as water flows out into rivers. In very wet winters, rising water levels may lead to the flooding of normally dry land, as well as reactivating flow in 'bournes' (streams that only flow for part of the year).

The underlying geology in this area is London Clay Formation, with no overlying superficial deposits. This bedrock geology is typically impermeable, therefore is not usually associated with groundwater emergence as supported by the BGS groundwater mapping which identifies the site to be located in an area where groundwater emergence is not predicted. Additionally, land levels to the south of the site, are lower than the land levels where the proposed development is situated. Subsequently, it is more likely groundwater emergence will occur in this lower lying area. Taking into consideration the above, the risk of groundwater flooding is considered to be *low*.

Notwithstanding this, as the proposals include development within the basement of the property, it is recommended that the basement is appropriately tanked and a damp proof membrane is installed (where possible) as a precautionary measure in the unlikely event of elevated groundwater levels.

3.6 Risk of Flooding from Sewers

In urban areas, rainwater is typically drained into surface water sewers or sewers containing both surface and wastewater known as "combined sewers". Flooding can result when the sewer is overwhelmed by heavy rainfall, becomes blocked, or has inadequate capacity; this will continue until the water drains away.

Inspection of the asset location mapping provided by Thames Water (TW) (Figure 3.2) identifies that in the area where the site is located, there are combined sewers only. The RBKC SFRA indicates that there has been 1 incident of sewer flooding within this postcode area, however, this is relatively coarse data and relates to a single isolated incident with no evidence that this event

affected the site. Furthermore, inspection of aerial height data reveals that the land in the surrounding area falls to the south of the site. As such, if water were to exit the network from the manhole closest to the development site, it would likely remain within the channel of the road and flow south along Howitt Road. Consequently, it is concluded that the risk of flooding from this source is *low*.

Figure 3.2- Asset Location Mapping provided by Thames Water (a full scale copy can be found in Appendix A.2).

Notwithstanding this, whilst the risk from sewer flooding is *low*, it is recommended that a non-return valve should be fitted to any connections to the sewer. This should prevent any backflow from the sewer into the development.

3.7 Risk of Flooding from Artificial Sources

Non-natural or artificial sources of flooding can include reservoirs, canals, and lakes, where water is retained above natural ground level. In addition, operational and redundant industrial processes

including mining, quarrying, and sand or gravel extraction, may also increase the depth of floodwater in areas adjacent to these features.

The potential effects of flood risk management infrastructure and other structures also needs to be considered. For example, reservoir or canal flooding may occur as a result of the facility being overwhelmed and/or as a result of dam or bank failure.

Inspection of the OS mapping for the area shows that there are no artificial sources of flooding within close proximity to the site. In addition, the EA's 'Flood Risk from Reservoirs' map shows that the site is not within an area considered to be at risk of flooding from reservoirs. Consequently, the risk of flooding is considered to be *low*.

3.8 Summary of Flood Risk

From the analysis above, it can be seen that **the risk of flooding to the site from all sources is *low*.** Notwithstanding this, as the proposals include development within the basement of the property, its recommended that the basement is tanked and a damp proof membrane is installed, as a precautionary measure in the unlikely event of elevated groundwater levels. Non-return valves should also be fitted on any connections to the public sewer to prevent backflow into the development.

Additionally, to ensure that the development meets the requirements of the NPPF, the following section of the report recommends mitigation measures, where appropriate, to ensure the risk of flooding offsite does not increase as a result of the proposals.

4 Existing Drainage

4.1 Existing Surface Water Drainage

TW has provided sewer mapping as part of their asset location data for the site and surrounding area. An extract of this mapping is provided in Figure 3.2. and shows the location of public sewers in close proximity to the site. It is evident that the sewers in this area are typically combined.

The existing site drainage has not been surveyed and it is unknown how the existing currently drains. However, it is likely to drain to the existing public combined sewer along Howitt Road, to the front of the property.

Surface water runoff is discharged at an unrestricted rate from the existing site and this rate of discharge has been calculated for a range of rainfall events with varying return periods. These rates are outlined in Table 4.1 below. These hydrological calculations have been undertaken using the Modified Rational Method and synthetic rainfall data derived using the variables obtained from the Flood Estimation Handbook (FEH) online web service.

Return Period (years)	Peak runoff from the existing site (l/s)
2	2.5
30	7.9
100	10.5

Table 4.1 – Summary of peak runoff rates for the existing site.

5 Sustainable Drainage Assessment

5.1 Site Characteristics

The important characteristics of the site, which have the potential to influence the surface water drainage strategy, are summarised in Table 5.1 below.

Site Characteristic	Development Site	
Total area of site	~170m^2	
Current site condition	Developed (brownfield)	
Greenfield runoff rates (based on the FEH methodology)	1:2 yr = 4.4 l/s/ha Qbar = 4.4 l/s/ha 1:30 yr = 9.8 l/s/ha 1:100 yr = 12.5 l/s/ha	
Infiltration	Negligible (assumed based on underlying geology and typical soil conditions)	
Current surface water discharge method	Assumed to drain into public combined sewer	
Is there a watercourse nearby?	No	
Impermeable area	**Existing** **~ 136 m^2**	**Proposed** **~ 141 m^2**

Table 5.1 – Site characteristics affecting rainfall runoff.

Reference to the tables above show the proposed development will increase slightly the percentage of impermeable area within the boundaries of the site. Consequently, this will increase the rate and volume of surface water runoff discharged from the site. It will therefore be necessary to provide mitigation measures to ensure the rate of runoff discharged from the site is not increased as a result of the proposed development.

5.2 Opportunities to Discharge Surface Water Runoff

Part H of the Building Regulations summarises a hierarchy of options for discharging surface water runoff from developments. The preferred option is to **infiltrate** water into the ground, as this deals with the water at source and serves to replenish groundwater. If this option is not viable, the next option is for the runoff to be discharged into a **watercourse**. The water should only be conducted into the **public sewer** system if neither of the previous options are possible.

Policy SI 13 of the London Plan (2021) summarises a hierarchy of options for discharging surface water runoff from developments. Policy SI 13 favours managing surface water runoff at source, by

either storing it for later **re-use** or allowing it to **infiltrate** into the ground. If this option is not viable, the next option of preference is for the runoff to be discharged into a **watercourse.** Only if neither of these options are possible, the water should be conducted into a **public sewer** system, with a connection into a surface water sewer being preferred over the discharge into either a combined or foul sewer.

The following opportunities for managing the surface water runoff discharged from the development site are listed in order of preference:

Water Re-Use – Water re-use systems can rarely manage 100% of the surface water runoff discharged from a development, as this requires the yield from the building and hardstanding area to balance perfectly with the demand from the proposed development. Furthermore, the proposed development only comprises alterations to the existing building and the majority of the existing structures will be retained. As such, it is considered that retrofitting a water re-use system into the development will not be economically viable, or indeed, feasible. Consequently, rainwater recycling systems are not considered for inclusion within the scheme, and an alternative solution for attenuating storm water will be required.

Infiltration – The soil and underlying geology at this location (London Clay, with no overlying deposits) is unlikely to be sufficiently permeable to support the use of infiltration SuDS as the primary solution for draining surface water runoff from the site. Furthermore, there is insufficient space on the site to comply with Building Regulations, which require a 5m easement from structures to any infiltration feature. As a result, infiltration SuDS are not considered to be a viable solution for managing surface water runoff discharged from the proposed development.

Discharge to Watercourses – There are no watercourses located within close proximity to the site, which show onward connectivity to a main river, the sea, or any other large surface water body. As a result, there is no opportunity to discharge surface water runoff from the development to an existing watercourse.

Discharge to Public Sewer System – With no alternative options available, it is assumed that the existing connection to the public sewer system will present the most viable solution for managing the surface water runoff discharged from the development.

5.3 Constraints and Further Considerations

The key constraints that are relevant to this development are listed below:

- There is limited open space to incorporate SuDS that require very large areas of land, such as wetlands and large infiltration basins.
- Due to the poor infiltration rates and limited space within the site, it will not be possible to reduce or maintain the volume of surface water runoff discharged from the development site.

- If additional surface water runoff is to be discharged into the public sewer system, or if a new connection is required, it will be necessary to gain consent for this connection from the sewerage undertaker (TW).

- As part of the development, some existing structures will be retained and there may be limited opportunity to include SuDS within the existing buildings. Retrofitting SuDS into the retained parts of the development may present an unsustainable or unattainable situation, if a large part of the existing drainage onsite remains unchanged.

- Ideally, post-development runoff rates should be restricted to greenfield runoff rates. However, on small sites where discharge rates are exceptionally low (less than 2.0l/s) higher rates are generally considered acceptable, due to the technical limitations of flow control devices. In this case, a limiting discharge rate of 2.0l/s is likely to be acceptable by the LPA, LLFA and TW.

5.4 Proposed Surface Water Management Strategy

The drainage strategy set out below discusses each of the different elements of the proposed scheme, along with the results from a numerical drainage model constructed for the site, which can be used to demonstrate how the overall objectives can be achieved. This does not represent a detailed surface water drainage design; it is simply an assessment to demonstrate that the objectives and requirements of the NPPF can be met at the planning stage.

Green Roofs

A green roof will be located across the roof of the rear extension. Rain landing on the roof will be intercepted by the green roof, which during low return period events will store and filter a large amount of runoff from the roof area within the soil substrate of the planted areas. Runoff from the rooflights can also be directed into the surrounding green roof, maximising the volume of runoff managed by the green roof system. The location and extent of the proposed green roof is shown on Figure 5.1 below. The design of the green roof should include an adequate drainage layer to avoid stagnation and overflow systems, in case the primary discharge pipe becomes blocked.

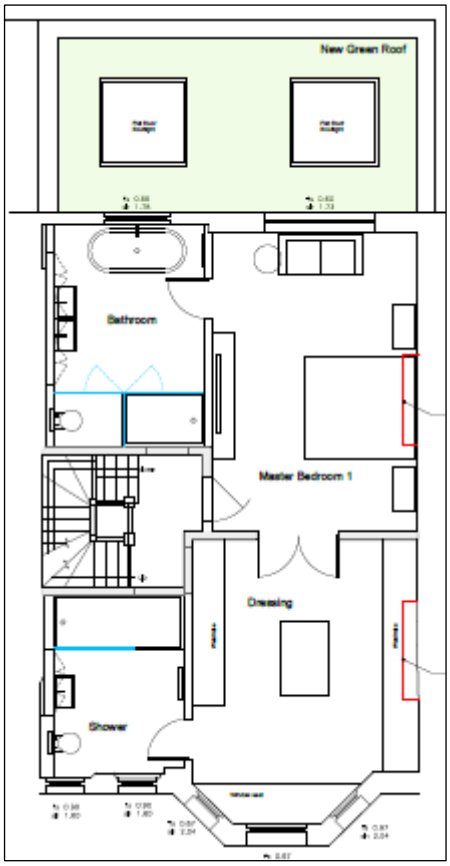


Figure 5.1 - Image showing the location of the proposed green roofs.

Although the incorporation of green roofs will provide a significant benefit to the quality of water discharged from the roofs under higher return period events, it is unlikely that a green roof can be designed to restrict the rate runoff is discharged from the site. Consequently, additional storage for storm water will be provided.

Underground Storage (Attenuation Tank)

Runoff draining from the roofs (including the green roof) as well as the lightwell and other areas of hardstanding, will be directed via underground pipes into an attenuation tank located beneath the building slab, which will store runoff from the development before being pumped into a manhole to the front of the property. A pumping station will be located within the front lightwell for this purpose. Runoff will then be discharged into the public combined sewer by gravity, using the existing connection. The rate runoff is discharged offsite will be restricted to a rate no greater than 2.0l/s. A summary of the Causeway Flow+ analysis for the system is shown in *Table 5.2*.

Parameter	Value (1:100yr+40%cc event)
SuDS	Attenuation Tank and Pumping Station
Total area draining to attenuation tank, including overflow from other SuDS	141 m^2
Infiltration	Not permitted
Area of storage tank	6 m^2
Depth of storage tank	800 mm
Porosity	95%
Flow control device	Pumping station
Limiting pumping rate	2 l/s
Critical storm duration	60 minutes

Table 5.2 – Summary of storage tank SuDS.

Runoff rates have been calculated for a range of annual return probabilities, including the 100-year return period event with a 40% increase in rainfall intensity to account for future climatic changes. The results have been subsequently compared to the existing drainage system. These values are summarised below in Table 5.3.

Return Period	Pre-development Discharge Rates	Post-development Peak Discharge Rates	% of Betterment
1 in 2yr	2.5 l/s	2.0 l/s	20%
1 in 30yr	7.9 l/s	2.0 l/s	75%
1 in 100yr	10.5 l/s	2.0 l/s	80%
1 in 100yr+40%cc	-	2.0 l/s	-

Table 5.3 – Summary of discharge rates, up to and including, 1 in 100yr+40%cc events.

It is evident that, with the inclusion of the proposed SuDS, there is the potential to accommodate all the surface water runoff from the site, up to and including, the design rainfall event. This assumes the rate at which water is discharged to the public sewer system will be attenuated to a rate that is no greater than 2.0l/s.

5.5 Indicative Drainage Layout Plan

Figure 5.2 below is an indicative drainage layout plan delineating how the proposed SuDS can be incorporated into the scheme proposals.

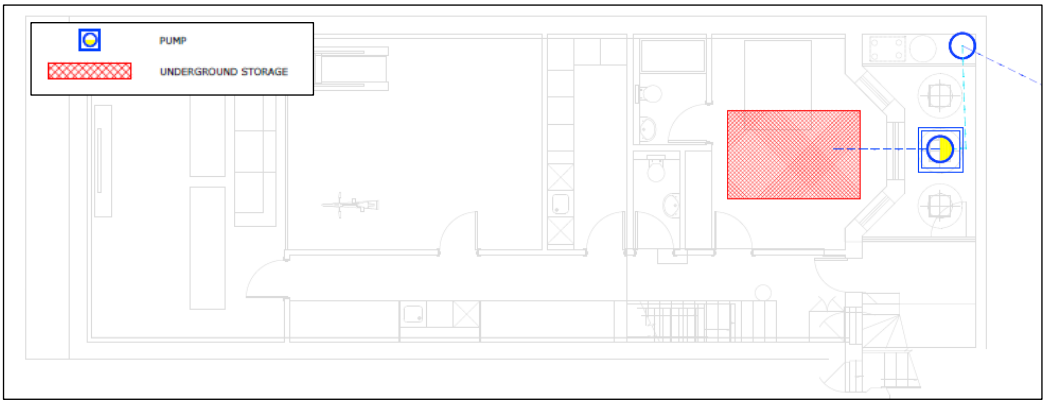


Figure 5.2 - Indicative drainage layout plan showing the proposed location of SuDS.

A full-scale copy of this layout is located in Appendix A.3 of this report.

5.6 Management and Maintenance

In order for any surface water drainage system to operate as originally designed, it is necessary to ensure that it is adequately maintained throughout its lifetime. Therefore, over the lifetime of a development there is a possibility that the performance of the system could be reduced or could fail if it is not correctly maintained. This is even more important when SuDS form a part of the surface water management system, as these require a more onerous maintenance regime than a typical piped network.

The key requirements of any management regime are routine inspection and maintenance. When the development is taken forward to the detailed design stage, an 'owner's manual' will need to be prepared. This should include:

- A description of the drainage scheme.
- A location plan showing all of the SuDS features and equipment, such as flow control devices etc.
- Maintenance requirements for each element, including any manufacturer-specific requirements.
- An explanation of the consequences of not carrying out the specified maintenance.
- Details of who will be responsible for the ongoing maintenance of the drainage system.

For the SuDS recommended by this assessment, the most obvious maintenance tasks will be desilting and cleaning the attenuation tank. General maintenance schedules have been included within the appendices of this report, which demonstrate the maintenance requirements of the proposed SuDS. For developments such as this, that to some extent rely on the ongoing inspection and maintenance of SuDS, it will be necessary to ensure that measures are in place to maintain

the system for the lifetime of the development. In this case, maintenance will be the responsibility of the property owner.

For some elements of the drainage system, including the green roof and pumping station, it may be necessary to use specialist contractors or have the original manufacturer inspect the features. If this is the case, the owner/occupant will need to make allowances for these inspections and works to be carried out.

Further details of the maintenance and management strategy should be confirmed, following the completion of a detailed drainage design for the development.

5.7 Sensitivity Testing and Residual Risk

When considering residual risk, it is necessary to consider the impact of a flood event that exceeds the design event, or the implications if the proposed drainage system was to become blocked.

The proposed drainage system has been designed to accommodate surface water runoff generated under an extreme rainfall event, with a return period of 1 in 100 years, including a 40% increase in peak rainfall intensity (to account for the impacts of climate change). As such, this additional percentage increase complies with the EA's most contemporary guidance on climate change for the upper allowances.

Nonetheless, if a rainfall event was to occur which exceeds the design parameters or if the pump was to fail, surface water would fill up the tank and pumping station and overflow into the lightwell. It is therefore recommended that an alarm system should be included and where possible, a backup pump is installed.

A non-return valve should also be installed, to prevent flooding from the sewer if the main public network becomes overwhelmed.

Whilst these additional measures will help to minimise the risk, it is evident that by simply increasing the volume of storage available on site to store storm water, the proposals will reduce the risk of flooding when compared to the existing situation. In conclusion, the proposed development will not result in an increased risk of flooding to the site or to the surrounding area.

6 Conclusions and Recommendations

The overarching objective of this report is to appraise the risk of flooding at 20 Howitt Road, London to ensure that the proposals for development are acceptable in this location and that the risk of flooding offsite will not increase as a result of the development. This report has therefore been prepared to appraise the risk of flooding from all sources and to provide a sustainable solution for managing the surface water runoff discharged from the development site, in accordance with the NPPF and local planning policy.

The risk of flooding has been considered for a wide range of sources and it has been identified that the risk to the proposed development is *low*. However, as a precautionary approach, it is recommended that the basement of the proposed development is appropriately tanked, and a damp proof membrane is included where possible, to reduce the impacts in the unlikely event of high groundwater. In addition, non-return valves should be fitted on any connections to the public sewer to prevent backflow into the development.

Furthermore, to minimise the impact that the building could have with respect to an increase is surface water runoff, the opportunities for managing surface water at the site have been further analysed. It is concluded that the most viable solution will be discharging surface water from the development via the existing connection to the combined public combined sewer system.

In order to restrict the rate at which surface water runoff is discharged offsite, various SuDS have been proposed, including a green roof, an attenuation tank and a pumping station. This SuDS will be used to store water onsite before it is discharged to the combined public sewer system. A pump station has been specified to discharge the surface water to the combined public sewer, limiting the rate to a maximum of 2.0l/s.

Details of the typical maintenance and management requirements for each element of the drainage system have been provided to ensure that the proposed drainage solution can be maintained and will continue to operate over the lifetime of the development. It is, however, recommended that an “owner’s manual” containing additional product specific maintenance requirements is produced as part of the detailed design for the site.

In conclusion, it is evident that the development is at low risk of flooding and a sustainable solution for managing the surface water runoff discharged from the proposed development at Howitt Road, London is available. Consequently, the proposals will meet the requirements of the NPPF, and local planning policy.

7 Appendices

Appendix A.1 – Drawings

Appendix A.2 – Thames Water Asset Location Data

Appendix A.3 – Indicative Drainage Layout Plan

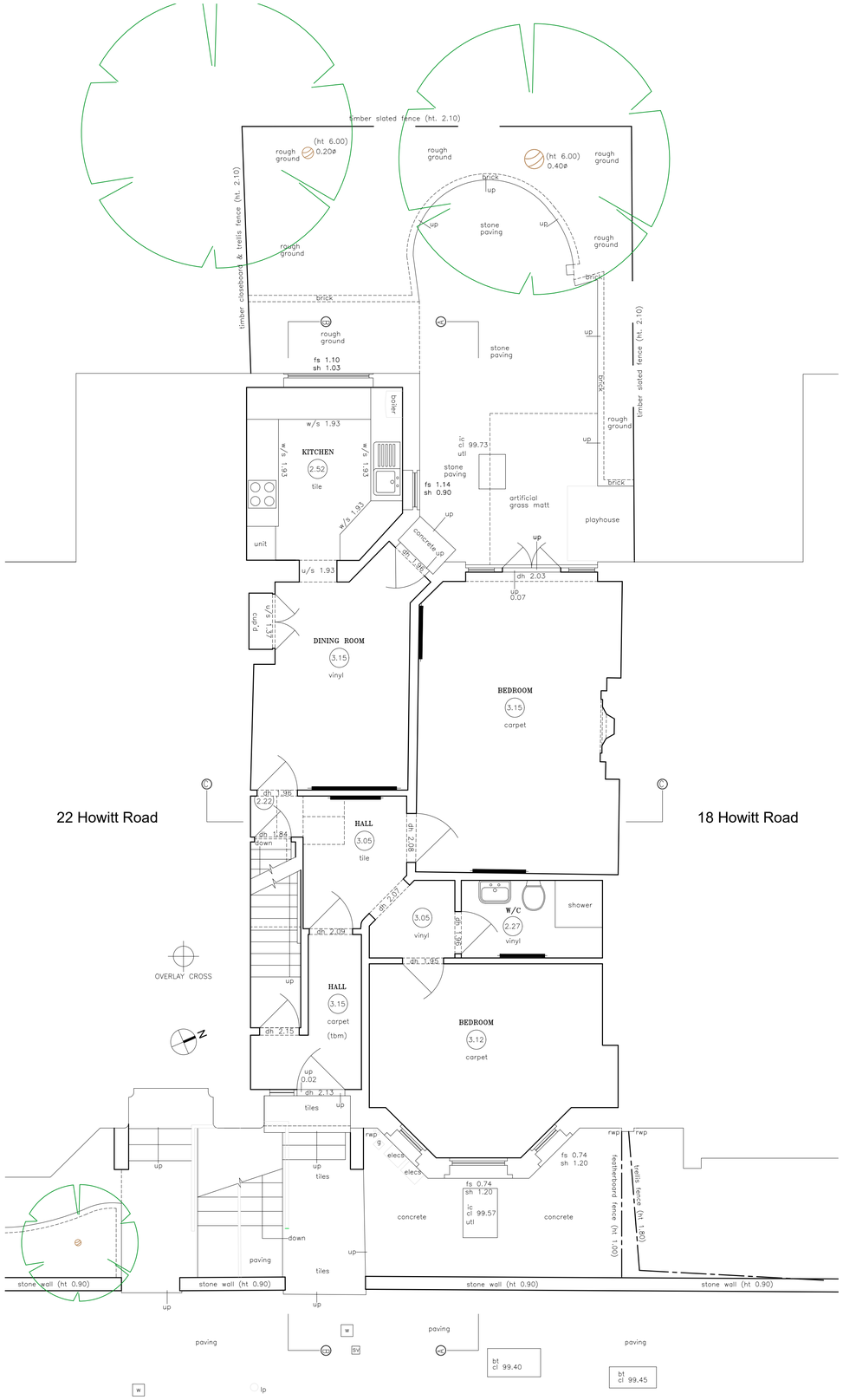
Appendix A.4 – Surface Water Management Calculations

Appendix A.5 – Maintenance Schedules

Appendix A.1 – Drawings

Location Plan

scale 1:1250 @ A4



22 Howitt Road

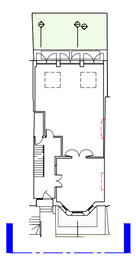
18 Howitt Road

1 Existing Ground Floor Plan 0 1 3m

2 Existing Front Elevation 1 0 1 3m

Datum 96.00m

Location Plan Scale 1:1250



Planning

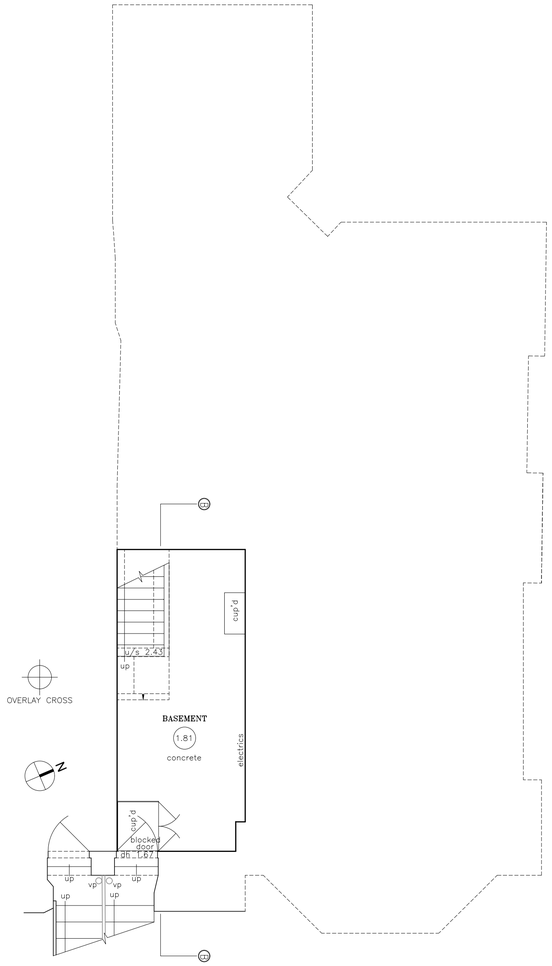
Revisions

-

Ko Architects
2/F, 7 Mulgrave Chambers
26-28 Mulgrave Road | Sutton SM2 6LE
T 020 8780 3397
E postbox@koandpartners.co.uk

Client:	**J Faith**
Project:	**20 Howitt Road, London, NW3 4LL**
Dwg:	LOCATION PLAN, EXISTING FRONT ELEVATION AND GROUND FLOOR PLANS
Dwg No:	522-E01
Revision:	-
Date:	OCT 2022
Scale:	1:50 @A1

Location Plan Scale 1:1250

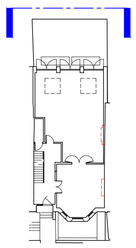


1 Existing Basement Plan

0 1

2 Existing Rear Elevation 2

0 1 3m



Planning (Preliminary)

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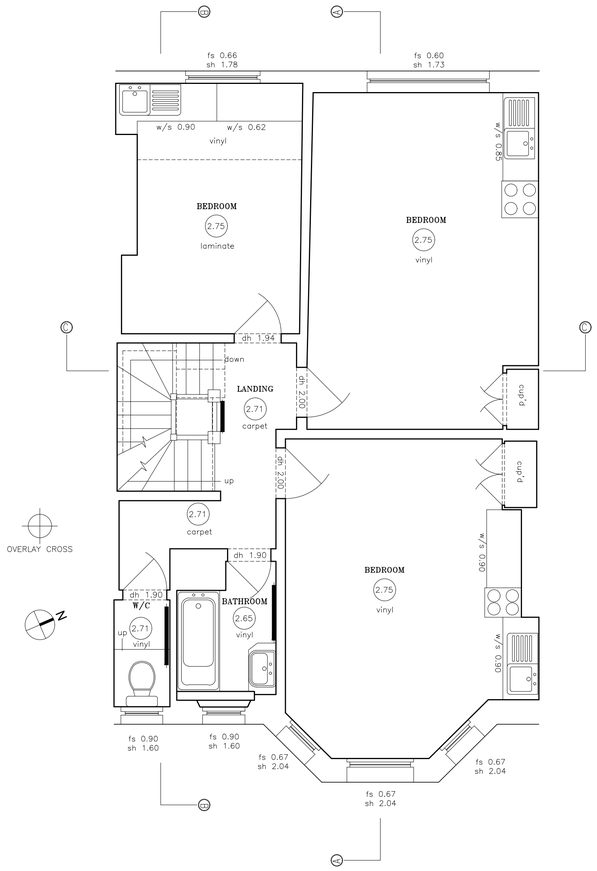
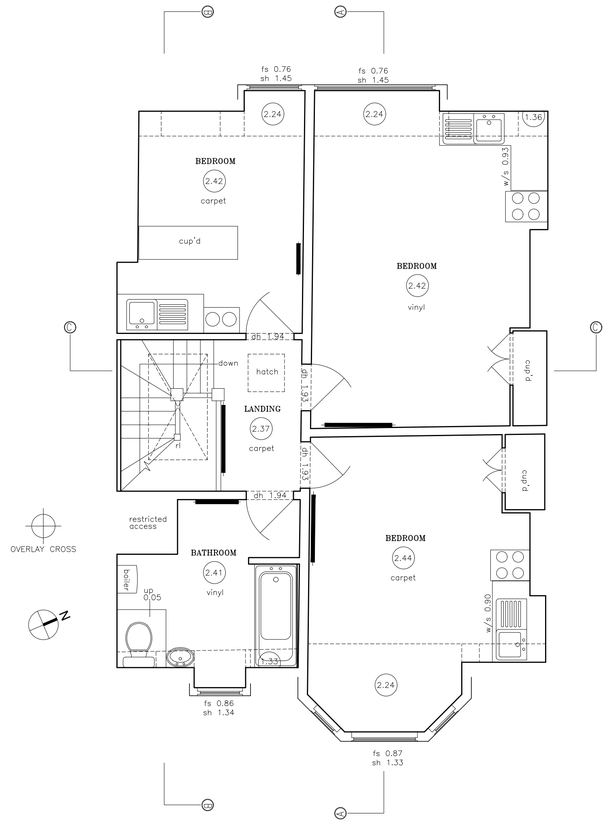
Client:	**J Faith**
Project:	**20 Howitt Road, London, NW3 4LL**
Dwg:	LOCATION PLAN, EXISTING REAR ELEVATION AND BASEMENT PLAN
Dwg No:	522-E02
Revision:	-
Date:	OCT 2022
Scale:	1:50 @A1

Location Plan Scale 1:1250



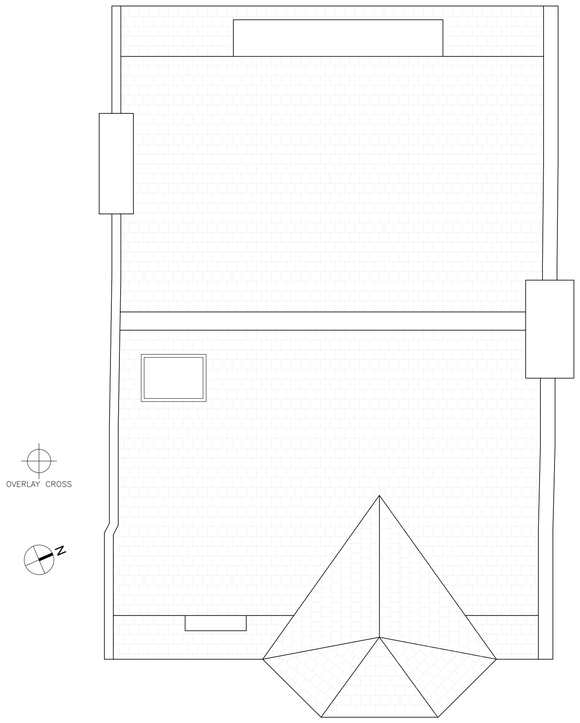
1 Existing First Floor Plan

0 1 3m



2 Existing Second Floor Plan

0 1 3m



3 Existing Roof Plan

0 1 3m

Planning (Preliminary)

Revisions

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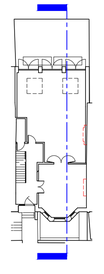
Client:	**J Faith**
Project:	**20 Howitt Road, London, NW3 4LL**
Dwg:	LOCATION PLAN, EXISTING FIRST, SECOND AND ROOF PLANS
Dwg No:	522-E03
Revision:	-
Date:	OCT 2022
Scale:	1:50 @A1

Location Plan Scale 1:1250

1 Existing Section A

0 1 3m



Planning (Preliminary)

Revisions

-

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26-28 Mulgrave Road | Sutton SM2 6LE
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E postbox@koandpartners.co.uk

Client: **J Faith**
Project: **20 Howitt Road, London, NW3 4LL**
Dwg: LOCATION PLAN, EXISTING SECTION A

Dwg No: 522-E04 Revision: -
Date: OCT 2022
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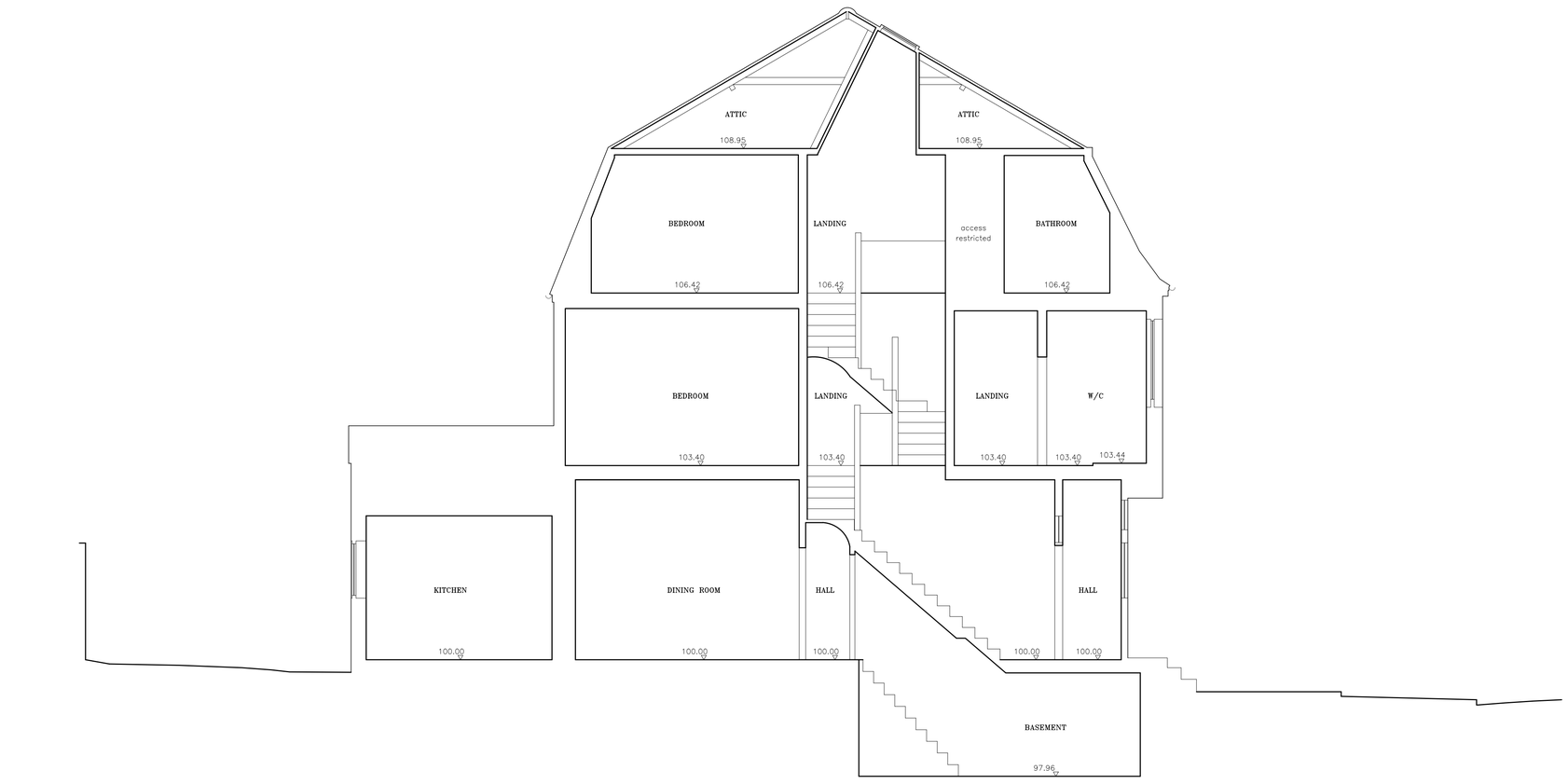
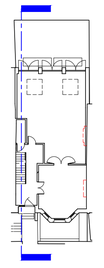
Location Plan Scale 1:1250



1 Existing Section B

0 1 3m



Planning (Preliminary)

Revisions

-

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26-28 Mulgrave Road | Sutton SM2 6LE
T 020 8780 3397
E postbox@koandpartners.co.uk

Client: **J Faith**
Project: **20 Howitt Road, London, NW3 4LL**
Dwg: LOCATION PLAN, EXISTING SECTION B

Dwg No: 522-E05 Revision: -
Date: OCT 2022
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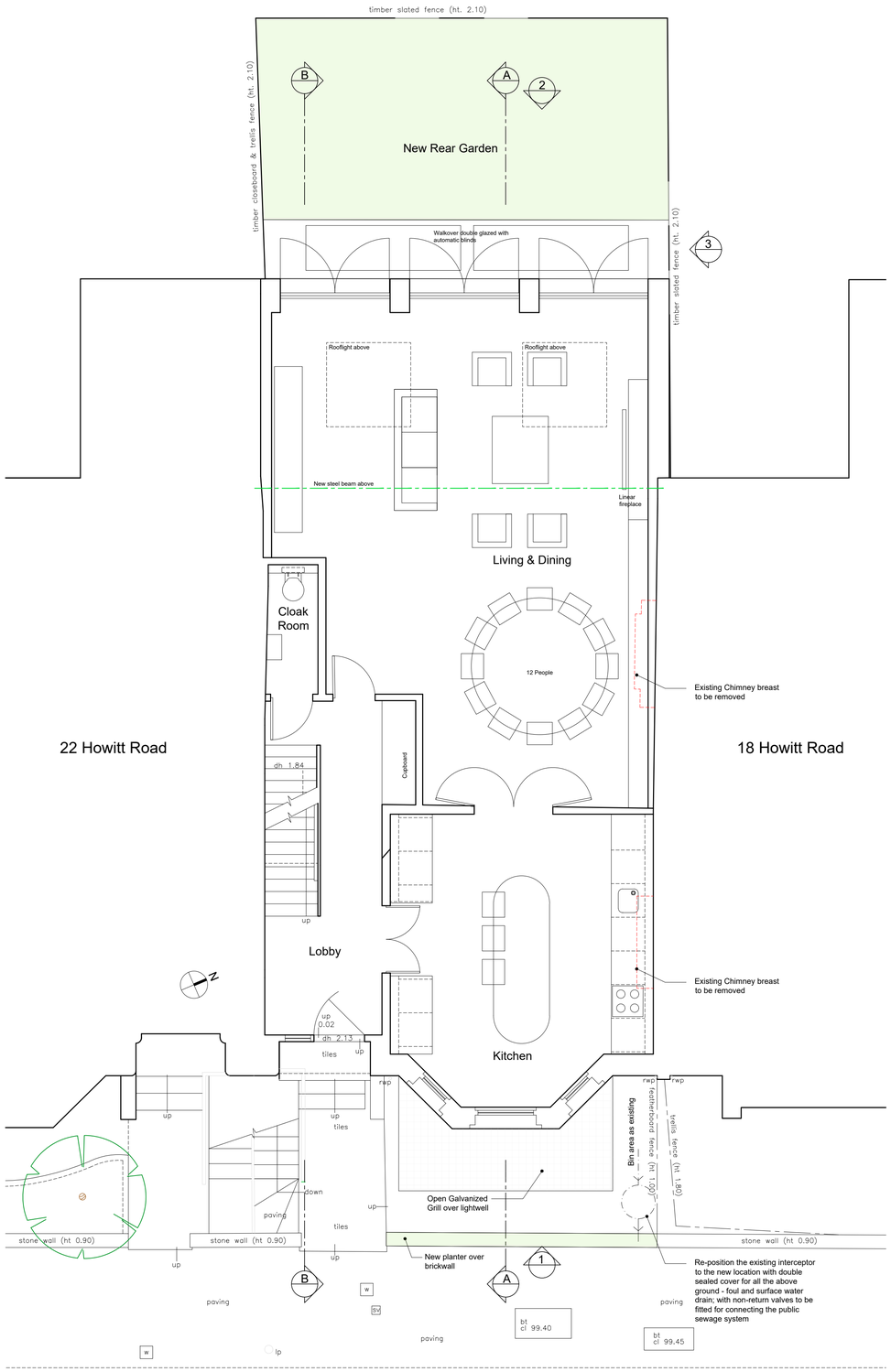
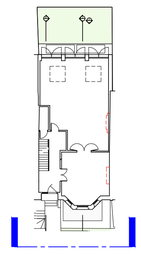


1 Proposed Ground Floor Plan 0 1 3m

2 Proposed Front Elevation 1 0 1 3m

Location Plan Scale 1:1250



Planning

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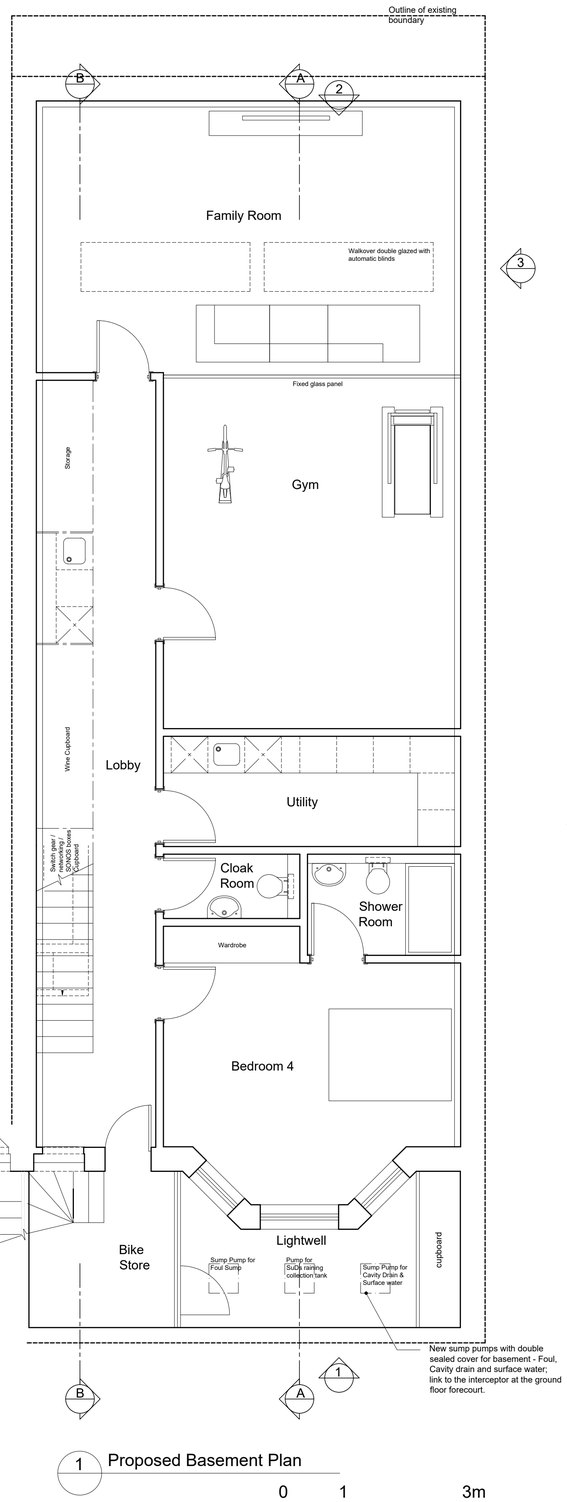
Client:	**J Faith**
Project:	**20 Howitt Road, London, NW3 4LL**
Dwg:	LOCATION PLAN, PROPOSED FRONT ELEVATION AND GROUND FLOOR PLANS
Dwg No:	522-A01
Revision:	-
Date:	FEB 2023
Scale:	1:50 @A1

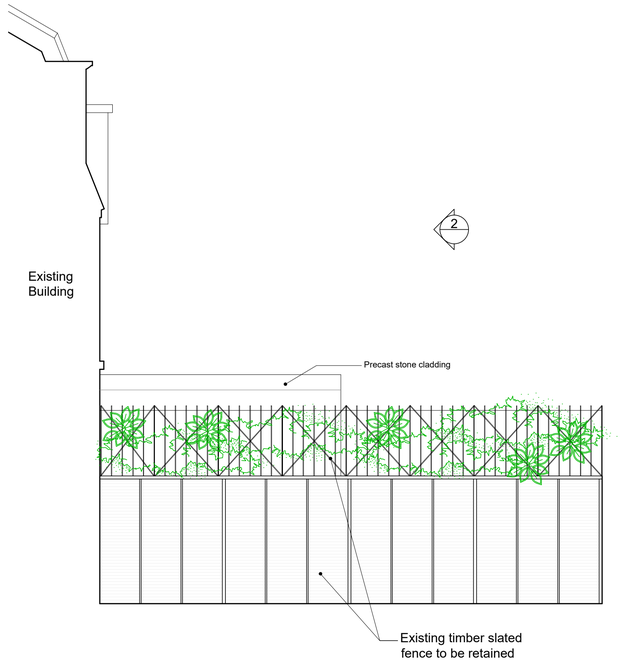


1 Proposed Basement Plan

0 1 3m

2 Proposed Rear Elevation 2

0 1 3m

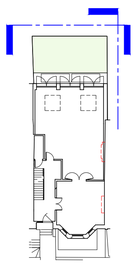


3 Proposed Side Elevation 3

0 1 3m

Artist Impression of Proposed Rear Extension

Location Plan Scale 1:1250



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Revisions

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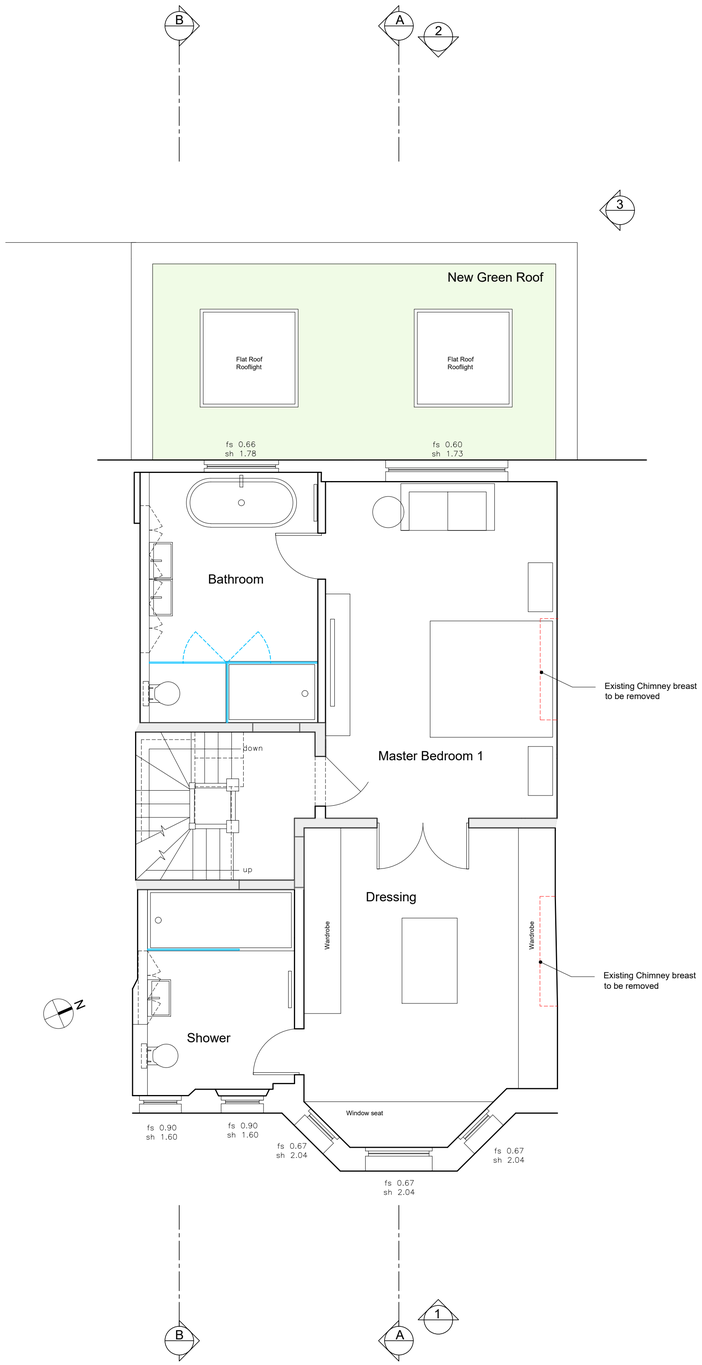
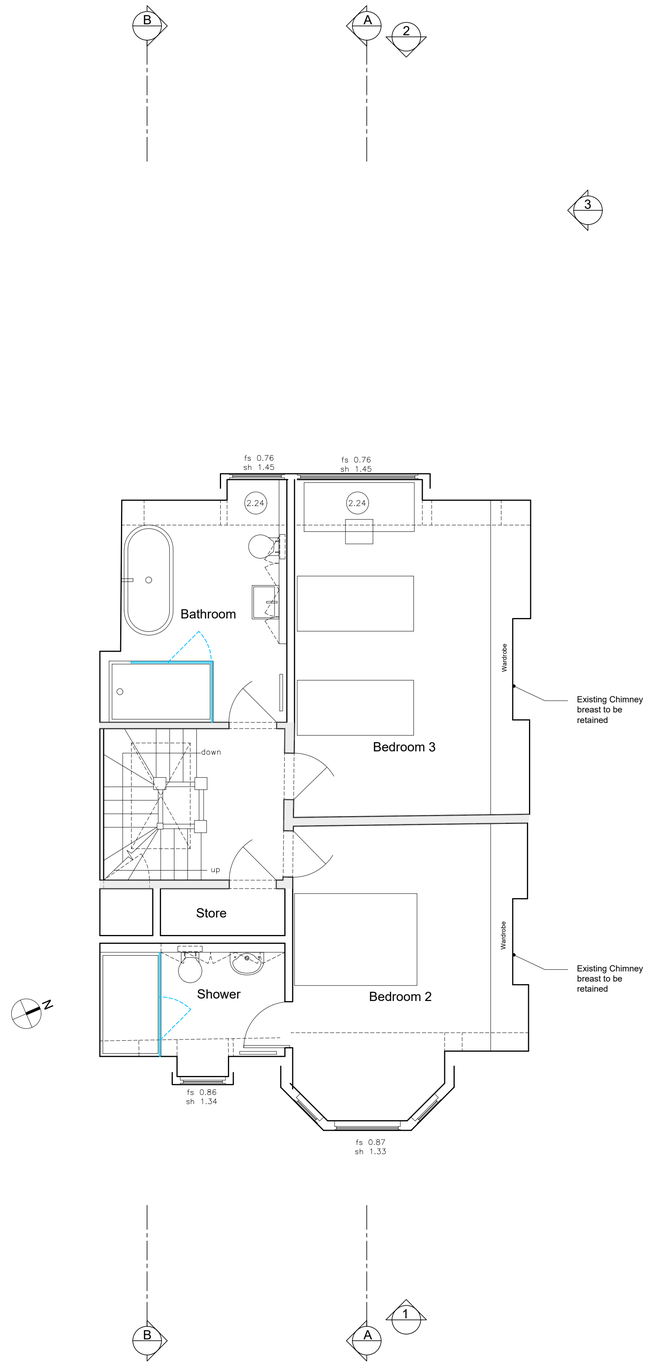
E postbox@koandpartners.co.uk

Client:	**J Faith**
Project:	**20 Howitt Road, London, NW3 4LL**
Dwg:	LOCATION PLAN, PROPOSED REAR & SIDE ELEVATIONS AND BASEMENT PLAN
Dwg No:	522-A02
Revision:	-
Date:	FEB 2023
Scale:	1:50 @A1



1 Proposed First Floor Plan

0 1 3m



2 Proposed Second Floor Plan

0 1 3m

Location Plan Scale 1:1250

Planning

Revisions

-

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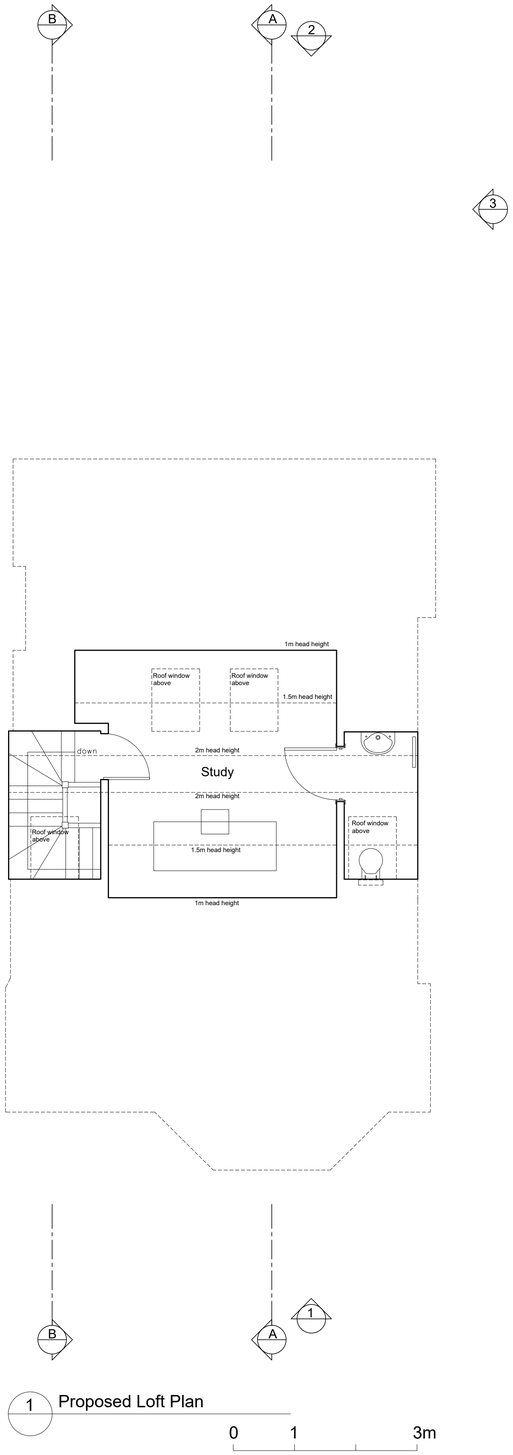
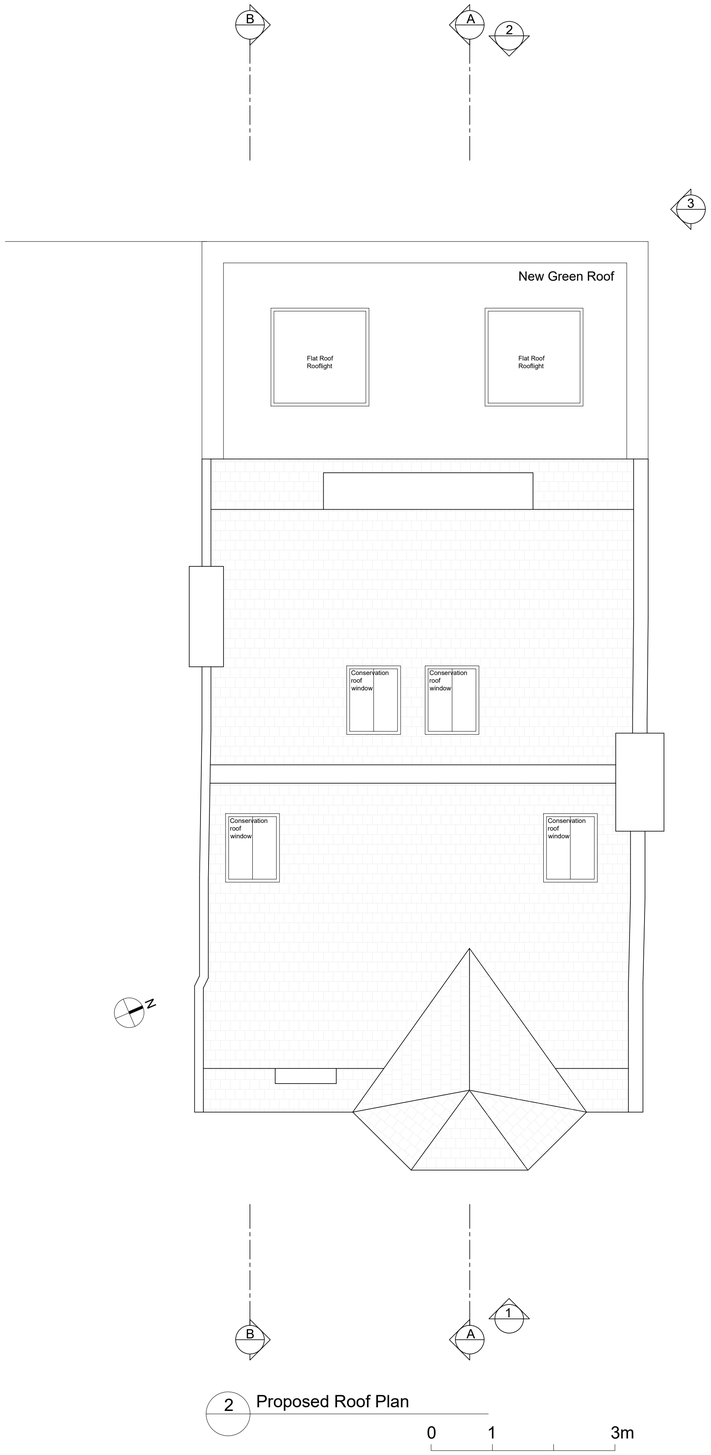
Client:	**J Faith**
Project:	**20 Howitt Road, London, NW3 4LL**
Dwg:	LOCATION PLAN, PROPOSED FIRST AND SECOND FLOOR PLANS
Dwg No:	522-A03
Revision:	-
Date:	FEB 2023
Scale:	1:50 @A1



1 Proposed Loft Plan

0 1 3m



2 Proposed Roof Plan

0 1 3m

Location Plan Scale 1:1250

Planning

Revisions

-

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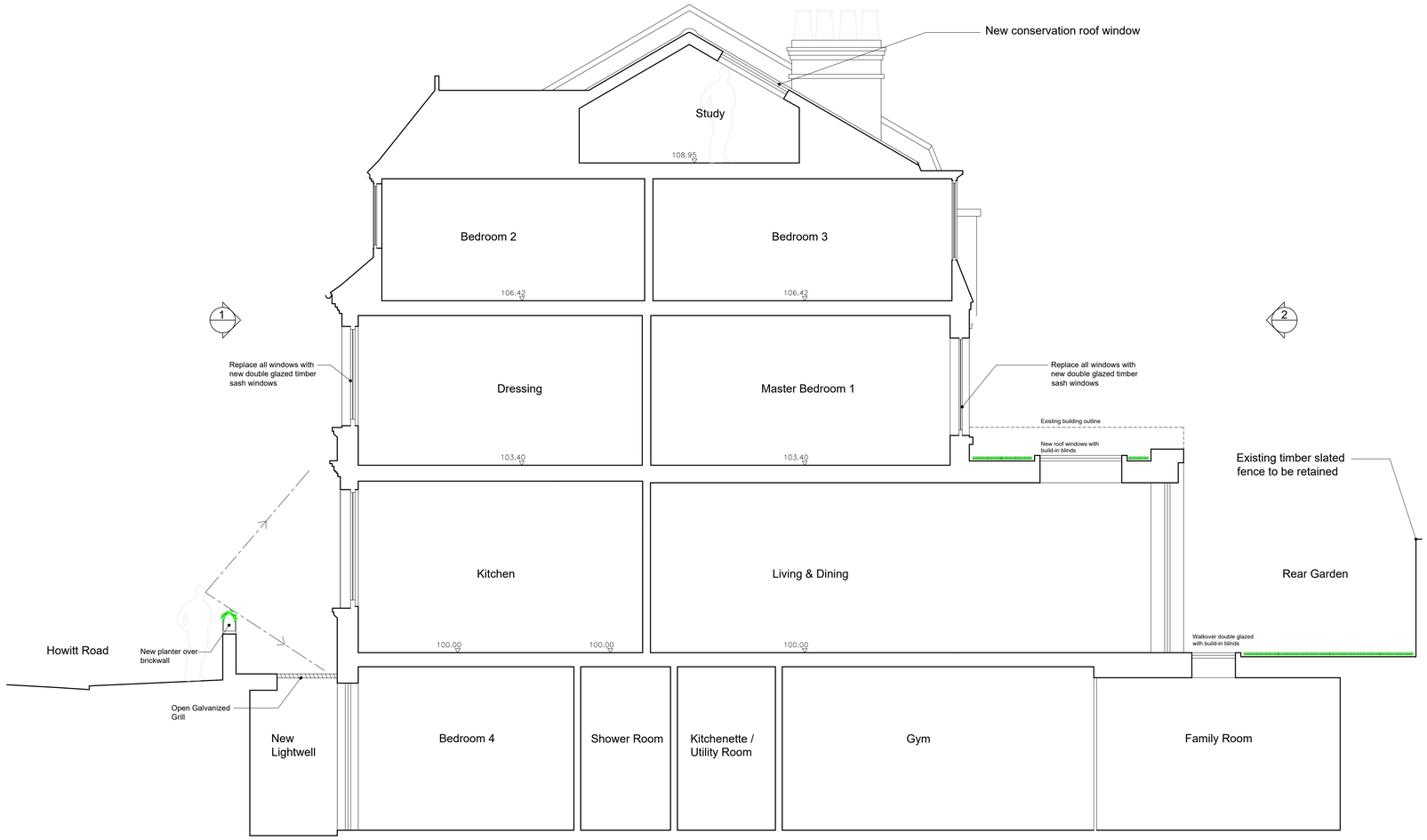
2/F, 7 Mulgrave Chambers
26-28 Mulgrave Road | Sutton SM2 6LE
T 020 8780 3397
E postbox@koandpartners.co.uk

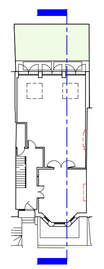
Client:	**J Faith**
Project:	**20 Howitt Road, London, NW3 4LL**
Dwg:	LOCATION PLAN, PROPOSED LOFT FLOOR AND ROOF PLANS
Dwg No:	522-A04
Revision:	-
Date:	FEB 2023
Scale:	1:50 @A1

Location Plan Scale 1:1250



1 Proposed Section A

0 1 3m



Planning

Revisions

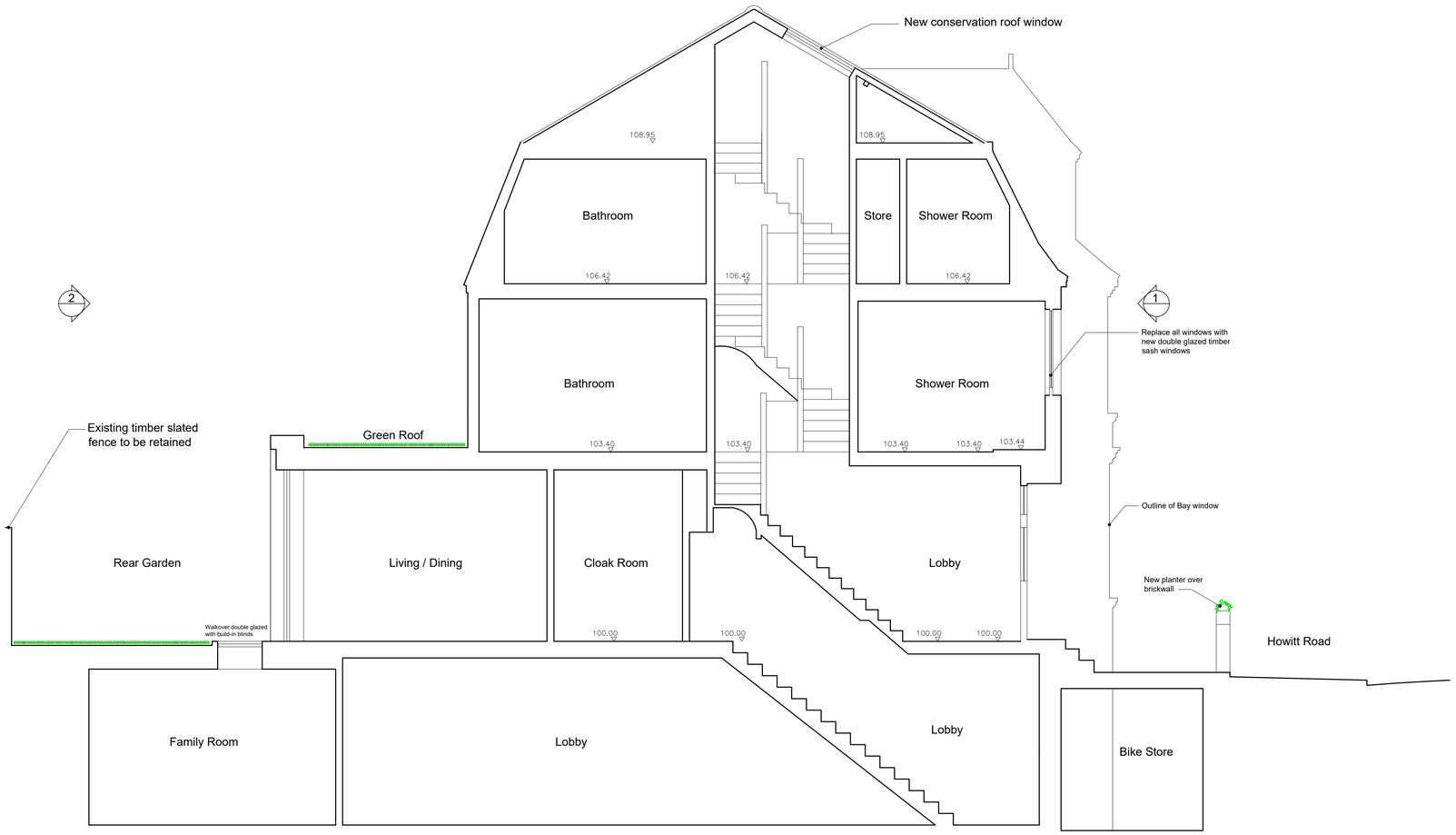
-

Ko Architects
2/F, 7 Mulgrave Chambers
26-28 Mulgrave Road | Sutton SM2 6LE
T 020 8780 3397
E postbox@koandpartners.co.uk

Client: **J Faith**
Project: **20 Howitt Road, London, NW3 4LL**
Dwg: LOCATION PLAN, PROPOSED SECTION A

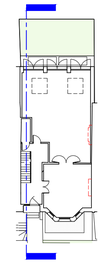
Dwg No: 522-A05 Revision: -
Date: FEB 2023
Scale: 1:50 @A1

Location Plan Scale 1:1250



1 Proposed Section B

0 1 3m



Planning

Revisions

-

Ko Architects
2/F, 7 Mulgrave Chambers
26-28 Mulgrave Road | Sutton SM2 6LE
T 020 8780 3397
E postbox@koandpartners.co.uk

Client: **J Faith**
Project: **20 Howitt Road, London, NW3 4LL**
Dwg: LOCATION PLAN, PROPOSED SECTION B

Dwg No: 522-A06 Revision: -
Date: FEB 2023
Scale: 1:50 @A1

Appendix A.2 – Thames Water Asset Location Data

Asset location search

Property Searches

Herrington Consulting Limited
Barham Business Park,Unit 6 Barham Business Park

CANTERBURY
CT4 6DQ

Search address supplied 20
Howitt Road
London
NW3 4LL

Your reference LM/3601

Our reference ALS/ALS Standard/2023_4773729

Search date 17 January 2023

Knowledge of features below the surface is essential for every development

The benefits of this knowledge not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility of any development.

Did you know that Thames Water Property Searches can also provide a variety of utility searches including a more comprehensive view of utility providers' assets (across up to 35-45 different providers), as well as more focused searches relating to specific major utility companies such as National Grid (gas and electric).

Contact us to find out more.

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

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

0800 009 4540

Asset location search

Property Searches

Search address supplied: 20, Howitt Road, London, NW3 4LL

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 0800 009 4540, or use the address below:

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

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

Waste Water Services

Please provide a copy extract from the public sewer map.

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

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

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

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

For your guidance:

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

Clean Water Services

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

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

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

For your guidance:

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

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

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

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

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

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

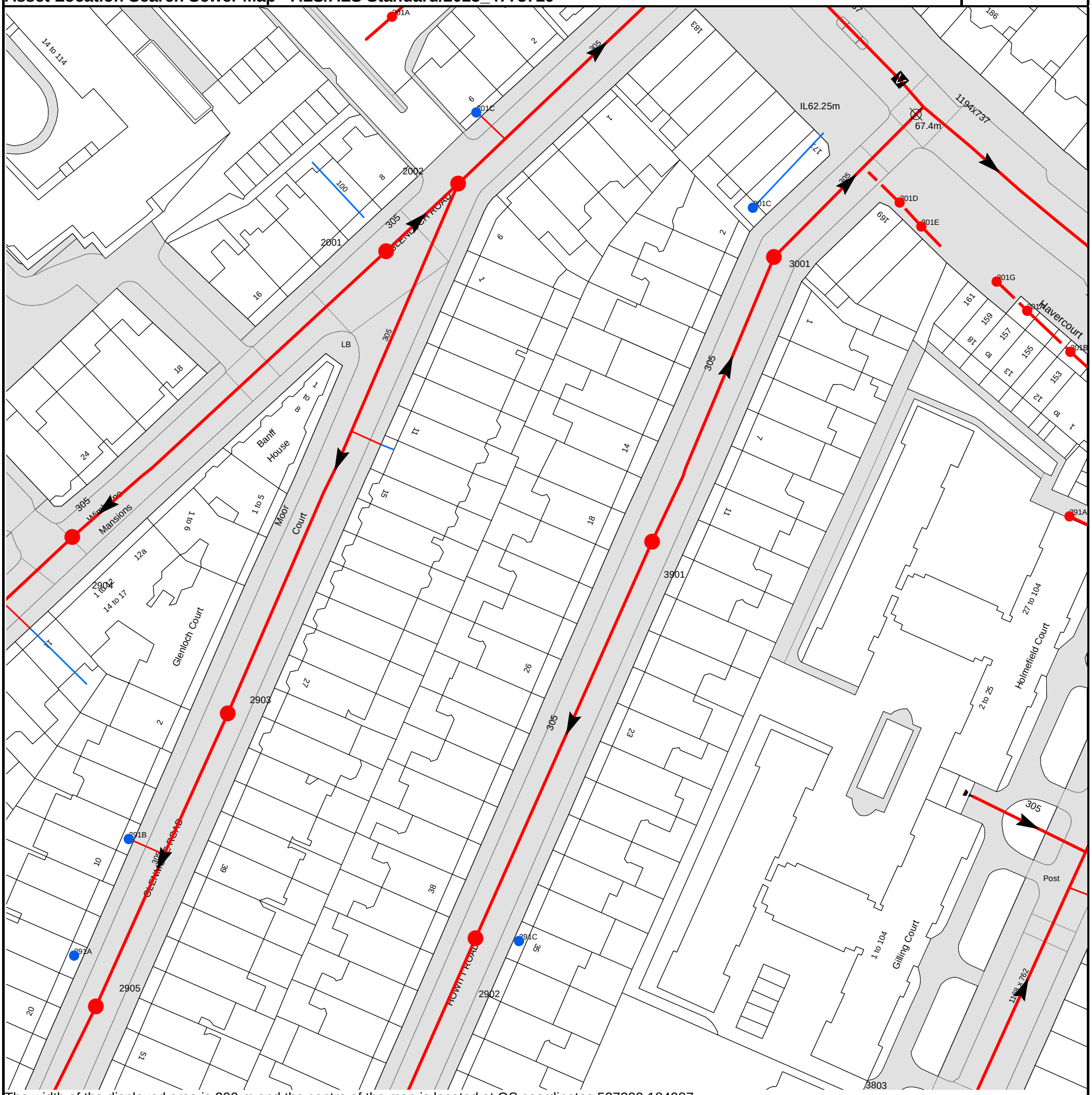
Clean Water queries

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

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

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

Asset Location Search Sewer Map - ALS/ALS Standard/2023_4773729



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 527299,184987

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
301B	n/a	n/a
301A	n/a	n/a
301G	n/a	n/a
3001	68.88	64.64
301E	n/a	n/a
301C	n/a	n/a
301D	n/a	n/a
391A	n/a	n/a
291A	n/a	n/a
2905	64.04	59.84
2902	66.47	62.08
291C	n/a	n/a
291B	n/a	n/a
2903	67.27	62.74
3901	69.11	65.48
2904	67.6	62.19
2001	70.38	65.3
2002	70.35	65.04
201C	n/a	n/a
201A	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.

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

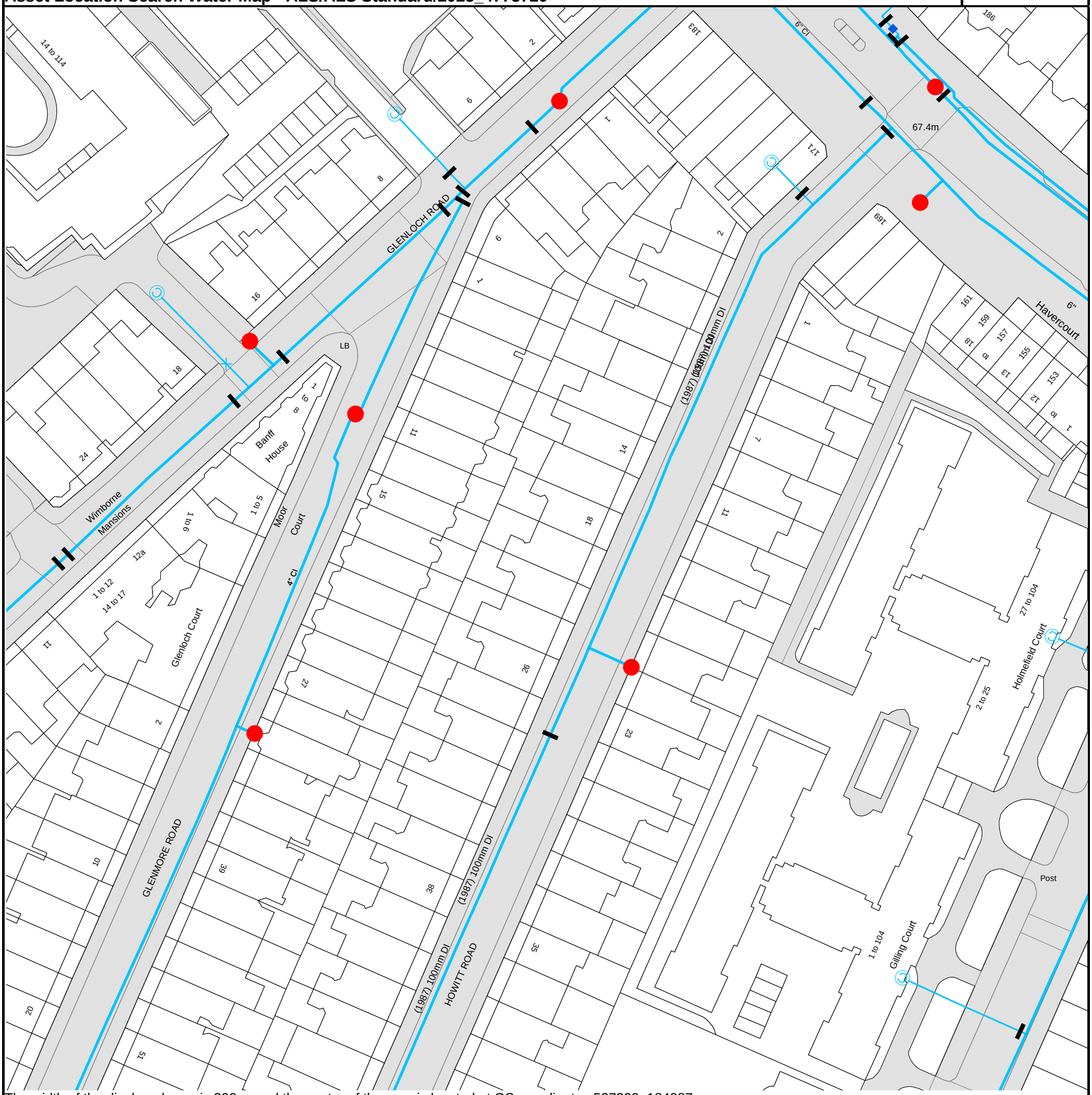
Ducts may contain high voltage cables. Please check with Thames Water.

- 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.

Asset Location Search Water Map - ALS/ALS Standard/2023_4773729



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 527299, 184987.

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 - Water Key

Water Pipes (Operated & Maintained by Thames Water)

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

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

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

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

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

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

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

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

Valves

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

Hydrants

- Single Hydrant

Meters

- Meter

End Items

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

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

Operational Sites

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

Other Symbols

- Data Logger

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

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

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

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

Terms and Conditions

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

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

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

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

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

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

Ways to pay your bill

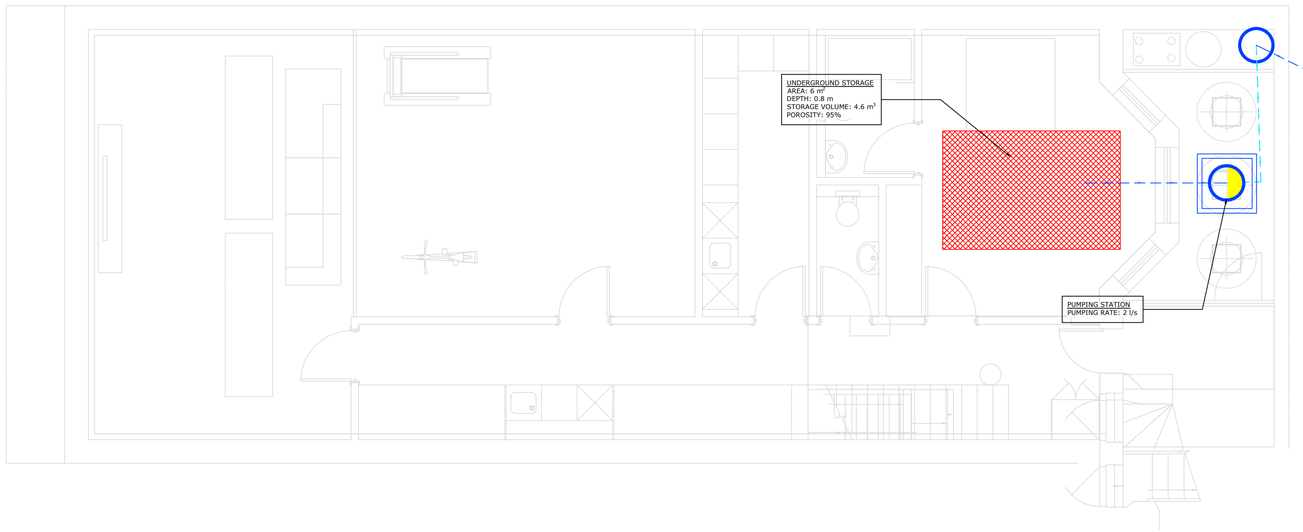
Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0800 009 4540** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

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

Appendix A.3 – Indicative Drainage Layout Plan

GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS, ARCHITECTS AND SPECIALISTS DRAWINGS AND THE SPECIFICATION.
2. ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH THE RELEVANT BRITISH STANDARDS, EUROPEAN NORMS, CODES OF PRACTICE AND BUILDING PRACTICE.
3. ALL DIMENSIONS ARE TO BE CHECKED BY THE CONTRACTOR PRIOR TO STARTING THE WORKS ON SITE. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
4. ALL DRAINAGE SYSTEMS WILL NEED TO BE INSTALLED AND DESIGNED FOR SUITABLE LOADING REQUIREMENTS.
5. THE CONTRACTOR SHALL OBTAIN PRIOR APPROVAL AND ALL NECESSARY LICENCES FROM THE THE HIGHWAY AUTHORITY AND/OR SEWERAGE UNDERTAKER BEFORE CARRYING OUT ANY WORKS.
6. THIS DRAWING WAS PRODUCED FOR USE IN CONJUNCTION WITH A PLANNING SUBMISSION AND SHOULD NOT BE USED FOR OTHER PURPOSES. A MORE DETAILED DESIGN INCLUDING PRODUCT SPECIFICATIONS WILL NEED TO BE PRODUCED PRIOR TO CONSTRUCTION.



SCALE 1 : 50 @ A1

1 m 0 4 m

KEY:

- EXISTING COMBINED SEWER
- EXISTING COMBINED SEWER CHAMBER
- SURFACE WATER DRAIN
- SURFACE WATER RISING MAIN
- SURFACE WATER INSPECTION CHAMBER
- PUMP
- UNDERGROUND STORAGE

herrington CONSULTING LIMITED

Unit 6-7 Barham Business Park
Elham Valley Road
Canterbury
Kent CT4 6DQ

Tel : 01227 833855
enquiries@herringtonconsulting.co.uk
www.herringtonconsulting.co.uk

London Office
Unit 52.11
Woolyard
52 Bermondsey Street
London
SE1 3UD

Rev	Description	Author	Checked	Date
P0	First issue	EC	SMB	13/02/23

CLIENT: Joshua Faith

PROJECT: 20 Howitt Road, London

SCALE	PROJ REF	ORIGINATOR	CHECKED BY
1:50	3601	EC	SMB

HC DWG REF: 3601_DWG_r0

DWG TITLE	DWG No.
INDICATIVE SURFACE WATER DRAINAGE LAYOUT	HC-3601-501

Appendix A.4 – Surface Water Management Calculations

Design Settings

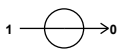
Rainfall Methodology	FEH-13	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	100	Maximum Rainfall (mm/hr)	250.0	Include Intermediate Ground	✓
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	✓
CV	1.000	Connection Type	Level Soffits		
Time of Entry (mins)	5.00	Minimum Backdrop Height (m)	0.200		

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	5.000	100.0	150	Circular	10.000	8.600	1.250	10.000	8.550	1.300
1.001	5.000	100.0	150	Circular	10.000	8.000	1.850	10.000	7.950	1.900

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	Tank		Junction		Pump	1000	Manhole	Adoptable
1.001	Pump	1000	Manhole	Adoptable	MH	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
Tank	0.000	0.000	10.000	1.400		Junction						
								0	1.000	8.600	150	Circular
Pump	5.000	0.000	10.000	2.000	1000	Manhole	Adoptable	1	1.000	8.550	150	Circular
												
								0	1.001	8.000	150	Circular
MH	10.000	0.000	10.000	2.050	1200	Manhole	Adoptable	1	1.001	7.950	150	Circular
												

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	9999	Check Discharge Volume	x

Storm Durations

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

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

Node Pump Online Pump Control

Flap Valve	x	Invert Level (m)	8.000	Switch off depth (m)	0.001
Replaces Downstream Link	✓	Switch on depth (m)	0.750		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	2.000	2.000	2.000

Node Tank Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Pit Width (m)	2.000	Inf Depth (m)	
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	8.600	Pit Length (m)	3.000	Number Required	1
Safety Factor	2.0	Time to half empty (mins)	36	Depth (m)	0.800		

Results for 30 year Critical Storm Duration. Lowest mass balance: 94.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	Tank	40	8.934	0.334	5.0	1.9677	0.0000	SURCHARGED
60 minute summer	Pump	40	8.933	0.933	2.5	0.7322	0.0000	SURCHARGED
15 minute summer	MH	1	7.950	0.000	2.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	Tank	1.000	Pump	2.5	0.523	0.143	0.0880	
60 minute summer	Pump	Pump	MH	2.0				5.3

Results for 100 year Critical Storm Duration. Lowest mass balance: 94.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	Tank	41	9.103	0.503	6.8	2.9675	0.0000	SURCHARGED
60 minute summer	Pump	41	9.102	1.102	2.7	0.8652	0.0000	SURCHARGED
15 minute summer	MH	1	7.950	0.000	2.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	Tank	1.000	Pump	2.7	0.533	0.152	0.0880	
60 minute summer	Pump	Pump	MH	2.0				7.2

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 94.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	Tank	44	9.413	0.813	9.5	4.7254	0.0000	SURCHARGED
60 minute summer	Pump	44	9.412	1.412	3.1	1.1082	0.0000	SURCHARGED
15 minute summer	MH	1	7.950	0.000	2.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	Tank	1.000	Pump	3.1	0.569	0.174	0.0880	
60 minute summer	Pump	Pump	MH	2.0				10.1

Appendix A.5 – Maintenance Schedules

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Operation and Maintenance Schedule – Geo-Cellular Storage System		
Maintenance Schedule	**Required Action**	**Typical Frequency**
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months then annually
	Remove debris and sediment from the catchment surface, wherever is presents a risk to the performance of the drainage system,	Monthly, or as required based on inspection frequencies.
	Remove sediment from pre-treatment structurers (e.g. sediment traps) and from internal forebays	Annually or as required based on inspection frequencies
Remedial Actions	Repair; inlets, outlets, overflow pipes, and vent mechanisms	As required, based on inspections
	Replace tank or geotextile if significant damage is observed or geotextile is torn.	As required
Monitoring	Inspect and check all inlets, outlets, vents, and overflows to ensure that they are in good condition and operating as designed.	Following installation, and annually hereafter
	Survey inside of tank, and at any sediment trap mechanisms, for sediment build-up and remove sediment if necessary. Use inspections to develop a regular maintenance and inspection procedure for sediment removal.	Every 5 years, or as required if inspections show high siltation rates.

General Operation and Maintenance Table for Geo-Cellular Storage Systems