PRICE& MYERS

35 Templewood Avenue NW3 7UY

Structural Engineering Planning Report

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Date	Revision	Notes/Amendments/Issue Purpose
February 2020	0	
June 2020	1	Amended to address comments in Campbell Reith Audit Report

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Appendices:
1)Retaining wall calculations
2)Proposed Construction sequence SK01-SK08
3)Proposed plans and sections 28585-1080/1090/1100/1110/1120/1130/2000/3100
4)Proposed drainage scheme SK601

1 Introduction

Price & Myers have been appointed by Douglas Paskin of PKS Architects to prepare a Structural Planning Report in relation to the construction of a new basement that will form part of a new house to be constructed in place of the existing one. The proposed basement will be formed on two levels with the lowest level being used for plant equipment. The existing pool originally part of the neighbouring Schreiber house, will be underpinned all the way around the outer walls that currently support the glass dome. The new basement will wrap around the south facing side of the existing pool and a suitable soft joint will be created between the underpinning of the pool and the new reinforced concrete walls of the new basement. Part of the new basement will be used as a car park and a new ramp, constructed in reinforced concrete, will run from West Heath Road along the boundary wall with the Schreiber House. A new swimming pool is also proposed within the basement. Above ground the new house will be “L” shaped wrapping around the listed pool of the Schreiber House. The section of the house above the pool will be two storeys high with the internal space being double height. The side of the of house bordering with 33 Templewood Avenue will be 3 storeys high. As the basement, it is proposed to form the main structure of the house in reinforced concrete so that a single contractor cold be used. Only for the third floor it is proposed to use steelwork to achieve smaller structural sections that can work with the proposed architectural scheme.

2 The site

35 Templewood Avenue is located near the junction between Templewood Avenue and West heath road along the border with Hampstead Heath. The site is sloping slightly towards the Heath. The existing house to be demolished is constructed with precast concrete planks spanning between loadbearing cavity walls. Existing foundations are formed of a grid of RC ground beams spanning between deeper concrete pads.
To allow the construction of the new basement it is proposed to fully remove the existing house foundations. If feasible, some of the existing concrete could be crushed on site and used as hardcore fill where necessary.

3 Neighbouring Buildings

The existing buildings bordering with our site are 33 Templewood Avenue and the Schreiber House along West Heath Road. It is not currently proposed to underpin the party wall dividing the car ramp of N33 from our site however, towards the southwest corner, underpinning of the party wall may be required depending on the relative depths between the new and existing walls. Along the boundary line with the Schreiber House no underpinning is proposed however the side wall of the ramp will be constructed in 1m wide reinforced concrete pins.

4 Ground Conditions

Geology

The results of the geotechnical investigation carried out by Jomas (Report No J19092) show approximately 1m of made ground overlying the London Clay (Bagshot Formation). with an estimated allowable bearing capacity of $150KN/m^2$ for foundations below level 109.3 mOD. Above this level a reduced bearing capacity of $125KN/m^2$ has been recommended however we believe that it should be possible, with additional site testing, to increase the lower value up to $150KN/m^2$ for the full extent of the foundations of the new building. Currently only a small area in the south-east corner of the level 1 basement would be founded slightly above the 109.3mOD level.

Ground Water and site Hydrology

Groundwater was not encountered in any of the two boreholes carried out by Jomas. Having checked the maps of the Lost Rivers of London, the river Westbourne runs to the east of the site however it is considered to be far enough away not to have an impact on our proposed works.

Other Underground Structures

As noted in the Jomas report (Chapter 16.3) existing sewers are present both along Templewood Avenue and West Heath Road and the impact from the new development on these sewers has been assessed as part of the GMA. The Edgware branch of the Northern Line runs approximately 200 m to the east of our site and it is therefore far and deep enough not to be affected by the proposed works.

5 Proposed Structure

It is proposed to construct the basement in reinforced concrete. To maximise the internal space the structural walls forming the perimeter of the basement along the party walls with 33 Templewood avenue, the Schreiber House and Templewood Avenue will be constructed following a typical underpinning sequence. Where open excavations are feasible the walls will be shuttered and cast in longer sections than the typical 1m pin width. It is proposed to fully underpin the perimeter walls of the existing listed pool including the small extensions on the side of the new ramp. The base of the pins will be constant along the pool perimeter and will be set by the lowest level of the new basement that wraps around the south side of the existing pool. The new basement walls will be cast up against the underpinning leaving a suitable gap for a vertical movement joint to keep the existing pool structure independent from the new basement structure. Once completed, the new retaining walls will be propped both at the base and top by the new slabs. Where openings are proposed within the ground floor slab along the top of the basement walls for example to allow the venting of the car park area or to accommodate service risers, reinforced concrete beams will be introduced to ensure that the top of the retaining wall is suitably restrained.
As noted in the Jomas report, to accommodate potential heave pressure generated on the basement floor slabs by the unloading of the clay, a suitable product such as the Cordek Cellcore will be specified to the underside of the new slabs. The new slabs will then be suitably reinforced to be able to span between the support points. The waterproofing of the basement will be achieved by means of a drain cavity system with membranes applied to both walls and floors. Sumps will need to be suitably located within the basement floor slabs to pump the water coming through the structure. Surface and foul water will be as much as possible discharged by gravity however a foul sump will need to be formed within the slab of the main basement floor slab. With regards to the structure of the pool, as it is likely that it will be constructed by a specialist pool contractor, it will be independent to that of the main basement.

6 Proposed Construction Sequence

With reference to SK01-SK08 It is proposed to construct the new basement retaining walls following a typical underpinning sequence. Where possible open excavation with vertically shuttered walls have been proposed. It is assumed that access to site will be via Templewood avenue in approximately the same location as the current entrance. This will avoid traffic obstruction along the busier West Heath Road. On this basis it is proposed to start the works from the new ramp at the opposite corner of the site. Rather than forming one large excavation, it is proposed to construct the new basement in smaller sections to keep the temporary works localised. In general, when forming individual pins standard Acrow props should be sufficient. However, when the main central soil mass is being excavated within the different sections of the basement, larger props such as RMD Superslim systems are expected to be used by the main contractor.

Step 1 – Demolition of the existing building. Having overlaid the new layouts onto that of the existing house it is very unlikely that any of the existing house foundations could be reused and therefore they will form part of the demolition works. As previously noted it may be possible to re-use some of the existing concrete on site by crushing it and using it as hardcore. The existing planting beds forming the existing garden are approximately 2m higher than the external pavement levels along West Heat Road and therefore the existing boundary wall is retaining. We understand that both the garden wall and the yew hedge are to be retained however we believe that it would be possible for the demolition contractor to carry out an overall reduced dig that could facilitate the underpinning process. The reduced dig would be carried out such that the existing foundations of the listed pool or neighbouring buildings would not be undermined.

Step 2- Start the underpinning works relating to the construction of the walls of the car park ramp from the West Heath Road end. As the underpinning approaches the car park area the depth of the pins would be close to 4.5m and therefore a two-stage underpinning sequence would be required with two lines of horizontal propping. The underpinning works for the plant room space to the side of the ramp can be included in this initial section of concrete works.

Each “L” shaped pin shall be formed as follows:

A) Excavate initial pit with an area of about 1m x 1m and shutter walls with a suitably framed timber structure to hold the surrounding soil.

B) Excavate pit to base of proposed pin constantly providing adequate propping. As noted in the Jomas report as the excavations are expected to remain stable in the short term it would be preferred to cast the new concrete directly against the clay to avoid the risk of deterioration of the sacrificial shuttering with time that could cause ground movement in the long term. However, if this was not possible, sacrificial expanded metal sheeting (such as Expamet Hy-Rib) should be installed to span horizontally against the clay face to provide adequate propping.

C) Introduce reinforcement to the base of the pin including the wall starter bars and dowels at the toe of the pin to allow the connection with the new basement floor slab.

D) Cast the base of the pin. Wait 24hrs

E) introduce the wall reinforcement and the horizontal dowels (pushed into the ground) to join the pins together. To improve the water resistance of the basement water bars may be installed along the vertical sides of each pins. At the top of the wall bars shall be left longer to be later folded to allow the connection with the ground floor slab. Alternatively, Halfen Kwikastrip or similar products could be used to join the wall to the floor.

F) Install shuttering and cast wall of pin.

Once a pin has been excavated it is not proposed to back fill each pit but to carefully manage the excavation by introducing a suitable propping arrangement. Where the wall is formed in two stage pins lapping bars will need to be pushed vertically into the ground prior to casting the upper pin to allow a suitable continuity of reinforcement between the upper and lower pins.

Step 3 – Form initial section of car ramp on the side of the existing pool by suitably sloping the excavated ground and shuttering the wall on both sides.

Step 4 – As we are getting nearer to the existing pool structure, continue the wall construction following a typical underpinning sequence.

Step 5- Once the single stage sections of the car ramp walls have been formed on both sides, reduce the level of the central soil mass to allow the introduction of the high-level propping system. Proceed with the excavation of the central soil mass and introduce a second level of props just above the level of the new ramp slab. Install new drainage where required and heave protection boards. Install reinforcement connected to the bases of the pins. Cast basement floor slab. Provide shuttering to the car ramp roof slab introduce the reinforcement and cast the slab.

Step 6 – With reference to the car park area of the basement, as the overall depth is closer to 4.5m, form the first stage underpinning along the party wall with the Schreiber House and 33 Templewood Avenue. The section of existing pool affected by these works should also be underpinned prior to forming the new lining wall sections. The two-stage pinning should extend to approximately the location of the step in the basement which happens along the wall dividing the cinema room from the main car park space.

Step 7 – Upon completion of the first level of pins, as per the previous area, the ground can be locally reduced to introduce the first line of horizontal propping. The excavation can then progress to allow the introduction of a second level of props towards the base of the pins.

Step 8 – Proceed with the second stage pins. When all of the pins have been completed and suitably joined to the upper pin section as indicated in step 2, continue the excavation of the central soil mass all the way down to formation level and install a third level of horizontal props just above the car park slab level.

Step 9- As step 5, install new drainage where required and heave protection boards. Install reinforcement connected to the bases of the pins. Cast basement floor slab. Provide shuttering to this section of ground floor slab, introduce the reinforcement and cast the slab. This sequence is slightly simplified. As the ground floor columns do not align with the basement retaining walls, transfer beams will need to be formed as part of the ground floor structure. Refer also to the proposed structure drawings.

Step 10 – Looking at the new pool area, the underpinning works could begin from the West Heath Road end by constructing the walls for the new lightwell. A concrete ring beam will be cast at the top of the lightwell walls to provide the necessary propping. The new drainage and heave protection could then be introduced followed by the basement floor slab and the retaining walls shuttered on both sides.

Step 11 – Form the remaining section of the basement box containing the new pool following a typical underpinning sequence and following the same principles described for the car park/ramp areas. The foundations for the new columns as well as columns starter bars should also be constructed in this step. The pool structure will be formed later either by the main contractor or by a specialist pool subcontractor. Coordination between the new columns and pool structure will need to be discussed as part of the waterproofing strategy.

Step 12 – The remaining section of basement, at the higher level, can also be formed to the side of the car park. It should be possible to form this section in single stage pins.

Step 13 – It should now be possible to begin the construction of the section of first level basement directly above the second level basement that will be used for plant equipment. Carry out the single stage pins along the party wall with 33 Templewood Avenue and along the boundary line with Templewood Avenue. The main access to site may need to be temporarily moved to progress the works in this area.

Step 14 – Upon completion of the perimeter pins, reduce the ground sufficiently to install a propping grid spanning from the top of the pins along the boundary walls to the sections of basement slabs already constructed. Excavate down sufficiently to install a second level of props. Cast the section of basement ground bearing slab on the side of Templewood Avenue.

Step 15 – At this stage, it should be possible to begin the underpinning works for the second level of basement. Following the principles proposed in the previous steps, excavate the single stage “L” pins forming the perimeter of the second level basement.

Step 16 – Once the perimeter pins have been formed reduce the ground sufficiently to allow the introduction of a propping grid just below the new first level basement suspended ground slab. Proceed with the excavation of the central soil mass sufficiently to install the final grid of props just above the second level basement ground bearing slab. Introduce the necessary drainage and heave protection boards and cast the ground bearing slab.

Step 17 – Cast the second level basement roof slab.

Step 18 – Cast the remaining section of ground floor slab. Remove all propping. Basement works complete.

Step 19 – Construct the reinforced concrete superstructure.

It is estimated that the construction of the basement will take approximately 11 months while the superstructure should take approximately 3 months.

7 Impact on Adjoining Buildings and Structures

The ground movement analysis carried out by Jomas, for the neighbouring buildings and boundary walls indicates mostly very slight damage (Category 1) with crack width less than 1mm that can be easily addressed with redecoration.
A reinforced concrete wall formed in an underpinning sequence will serve as the new basement perimeter wall. This wall will be fully propped during the excavation to minimise potential ground movements as detailed in the proposed construction sequence shown in SK01-SK08. As noted in the proposed construction sequence it is not proposed to back fill the underpins trenches to avoid problems with poor compaction of the backfill. Instead each pin will be initially propped against the central soil mass. At a later stage each individual prop will be replaced by the main propping system. The walls will therefore remain propped at all times until the permanent structure is in place and we therefore expect no ground stability issues.
With good workmanship and a properly designed and reviewed temporary works scheme, we would expect there to be very little impact on adjacent structures and buildings because of these works.

During the construction of the basement, monitoring points will be set up to record any variable movements between properties. By using a system of targets, monitored and logged at regular intervals, any differential movements can be identified and the construction method and sequence altered accordingly to limit movements.

The proposed monitoring strategy is as follows:

3D reflective targets will be applied to all the neighbouring buildings. Locations to be agreed with the monitoring company to make sure measurements can be safely and easily taken. It is proposed to use precise levelling with an accuracy of ±1mm.

Proposed frequency of measurements:

Two readings prior to the beginning of the works.
During demolition works – fortnightly.

During underpinning, excavation and until the RC structure of the basement is completed – weekly.
Upon completion of the basement – 2no fortnightly surveys and then monthly surveys to the end of the superstructure.

Proposed trigger values: for both vertical and horizontal movement:

For Schreiber House and Pool

Amber ± 3.5mm
Action: if movement exceeds ± 3.5mm review the underpinning sequence and propping arrangement and increase monitoring to twice a week for the affected area of the works.

Red ± 5mm
Action: if movement exceeds ± 5mm stop the works and undertake remedial measures to stop the movement.

For all other neighbouring structures

Amber ± 5mm
Action: if movement exceeds ± 5mm review the underpinning sequence and propping arrangement and increase monitoring to twice a week for the affected area of the works.

Red ± 7mm
Action: if movement exceeds ± 7mm stop the works and undertake remedial measures to stop the movement.

8 Party Wall Matters

The proposed development falls within the scope of the Party Wall etc Act 1996. Procedures under the Act will be dealt with in full by The Employer's Party Wall Surveyor. The Party Wall Surveyor will prepare and serve necessary Notices under the provisions of the Act and agree Party Wall Awards in the event of disputes. The Contractor will be required to provide The Party Wall Surveyor with appropriate drawings, Method Statements and other relevant information covering the works that are notifiable under the Act. The resolution of matter under the Act and provision of the Party Wall Awards will protect the interests of all owners. The design of the new basement will be developed so as not to preclude or inhibit similar, or indeed any, works on the adjoining properties. The Surveyors will verify this as part of the process under the Act.

9 Noise, Dust and Vibration

The Contractor shall undertake the works in such a way as to minimise noise, dust and vibration when working close to adjacent buildings to protect the amenities of the nearby occupiers.

Noise:

Noise is often a complaint from neighbours however this can be managed by:

- keeping a good relationship with the neighbours by informing them on when higher noise level may be generated. If these times were not acceptable to the neighbours then, within reason, a compromise should be found on when the works can be carried out.

-providing additional noise dampening barriers around the areas of noise generation.

-utilising modern equipment with a lower noise impact than older machinery.

-respecting the allowable hours of works as noted in the planning permission.

Dust:

The contractor must make sure that the site is suitably protected to prevent the spread of dust to the neighbouring properties. Most of the dust will be generated during the basement excavation and the zone generally affecting the neighbouring properties is the entrance area where spoil is taken out of the property via conveyor belts or lorries. Any dropped soil or waste material is then spread by wind and foot traffic onto the neighbouring properties. The contractor will therefore be required to keep the front area of the site clean at all times especially during windy days.

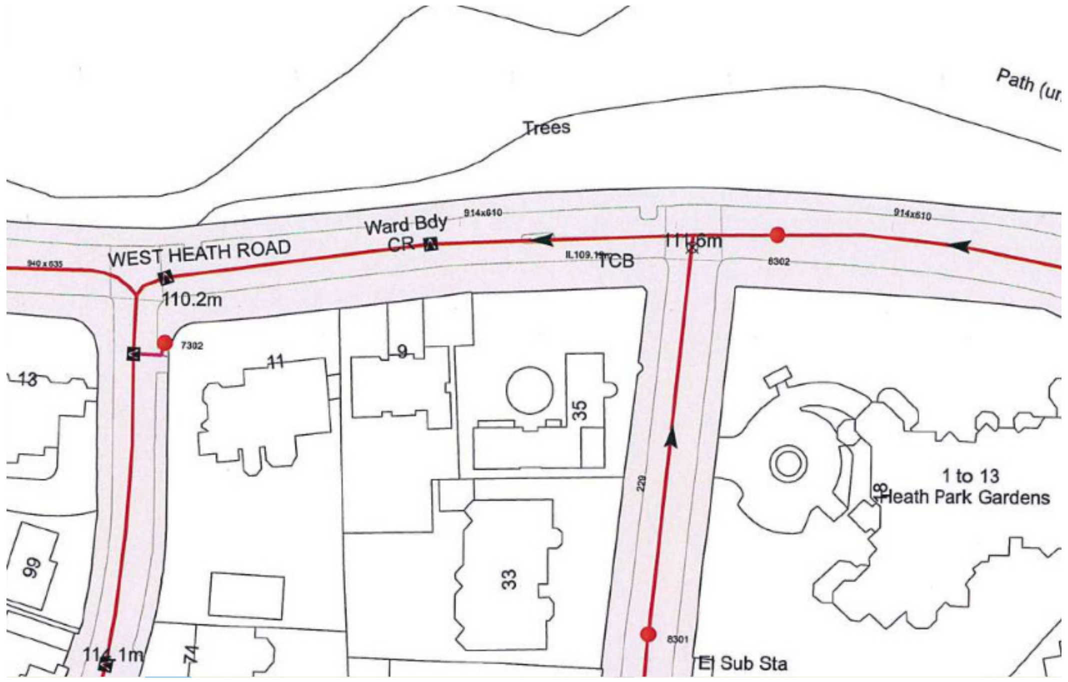
Vibration:

The contractor shall use power generators and compressors that will minimise noise. These shall be positioned in such a way as to reduce the transmission of vibration via the existing and new structural elements to the neighbouring properties. Suitable vibration isolators may need to be installed to the supporting bases of the most critical equipment. Wherever possible the breaking of existing structure such as concrete floors shall be carried out by saw cutting to minimise vibrations.

10 SUDS

Existing Drainage system

Thames Water's Asset search shows that there is a 229mm diameter combined water public sewer in Templewood Avenue which connects into a large 914 x 610mm sewer in West Heath Road. The topographic survey of the existing site shows that there are private manholes at both entrances to the site, which suggests there may be multiple connections to the public sewers. This will be confirmed by a CCTV Survey, which will also confirm the conditions of the connections.



Extract from TW asset map showing existing drainage layout

Existing run-off

The total site area is approximately 1,030m² or 0.1 ha, of this approximately 620m² or 0.062 ha is impermeable.
The existing run-off rate for the design storm events was calculated using the modified rational method as shown below:

$Q_x = 2.78 \times i \times A$

Where 'x' is the return period in years, 'A' is the catchment area in ha and 'i' is the rainfall intensity in mm/hr as estimated from Micro Drainage software.

$Q1_{ex} = 2.78 \times 32.9 \times 0.062 = 5.67$ l/s
$Q30_{ex} = 2.78 \times 80.8 \times 0.062 = 13.93$ l/s
$Q100_{ex} = 2.78 \times 105.1 \times 0.062 = 18.12$ l/s

Proposed run-off

The development proposals result in a slight increase in impermeable area to 790m² or 0.079ha. The proposed soft landscaping will infiltrate directly into the ground as existing. However, the landscaping above the car access ramp will require a positive drainage system and has been included in the overall impermeable area calculations.

The total unmitigated run-off rates were calculated for each of the storm events, as shown below:

$Q_x = 2.78 \times i \times A$

Where 'x' is the return period in years, 'A' is the catchment area in ha and 'i' is the rainfall intensity in mm/hr as estimated from Micro Drainage software.

$Q1_{pr} = 2.78 \times 32.9 \times 0.079 = 7.23$ l/s
$Q30_{pr} = 2.78 \times 80.8 \times 0.079 = 17.75$ l/s
$Q100_{pr} = 2.78 \times 105.1 \times 0.079 = 23.08$ l/s

The current EA guidance states that for the years 2070 to 2115 there is a 50% chance the peak rainfall intensity will increase by 20% or more and that there is a 10% change it will increase by 40% or more. For this building, which is classed as more vulnerable an allowance of an additional 40% is considered appropriate. The climate change allowance is included in the volume calculations for the design of SuDS measures.

This results in an overall run-off rate of:

$Q100{+}40_{pr} = 2.78 \times 147.2 \times 0.079 = 32.33$ l/s

SUDS Assessment

As mentioned in the Ground Investigation and Basement Impact Assessment by Jomas Ltd, the site is at low/very low risk of flooding from surface water, groundwater and watercourses.

In accordance with the London Plan, EA guidelines, Camden Borough Council's SFRA, and CIRIA documents, surface water run-off should be managed as close to its source as possible. The London Plan states that all new developments should aim to reduce run-off to greenfield rates "utilising SuDS unless there are practical reasons for not doing so".

The possibility of implementing SuDS at the site was assessed using a hierarchy of preferred surface water management methods. The following paragraphs discuss the various methods in order of that hierarchy and evaluate the site's suitability for each method.

Store Rainwater for Later Use

Rainwater harvesting promotes the storage and re-use of rain water collected from roofs and hard surfaced areas. This type of system contributes to the reduction of runoff rates and volumes within a development. However, the capacity of rainwater harvesting systems to attenuate rainwater depends on the water use within the building. If there is no activity in the building and the harvester is full, no attenuation will be provided during a subsequent storm event. In the worst-case scenario, the rainwater harvester will provide no attenuation. There are also limitations with rainwater harvesting if there is restricted space available. Therefore, due to lack of space and potential for water re-use, it was not considered appropriate at this site.

Infiltration

The ground investigation carried out by Jomas (2020), states that the ground conditions are Bagshot Formation – clay for up to 1m bgl, followed by Bagshot Formation – sand. This suggests that the ground conditions may be suitable for infiltration. However, due to limited space available to meet building regulation requirements, it is not possible to position a soakaway a minimum of 5m from the buildings or the site boundary. Thus, infiltration cannot be used.

Attenuation

The next preferred option is to attenuate. As mentioned, the SFRA states that new developments should aim to restrict to Greenfield run-off rates.

The existing Greenfield run-off rates for storm events of several different return periods were calculated using the Greenfield Runoff Estimator tool from uksuds.com as shown in the table below. Supporting documentation is contained in the Appendix

Q1ex Gr	=0.32 l/s
Q30 ex Gr	=0.85 l/s
Q100 ex Gr	=1.18 l/s

As can be seen, the run-off rate for the 1 in 100 years storm event is 1.18l/s, however, the Building Regulations Part H states that the minimum surface water diameter pipe for a drainage system should not be smaller than 75mm diameter, in order to avoid the risk of blockages, as self-cleansing velocity cannot be achieved. A flow control of 75mm diameter was therefore used in Microdrainage software to calculate the maximum peak flow rate for the development; this was found to be 3.1 l/s.

Based on this flow rate, the attenuation volume was calculated for the 1 in 100 years storm event plus 40% for climate change and a total of 32m^3 of storage is required. This will be provided by a 1.5m deep underground storage tank in the soft landscaping adjacent to the existing pool.

The podium above the access route will be drained via a lined filter drain running adjacent to it in the soft landscaping, prior to connecting to the attenuation tank. Where the external cover level is lower, at the proposed swimming pool deck and in the lightwells on the eastern side of the building, the surface water run-off will require pumping to the gravity network prior to connecting into the tank. Separate pumps may be required for these; however, this will be developed in the detailed design stages. Refer to the below ground drainage proposals.

The restricted run-off from the attenuation tank will then connect into the public sewer in West Heath Road, using an existing connection if possible. A S106 application may be required for the connection to the public sewer.

Foul water

A new network will be required for the foul water. Foul water from the ground floor and above will be drained via a gravity system, however, any drainage in the lower ground floor and basement will need to be pumped to connect into the public sewer. A holding tank is proposed for backwash from the swimming pool which will then discharge into the foul water drainage system.

It is proposed that the connection to the public sewer in Templewood Avenue will be reused if possible.

11 Design Criteria

Loading

Imposed loading (to BS 6399:part 1)

Residential = 1.5 KN/m^2

Wind loading (to BS 6399:part 2)

Basic wind speed = 20 m/s

Overburden pressure for retaining wall design generally

permanent 30.0 KN/m^2
variable 5.0 KN/m^2

Soil conditions Ko

Water assumed 1m below ground level

12 Design Risks

The primary design risks identified during the work done to this point are:

Unforeseen underground structures.
High or increasing water table across site.
Working in confined spaces during the underpinning process.