3 Screening

The London Borough of Camden guidelines suggest that any development proposal that includes a subterranean basement should be screened to determine whether or not a full Basement Impact Assessment is required. A number of screening tools are included in the Arup document and the following table uses these to assess the Surface Water flow.

Question	Response for 32 Glenilla Road
1: Is the site within the catchment of the ponds on Hampstead Heath	No. The Site lies to the south of the Hampstead Heath Ponds catchment area.
2: As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No. The area of hardstanding will remain the same and therefore the flow rates will not be changed. Where possible the proposed drainage will be connected to the existing on site drainage, mimicking the existing conditions. Where new drainage is required it will reflect the existing connections.
3: Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No. The current building occupies the entire site and the proposed building will also reflect this.
4: Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	The existing building covers the entire site area. Surface water from the building currently drains to the public sewers. The proposed surface water drainage will mimic existing conditions. The site is underlain by London Clay which has very poor infiltration properties and therefore restrict the flow of groundwater. Therefore, the proposed basement will have a negligible effect on the local hydrogeology.
5: Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No. There are no changes in the quality of surface water, as the proposed redevelopment will not change the use of the site and there will be no below ground structures (such as piles) with the sensitive groundwater zones that could have the potential to affect the quality of groundwater.
6: Is the site in an area known to be at risk from Surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King's Cross, or is it at risk from flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?	Based on the Environment Agency flood map, the site is at risk of surface water flooding. Flood mitigation measures should be implemented to reduce the flood risk to the new basement. The site is located in Flood Zone 1, with no immediate risk of flooding from Rivers and Sea. Therefore, in accordance with Camden Planning Guidance, CPG4, a site specific FRA is required to assess the flood risk to the proposed development and the risk of loss of life, and to recommend any flood mitigation measures that may be required.

4 Scoping and Investigations

The purpose of scoping is to assess in more detail the factors to be investigated in the impact assessment. Potential consequences are assessed for each of the identified potential impact factors.

Potential Impact	Possible Consequence
Surface water flooding on Glenilla Road	The Environment Agency's surface water Flood Map shows that there is a risk of flooding from surface water adjacent to the proposed development on Glenilla Road. The risk of surface water run-off entering the property and proposed basement will be assessed further.

These potential impacts have been further assessed through the preparation of a Flood Risk Assessment.

5 Development Proposals

The proposed development will demolish the existing church building and build 2 independent residential properties over a similar footprint. The proposals will provide new basements for both properties.

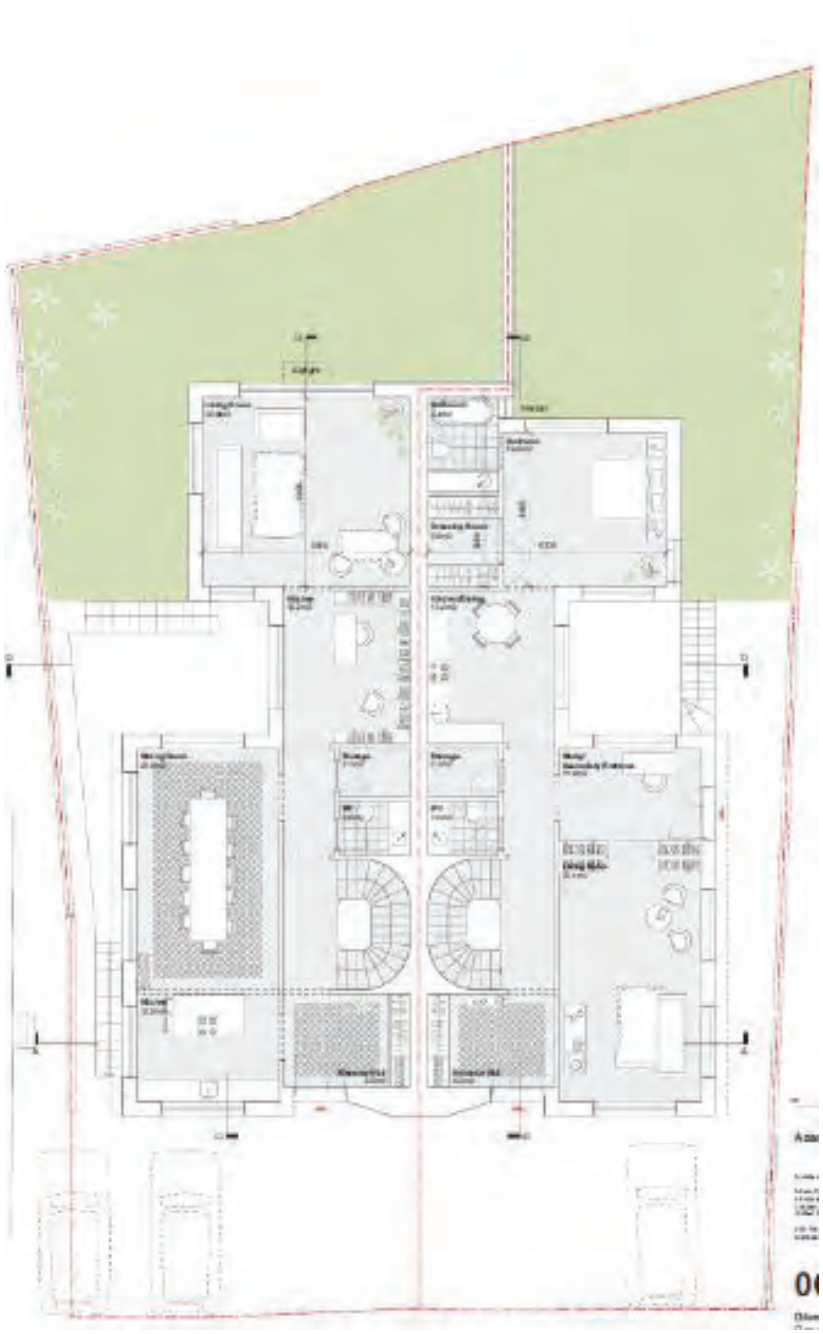


Figure 3 Proposed Development – Ground Floor

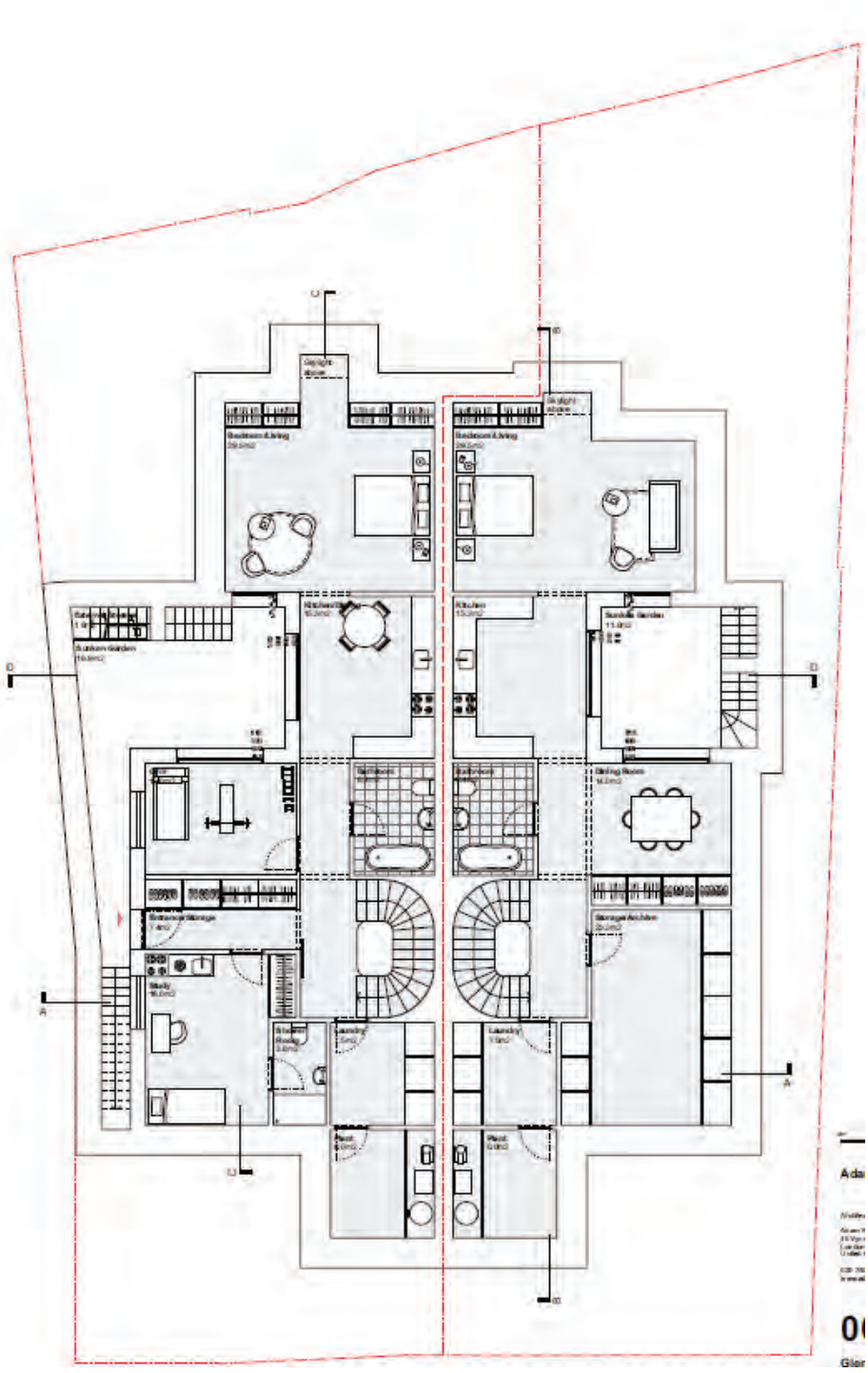


Figure 4 Proposed Development – Basement floor plan

6 Flood Risk Assessment

6.1 Flood Risk from Watercourses (Fluvial/Tidal)

The EA's indicative floodplain map shows that the site is not at risk of flooding from the River Thames or other watercourses. The map shows that the site lies in Flood Zone 1, an area with less than 0.1% annual probability of tidal and/or fluvial flooding.

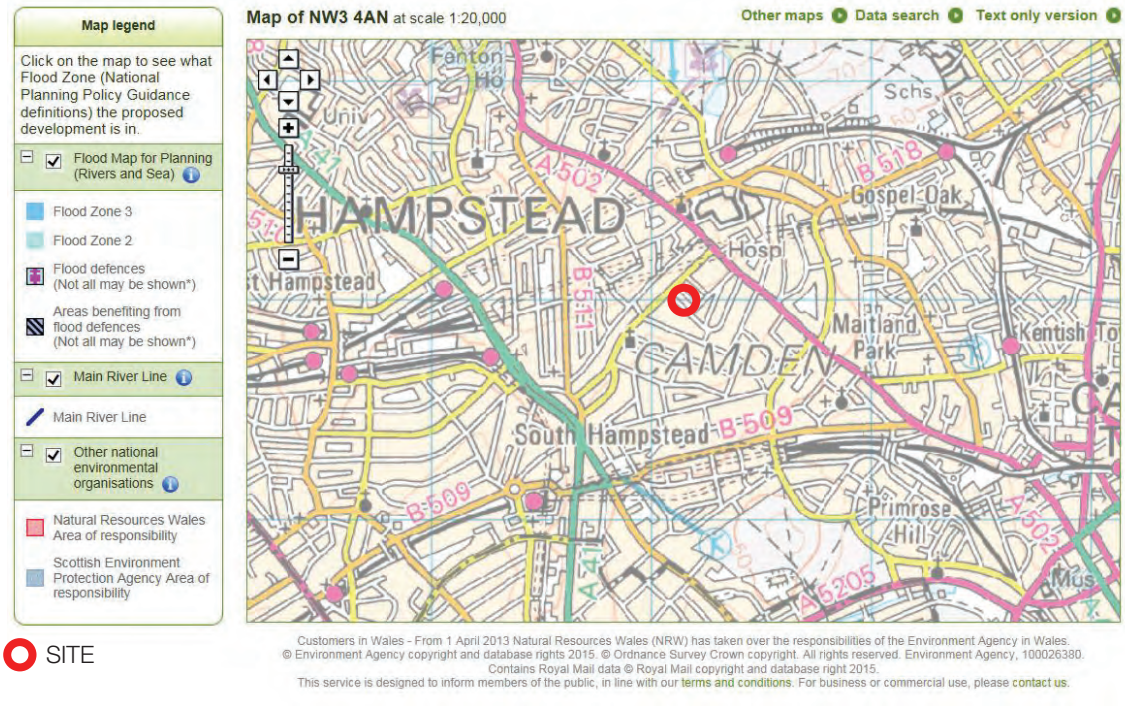


Figure 5 Environment Agency's indicative floodplain map

6.2 Flood Risk from Groundwater

A ground investigation report was not available at the time of writing, however information published by the British Geological Survey (BGS) shows that the site is underlain by London Clay Formation with no superficial deposits (Figure 6).

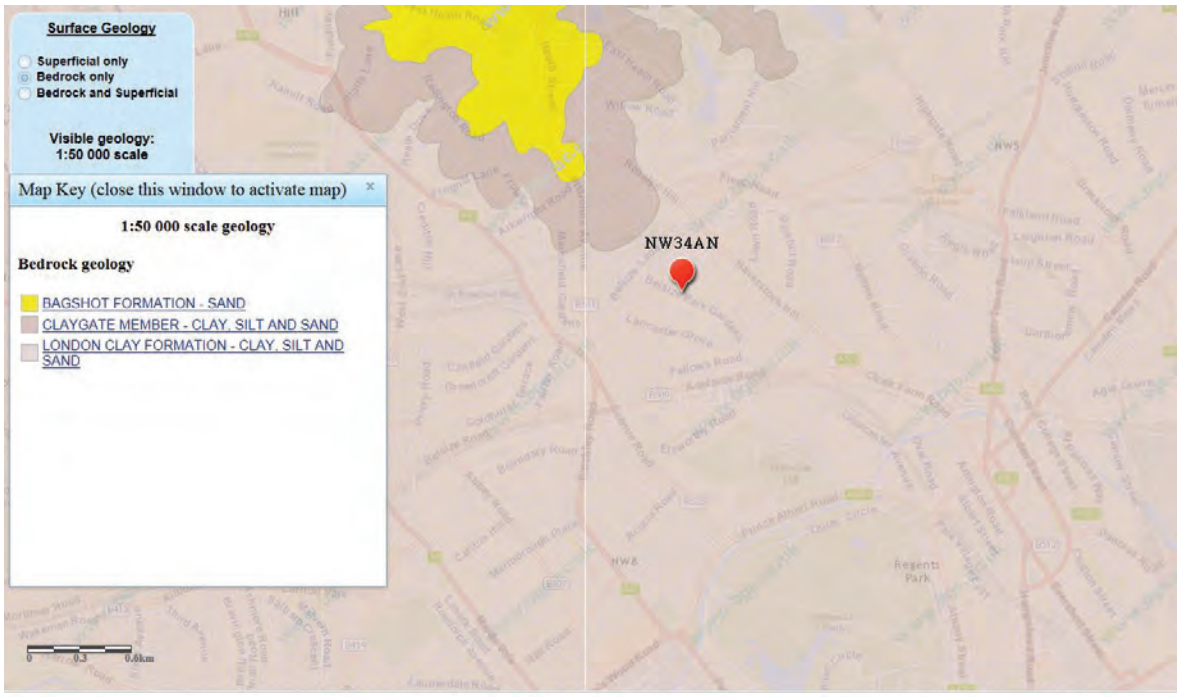


Figure 6 Local geology (extract from BGS map viewer)

This also correlates with borehole logs carried out at a nearby site on Belsize Lane to the north west of the site, where London Clay was found to be directly below the made ground. The SFRA states that no records of historical groundwater flooding have been recorded on Glenilla Road or the surrounding area. However, as the development proposals include a basement, it is important that groundwater levels including levels from any perched water are investigated to determine the risk of groundwater flooding.

The London Clay acts as an impermeable cap to the Chalk aquifer, preventing incidents of deep groundwater flooding. The basement should be designed and constructed to be fully waterproof for the lifetime of the development in accordance with current best practice and standards. This will eliminate the flood risk from groundwater to the proposed development. Therefore, the flood risk from groundwater to and from the proposed development is considered low.

The EA have defined Source Protection Zones for 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The EA maps confirm that the site is not located within any groundwater Source Protection Zone (Figure 7).

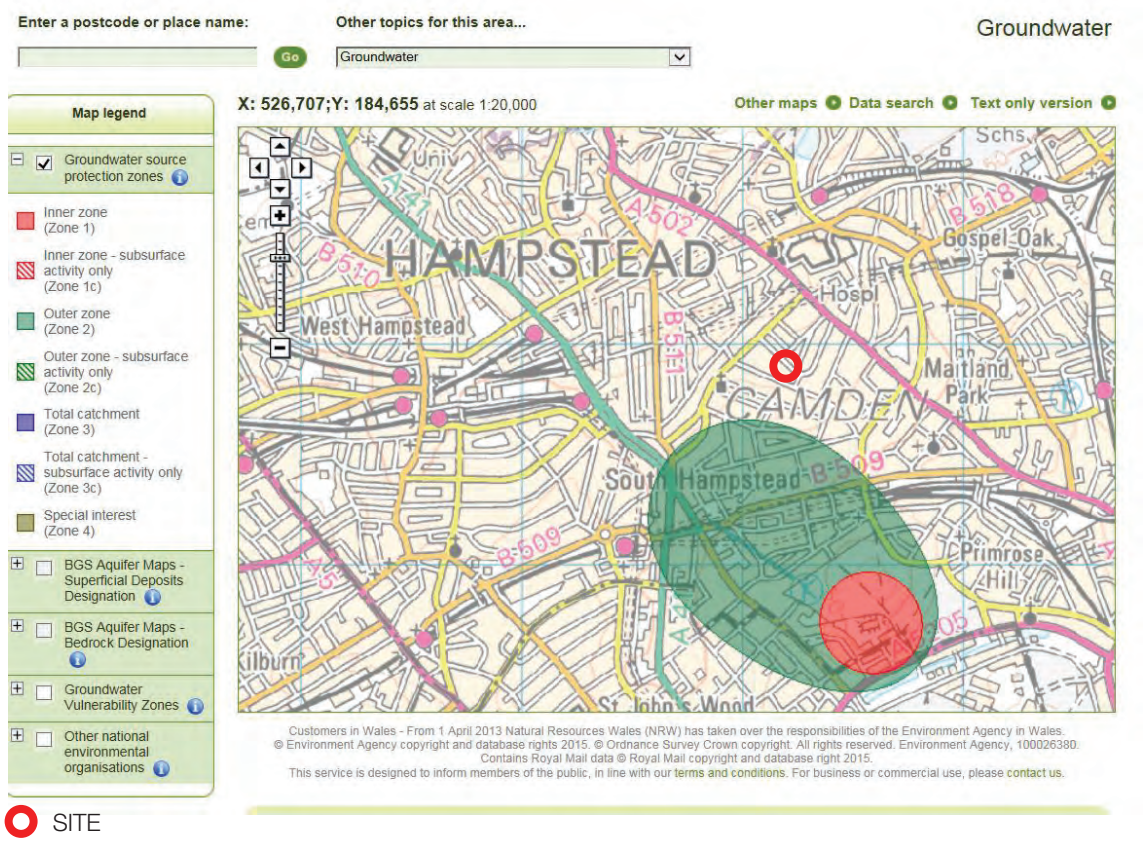


Figure 7 Environment Agency's groundwater source protection zones map

There are two main water bearing aquifers in the London Basin known as the Upper and Lower Aquifers; these are separated from each other by the thick impermeable layer of London Clay. The Upper Aquifer comprises groundwater located within deposits of River Terrace Gravels and granular soils, (including the Bagshot Formation) which overlie the London Clay. The Lower Aquifer comprises groundwater within the Thanet Sand, Upnor and Chalk Formations. The British Geological Survey (BGS) shows there are no superficial deposits on the site, (this will need to be confirmed by site investigation) and the proposed development will not extend beneath the London Clay. The proposed development is therefore not expected to have an impact on any of the local aquifers. This is confirmed by Figures 8 & 9 below, taken from the EA's website, which show that the site is not located within any aquifer catchment areas. As the site is not located within any aquifer catchment areas the proposed basement will not have an impact on any below ground flow paths and therefore will not increase the risk of flooding to the surrounding areas.

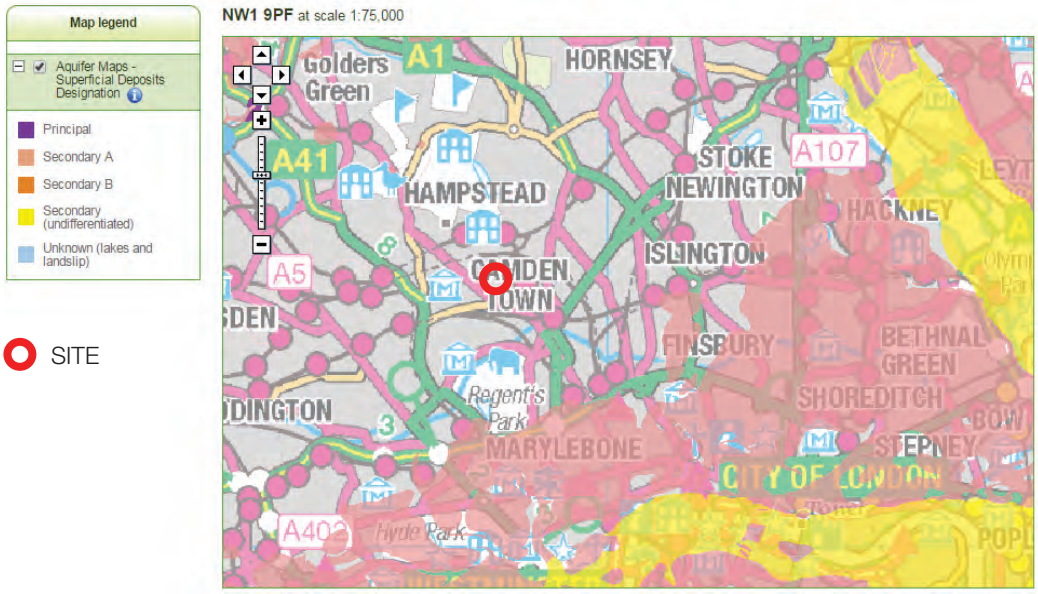


Figure 8 Environment Agency's superficial deposits aquifer map

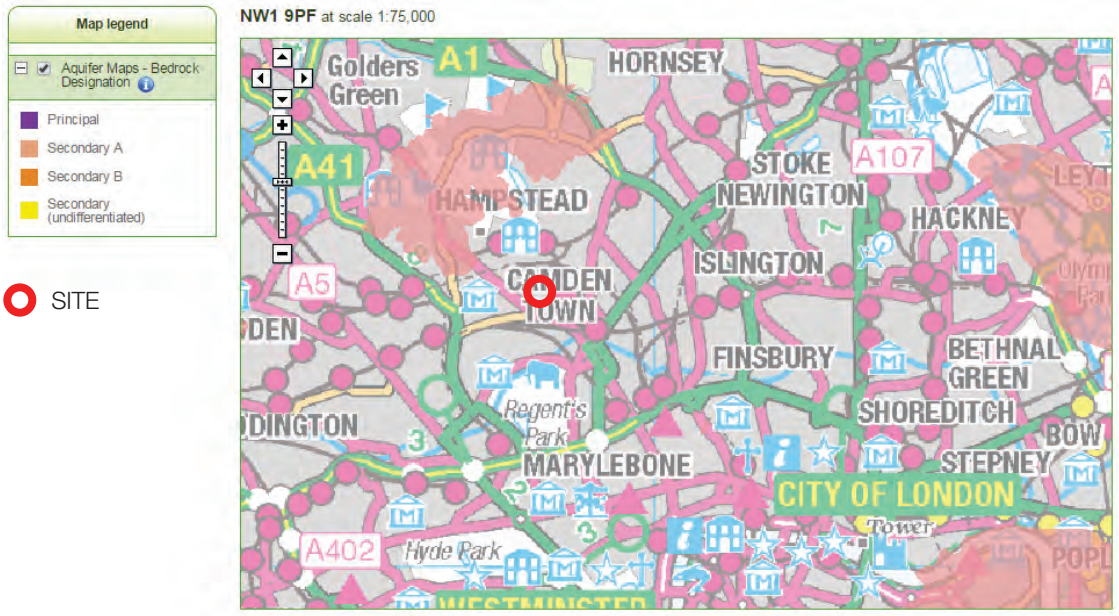


Figure 9 Environment Agency's bedrock aquifer map

6.3 Flood Risk from Surface Water and overland flows

Surface water flooding occurs when intense rainfall in unable to soak into the ground or enter a drainage system, due to blockages or the capacity of the system being exceeded. Developments with lower ground floors are naturally susceptible to this type of flooding. The EA provides an indicative map which highlights areas that are at risk of surface water flooding. Figure 10 shows that there is a "Medium" risk of flooding from surface water in Glenilla Road in the area adjacent to the proposed development.

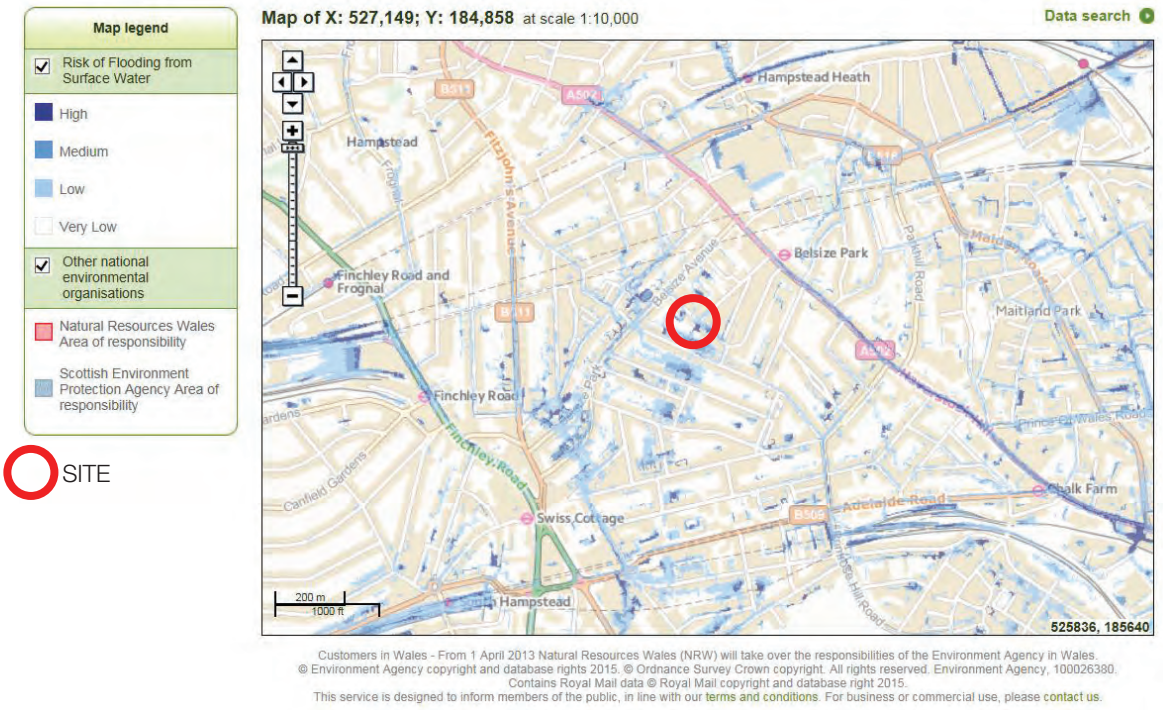


Figure 10 Environment Agency's indicative surface water flooding map

While the Environment Agency's surface water Flood Map shows that there is a risk of flooding from surface water at this location, an extended topographical survey map confirms that the site is not within a valley. This map shows a constant fall from north-west to south-east which will encourage surface water to flow downstream without flooding the local area. There is no mention of flooding incidents on Glenilla Road in the London Borough of Camden's document *"Floods in Camden: Report of the Floods Scrutiny Panel".* Furthermore, the ground floor level is located approximately 300mm above the lowest levels within the road.

Therefore a freeboard is provided between the access point to the basement and the potential flowing water level in the road. It is recommended the top step within the garden area which leads to the basement level to be raised in comparison with the external levels. This will discourage overland flows from entering the new lightwell and basement courtyard.

7 Run-off Assessment

In accordance with the EA's guidelines, Building Regulations and Water Authorities advice, the preferred means of surface water drainage for any new development is into a suitable soakaway or infiltration drainage system. Sustainable drainage systems (SUDS) can reduce the impact of urbanisation on watercourse flows, ensure the protection and enhancement of water quality and encourage recharge of groundwater in a manner that mimics nature. If drainage to an infiltration system proved to be an unsuitable option for a site then drainage to a watercourse must be assessed. Drainage to the public sewers can be considered only when all other alternative options are not suitable.

Drainage to infiltration systems is not a suitable option considering that there is no available land on site to accommodate such systems and the site is underlain by impermeable London Clay. Infiltration systems must be located at least 5m away from any structure. There are also no suitable watercourses in the vicinity of the site and therefore drainage to the public sewers is the only available option.

The NPPF and the EA require the surface water arising from a developed site to mimic the surface water flows arising from the site prior to the proposed development. The proposed development will not add impermeable areas on site and therefore will not increase the peak run-off rates. However, the London Plan requires new developments to limit surface water run-off to Greenfield rates; therefore attenuation must be considered.

The Greenfield run-off rate for the site was estimated using the Greenfield Run-off estimator tool (uksuds.com, please refer to separate Drainage Report) using the BFI specified from FEH data. The site was considered holistically because the site area for the estimator tool is 0.1ha. The 1 in 100 year Greenfield run-off rate can be calculated by multiplying the 100 year growth curve factor by Q_{bar}:

Q_{100GF} = 3.19 x 0.30 = 0.96 l/sec

In accordance with best practice guidelines surface water should be attenuated to no less than 5l/sec, as low flow rates require small diameter flow control devices which are more likely to suffer from blockages. Therefore surface water from each property will be attenuated to 5l/sec. This will ensure that the two drainage systems (one for each property) are separate. The house owners will be responsible to maintain their drainage and SUDS. The storage volume required to attenuate to 5l/sec for the 1 in 100 year plus 30% (climate change) storm event is shown in the table below (please refer to separate Drainage Report for preliminary calculations).

	House 32a	House 32b
Attenuation volume	18 m^3	15.3 m^3

8 Conclusions

- The site is located in Flood Zone 1 “areas with little or no potential risk of flooding (annual probability less than 0.1% for fluvial flooding), which are already developed.” Therefore there is no risk of flooding from rivers and/or the sea. Proposed developments in these areas have no restrictions provided that the surface water drainage proposals will not increase the flood risk to the site or the surrounding areas.

- The site is at low risk of flooding from rising groundwater; however groundwater levels should be confirmed at site investigation. Engineering techniques such as drainage cavity systems and waterproofing should be considered during the detailed design.

- There is a low risk of surface water flooding as there is a constant fall away from the property along Glenilla Road.

- Surface water will be attenuated to 5l/sec for each property benefiting the public sewers which are currently receiving unrestricted run-off rates from the existing development.

- The proposed development has an acceptable flood risk within the terms and requirements of the NPPF and accompanying technical guidance.

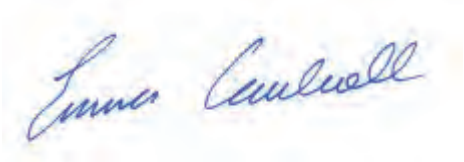
Appendix A – Topographical Survey Drawings

PRICE&MYERS

Drainage Strategy

32 Glenilla Road, London, NW3 4AN

Prepared by: Jaklin Zankova BEng (Hons)
Reviewed by: Emma Caulwell BE MSc CEng MICE



Date: October 2015
Job No.: 24357

Revisions

Rev	Date	By	Notes
1	27.10.15	DR	Issued for planning
2	16.11.16	JZ	Issued for planning

Table of Contents

Abbreviations

AOD	Above Ordnance Datum
EA	Environment Agency
FFL	Finished Floor Level
NPPF	National Planning Policy Framework
TW	Thames Water

1 Introduction

Price & Myers have been commissioned to formulate the Drainage Strategy to support the Basement Impact Assessment for the proposed redevelopment of 32 Glenilla Road.

This report sets out the strategy for the drainage design for the proposed redevelopment of 32 Glenilla Road in Camden, London, to determine the possible options for foul and surface water drainage. The report will also assess the impact (if any) of the proposed development on the public sewers and the surrounding properties. Infiltration is not expected to be suitable, considering the proposed building occupies the 80 % of the site and the site is underlain by London Clay, therefore attenuation will be prioritized prior to discharge to the public sewer. Discharging foul water drainage to the public sewers will be prioritised in accordance with Building Regulations Part H.

The site is located on Glenilla Road in the London Borough of Camden (Figure 1). The site is bound by Glenilla Road to the north and existing residential properties to the east, south and west. The site is currently occupied by a single-storey derelict church hall. The topographical survey drawing (Appendix A) shows that the site is generally flat with levels varying across the site from approximately 61.80mAOD on the northern boundary to 61.60m AOD on the southern boundary. The site postcode is NW3 4AN and the grid reference is 527153E, 184858N.

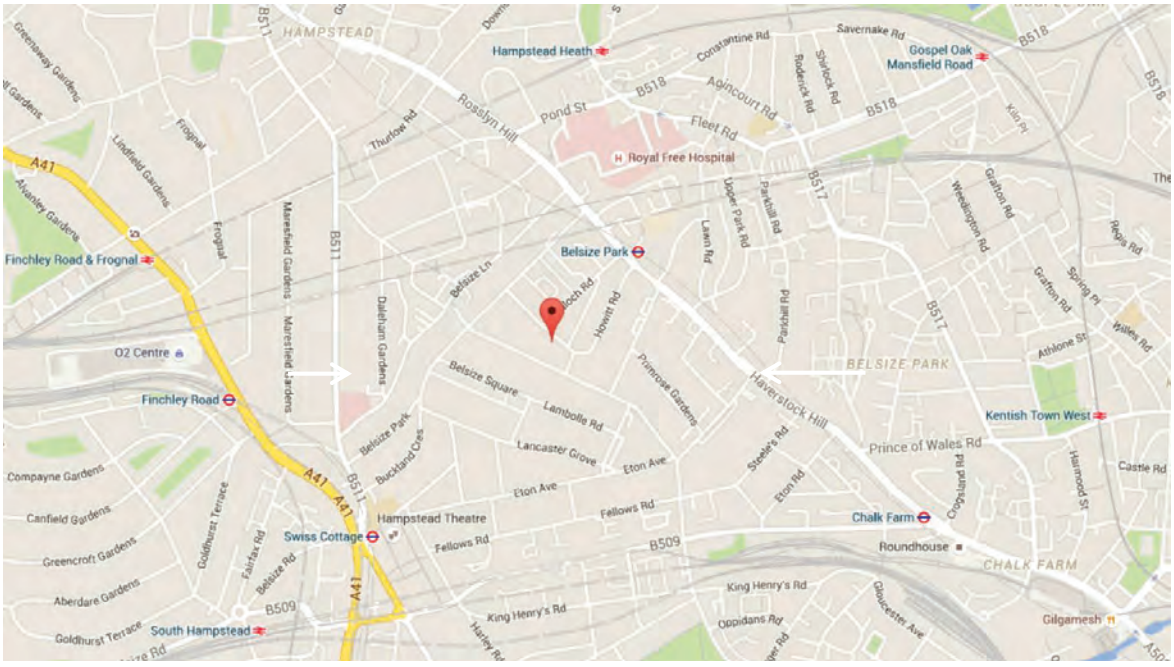


Figure 1 Site Location (Google Maps)

2 Development Proposals

The proposed development will demolish the existing church building and build 2 independent residential properties within an extended site boundary. The proposals will provide new basements for both properties.

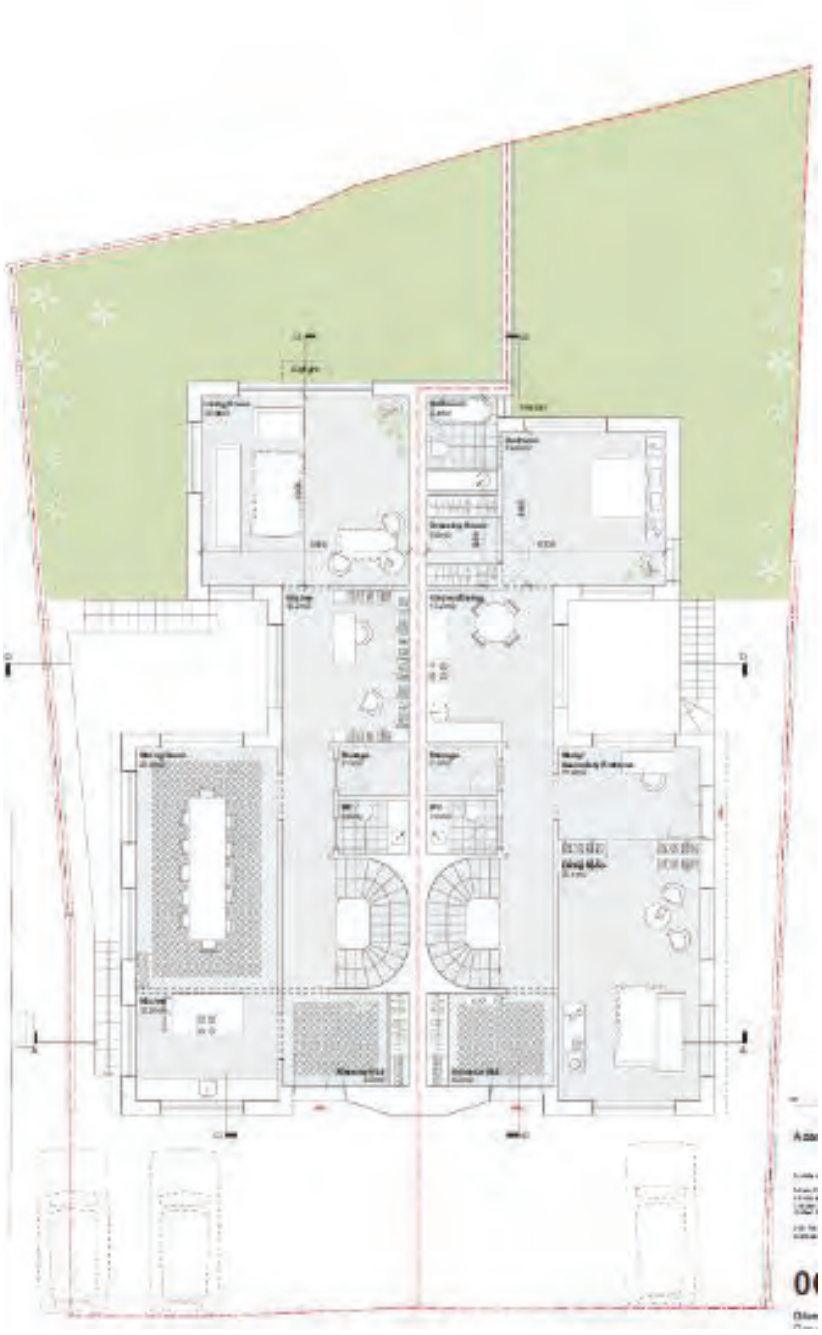


Figure 2 Proposed Development - Ground floor plan

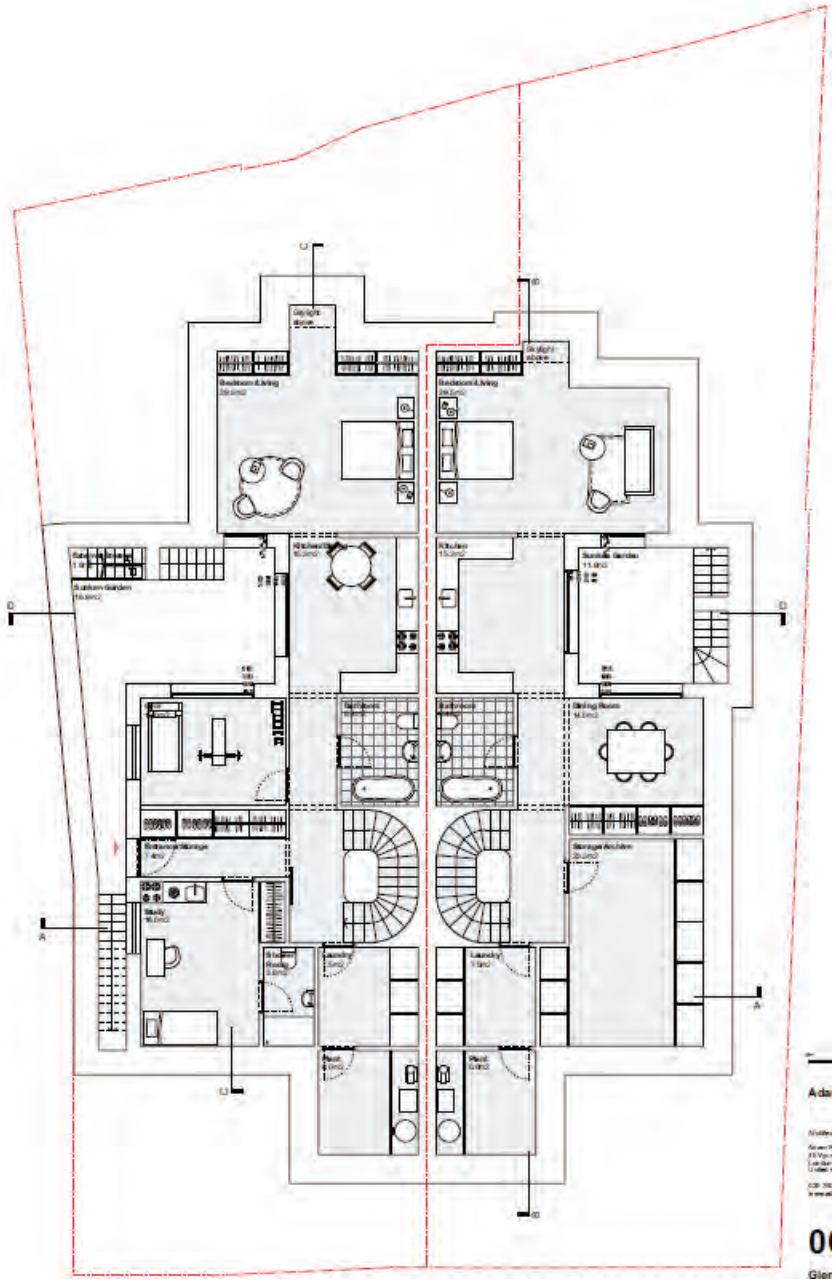


Figure 3 Proposed Development – Basement floor plan

3 Existing Drainage

At present the site area is approximately 80% impermeable. The majority of the site is occupied by the derelict church hall with some areas of soft landscaping around the perimeter. Thames Water sewer records show that there is a 381mm diameter combined sewer running north-west to south-east along Glenilla Road. There is also an adopted lateral drain running from 34 Glenilla Road (see Figure 4). The existing site boundary of No.32 will be extended to include the adopted lateral drain and Thames water manhole 181A. The owner of No.34 is a partner in the proposed development and will own House 32a, therefore the drainage strategy will seek to reuse the existing lateral drain connection to the Thames Water sewer.

Figure 4 Existing Public Sewers (Thames Water)

The existing run-off rate for the 1 in 100 years storm event was calculated based on the modified rational method:

Q = 2.78 x A x i (where "A" is the catchment area in Hectares and "i" is the rainfall intensity in mm/hours).

Q = 2.78 x 0.053 x 107.5 = **15.8 l/sec.**

The church building is unoccupied at present and therefore doesn't generate any foul water flows. When the church was operational, peak foul water flows were estimated to be approximately 2.8 l/s based on a conservative assumption of the presence of a kitchenette and toilet facilities.

4 Proposed Surface Water Drainage

In accordance with the Environment Agency guidelines, Building Regulations and Water Authorities advice, the preferred means of surface water drainage for any new development is into a suitable soakaway or infiltration drainage system. Sustainable drainage systems (SUDS) can reduce the impact of urbanisation on watercourse flows, ensure the protection and enhancement of water quality and encourage recharge of groundwater in a manner that mimics nature. If drainage to an infiltration system proved to be an unsuitable option for a site then drainage to a watercourse must be assessed. Drainage to the public sewers can be considered only when all other alternative options are not suitable.

Drainage to infiltration systems is not a suitable option considering that there is no available land on site to accommodate such systems. Infiltration systems must be located at least 5m away from any structure. There are also no watercourses in the vicinity of the site and therefore drainage to the public sewers is the only available option.

The National Planning Policy Framework NPPF, the Environment Agency (EA) and Thames Water (TW) require the surface water arising from a developed site to mimic the surface water flows arising from the site prior to the proposed development. The proposed development will not add impermeable areas on site and therefore will not increase the peak run-off rates. However, the London Plan requires attenuation to Greenfield run-off rates from new developments. Therefore, attenuation must be considered.

The Greenfield run-off rate for the site was estimated using the Greenfield run-off estimator tool with the BFI specified from FEH data (uksuds.com, Appendix B). The 1 in 100 year Greenfield run-off rate can be calculated by multiplying the 100 year growth curve factor by Q_{bar}:

$$Q_{100GF} = 3.19 \times 0.30 = 0.96 \text{ l/sec}$$

Part H of the Building Regulations states that the smallest below ground pipe should be of 75mm diameter. Therefore the flow control device will use a 75mm diameter vortex control to reduce the risk of blockages. This was found to be 2.5 l/s. Therefore, surface water from each development site will be restricted to 2.5 l/sec.

The drainage strategy will provide independent drainage networks for each property, so that they can be adequately maintained by the owner. The surface flows will be restricted to 2.5 l/sec from each property via attenuation tanks. The storage volume required to attenuate to 2.5 l/sec for the 1 in 100 year plus 30% (climate change) storm event is shown in the Table 1 below (refer to Appendix B for preliminary calculations).

	House 32a	House 32b
Site area	0.018ha	0.021ha
Attenuation volume	18 m^3	15.3 m^3

Table 1 Attenuation storage requirements

A SUDS Maintenance programme for the proposed development has been has been set out in Table 2 below.

SuDS Maintenance Programme

SUDS Element	Attenuation Storage	
Maintenance Issues	Failure of components, blockage from debris	
Maintenance Period	Maintenance Task	Frequency
Regular	Inspect and identify any elements that are not operating correctly.	Monthly for three months, then six monthly
	Remove sediment/debris from catchment surface that may lead to blockage of structures.	Monthly or as required
	Remove sediment/debris from catchpits/gullies and control structures.	Annually, after severe storms or as required
Remedial Work	Repair inlets, outlets, vents, overflows and control structures.	As required
Monitoring	Inspect all inlets, outlets, vents, overflows and control structures to ensure they are in good condition and operating as designed.	Annually or after severe storms

Table 2 SUDS Maintenance Programme

5 Proposed Foul Water Drainage

In accordance with the Building Regulations Part H, foul water drainage to the public sewers is the preferred option. TW's sewer records confirm that there are public sewers in this area. Thames Water approval for new connections will be required under a Section 106 agreement. The proposed peak foul rates were estimated using the discharge unit method from BS 12056-2:2000, the rates are presented in Table 3 below (refer to Appendix B for the calculations).

	House 32a	House 32b
Peak foul rates	2.63 l/s	5.56 l/s

Table 3 Proposed peak foul water flow rates

While the proposed development will increase the foul peak run-off rate, the surface water will be reduced by approximately 10.8 l/sec. Therefore, the proposed development will reduce the combined peak run-off rate to the public sewers in comparison with the existing. Furthermore, the reduction in the surface water peak run-off rates will benefit the public sewers, as flooding in London is common during heavy rainfall events.

Non-return valves will be installed in the final manhole before leaving site to prevent flooding on site in the event of the public sewer surcharging. Gravity drainage must be prioritised with pumped foul water from the lower ground floor level only (if possible). Storage in the pumping system for 24 hours must be provided to allow for pump failures, in accordance with the Building Regulations requirements.

Peak flow rates	Existing	Proposed	
		32a	32b
Foul water	2.8 l/s	2.63 l/s	5.56 l/s
Surface water	15.8 l/s	2.5 l/s	2.5 l/s
TOTAL	18.6 l/s	13.19 l/s	

Table 4 Proposed discharge rates to public sewers

6 Conclusions

- The proposed development will reduce the impermeable areas on site and subsequently the run-off rates.

- Drainage to the ground via infiltration systems is not feasible due to the lack of available space for accommodating such systems on site.

- Surface water drainage to the public sewer is the only available option as there are no watercourses in the vicinity of the site.

- Surface water will be attenuated to 5 l/sec, benefiting the public sewers which are currently receiving unrestricted run-off rates from the existing development.

- The proposed development will increase the peak foul water flow rates from zero at present to approximately 2.6 l/s for House 32a and 5.6 l/s for House 32b. However, the proposed combined peak flow rate will be lower than the existing, benefiting the combined public sewers.

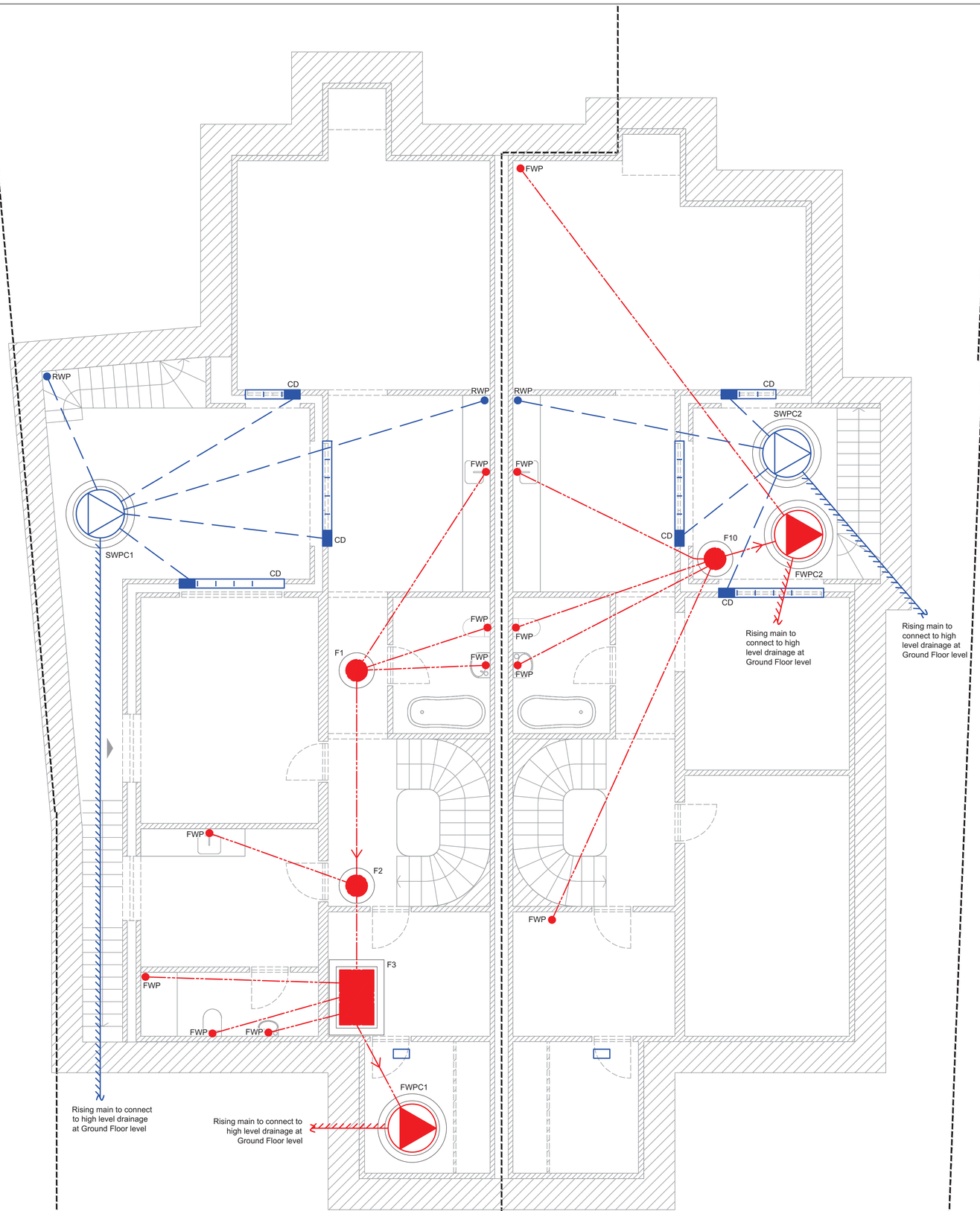
- Gravity drainage will be prioritised and protection measures must be provided where pumping is unavoidable in order to reduce the flood risk from pump failures.

- Drainage to the public sewer requires Thames Water's consent.

Appendix A – Topographical Survey Drawings

Appendix B – Preliminary Drainage Calculations

Appendix C – Preliminary Drainage Layout



Notes :

1. This drawing is to be read in conjunction with all relevant Architect's, Engineer's and specialists' drawings and specifications.
2. Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check that this drawing has been printed to the intended scale this bar should be 50mm long @ A1 or 25mm long @ A3.
3. Health & Safety :
   All specific drawing notes are to be read in conjunction with the project "Information Pack" and "Site Rules".
4. For general notes refer to Drawing No. 24357-GN02.
5. Pump station dimensions are indicative and TBC by pump manufacturer. Foul water pump to be sized for 24hr storage.
6. All SWP & FWP locations are indicative only. TBC by Architect.

DRAINAGE LEGEND

- New FW Drain
- New SW Drain
- FW Rising Main
- SW Rising Main
- Site Boundary

DRAINAGE KEY

RWP	Rainwater Down Pipe
FWP	Foul Waste Pipe
CD	Channel Drain with Sump unit
S1	Surface Water Manhole Chamber
F1	Foul Water Manhole Chamber
S1 F1	Pumping Station Manhole Chamber

ABBREVIATIONS

IL	- Invert Level
CL	- Cover Level
CD	- Channel Drain
F1	- Foul Water Manhole
S1	- Surface Water Manhole
FWP	- Foul Waste Pipe
RWP	- Rainwater pipe
FWPC	- Foul Water Pump Chamber
SWPC	- Surface Water Pump Chamber

Ver	Date	Drawn	Eng	Amendment
2	18.11.16	NP	JZ	Issued for Information
1	16.11.16	NP	JZ	Issued for Information

32 GLENILLA ROAD LONDON, NW3 4AN

BELOW GROUND DRAINAGE LAYOUT BASEMENT

Status
FOR INFORMATION
NOT FOR CONSTRUCTION

Drawn NP	Eng JZ
Scales 1:50 at A1	1:100 at A3
Drawing No 24357-601	Ver 2

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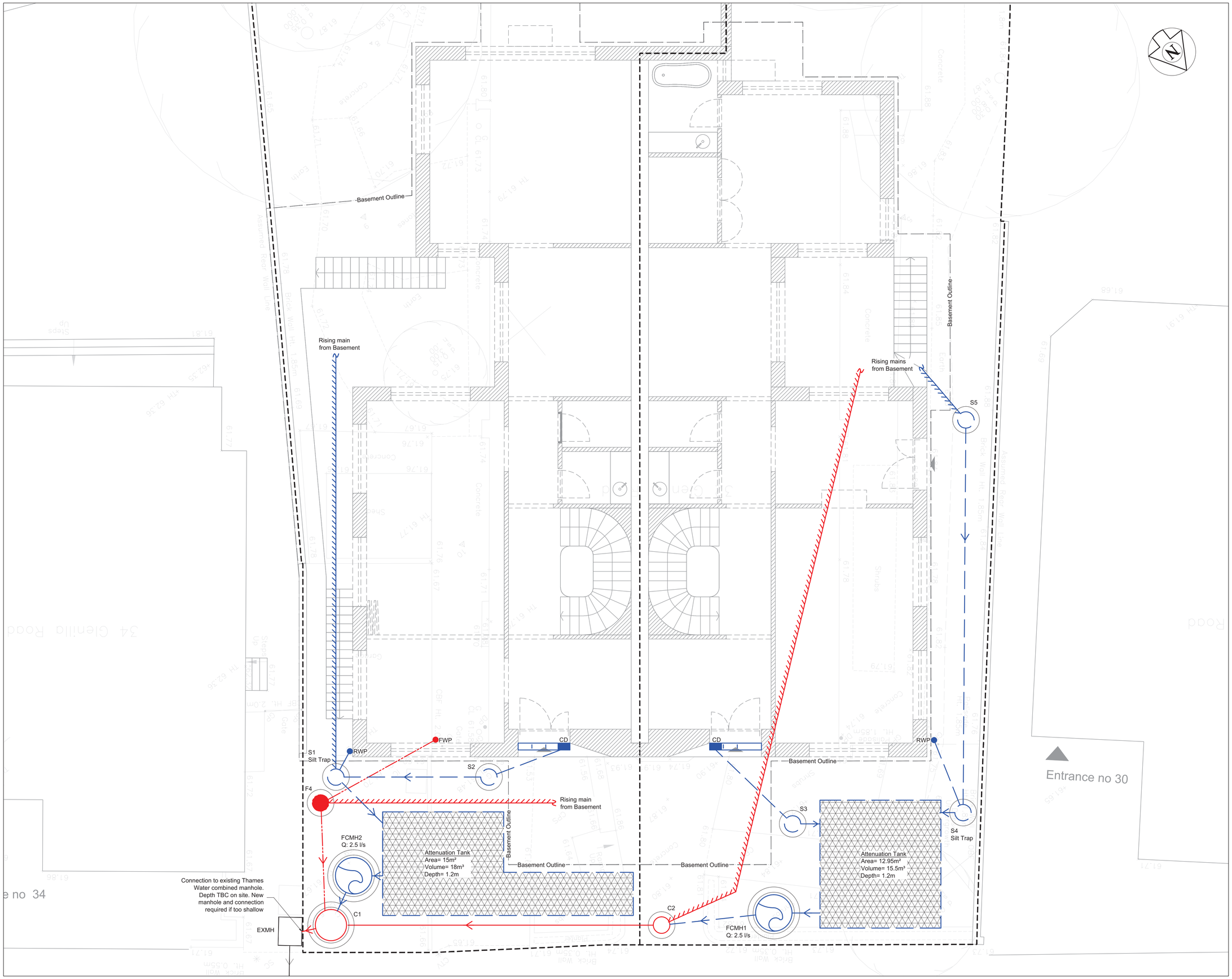

Notes :

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4. For general notes refer to Drawing No. 24357-GN02.
5. All SWP & FWP locations are indicative only. TBC by Architect.

DRAINAGE LEGEND

New FW Drain	
New SW Drain	
New Combined Sewer	
Existing Combined Sewer	
FW Rising Main	
SW Rising Main	
Site Boundary	

DRAINAGE KEY

RWP	Rainwater Down Pipe
FWP	Foul Waste Pipe
CD	Channel Drain with Sump unit
S1	Surface Water Manhole Chamber
F1	Foul Water Manhole Chamber
C1	Combined Water Manhole Chamber
EX	Existing Combined Thames Water Manhole Chamber
FCMH1	Flow Control Chamber (SW only)
	Attenuation Tank

ABBREVIATIONS

IL	- Invert Level
CL	- Cover Level
F1	- Foul Water Manhole
S1	- Surface Water Manhole
FWP	- Foul Waste Pipe
RWP	- Rainwater pipe
YG	- Yard gully
FWPC	- Foul Water Pump Chamber
SWPC	- Surface Water Pump Chamber
FCMH1	- Flow Control (SW Only) Manhole

Ver	Date	Drawn	Eng	Amendment
2	18.11.16	NP	JZ	Issued for Information
1	16.11.16	NP	JZ	Issued for Information

32 GLENILLA ROAD
LONDON, NW3 4AN

BELOW GROUND DRAINAGE LAYOUT GROUND FLOOR

Status
FOR INFORMATION
NOT FOR CONSTRUCTION

Drawn NP	Eng JZ
Scales 1:50 at A1	1:100 at A3
Drawing No	Ver
24357-602	2

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APPENDIX E

CGL borehole logs

BOREHOLE LOG

Project				BOREHOLE No
32 Glenilla Road, London				BH01
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18516	25-08-15	61.80		
Client				Sheet
Mr & Mrs Gausen and Mr de Botton				1 of 2

SAMPLES & TESTS			Water	STRATA				Instrument /Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				61.60		0.20	Concrete. [MADE GROUND]	
0.50-1.00	B					(1.50)	Soft to firm dark grey to light orange brown gravelly CLAY. Gravel is angular to subrounded fine to coarse of flint, brick, chalk and concrete. [MADE GROUND]	
1.20-1.65	B							
1.20		N7		60.10		1.70		
							Firm to stiff dark brown CLAY. [LONDON CLAY FORMATION]	
2.00-2.45	U							
2.45-2.50	D							
3.00-3.45	D							
3.00		N10						
3.70	D							
4.00-4.45	U							
4.45-4.50	D							
5.00-5.45	D							
5.00		N11						
5.45-5.50	B		1					
5.70	D		1			(8.30)	5.80 - 5.90 Claystone band.	
6.00-6.45	U							
7.00	D							
7.50-7.95	D							
7.50		N15						

Boring Progress and Water Observations

Date	Comment	Strike Depth	Casing Depth	Casing Dia. mm	Standing Depth
		5.80	5.5		5.50

General Remarks

1. Groundwater encountered at 5.8mbgl.

2. ES = environmental sample; N = SPT 'N' value; B = bulk disturbed sample; D = small disturbed sample; U = undisturbed U100 sample.

3. Installation details: 0.0 to 3.0m plain pipe with bentonite seal; 3.0 to 10.0m slotted pipe with gravel filter; 10.0 to 11.0 bentonite seal; 11.0 to 15.0m backfilled with arisings.

4. Ground level estimated from topographic site survey.

Method/ Plant Used	Field Crew	Logged By	Checked By
Dando 2000	Paul Blackledge Drilling	NDH	SMK

BOREHOLE LOG

Project				BOREHOLE No
32 Glenilla Road, London				BH01
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18516	25-08-15	61.80		
Client				Sheet
Mr & Mrs Gausen and Mr de Botton				2 of 2

SAMPLES & TESTS			Water	STRATA				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Instrument /Backfill
8.50	B						Firm to stiff dark brown CLAY. [LONDON CLAY FORMATION] *(continued)*	
9.00-9.45	U							
9.45-9.50	D							
				51.80		10.00		
10.50-10.95	D						Stiff dark brown slightly sandy CLAY with fine selenite. Sand is fine to medium. [LONDON CLAY FORMATION]	
10.50		N23						
11.50	B							
12.00-12.45	U							
12.45-12.50	D					(5.50)		
13.50-13.95	B							
13.50		N24						
14.50	D							
15.00-15.45	U							
				46.30		15.50		
15.45-15.50	D						*(Borehole terminated at 15.5m)*	

Boring Progress and Water Observations

Date	Comment	Strike Depth	Casing Depth	Casing Dia. mm	Standing Depth

General Remarks

1. Groundwater encountered at 5.8mbgl.

2. ES = environmental sample; N = SPT 'N' value; B = bulk disturbed sample; D = small disturbed sample; U = undisturbed U100 sample.

3. Installation details: 0.0 to 3.0m plain pipe with bentonite seal; 3.0 to 10.0m slotted pipe with gravel filter; 10.0 to 11.0 bentonite seal; 11.0 to 15.0m backfilled with arisings.

4. Ground level estimated from topographic site survey.

Method/ Plant Used	Field Crew	Logged By	Checked By
Dando 2000	Paul Blackledge Drilling	NDH	SMK

WINDOW SAMPLE LOG

Project				HOLE No
32 Glenilla Road, London				WS01
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18516	25-08-15	61.76		
Client				Sheet
Mr & Mrs Gausen and Mr de Botton				1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument /Backfill
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				61.56		0.20	Concrete. [MADE GROUND]	
0.50	ES					(0.90)	Firm dark brown slightly sandy slightly gravelly clay. Gravel is sub angular to rounded fine to coarse of flint chalk brick and glass. Sand is fine to coarse. [MADE GROUND]	
0.70	D							
1.00	ES			60.66		1.10		
1.00		N12				(0.80)	Firm dark brown clay with fine rootlets. [MADE GROUND]	
				59.86		1.90		
2.00		N16				(1.30)	Firm dark grey to dark red gravelly clay. Gravel is sub rounded to angular fine to coarse of flint concrete and brick [MADE GROUND]	
2.50	ES							
3.00		N10		58.56		3.20		
4.00	D					(1.80)	Firm dark blue grey and orange brown mottled CLAY. [LONDON CLAY FORMATION]	
4.00	ES							
4.00		N11						
				56.76		5.00		
							(Window sample terminated at 5m)	

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. No groundwater encountered in the borehole.

2. ES= environmental sample, D= disturbed sample, N= SPT 'N' value.

3. Installation details; 0.0-1.0mbgl: plain pipe with bentonite backfill; 1.0-4.0mbgl: slotted pipe with gravel backfill. Gas tap, bung and flush cover installed.

4. Ground level estimated from topographic site survey.

Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked window sample rig	RP Drilling	NDH	RJB

WINDOW SAMPLE LOG

Project				HOLE No
32 Glenilla Road, London				WS02
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18516	25-08-15	61.69		
Client				Sheet
Mr & Mrs Gausen and Mr de Botton				1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument /Backfill
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
0.20	ES						Thin layer of decorative gravel over soft to firm dark grey to light orange brown to dark grey gravelly clay. Gravel is angular to sub rounded flint brick chalk and concrete [MADE GROUND]	
0.80	D							
1.00		N7				(2.90)		
2.00		N9						
2.50	ES			58.79		2.90		
3.00	D						Firm dark blue grey and orange brown mottled CLAY. [LONDON CLAY FORMATION]	
3.00		N10						
4.00		N12				(2.10)		
5.00	ES			56.69		5.00	*(Window sample terminated at 5m)*	

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. No groundwater encountered in the borehole.

2. ES= environmental sample, D= disturbed sample, N= SPT 'N' value.

3. Installation details; 0.0-1.0mbgl: plain pipe with bentonite backfill; 1.0-4.0mbgl: slotted pipe with gravel backfill. Gas tap, bung and flush cover installed.

4. Ground level estimated from topographic site survey.

Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked window sample rig	RP Drilling	NDH	RJB

WINDOW SAMPLE LOG

Project				HOLE No
32 Glenilla Road, London				WS03
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18516	25-08-15	61.69		
Client				Sheet
Mr & Mrs Gausen and Mr de Botton				1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument /Backfill
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
0.30	ES						Thin layer of decorative gravel over soft to firm dark grey to light orange brown and yellow to dark grey gravelly clay. Gravel is angular to sub rounded flint brick chalk and concrete. [MADE GROUND]	
1.00	D							
1.00		N7				(2.50)		
1.50	ES							
2.00		N6						
				59.19		2.50		
							Firm dark blue grey and orange brown mottled CLAY. [LONDON CLAY FORMATION]	
3.00	ES							
3.00		N10						
						(2.50)		
4.00		N11						
				56.69		5.00		
5.00		N12					*(Window sample terminated at 5m)*	

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. No groundwater encountered in the borehole.
2. ES= environmental sample, D= disturbed sample, N= SPT 'N' value.
3. Borehole backfilled with arisings on completion.
4. Ground level estimated from topographic site survey.

Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked window sample rig	RP Drilling	NDH	RJB

WINDOW SAMPLE LOG

Project				HOLE No
32 Glenilla Road, London				WS05
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18516	25-08-15	61.89		
Client				Sheet
Mr & Mrs Gausen and Mr de Botton				1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument /Backfill
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
0.40	ES						Thin layer of decorative gravel over soft to firm dark grey to light orange brown to dark grey gravelly clay. Gravel is angular to sub rounded flint brick chalk concrete and glass [MADE GROUND]	
0.50	D							
0.90	ES					(1.80)		
1.00		N4						
				60.09		1.80		
							Firm dark blue grey and orange brown mottled CLAY. [LONDON CLAY FORMATION]	
2.00		N7						
2.50	D							
2.50	ES							
3.00		N8						
						(3.20)		
4.00		N10						
				56.89		5.00		
5.00		N10					*(Window sample terminated at 5m)*	

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. No groundwater encountered in the borehole.
2. ES= environmental sample, D= disturbed sample, N= SPT 'N' value.
3. Borehole backfilled with arisings on completion.
4. Ground level estimated from topographic site survey.

Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked window sample rig	RP Drilling	NDH	RJB

WINDOW SAMPLE LOG

Project				HOLE No
32 Glenilla Road, London				**WS06**
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18516	25-08-15	61.89		
Client				Sheet
Mr & Mrs Gausen and Mr de Botton				1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument /Backfill
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
0.40	ES						Thin layer of decorative gravel over soft to firm dark grey to light orange brown to dark grey gravelly clay. Gravel is angular to sub rounded flint brick chalk concrete and glass [MADE GROUND]	
0.50	D							
						(1.80)		
1.00	ES							
1.00		N6						
				60.09		1.80		
							Firm dark blue grey and orange brown mottled CLAY. [LONDON CLAY FORMATION]	
2.00		N7						
2.50	D							
3.00	ES							
3.00		N10						
						(3.20)		
4.00		N10						
				56.89		5.00		
5.00		N18					*(Window sample terminated at 5m)*	

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. No groundwater encountered in the borehole.

2. ES= environmental sample, D= disturbed sample, N= SPT 'N' value.

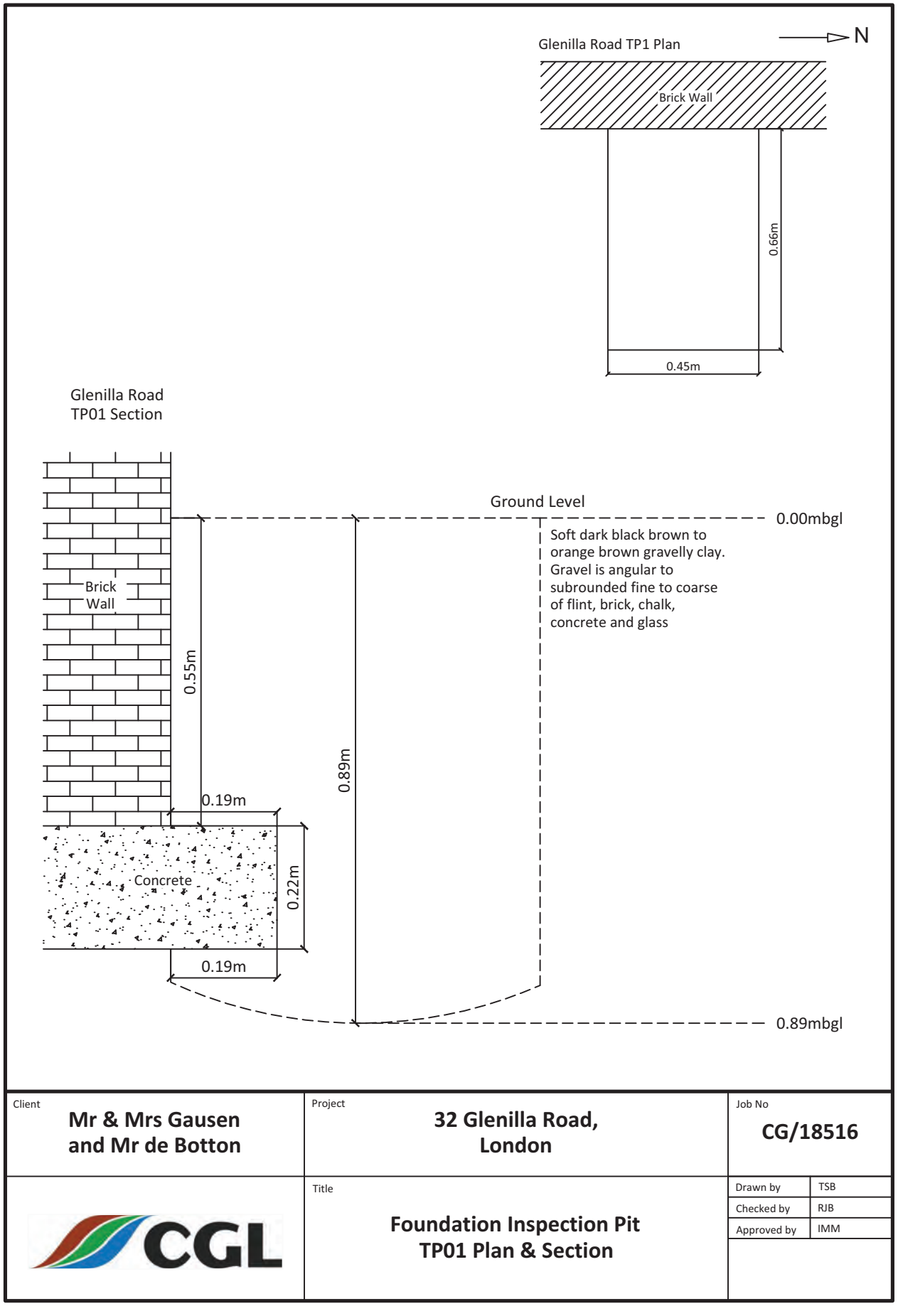
3. 3. Installation details; 0.0-2.0mbgl: plain pipe with bentonite backfill; 2.0-5.0mbgl: slotted pipe with gravel backfill. Gas tap, bung and flush cover installed.

4. Ground level estimated from topographic site survey.

Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked window sample rig	RP Drilling	NDH	RJB

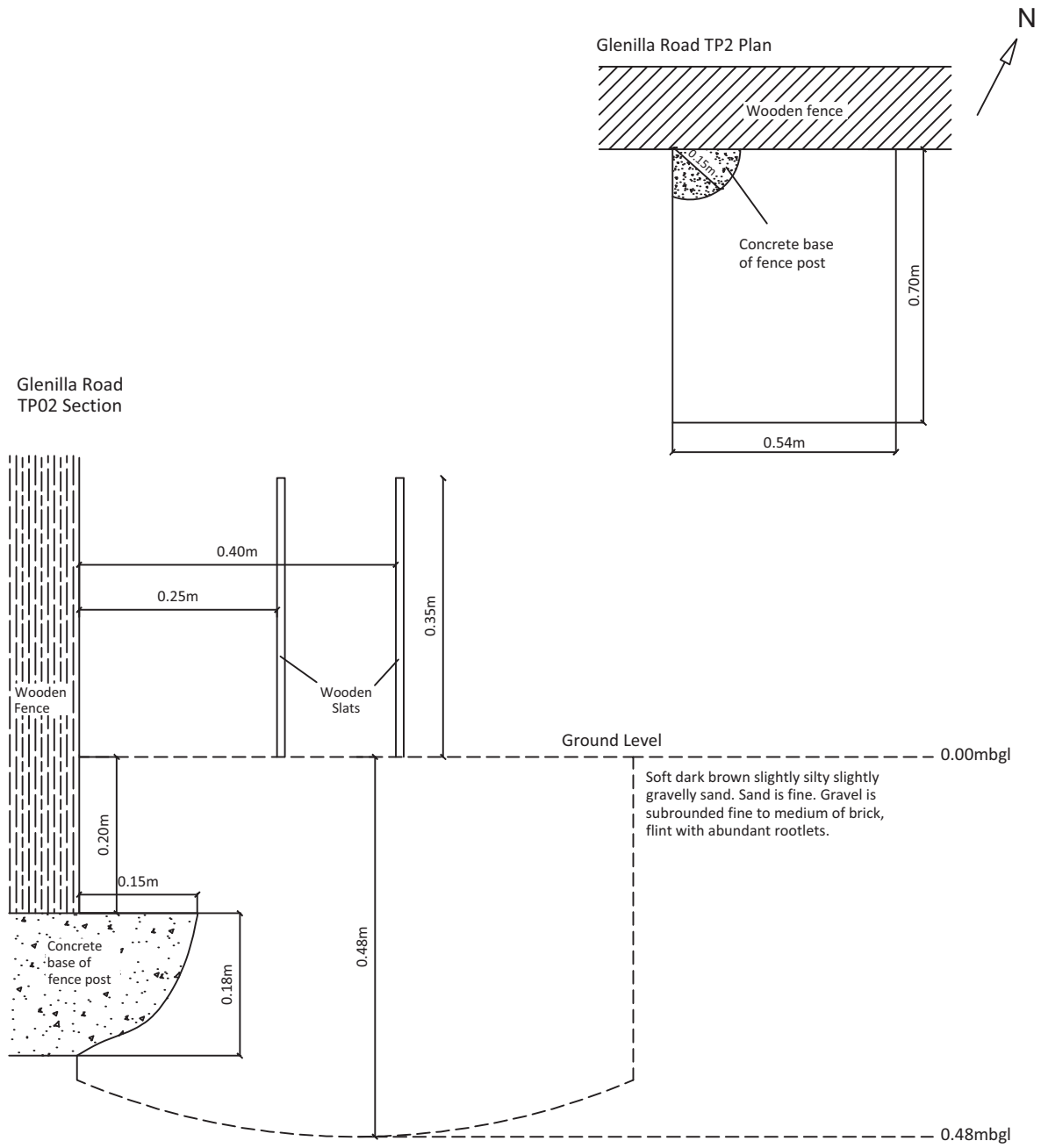
APPENDIX F

CGL foundation inspection pit details

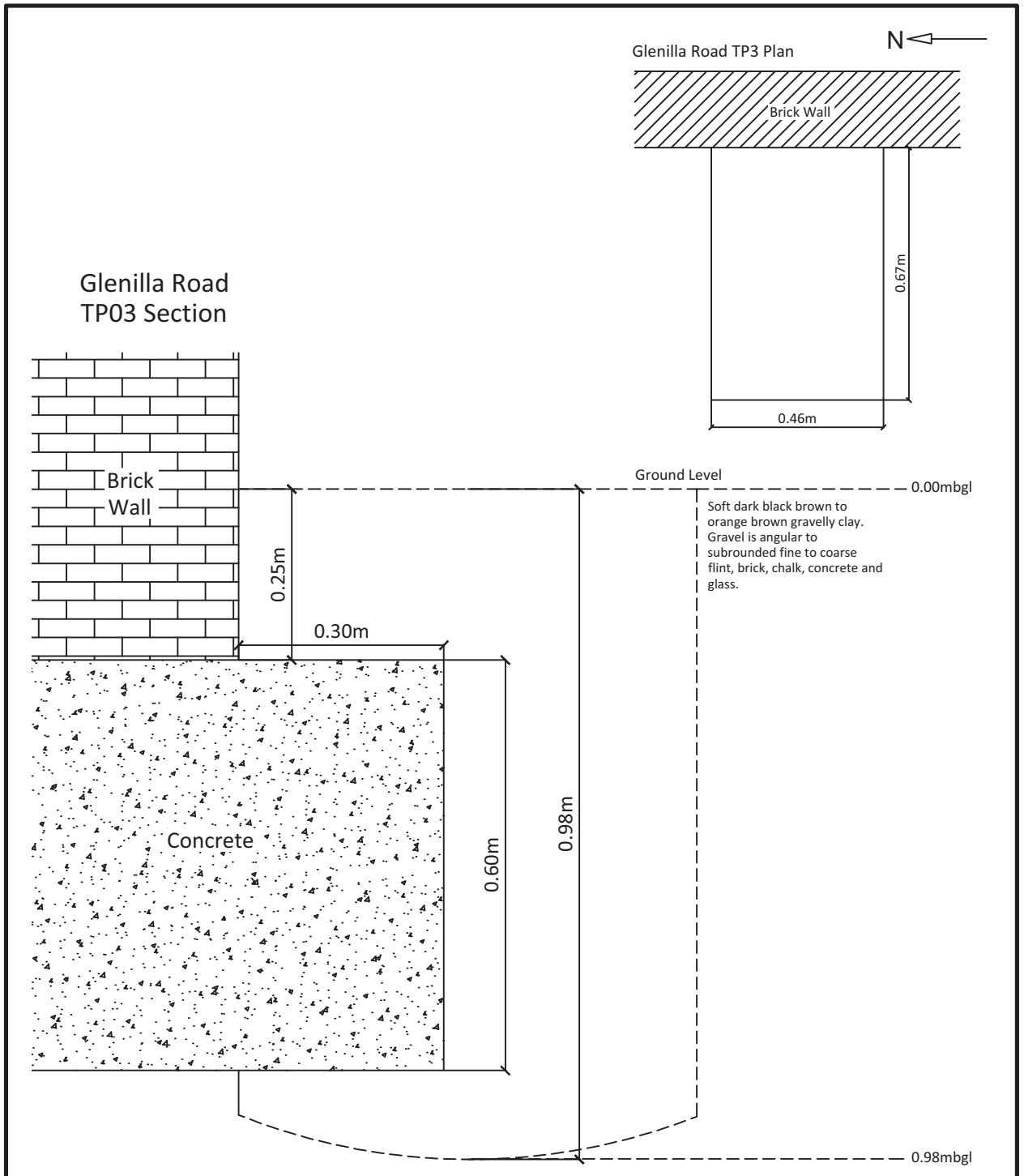


Client	Project	Job No
Mr & Mrs Gausen and Mr de Botton	**32 Glenilla Road, London**	**CG/18516**

	Title		
CGL	**Foundation Inspection Pit TP01 Plan & Section**	Drawn by	TSB
		Checked by	RJB
		Approved by	IMM



Client **Mr & Mrs Gausen and Mr de Botton**	Project **32 Glenilla Road, London**	Job No **CG/18516**
CGL	Title **Foundation Inspection Pit TP02 Plan & Section**	Drawn by: TSB Checked by: RJB Approved by: IMM



Client **Mr & Mrs Gausen and Mr de Botton**	Project **32 Glenilla Road, London**	Job No **CG/18516**
CGL	Title **Foundation Inspection Pit TP03 Plan & Section**	Drawn by: TSB Checked by: RJB Approved by: IMM

APPENDIX G

Ground gas and groundwater monitoring record

GAS MONITORING RECORD SHEET

JOB DETAILS			
Site:	32 Glenilla Road, London	Job No:	CG/18516
Date:	03/09/2015	Engineer:	NDH
Time:	am	Client	Mr & Mrs Gausen and Mr de Botton

METEOROLOGICAL & SITE INFORMATION

State of ground:	Dry		Moist	X	Wet				
Wind:	Calm		Light	X	Moderate		Strong		
Cloud cover:	None		Slight		Cloudy		Overcast	X	
Precipitation:	None	X	Slight		Moderate		Heavy		
Barometric pressure (mb):	1006		Local pressure system*:	Steady			Air temperature (°C):	13-16	

Well No.	Time (s)	Flow (l/hr)	dA (PA)	O_2 (% vol. in air)	CO_2 (% vol. in air)	CH_4 (% vol. in air)	PID (ppm)	Depth to Groundwater (mbgl)	Comments
BH01	0	28.7	324.0	20.6	<0.1	<0.1	<0.1	2.89	Base of well at 10.04mbgl
	15	7.6	63.0	11.7	4.9	<0.1	<0.1		
	30	3.3	15.0	10.9	7.3	<0.1	<0.1		
	45	0.2	1.0	10.7	7.4	<0.1	<0.1		
	60	<0.1	0.0	10.6	7.4	<0.1	<0.1		
	90	<0.1	0.0	10.6	7.4	<0.1	<0.1		
	120	<0.1	0.0	10.6	7.4	<0.1	<0.1		
	150	<0.1	0.0	10.6	7.4	<0.1	<0.1		
	180	<0.1	0.0	10.6	7.4	<0.1	<0.1		
	240	<0.1	0.0	10.6	7.4	<0.1	<0.1		
	300	<0.1	0.0	10.6	7.4	<0.1	<0.1		
WS01	0	<0.1	0.0	20.3	<0.1	<0.1	<0.1	2.70	Base of well at 3.06mbgl
	15	<0.1	0.0	17.5	3.0	<0.1	<0.1		
	30	<0.1	0.0	16.6	3.1	<0.1	<0.1		
	45	<0.1	0.0	16.5	3.2	<0.1	<0.1		
	60	<0.1	0.0	16.4	3.2	<0.1	<0.1		
	90	<0.1	0.0	16.4	3.2	<0.1	<0.1		
	120	<0.1	0.0	16.4	3.2	<0.1	<0.1		
	150	<0.1	0.0	16.3	3.2	<0.1	<0.1		
	180	<0.1	0.0	16.3	3.3	<0.1	<0.1		
	240	<0.1	0.0	16.3	3.3	<0.1	<0.1		
	300	<0.1	0.0	16.3	3.3	<0.1	<0.1		
WS02	0	<0.1	0.0	20.5	<0.1	<0.1	<0.1	1.88	Base of well at 3.1mbgl
	15	<0.1	0.0	17.5	3.7	<0.1	<0.1		
	30	<0.1	0.0	17.0	3.8	<0.1	<0.1		
	45	<0.1	0.0	17.0	3.8	<0.1	<0.1		
	60	<0.1	0.0	17.0	3.7	<0.1	<0.1		
	90	<0.1	0.0	17.0	3.7	<0.1	<0.1		
	120	<0.1	0.0	17.0	3.6	<0.1	<0.1		
	150	<0.1	0.0	16.9	3.6	<0.1	<0.1		
	180	<0.1	0.0	16.9	3.6	<0.1	<0.1		
	240	<0.1	0.0	16.9	3.6	<0.1	<0.1		
	300	<0.1	0.0	17.0	3.5	<0.1	<0.1		
WS06	0	<0.1	0.0	20.5	<0.1	<0.1	<0.1	4.15	Base of well at 4.95mbgl
	15	<0.1	0.0	16.6	4.8	<0.1	<0.1		
	30	<0.1	0.0	16.3	4.9	<0.1	<0.1		
	45	<0.1	0.0	16.3	5.0	<0.1	<0.1		
	60	<0.1	0.0	16.2	5.1	<0.1	<0.1		
	90	<0.1	0.0	16.2	5.2	<0.1	<0.1		
	120	<0.1	0.0	16.1	5.2	<0.1	<0.1		
	150	<0.1	0.0	16.1	5.3	<0.1	<0.1		
	180	<0.1	0.0	16.0	5.3	<0.1	<0.1		
	240	<0.1	0.0	16.0	5.3	<0.1	<0.1		
	300	<0.1	0.0	15.9	5.4	<0.1	<0.1		
	360	-	-	15.8	5.4	<0.1	-		
	420	-	-	15.7	5.5	<0.1	-		
	480	-	-	15.6	5.6	<0.1	-		
	540	-	-	15.6	5.7	<0.1	-		
	600	-	-	15.6	5.6	<0.1	-		
	660	-	-	15.7	5.4	<0.1	-		
	720	-	-	15.8	5.1	<0.1	-		

Notes:

The measurement of hydrogen sulphide and hydrocarbon free product is undertaken on a site specific basis, if deemed necessary.
** With reference to the Weather Underground rolling weather archive for London Weather Centre weather station.*

GROUNDWATER MONITORING RECORD SHEET

JOB DETAILS			
Site:	32 Glenilla Road, London	Job No:	CG/18516
Date:	03/09/2015	Engineer:	NDH
Time:	AM	Client	Mr & Mrs Gausen and Mr de Botton
Weather:	Overcast		

MONITORING & SAMPLING DETAILS								
Well / Borehole reference:	BH1	WS1	WS2	WS6				
Monitoring details								
Ground elevation (+mOD)								
Groundwater depth (mbgl)	2.89	2.7	1.88	4.15				
Groundwater elevation (+mOD)								
Depth to base of well (mbgl)	10.04	3.06	3.1	4.95				
Diameter of well (m)	0.05	0.05	0.05	0.05				
Condition of well	Good	Good	Good	Good				
Top of response zone (mbgl)	3	1	1	2				
Base of response zone (mbgl)	10	4	4	5				
Free product thickness (m)	NA	NA	NA	NA				
Hydrocarbon sheen noted (Y/N)	N	N	N	N				
Purging details								
Purge method	Bailer	Bailer	Bailer	Bailer				
Purged volume (litres)	10	0.5	5	0				
Recharge (good / poor)	Poor	Poor	Poor	Poor				
Sampling details								
Sampling method	2G1V	2G1V	2G1V	1G1V				
Volume of water sample taken (litres)	0.64	0.64	0.64	<0.34				
Volume of free product sample taken (litres)	NA	NA	NA	NA				
Colour / odours noted*	Dark Brown	Dark Brown	Dark Brown	Dark Brown				
In-situ measurements								
pH	7.07	7.2	7.89	7.3				
Temperature (°C)	14.5	13.9	14	13.7				
Dissolved oxygen (mg/l)	1.3	2.1	2.2	1.6				
Redox potential (mV)	325	333	338	303				
Electrical conductivity (µS/cm)	-	-	-	-				
Total dissolved solids (ppt)	-	-	-	-				

* Respiratory protective equipment to be worn if odours are noted during initial monitoring & on sites which are potentially contaminated

NOTES

APPENDIX H

Chemical testing results

Sarah Key
Card Geotechnics Ltd
4 Godalming Business Centre
Woolsack Way
Godalming
Surrey
GU7 1XW

t: 01483 310600
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e: sarahk@cgl-uk.com

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 15-78181

Project / Site name:	Glenilla Road	**Samples received on:**	03/09/2015
Your job number:	CG-18516	**Samples instructed on:**	03/09/2015
Your order number:		**Analysis completed by:**	14/09/2015
Report Issue Number:	1	**Report issued on:**	14/09/2015
Samples Analysed:	3 water samples		

Signed:

Rexona Rahman
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Signed:

Emma Winter
Assistant Reporting Manager
For & on behalf of i2 Analytical Ltd.

Other office located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Analytical Report Number: 15-78181

Project / Site name: Glenilla Road

Lab Sample Number				482010	482011	482012		
Sample Reference				WS2	WS1	BH1		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				None Supplied	None Supplied	None Supplied		
Date Sampled				03/09/2015	03/09/2015	03/09/2015		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
General Inorganics								
pH	pH Units	N/A	ISO 17025	6.9	7.0	7.0		
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10		
Sulphate as SO_4	µg/l	45	ISO 17025	156000	287000	3900000		
Hardness - Total	mgCaCO3/l	1	ISO 17025	507	954	4730		
Total Phenols								
Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10	< 10		
Speciated PAHs								
Naphthalene	µg/l	0.01	ISO 17025	2.9	< 0.01	< 0.01		
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Total PAH								
Total EPA-16 PAHs	µg/l	0.2	ISO 17025	2.92	< 0.20	< 0.20		
Heavy Metals / Metalloids								
Antimony (dissolved)	µg/l	0.4	ISO 17025	1.6	1.2	1.2		
Arsenic (dissolved)	µg/l	0.15	ISO 17025	4.91	2.15	0.71		
Barium (dissolved)	µg/l	0.06	ISO 17025	63	46	26		
Beryllium (dissolved)	µg/l	0.1	ISO 17025	< 0.1	< 0.1	< 0.1		
Boron (dissolved)	µg/l	10	ISO 17025	170	260	520		
Cadmium (dissolved)	µg/l	0.02	ISO 17025	< 0.02	0.03	0.09		
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	< 5.0		
Chromium (III)	µg/l	1	NONE	3.1	2.8	6.1		
Chromium (dissolved)	µg/l	0.2	ISO 17025	3.1	2.8	6.1		
Copper (dissolved)	µg/l	0.5	ISO 17025	3.0	4.6	3.8		
Lead (dissolved)	µg/l	0.2	ISO 17025	7.1	1.3	< 0.2		
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	< 0.05	0.07		
Nickel (dissolved)	µg/l	0.5	ISO 17025	5.9	5.2	15		
Selenium (dissolved)	µg/l	0.6	ISO 17025	1.9	2.7	8.2		
Vanadium (dissolved)	µg/l	0.2	ISO 17025	0.9	0.4	1.0		
Zinc (dissolved)	µg/l	0.5	ISO 17025	3.7	15	13		
Calcium (dissolved)	mg/l	0.012	ISO 17025	130	250	560		
Magnesium (dissolved)	mg/l	0.005	ISO 17025	44	77	810		

Analytical Report Number: 15-78181

Project / Site name: Glenilla Road

Lab Sample Number				482010	482011	482012		
Sample Reference				WS2	WS1	BH1		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				None Supplied	None Supplied	None Supplied		
Date Sampled				03/09/2015	03/09/2015	03/09/2015		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0		
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >C5 - C6	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aliphatic >C6 - C8	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aliphatic >C8 - C10	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aromatic >C5 - C7	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aromatic >C7 - C8	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aromatic >C8 - C10	µg/l	10	NONE	120	< 10	< 10		
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	650	< 10	< 10		
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	41	< 10	< 10		
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	810	< 10	< 10		

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 15-78181

Project / Site name: Glenilla Road

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Boron in water	Determination of boron by acidification followed by ICP-OES. Accredited matrices: SW PW GW	In-house method based on MEWAM	L039-PL	W	ISO 17025
BTEX and MTBE in water	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073W-PL	W	ISO 17025
Cr (III) in water	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method by continuous flow analyser. Accredited Matrices SW, GW, PW.	L080-PL	W	ISO 17025
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 "for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Monohydric phenols in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
pH in water	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	ISO 17025
Speciated EPA-16 PAHs in water	Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW	In-house method based on USEPA 8270	L070-UK	W	ISO 17025
Sulphate in water	Determination of sulphate in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Total cyanide in water	Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Total Hardness of water	Determination of hardness in waters by calculation from calcium and magnesium. Accredited Matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045-PL	W	ISO 17025
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-UK	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

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Analytical Report Number : 15-78150

Replaces Analytical Report Number : 15-78150, issue no. 1

Project / Site name:	Glenilla Road	**Samples received on:**	02/09/2015
Your job number:	CG/18516	**Samples instructed on:**	02/09/2015
Your order number:	2385	**Analysis completed by:**	02/10/2015
Report Issue Number:	2	**Report issued on:**	02/10/2015
Samples Analysed:	1 leachate sample - 9 soil samples		

Signed:

Rexona Rahman
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Signed:

Emma Winter
Assistant Reporting Manager
For & on behalf of i2 Analytical Ltd.

Other office located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Analytical Report Number: 15-78150

Project / Site name: Glenilla Road

Your Order No: 2385

Lab Sample Number				481794	481795	481796	481797	481798
Sample Reference				WS1	WS1	WS1	WS2	WS3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	1.00	4.00	0.20	0.30
Date Sampled				25/08/2015	25/08/2015	25/08/2015	25/08/2015	25/08/2015
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	14	12	15	20	28
Total mass of sample received	kg	0.001	NONE	0.33	0.32	1.1	0.53	0.45
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	Chrysotile
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	-	Not-detected	Detected
Asbestos Quantification	%	0.001	ISO 17025	-	-	-	-	< 0.001
General Inorganics								
pH	pH Units	N/A	MCERTS	7.7	7.6	7.5	7.1	7.0
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO_4	mg/kg	50	MCERTS	830	690	120000	1100	970
Water Soluble Sulphate (Soil Equivalent)	g/l	0.0025	MCERTS	0.087	0.31	5.1	-	-
Water Soluble Sulphate as SO_4 (2:1)	mg/kg	2.5	MCERTS	87	310	5100	-	-
Water Soluble SO4 (BRE SD 2:1 Leach Equivalent)	g/l	0.00125	MCERTS	0.044	0.16	2.6	-	-
Total Sulphur	mg/kg	50	NONE	-	-	40000	-	-
Organic Matter	%	0.1	MCERTS	1.5	1.1	0.1	3.9	5.9
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	0.08	< 0.05	< 0.05	0.18	0.19
Acenaphthylene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	0.32	0.34
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	0.16	0.18
Fluorene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	0.41	0.29
Phenanthrene	mg/kg	0.1	MCERTS	1.3	0.93	< 0.10	8.1	6.5
Anthracene	mg/kg	0.1	MCERTS	0.27	0.21	< 0.10	2.0	1.4
Fluoranthene	mg/kg	0.1	MCERTS	4.4	2.6	< 0.10	17	17
Pyrene	mg/kg	0.1	MCERTS	4.0	2.3	< 0.10	14	15
Benzo(a)anthracene	mg/kg	0.1	MCERTS	2.7	1.7	< 0.10	8.3	9.7
Chrysene	mg/kg	0.05	MCERTS	2.7	1.4	< 0.05	7.9	9.4
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	2.8	1.9	< 0.10	7.6	10
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	2.1	1.1	< 0.10	6.0	8.3
Benzo(a)pyrene	mg/kg	0.1	MCERTS	2.4	1.2	< 0.10	8.3	9.0
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	1.4	0.69	< 0.10	3.3	4.2
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	0.39	< 0.10	< 0.10	1.1	0.80
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.5	0.82	< 0.05	3.4	5.6
Coronene	mg/kg	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	0.67
Total PAH								
Total WAC-17 PAHs	mg/kg	1.6	NONE	26	15	< 1.6	88	99
Heavy Metals / Metalloids								
Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	< 1.0	1.5	< 1.0	3.4	6.4
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	20	18	12	27	29
Barium (aqua regia extractable)	mg/kg	1	MCERTS	170	140	36	290	480
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.5	1.2	1.0	1.5	1.8
Boron (water soluble)	mg/kg	0.2	MCERTS	1.1	1.4	1.1	1.6	1.9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	0.6
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (III)	mg/kg	1	NONE	51	42	48	42	35
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	51	42	48	42	35
Copper (aqua regia extractable)	mg/kg	1	MCERTS	50	81	14	63	100
Lead (aqua regia extractable)	mg/kg	1	MCERTS	190	220	15	490	550
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	38	27	35	33	35
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	81	67	68	76	64
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	160	100	60	200	350

Analytical Report Number: 15-78150

Project / Site name: Glenilla Road

Your Order No: 2385

Lab Sample Number				481794	481795	481796	481797	481798
Sample Reference				WS1	WS1	WS1	WS2	WS3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	1.00	4.00	0.20	0.30
Date Sampled				25/08/2015	25/08/2015	25/08/2015	25/08/2015	25/08/2015
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	3.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	13
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	16
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	3.9	< 2.0	< 2.0	8.9	5.6
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	20	19	< 10	97	87
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	23	28	< 10	170	150
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	47	47	< 10	270	240

Analytical Report Number: 15-78150

Project / Site name: Glenilla Road

Your Order No: 2385

Lab Sample Number				481799	481800	481801	481802	
Sample Reference				WS3	WS6	WS6	WS5	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				3.00	0.40	3.00	0.80	
Date Sampled				25/08/2015	25/08/2015	25/08/2015	25/08/2015	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Moisture Content	%	N/A	NONE	21	20	21	19	
Total mass of sample received	kg	0.001	NONE	0.49	0.51	0.57	0.59	
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	Chrysotile	
Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	-	Detected	
Asbestos Quantification	%	0.001	ISO 17025	-	-	-	0.001	
General Inorganics								
pH	pH Units	N/A	MCERTS	7.6	7.9	7.8	8.0	
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	
Total Sulphate as SO_4	mg/kg	50	MCERTS	1800	550	1300	1600	
Water Soluble Sulphate (Soil Equivalent)	g/l	0.0025	MCERTS	-	-	0.99	-	
Water Soluble Sulphate as SO_4 (2:1)	mg/kg	2.5	MCERTS	-	-	990	-	
Water Soluble SO4 (BRE SD 2:1 Leach Equivalent)	g/l	0.00125	MCERTS	-	-	0.49	-	
Total Sulphur	mg/kg	50	NONE	-	-	480	-	
Organic Matter	%	0.1	MCERTS	0.1	1.5	0.6	1.7	
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.65	
Acenaphthylene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	0.30	
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	
Fluorene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	< 0.10	
Phenanthrene	mg/kg	0.1	MCERTS	< 0.10	0.24	< 0.10	1.6	
Anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	0.41	
Fluoranthene	mg/kg	0.1	MCERTS	< 0.10	0.76	< 0.10	6.0	
Pyrene	mg/kg	0.1	MCERTS	< 0.10	0.75	< 0.10	5.7	
Benzo(a)anthracene	mg/kg	0.1	MCERTS	< 0.10	0.53	< 0.10	4.3	
Chrysene	mg/kg	0.05	MCERTS	< 0.05	0.51	< 0.05	3.1	
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	< 0.10	0.40	< 0.10	5.2	
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	< 0.10	0.29	< 0.10	2.7	
Benzo(a)pyrene	mg/kg	0.1	MCERTS	< 0.10	0.33	< 0.10	4.0	
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	2.2	
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	0.36	
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	2.5	
Coronene	mg/kg	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Total PAH								
Total WAC-17 PAHs	mg/kg	1.6	NONE	< 1.6	3.8	< 1.6	39	
Heavy Metals / Metalloids								
Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	9.2	15	13	23	
Barium (aqua regia extractable)	mg/kg	1	MCERTS	51	89	78	330	
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.5	1.0	1.5	1.5	
Boron (water soluble)	mg/kg	0.2	MCERTS	0.9	1.1	0.7	0.9	
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2	< 1.2	
Chromium (III)	mg/kg	1	NONE	63	43	61	36	
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	63	43	61	36	
Copper (aqua regia extractable)	mg/kg	1	MCERTS	16	29	17	72	
Lead (aqua regia extractable)	mg/kg	1	MCERTS	21	220	27	1300	
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	1.5	
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	39	26	56	27	
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	86	68	91	60	
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	68	69	75	520	

Analytical Report Number: 15-78150

Project / Site name: Glenilla Road

Your Order No: 2385

Lab Sample Number				481799	481800	481801	481802	
Sample Reference				WS3	WS6	WS6	WS5	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				3.00	0.40	3.00	0.80	
Date Sampled				25/08/2015	25/08/2015	25/08/2015	25/08/2015	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	2.8	
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	1.6	
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	2.1	
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10	< 10	39	
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	< 10	< 10	62	
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	100	

Analytical Report Number: 15-78150
Project / Site name: Glenilla Road
Your Order No: 2385

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

"The analysis was carried out using our documented in-house method A006 based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
481798	WS3	0.30	102	Loose Fibres	**Chrysotile**	< 0.001	**< 0.001**
481802	WS5	0.80	103	Loose Fibres	**Chrysotile**	0.001	**0.001**

Opinions and interpretations expressed herein are outside the scope of UKAS accreditatior

Analytical Report Number: 15-78150

Project / Site name: Glenilla Road

Your Order No: 2385

Lab Sample Number				482013				
Sample Reference				WS6				
Sample Number				None Supplied				
Depth (m)				0.45				
Date Sampled				25/08/2015				
Time Taken				None Supplied				
Analytical Parameter (Leachate Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
General Inorganics								
pH	pH Units	N/A	ISO 17025	7.3				
Total Cyanide	µg/l	10	ISO 17025	< 10				
Sulphate as SO_4	µg/l	100	ISO 17025	2490				
Total Phenols								
Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10				
Speciated PAHs								
Naphthalene	µg/l	0.01	NONE	< 0.01				
Acenaphthylene	µg/l	0.01	NONE	< 0.01				
Acenaphthene	µg/l	0.01	NONE	< 0.01				
Fluorene	µg/l	0.01	NONE	< 0.01				
Phenanthrene	µg/l	0.01	NONE	< 0.01				
Anthracene	µg/l	0.01	NONE	< 0.01				
Fluoranthene	µg/l	0.01	NONE	< 0.01				
Pyrene	µg/l	0.01	NONE	< 0.01				
Benzo(a)anthracene	µg/l	0.01	NONE	< 0.01				
Chrysene	µg/l	0.01	NONE	< 0.01				
Benzo(b)fluoranthene	µg/l	0.01	NONE	< 0.01				
Benzo(k)fluoranthene	µg/l	0.01	NONE	< 0.01				
Benzo(a)pyrene	µg/l	0.01	NONE	< 0.01				
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01				
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01				
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01				
Total PAH								
Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2				
Heavy Metals / Metalloids								
Antimony (dissolved)	µg/l	1.7	ISO 17025	< 1.7				
Arsenic (dissolved)	µg/l	1.1	ISO 17025	< 1.1				
Barium (dissolved)	µg/l	0.05	ISO 17025	34				
Beryllium (dissolved)	µg/l	0.2	ISO 17025	0.2				
Boron (dissolved)	µg/l	10	ISO 17025	19				
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08				
Chromium (hexavalent)	µg/l	5	NONE	< 5.0				
Chromium (III)	µg/l	1	NONE	6.6				
Chromium (dissolved)	µg/l	0.4	ISO 17025	6.6				
Copper (dissolved)	µg/l	0.7	ISO 17025	8.5				
Lead (dissolved)	µg/l	1	ISO 17025	9.9				
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5				
Nickel (dissolved)	µg/l	0.3	ISO 17025	4.2				
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0				
Vanadium (dissolved)	µg/l	1.7	ISO 17025	< 1.7				
Zinc (dissolved)	µg/l	0.4	ISO 17025	6.8				

Analytical Report Number: 15-78150

Project / Site name: Glenilla Road

Your Order No: 2385

Lab Sample Number				482013				
Sample Reference				WS6				
Sample Number				None Supplied				
Depth (m)				0.45				
Date Sampled				25/08/2015				
Time Taken				None Supplied				
Analytical Parameter (Leachate Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	µg/l	1	NONE	< 1.0				
Toluene	µg/l	1	NONE	< 1.0				
Ethylbenzene	µg/l	1	NONE	< 1.0				
p & m-xylene	µg/l	1	NONE	< 1.0				
o-xylene	µg/l	1	NONE	< 1.0				
MTBE (Methyl Tertiary Butyl Ether)	µg/l	10	NONE	< 10				
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >C5 - C6	µg/l	10	NONE	< 10				
TPH-CWG - Aliphatic >C6 - C8	µg/l	10	NONE	< 10				
TPH-CWG - Aliphatic >C8 - C10	µg/l	10	NONE	< 10				
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10				
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10				
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10				
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10				
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic >C5 - C7	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic >C7 - C8	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic >C8 - C10	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10				

Analytical Report Number : 15-78150

Project / Site name: Glenilla Road

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
481794	WS1	None Supplied	0.50	Brown loam and clay with vegetation.
481795	WS1	None Supplied	1.00	Brown loam and clay with vegetation.
481796	WS1	None Supplied	4.00	Light brown clay and sand.
481797	WS2	None Supplied	0.20	Brown loam and clay with gravel.
481798	WS3	None Supplied	0.30	Grey loam and clay.
481799	WS3	None Supplied	3.00	Light brown clay.
481800	WS6	None Supplied	0.40	Brown clay and sand with gravel.
481801	WS6	None Supplied	3.00	Light brown clay.
481802	WS5	None Supplied	0.80	Brown clay and sand with gravel.

Analytical Report Number : 15-78150

Project / Site name: Glenilla Road

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Asbestos Quantification	The analysis was carried out using documented in-house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006	D	ISO 17025
Boron in leachate	Determination of boron by acidification followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in leachates	Determination of BTEX and MTBE in leachates by headspace GC-MS.	In-house method based on USEPA8260	L073W-PL	W	NONE
BTEX and MTBE in soil	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073S-PL	W	MCERTS
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	NONE
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in leachate	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Organic matter in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS
pH in leachate	Determination of pH in leachate by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	ISO 17025
pH in soil (automated)	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS

Analytical Report Number : 15-78150

Project / Site name: Glenilla Road

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L070-PL	W	NONE
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate in leachates	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total cyanide in leachate	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	NONE
TPHCWG (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L076-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

APPENDIX I

Geotechnical testing results

SUMMARY OF GEOTECHNICAL TESTING

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression			Chemical Tests			Other tests and comments
Borehole / Trial Pit	Sample Ref	Depth (m)	Type	Description	MC (%)	LL (%)	PL (%)	PI (%)	<425 µm (%)	Bulk Mg/m³	Dry Mg/m³	Cell Pressure kPa	Deviator Stress kPa	Shear Stress kPa	pH	2:1 W/S SO4 (g/L)	W/S Mg (mg/L)	
BH1		2.00-2.45	U	Firm reddish brown CLAY with rare roots and rootlets	35	69	25	44	98	1.86	1.38	40	98	49				
BH1		4.00-4.45	U	Mottled brown, orange and grey CLAY with rare gypsum	30	76	24	52	100									
BH1		6.00-6.45	U	Firm to stiff fissured brown CLAY with rare gypsum and pyrite nodules	30	78	27	51	100	1.92	1.48	120	192	96				
BH1		9.00-9.45	U	Mottled brown and orange silty CLAY with rare gypsum	32	77	27	50	100									
BH1		12.00-12.45	U	Dark grey-brown silty CLAY	27	74	26	48	100									
BH1		15.00-15.45	U	Stiff fissured dark grey brown CLAY	29	76	26	50	100	1.88	1.46	300	268	134				

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by

S Burke

Senior Technician
21/09/2015

Project Number:

GEO / 23078

Project Name:

GLENILLA ROAD
CG/18516

GEOLABS®

BS 1377 : Part 7 : 1990 Clause 8

Quick Undrained Triaxial Compression Test

BH/TP No	BH1
Depth (m)	2.00-2.45
Sample Type	U

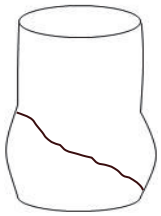
Description:

Firm reddish brown CLAY with rare roots and rootlets

Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	201.2
Diameter	(mm)	102.4
Moisture Content	(%)	35
Bulk Density	(Mg/m³)	1.86
Dry Density	(Mg/m³)	1.37
Test Details		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.9
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	40
Strain at failure	(%)	14.4
Maximum Deviator Stress	(kPa)	98
Shear Stress Cu	(kPa)	49

Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	60

Checked and Approved by:

S Burke

Senior Technician
21/09/2015

Project Number:

GEO / 23078

Project Name:

GLENILLA ROAD
CG/18516

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UKAS TESTING 1982

BS 1377 : Part 7 : 1990 Clause 8

Quick Undrained Triaxial Compression Test

BH/TP No	BH1
Depth (m)	6.00-6.45
Sample Type	U

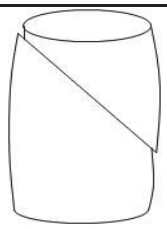
Description:

Firm to stiff fissured brown CLAY with rare gypsum and pyrite nodules

Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	200.9
Diameter	(mm)	99.4
Moisture Content	(%)	30
Bulk Density	(Mg/m³)	1.92
Dry Density	(Mg/m³)	1.48
Test Details		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.5
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	120
Strain at failure	(%)	7.5
Maximum Deviator Stress	(kPa)	192
Shear Stress Cu	(kPa)	96

Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	50

Checked and Approved by:

S Burke

Senior Technician
21/09/2015

Project Number:

GEO / 23078

Project Name:

GLENILLA ROAD
CG/18516

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UKAS TESTING 1982

BS 1377 : Part 7 : 1990 Clause 8

Quick Undrained Triaxial Compression Test

BH/TP No	BH1
Depth (m)	15.00-15.45
Sample Type	U

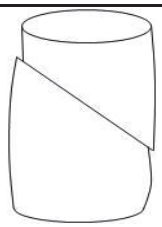
Description:

Stiff fissured dark grey brown CLAY

Specimen Details

Specimen conditions		Undisturbed
Length	(mm)	201.3
Diameter	(mm)	103.6
Moisture Content	(%)	29
Bulk Density	(Mg/m³)	1.88
Dry Density	(Mg/m³)	1.45
Test Details		
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.7
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	300
Strain at failure	(%)	9.9
Maximum Deviator Stress	(kPa)	268
Shear Stress Cu	(kPa)	134

Mode of failure



Orientation of the sample	Vertical
Distance from top of tube mm	40

Checked and Approved by:

S Burke

Senior Technician
21/09/2015

Project Number:

GEO / 23078

Project Name:

GLENILLA ROAD
CG/18516

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UKAS TESTING 1982

APPENDIX J

Contamination assessment tables

ASSESSMENT CRITERIA

Table 1 below sets out CGL's rationale for generic assessment criteria (GAC) adoption in order to evaluate risks posed to potential receptors at 32 Glenilla Road, London from identified chemical contamination. Potential receptors have been identified with reference to the Part IIA regime and associated DEFRA guidance. As with the Part IIA regime, under the planning regime all receptors (humans, controlled waters, ecology, crops/livestock and buildings) have been considered if there is the potential for them to be adversely affected by exposure to contamination. The results of the assessment for 32 Glenilla Road, London are then presented in Tables 2 to 6 of this appendix.

Table 1. Rationale for Assessment Criteria Adoption

Source / Media	CGL's Approach & Rationale
Risks to Human Health (long-term chronic risks)	
Soil contaminants	• Laboratory test results have been compared against Generic Assessment Criteria (GACs) derived in-house by CGL using the Contaminated Land Exposure Assessment (CLEA) model and version 1.06 of the CLEA software. Where Soil Guideline Values (SGVs) have been published previously by the Environment Agency, the CGL GACs have updated these based on current exposure parameters (e.g. updated inhalation rates). • The GACs have been generated assuming a sandy loam soil type and a Soil Organic Material of 1% for the Made Ground (measured range 0.32% to 0.59%) and 1% for the natural soils (measured 0.49% to 1.1%). • In the event impacts are identified on a site above the GAC level for arsenic, cadmium, chromium VI, benzene or benzo(a)pyrene, the results have been compared to the applicable Category 4 Screening Level (C4SL) published by DEFRA to further assess risks. • The exception to the above relates to lead. The SGV for lead has been withdrawn and the C4SL for lead is used by CGL directly as a first tier of assessment. • The CGL GACs represent conservative screening criteria (set at acceptable or minimal risk) and have generally been calculated using the default parameters for the standard land use scenarios set out in the CLEA technical report and toxicological inputs in line with the requirements of Science Report SC050021/SR2 and, in the case of petroleum hydrocarbons, Science Report P5-080/TR3. • Where a CGL GAC has not been derived alternative assessment criteria will be sourced from current commercially-available sources (including international standards where no suitable UK assessment criteria exists). • Where the dataset is of appropriate size, assessment against the applicable GAC or C4SL is carried out at the 95th percentile of the sample mean (designated US_{95}), which is considered to represent a reasonable worst-case scenario. An assessment of the normality of the data has been undertaken. Where datasets are normally distributed the one sample t-test has been applied to calculate the US_{95}. In the case of non-parametric datasets, the Chebychev Theorem has been applied. The Grubbs Test has also been used to identify potential outliers within datasets. • It is noted that the British Geological Survey has published background levels for a number of organic and inorganic constituents. In the event that the C4SL or a GAC is found to be exceeded, the risk may still be considered to be low, unlikely to meet the definition of contaminated land under Part IIA and potentially suitable for use from a development perspective, if the contaminant concentrations are below local background levels, assuming no other contributing factors. • At this time an authoritative GAC is not available for asbestos fibres in soil. A positive identification of asbestos fibres in a soil sample by the laboratory is considered sufficient to warrant additional assessment of risks. Laboratory identification and quantification by microscopy may be required subject to source of material.
Dissolved contaminants	• Concentrations of organic constituents detected above the laboratory reporting limit in shallow groundwater or perched water have been assessed against Water Screening Values (WSVs) developed by Atkins. These WSVs assess chronic risks to human health via the indoor air inhalation pathway only.
Ground gas	• Concentrations and flow rates of carbon dioxide and methane in ground gas are converted to Gas Screening Values (GSVs) in accordance with CIRIA (2007). Potential risks associated with gas chemistry are evaluated in accordance with guidance presented in CIRIA (2007), NHBC (2007), BSI (2007).

Table 1 (continued). Rationale for Assessment Criteria Adoption

Risks to Buildings & Structures	
Water supply pipes	• The evaluation of water supply pipe requirements at the site has been undertaken in general accordance with guidance and criteria produced by the UK Water Industry (2011).
Sulfate & pH conditions	• The evaluation of risks to buried concrete has followed the guidance and criteria produced by BRE (2005).
Risks to Vegetation & Plants	
Soil contaminants	• Risks to plant growth (i.e. phytotoxicity) have been assessed for specific contaminants where the limits for phytotoxic effect proposed (e.g. by BS 3882) are significantly lower than the health GAC.

Table 2. Soil risks to human health (residential land use with homegrown produce) – **Made Ground**

Determinand	GAC SOM = 2.5%	C4SL (based on 6% SOM)[1]	Note on SSL[2]	Measured range (mg/kg)	US_{95} (mg/kg)	US_{95} > Assessment Criteria? (Y/N) #- outlier detected
Antimony	*	*	-	<1.0 to 6.4	6.26	*
Arsenic	32	37	-	9.2 to 29.0	26.42	N
Barium	*	*	-	89.0 to	369.22	*
Beryllium	56	*	-	1.0 to 1.8	1.65	N
Boron	*	*	-	0.9 to 1.9	1.64	*
Cadmium	11	22	-	<0.2 to 0.6	0.56	N#
Chromium (III)	3,200	*	-	35.0 to 51.0	46.23	N
Chromium (VI)	6.3	21	-	<1.2	1.20	N
Total Chromium	*	*	-	35.0 to 51.0	46.23	*
Copper	4,200	*	-	29.0 to	86.15	N
Lead[3]	200	200	-	190.0 to	1248.22	Y
Mercury (inorganic)	180	*	-	<0.3 to 1.5	1.37	N#
Nickel	130	*	-	26.0 to 38.0	35.13	N
Selenium	350	*	-	<1.0	1.00	N
Vanadium	720	*	-	60.0 to 81.0	75.74	N
Zinc	18,000	*	-	69.0 to	374.25	N
Benzene	0.20	0.87	-	<0.001	0.001	N
Toluene	320	*	-	<0.001	0.001	N
Ethyl benzene	210	*	-	<0.001	0.001	N
m-xylene[4]	250	*	-	<0.001	0.001	N
o-xylene	240	*	-	<0.001	0.001	N
p-xylene	240	*	-	<0.001	0.001	N
Phenol[5]	560	*	-	<0.1	1.00	N
TPH aliphatic EC5-6	130	*	-	<0.1	0.10	N
TPH aliphatic EC>6-8	340	*	-	<0.1	0.10	N
TPH aliphatic EC>8-10	82	*	-	<0.1	0.10	N
TPH aliphatic EC>10-12	5,100	*	(b)	<1.0	1.00	N
TPH aliphatic EC>12-16	6,300	*	(b)	<2.0 to 3.0	3.14	N
TPH aliphatic EC>16-35	130,000	*	(a)	<16.0	20.47	N#
TPH aromatic EC5-7	0.20	*	-	<0.1	0.10	N
TPH aromatic EC>7-8	320	*	-	<0.1	0.10	N
TPH aromatic EC>8-10	90	*	-	<0.1	0.10	N
TPH aromatic EC>10-12	180	*	-	<1.0 to 1.6	1.54	N#
TPH aromatic EC>12-16	320	*	-	<2.0 to 8.9	6.36	N
TPH aromatic EC>16-21	590 [150]	*	(a)	<10.0 to	76.18	N
TPH aromatic EC>21-35	1,500 [12]	*	(a)	<10.0 to	130.77	N
Naphthalene	12	*	-	<0.05 to	0.61	N
Acenaphthene	1,200	*	(b)	< 0.1 to 0.18	0.19	N
Fluorene	1,400 [380]	*	(a)	<0.1 to 0.41	0.42	N
Anthracene	17,000 [19]	*	(a)	<0.1 to 2.0	1.37	N
Fluoranthene	1,800 [47]	*	(a)	<0.1 to 17.0	13.90	N
Pyrene	1,200 [5.5]	*	(a)	<0.1 to 15.0	11.96	N
Benzo(a)anthracene	16 [4.3]	*	(a)	<0.1 to 9.7	7.58	N
Chrysene	150 [1.1]	*	(a)	<0.05 to 9.4	7.15	N
Benzo(b)fluoranthene	18 [3.0]	*	(a)	<0.1 to 10.0	7.65	N
Benzo(k)fluoranthene	20 [1.7]	*	(a)	<0.1 to 8.3	5.96	N
Benzo(a)pyrene	3.0 [2.3]	5	-	<0.1 to 9.0	7.22	Y
Indeno(1,2,3-cd)perylene	18 [0.15]	*	(a)	<0.1 to 4.2	3.27	N
Dibenzo(a,h)anthracene	2.0 [0.01]	*	(a)	<0.1 to 1.1	0.80	N
Benzo(g,h,i)perylene	220 [0.05]	*	(a)	<0.05 to 5.6	3.96	N

[1] *= No value currently defined.

[2] -= green; (a) = amber i.e GAC set to model output, [SSL provided in square brackets]; (b) = red i.e SSL exceeded & considered to affect interpretation. GAC calculated in accordance with CLEA Software Handbook.

[3] Published C4SL.

[4] Concentrations for total xylenes should be compared to the value for m-xylene for fresh spills and to o-xylene for all other cases.

[5] GAC relates to phenol (C_6H_5OH) only.

Table 3. Soil risks to human health (residential land use with homegrown produce) – natural soils

Determinand	GAC SOM = 1%	C4SL (based on 6% SOM)[1]	Note on SSL[2]	Measured range (mg/kg)	Measured range > Assessment Criteria? (Y/N)
Antimony	*	*	-	<1.0 to 6.4	*
Arsenic	32	37	-	9.2 to 13.0	N
Barium	*	*	-	36.0 to 78.0	*
Beryllium	56	*	-	1.0 to 1.5	N
Boron	*	*	-	0.7 to 1.1	N
Cadmium	11	22	-	<0.2	N
Chromium (III)	3,200	*	-	48.0 to 63.0	N
Chromium (VI)	6.3	21	-	<1.2	N
Total Chromium	*	*	-	48.0 to 63.0	*
Copper	4,200	*	-	14.0 to 17.0	N
Lead[3]	200	200	-	15.0 to 27.0	N
Mercury (inorganic)	180	*	-	<0.3	N
Nickel	130	*	-	35.0 to 56.0	N
Selenium	350	*	-	<1.0	N
Vanadium	720	*	-	68.0 to 91.0	N
Zinc	18,000	*	-	60.0 to 75.0	N
Benzene	0.10	0.87	-	<0.001	N
Toluene	140	*	-	<0.001	N
Ethyl benzene	90	*	-	<0.001	N
m-xylene[4]	110	*	-	<0.001	N
o-xylene	100	*	-	<0.001	N
p-xylene	100	*	-	<0.001	N
Phenol[5]	280	*	-	<0.1	N
TPH aliphatic EC5-6	80	*	-	<0.1	N
TPH aliphatic EC>6-8	160	*	-	<0.1	N
TPH aliphatic EC>8-10	34	*	-	<0.1	N
TPH aliphatic EC>10-12	4,300	*	(b)	<1.0	N
TPH aliphatic EC>12-16	6,200	*	(b)	<2.0	N
TPH aliphatic EC>16-35	130,000 [8.6]	*	(a)	<16.0	N
TPH aromatic EC5-7	0.10	*	-	<0.1	N
TPH aromatic EC>7-8	140	*	-	<0.1	N
TPH aromatic EC>8-10	37	*	-	<0.1	N
TPH aromatic EC>10-12	75	*	-	<1.0	N
TPH aromatic EC>12-16	140	*	-	<2.0	N
TPH aromatic EC>16-21	290 [60]	*	(a)	<10.0	N
TPH aromatic EC>21-35	1,100 [4.8]	*	(a)	<10.0	N
Naphthalene	5	*	-	<0.05	N
Acenapthylene	210 [36]	*	(a)	<0.1	N
Acenaphthene	540	*	(b)	< 0.1	N
Fluorene	670 [150]	*	(a)	<0.1	N
Phenanthrene	770 [17]	*	(a)	<0.1	N
Anthracene	9,300 [7.7]	*	(a)	<0.1	N
Fluoranthene	910 [19]	*	(a)	<0.1	N
Pyrene	620 [2.2]	*	(a)	<0.1	N
Benzo(a)anthracene	11 [1.7]	*	(a)	<0.1	N
Chrysene	100 [0.4]	*	(a)	<0.05	N
Benzo(b)fluoranthene	14 [1.2]	*	(a)	<0.1	N
Benzo(k)fluoranthene	16 [0.7]	*	(a)	<0.1	N
Benzo(a)pyrene	2.4 [0.9]	5	(a)	<0.1	N
Indeno(1,2,3-cd)perylene	13 [0.06]	*	(a)	<0.1	N
Dibenzo(a,h)anthracene	1.7 [0.004]	*	(a)	<0.1	N
Benzo(g,h,i)perylene	200 [0.02]	*	(a)	<0.05	N

[1] *= No value currently defined.

[2] -= green; (a) = amber i.e GAC set to model output, [SSL provided in square brackets]; (b) = red i.e SSL exceeded & considered to affect interpretation. GAC calculated in accordance with CLEA Software Handbook.

[3] Published C4SL.

[4] Concentrations for total xylenes should be compared to the value for m-xylene for fresh spills and to o-xylene for all other cases.

[5] GAC relates to phenol (C_6H_5OH) only.

Table 4: Risks to controlled waters (soil leachate) - Freshwater

Contaminant	Freshwater EQS[1] (µg/l)	EC Drinking Water Value (µg/l)	Measured range (µg/l)	No. of samples exceeding EQS	No. of samples exceeding Drinking Water Value
Arsenic	50	10	<1.1	0 of 1	0 of 1
Cadmium	0.25[2]	5	<0.08	0 of 1	0 of 1
Chromium VI	3.4	50[3]	<5.0	1 of 1[4]	0 of 1
Chromium III	4.7	50[3]	6.6	1 of 1[4]	0 of 1
Lead	7.2	10	9.9	**1 of 1**	0 of 1
Mercury	0.05	1	<0.5	1 of 1[4]	0 of 1
Selenium	*[5]	10	<4.0	*	0 of 1
Boron	2,000[6]	1,000	19.0	0 of 1	0 of 1
Copper	28[2]	2,000	8.5	0 of 1	0 of 1
Nickel	20	20	4.2	0 of 1	0 of 1
Zinc	125[2]	(5,000)[7]	6.8	0 of 1	0 of 1
Barium	*	(1,000)[7]	34.0	*	0 of 1
Beryllium	(15)[8]	*	0.2	0 of 1	*
Vanadium	60[2]	*	<1.7	0 of 1	*
Phenols	7.7	(0.5)[7]	<10.0	0 of 1	1 of 1[4]
Free Cyanide	1	50[9]	<10.0	1 of 1[4]	0 of 1
Sulphate (mg/l)	400[5]	250	2.49	0 of 1	0 of 1
TPH	*	(10)[7]	<20.0	*	1 of 1[4]
PAH	*	0.1[10]	0.04	*	0 of 1
Anthracene	0.1	*	<0.01	0 of 1	*
Benzo(a)pyrene	0.05	0.01	<0.01	0 of 1	0 of 1
Benzo(b+k)fluoranthene	0.03[11]	*	<0.02	0 of 1	*
Benzo(ghi)perylene/ Indeno(1,2,3-cd)pyrene	0.002[12]	*	<0.01	0 of 1	*
Fluoranthene	0.1	*	<0.01	0 of 1	*
Naphthalene	2.4	*	<0.01	0 of 1	*
Benzene	10	1	<1.0	0 of 1	0 of 1
Toluene	50	*	<1.0	0 of 1	*
Ethylbenzene	20[5]	*	<1.0	0 of 1	*
Xylenes	30[5]	*	<1.0	0 of 1	*
Hardness (mg/l $CaCO_3$)	*	*	NA	*	*
pH	6.0 - 9.0	6.5 - 10.0	7.3	0 of 1	0 of 1

[1] Annual Averages prescribed within The River Basin Districts Typology, Standards and Groundwater threshold values. (Water Framework Directive) (England and Wales) Directions 2010.

[2] EQS varies with water hardness where range given. Evaluated against appropriate band.

[3] This value relates to total chromium.

[4] Laboratory limit of detection exceeds EQS/DWV. The exceedance is therefore not considered to be significant.

[5] * = No values defined or given.

[6] Dangerous Substance Directive 2006 (Annual Average).

[7] Concentration formerly prescribed within the Water Supply (Water Quality) Regulations 1989.

[8] Dutch Indication Level of Serious Contamination.

[9] Drinking water standard based on total cyanide.

[10] Sum concentration of 4 PAH comprising benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene and indeno(1,2,3-cd)pyrene.

[11] This value applies to the sum of benzo(b)fluoranthene and benzo(k)fluoranthene.

[12] This value applies to the sum of benzo(ghi)perylene and indeno(1,2,3-cd)pyrene.

Table 5. Risks to controlled waters (groundwater) - Freshwater

Contaminant	Freshwater EQS[1] (µg/l)	EC Drinking Water Value (µg/l)	Measured range (µg/l)	No. of samples exceeding EQS	No. of samples exceeding Drinking Water Value
Arsenic	50	10	0.71 to 4.91	0 of 3	0 of 3
Cadmium	0.25[2]	5	<0.02 to 0.09	0 of 3	0 of 3
Chromium VI	3.4	50[3]	<5.0	3 of 3[4]	0 of 3
Chromium III	4.7	50[3]	2.8 to 6.1	**1 of 3**	0 of 3
Lead	7.2	10	<0.2 to 7.1	0 of 3	0 of 3
Mercury	0.05	1	<0.05 to 0.07	**1 of 3**	0 of 3
Selenium	*[5]	10	1.9 to 8.2	*	0 of 3
Boron	2,000[6]	1,000	170.0 to 520.0	0 of 3	0 of 3
Copper	28[2]	2,000	3.0 to 4.6	0 of 3	0 of 3
Nickel	20	20	5.2 to 15.0	0 of 3	0 of 3
Zinc	125[2]	(5,000)[7]	3.7 to 15.0	0 of 3	0 of 3
Barium	*	(1,000)[7]	26.0 to 63.0	*	0 of 3
Beryllium	(15)[8]	*	<0.1	0 of 3	*
Vanadium	60[2]	*	0.4 to 1.0	0 of 3	*
Phenols	7.7	(0.5)[7]	<10.0	3 of 3[4]	3 of 3[4]
Free Cyanide	1	50[9]	<10.0	3 of 3[4]	3 of 3[4]
Sulphate (mg/l)	400[5]	250	156.0 to 3900.0	**1 of 3**	2
TPH	*	(10)[7]	<20.0 to 810.0	*	**1 of 3**
PAH	*	0.1[10]	<0.04	*	3 of 3[4]
Anthracene	0.1	*	<0.01	0 of 3	*
Benzo(a)pyrene	0.05	0.01	<0.01	0 of 3	0 of 3
Benzo(b+k)fluoranthene	0.03[11]	*	<0.02	0 of 3	*
Benzo(ghi)perylene/ Indeno(1,2,3-cd)pyrene	0.002[12]	*	<0.01	0 of 3	*
Fluoranthene	0.1	*	<0.01	0 of 3	*
Naphthalene	2.4	*	<0.01 to 2.9	**1 of 3**	*
Benzene	10	1	<1.0	0 of 3	0 of 3
Toluene	50	*	<1.0	0 of 3	*
Ethylbenzene	20[5]	*	<1.0	0 of 3	*
Xylenes	30[5]	*	<1.0	0 of 3	*
Hardness (mg/l $CaCO_3$)	*	*	507.0 to 4730.0	*	*
pH	6.0 - 9.0	6.5 - 10.0	6.9 to 7.0	0 of 3	0 of 3

[1] Annual Averages prescribed within The River Basin Districts Typology, Standards and Groundwater threshold values. (Water Framework Directive) (England and Wales) Directions 2010.

[2] EQS varies with water hardness where range given. Evaluated against appropriate band.

[3] This value relates to total chromium.

[4] Laboratory limit of detection exceeds EQS/DWV. The exceedance is therefore not considered to be significant.

[5] * = No values defined or given.

[6] Dangerous Substance Directive 2006 (Annual Average).

[7] Concentration formerly prescribed within the Water Supply (Water Quality) Regulations 1989.

[8] Dutch Indication Level of Serious Contamination.

[9] Drinking water standard based on total cyanide.

[10] Sum concentration of 4 PAH comprising benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene and indeno(1,2,3-cd)pyrene.

[11] This value applies to the sum of benzo(b)fluoranthene and benzo(k)fluoranthene.

[12] This value applies to the sum of benzo(ghi)perylene and indeno(1,2,3-cd)pyrene.

Table 6. Soil risks to vegetation and plants

Determinant	Assessment Criteria	Measured range (mg/kg)	Measured range > Assessment Criteria? (Y/N)
Copper[1]	135	14.0 to 100.0	N
Zinc[1]	200	60.0 to 520.0	Y
Nickel[1]	75	26.0 to 56.0	N
Boron[2]	5	0.7 to 1.9	N

[1] BSI (2007) Specification for topsoil and requirements for use. BS13882. Values taken for pH6-7

[2] Limit for phytotoxic effect. Nable, Banuelos and Paul. (1997). Boron Toxicity, Plant and Soil, Volume 193, pp1 81-198