Aval Consulting Group.

Drainage Strategy

Friars Garth, Epsom KT18 5DH

Weldin Builders Ltd

February 2024

Aval Consulting Group.

Project Information

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Date of Issue	27 February 2024

Revision History

Revision	Date	Author	Reviewer	Approver	Status
A	12 July 2022	PR	WR	AC	Draft
A	14 July 2022	PR	WR	AC	Final
B	02 September 2022	PR	WR	AC	Final
C	28 September 2022	PR	WR	AC	Final
D	27 February 2024	PR	WR	AC	Final

Disclaimer

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1. Executive Summary

Aval Consulting Limited has been commissioned by Weldin Builders Ltd ('the client') to provide a Drainage Strategy in relation to a planning application for the proposed development of a residential flat block with associated gardens, public open spaces, new road and associated infrastructure located at Friars Garth, Epsom KT18 5DH.

This report covers the proposed drainage strategy and will explain the philosophy of the drainage design, with details on infiltration testing and surface water discharge.

The proposed development will also include information on surface water management and SuDS for the proposed development to reduce surface water discharge.

Maintenance details, exceedance flow and the protection of the surface water drainage system will also be highlighted.

2. Introduction

2.1 Overview

AVAL Consulting Group Limited (ACL) has been commissioned by the client to produce a Drainage Strategy at Friars Garth, Epsom KT18 5DH. This is to accompany the planning application to the Local Authority for consent to undertake the proposed work.

The site drawings are presented in Appendix A.

2.2 Site Location and Details

Figure 2.1 shows the proposed site location. The surroundings of the proposed development are largely residential in nature. The site is bounded by The Parade Road to the north, The Cressinghams Private Road to the south and east and The Newlife Fertilitiy Clinic to the west.

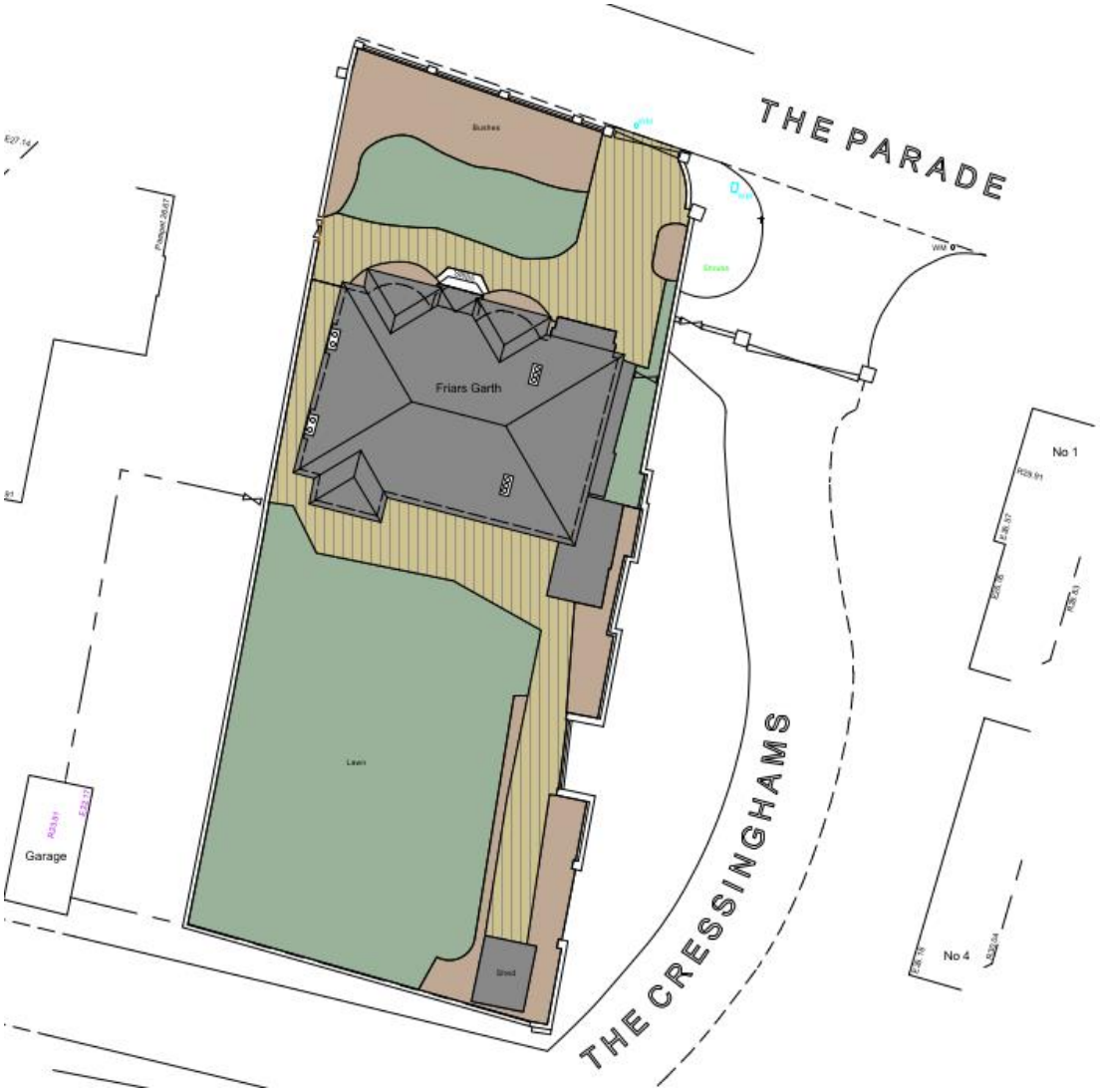


Figure 2.1: Proposed Site Location (Source: nyesaunders)

3. Relevant Standards and Policies

This section summarises all legislation, policy, statutory and non-statutory guidelines relevant to the proposed development. That also includes all the latest regional and local planning policy guidance specifically applicable to the proposed development.

3.1 The National Planning Policy Framework (NPPF)

The latest National Planning Policy Framework (NPPF) was published on 20th July 2021. The NPPF is supported by technical guidance set out within the Planning Practice Guidance for Flood Risk and Drainage, including the classification of the site vulnerability and the requirement do an Exception Test in relation to the Flood Zone and Vulnerability Classification.

One of the key aims of the NPPF is to ensure that flood risk is taken into account at all stages of the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk.

It advises that where new development is necessary in areas of higher risk, flood mitigation resilience and resistance measures should be incorporated which can include but not limited to a higher finished floor level, installing flood boards and moving electrical points above. The developments upstream of the proposed development should also be taken into the consideration of flood risk.

The NPPF's flood risk advice is all set out in Chapter 14 of the Framework document, meeting the challenge of climate change, flooding and coastal change.

3.2 Flood and Water Management Act 2010

The Flood and Water Management Act 2010 received Royal Assent on 8th April 2010. This Act provides duties on the Environment Agency, Local Authorities, Developers and other bodies to manage flood risks. The Act has significant planning and design implications for Developers.

It should be noted that these standards and procedures are being reviewed by the respective regulatory bodies and third parties against the requirements imposed by the Flood and Water Management Act 2010. The advice and recommendations provided may change when associated regulations have been issued in order to implement the full scope of the Act.

3.3 Epsom and Ewell Borough Council Core Strategy

Epsom and Ewell Borough Council's Core Strategy (adopted on 24th July 2007) highlights the main policy regarding Flood Risk.

Policy CS 6 states:

"Proposals for development should result in a sustainable environment and reduce, or have a neutral impact upon, pollution and climate change. The Council will expect proposals to demonstrate how sustainable construction and design can be incorporated to improve the energy efficiency of development - both new build and conversion.

In order to conserve natural resources, minimise waste and encourage recycling, the Council will ensure that new development:

● minimises the use of energy in the scheme by using an appropriate layout, building design and orientation;

● minimises the emission of pollutants, including noise, water and light pollution, into the wider environment;

● has no adverse effects on water quality, and helps reduce potential water consumption, for example by the use of water conservation and recycling measures and by minimising off-site water discharge by using methods such as sustainable urban drainage;

● avoids increasing the risk of, or from, flooding;

● minimises the energy requirements of construction, for example by using sustainable construction technologies and encouraging the recycling of materials;

● encourages the use of renewable energy by the incorporation of production facilities within the design of the scheme;

● incorporates waste management processes, for example for the recycling of water and waste. The waste hierarchy (Reduce-Reuse-Recycle-Recover-Dispose) should be applied to all stages of development design, construction and final operation."

4. Climate Change and Surface Water Management

The National Planning Policy Framework 2021 (NPPF) and accompanying Planning Practice Guidance indicate surface water run-off should be controlled as near to its source as possible through a sustainable drainage approach to surface water management.

Consideration should therefore firstly be given to using sustainable urban drainage (SuDS) techniques including soakaways, infiltration trenches, permeable pavements, grassed swales, ponds and wetlands to reduce flood risk by attenuating the rate and quantity of surface water run-off from a site. This approach can also offer other benefits in terms of promoting groundwater recharge, water quality improvement and amenity enhancements. The NPPF sets out a hierarchy for the disposal of surface water which encourages a SuDS approach, which will be mentioned in Section 4.4.

4.1 Climate Change

There are indications that the climate in the UK is changing significantly, and it is widely believed that the nature of climate change will vary greatly by region. Current expert opinion indicates the likelihood that future climate change would produce more frequent short-duration and high-intensity rainfall events with the addition of more frequent periods of long-duration rainfall.

The Environment Agency has highlighted the climate change allowance for all proposed developments as described in Section 4.2

4.2 Small and Urban Catchment Climate Change Growth

The table below highlights the potential climate change expected in the future.

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

As this development is for residential use, **a climate change growth factor of 40% is proposed** to be used for the surface water runoff/storage calculations.

4.3 Existing Public and Private Sewers

There is evidence of an existing 450mm diameter Thames Water surface water sewer located north of the site on The Parade.

Appendix B contains the Thames Water Asset Search.

4.4 Methods of Surface Water Management

As set out within the NPPF 2021, there are four methods that have been reviewed for the management and discharge of surface water for the site which are detailed below; these may be applied individually or collectively to form a complete strategy. They should be applied in the order of priority as listed:

- Discharge via infiltration;
- Discharge via watercourse;
- Discharge via a dedicated public surface water system; and
- Discharged via a combined sewer.

Discharge via Infiltration

The first consideration for the disposal of surface water is via infiltration. Infiltration tests were undertaken at the site by the client (Weldin Builders Ltd) to investigate the potential method of discharging surface water via infiltration. The tests were undertaken as per BRE 365 guidance, with three tests undertaken within the same trial pit.

Appendix C contains the results of the infiltration tests. As can be seen, the results show the infiltration rates are very poor at the site, with the highest infiltration rate of 0.012 m/hr (3.37 x 10^{-6} m/s) in the first test and the lowest infiltration rate of 0.0069 m/hr (1.92 x 10^{-6} m/s) in the third test. The lowest infiltration rate is to be used to design a soakaway. Therefore, the infiltration rate of 0.0069 m/hr is not sufficient for the disposal of surface water via infiltration.

Further calculations were taken into consideration to understand if a portion of the site could be drained via infiltration. The driveway of the proposed development has a suitable surface area to propose permeable paving and was used to check if infiltration would be viable within this area. The infiltration rate of 0.0069 m/hr was used and results concluded the infiltration rates were not sufficient and would cause flooding. The calculations can be seen in Appendix D.

Appendix C contains the borehole testing which was undertaken by Albury S.I. Ltd between the 6th and 7th of June 2022 which identifies groundwater at 2.5m deep. No information was available on the groundwater levels during the winter months and as expected the groundwater levels would rise during the winter months, which needs to be taken into consideration.

Therefore, it is recommended to undertake boreholes testing during the winter months to confirm groundwater levels as this may have an effect on the design of the Drainage system and the placement of the attenuation tank.

As noted above, the shallow groundwater levels would also limit the potential performance of the infiltration system. With shallower groundwater levels during the winter, the infiltration system may not be able to discharge surface water and would therefore cause flooding within the site.

Therefore, a discharge via infiltration is not possible.

Discharge to a Watercourse

Where infiltration techniques are not considered or not feasible, suitable a connection to a watercourse is the preferred option.

There are no watercourses in close vicinity to the proposed development and so, a discharge towards a river is not possible.

Discharge via a Dedicated Surface Water Sewer

Following the above, the preferred option to discharge surface water is to the existing Thames Water surface water sewer network located at the access of the site on The Parade Road.

4.5 Proposed Surface Water Discharge Strategy

The primary option for surface water disposal is via the existing 450mm diameter Thames Water surface water gravity sewer located north of the site on The Parade Road.

Sustainable Urban Drainage Systems (SuDS) are important in every development to ensure the long-term functionality of drainage systems both locally and regionally. As part of this design, SUDS have been incorporated wherever practicably feasible. The SuDS element proposed within this design includes surface water attenuation (an attenuation tank) prior to off-site discharge.

As per the LLFA's requirements, the proposed discharge rate under the 1 in 1 flood event should be no more than 1.9 l/s and no more than 2.9 l/s under the 1 in 100 year flood event with 40% Climate Change.

The proposed Drainage Strategy meets the LLFA's requirements by achieving maximum surface water discharge rates of 1.6 l/s under the 1 in 1 year flood event and 1.8 l/s under the 1 in 100 year flood event plus 40% Climate Change, respectively.

To achieve the maximum discharge rates, a suitably designed vortex flow control unit (Hydrobrake or equivalent, constructed within manhole) is proposed to limit the discharge flow rate, with an attenuation tank proposed to temporarily hold excess surface water during larger rainfall events. The attenuation tank has been sized to accommodate the 1 in 100 year flood event plus a 40% allowance for climate change. An urban creep of 10% has also been included within the drained areas.

As stated above in section 4.4, borehole testing would need to be undertaken during the winter months to ensure the tanks are not affected due to any buoyancy from shallow groundwater levels.

Currently the proposed location and depth of the storage tank satisfies the requirements of a 1m unsaturated zone between the ground water level and the invert of the tank. However, as the borehole testing were undertaken in the summer months it is expected that the ground water levels could be higher during the winter months, which would result in potential buoyancy. A solution to protect the tank from potential buoyancy is to use a cover slab to weigh the units down. This would need to be confirmed during the detailed design stage. If groundwater levels are within 1m of the tanks and fail to achieve the 1m unsaturated zone then a redesign is required.

Permeable paving is also used to temporarily store surface water prior to discharging into the sewer. The proposed system includes a 0.3m deep sub-base which allows for surfacer wate from the carpark to be stored within the sub-base. An Orifice Plate is added to restrict the discharge rate from the permeable paving sub-base into the rest of the proposed drainage system.

The new connection is subject to a formal Thames Water Section 106 agreement. Appendix D includes the drawings and calculations of the Drainage Strategy.

5. Foul Water Discharge

5.1 Existing Public and Private Sewers

There is evidence of an existing 300mm diameter Thames Water foul water sewer located north of the site on The Parade.

5.2 Proposed Foul Water Discharge Strategy

Based on the peak daily flow of 4000 litres per dwelling as per the BS EN 12056-2 System II, the 12no. residential units within the proposed development will generate a peak foul design flow of 0.45 l/s. This will be discharged into the existing Thames Water 300mm diameter foul water sewer network via the existing connection from the site.

This is subject to a formal Thames Water Section 106 agreement. The Drainage Strategy drawing in Appendix D includes a preliminary foul drainage layout.

6. Proposed Exceedance Flow and Drainage During Construction

Under rainfall events which are greater than design events or if the proposed drainage system had to fail due to blockages, the surface water would flow towards the access of the site and away from the residential block.

A Construction Environmental Management Plan (CEMP), which was undertaken by Weldin Builders, was also created to highlight the method of protecting the drainage system during construction and the method of handling runoff during construction.

Appendix E contains the flood exceedance flow plan and the CEMP.

7. SuDS Appraisal and Proposed SuDS for Development

7.1 SuDS- General

Whilst the temporary storage volumes will be provided within an oversized pipework, the means by which the surface water is both stored and conveyed to the attenuation system should also incorporate various forms of Sustainable Drainage Systems (SuDS) where possible in accordance with the Environment Agency's general guidance and the National Planning Policy Framework.

Appropriately designed, constructed and maintained, SuDS are more sustainable than conventional drainage systems. Their benefits in general terms are summarised below.

SuDS can:

- Reduce run-off surface water flow-rates and/or volumes and hence reduce the risk of flooding;
- Encourage natural groundwater re-charge;
- Reduce pollutant concentrations in storm water;
- Provide habitats for wildlife.

7.2 SuDS Appraisal

There are many site-specific factors which will influence the choice of any single or combination of SuDS device used within a development. The primary factors are:

- Whether the development is domestic, commercial or industrial;
- Whether the underlying ground is contaminated. If so, infiltration systems (soakaways) will most probably not be permitted;
- Whether the underlying ground is permeable enough for infiltration systems (soakaways) to be considered;
- Whether the groundwater levels are deep enough for infiltration systems (soakaways) to be considered;
- Whether the site is steeply sloping and its general topography;
- The availability of space inside the development for each potential SuDS facility;

Health and Safety aspects should the development be likely to be inhabited or used by children.

7.3 Types of SuDS with Respect to Proposed Development

Based on local and regional policy, the primary SuDS elements proposed for this development are outlined below:

7.3.1 Attenuation Storage

Attenuation storage can assist with the temporary storage of surface water whilst also allowing for a reduction in discharge rate. This will benefit by preventing any potential flooding at the site or elsewhere.

The proposed development requires an impermeable area of 860m^2 to be accommodated via attenuation storage at a maximum discharge rate of 1.90 l/s. A storage capacity of 30m^3 was calculated using these requirements.

The storage is proposed to be placed within the car parking area as the available surface area of the site is limited.

7.3.2 Permeable Paving

Permeable Paving is proposed to be included within the driveway/carpark. Permeable paving allows for a sustainable discharge of surface water via the sub-base whilst also being able to absorb any carbon-induced particles from vehicles.

In this case, a direct discharge from sub-base to the proposed surface water system is chosen as the infiltration rate is too low for a natural discharge.

8. Maintenance

A maintenance plan is provided under a separate document. This can be seen in Appendix F.

9. Conclusion

The primary option for surface water disposal is via attenuation and discharge to the Thames Water surface water sewer located on The Parade, which is subject to section 106 approval by Thames Water.

The primary option for foul water disposal is proposed to be discharged to an existing Thames Water foul water sewer located on The Parade, which is subject to section 106 approval by Thames Water.

The surface water discharge rate is proposed to be restricted to no more than 1.5 l/s under the 1 in 1 year flood event and no more than 1.8 l/s under the 1 in 100 year flood event with 40% Climate Change.

SuDS in the form of attenuation tanks are proposed to store surface water prior to being discharged.

Appendices

Appendix A: Existing and Proposed Site Plan and Topographical Survey

Rev	Amendments	Date

Project	Project No.	Drawing No.	Revision.	Date
Friars Garth, The Parade. Epsom	21308	E101	#	04/2021
Drawing Title	**Scale**	**Paper Size**	**Drawn By**	**Checked By**
Existing Site Plan	1:200	A3	EY	RLS

nyesaunders
CHARTERED ARCHITECTS
3 Church Street, Godalming, Surrey. GU7 1EQ
Web: www.nyesaunders.co.uk e-mail: info@nyesaunders.co.uk Tel: 01483 418600

Scale 1:200

Rev	Amendments	Date
H	building narrowed by 1m	24/11/2021
G	areas of garden spaces, changes to curb and setts	08/11/2021
F	Pavement widened and bin collection point	27/09/2021
E	Bin collection provision amended	23/09/2021
D	Bin collection provision amended	23/09/2021
C	Visibility Splay and kerb line	17/08/2021
B	Drive entrance and width amended, front wall and bin drop off area amended	01/04/2021
A	Bin Storage amended	29/09/2020

Do not scale from this drawing except for Planning Application purposes

All dimensions are to be verified prior to construction

This drawing is prepared for Local Authority approval on behalf of the applicant named below and/or named on the planning or building regulation application forms and may be used for no other purpose. The copyright of the drawing and designs remains the architect's. All copies are for information only about the application; they may be used for no other purpose without the express written permission of Nye Saunders Ltd Chartered Architects.

Project	Project No.	Drawing No.	Revision.	Date
Friars Garth, The Parade. Epsom	21308	P300	H	04/2021
Drawing Title	**Scale**	**Paper Size**	**Drawn By**	**Checked By**
Proposed Site Plan	1:200	A3	EY	RLS

nyesaunders
CHARTERED ARCHITECTS
3 Church Street, Godalming, Surrey. GU7 1EQ
Web: www.nyesaunders.co.uk e-mail: info@nyesaunders.co.uk Tel: 01483 418600

LEGEND

Survey Station	Building
Slopes (top / bottom)	Contours (50.00)
Gate	Fence
Tree — Species are indicative only a mean spread and bole drawn to scale	Vegetation
	Hedge, width to scale
	Kerb/Upstands
	Overhead Feature
	Safety Barrier
	Verge/Edge of Surface
	Water

ABBREVIATIONS

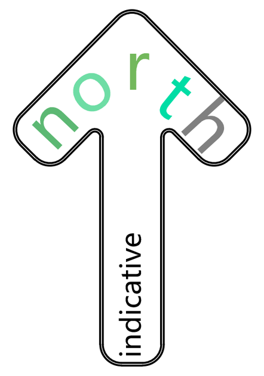
AV	Air Valve	R	Ridge Level
AB	Advertisement Board	RE	Rodding Eye
B	Bollard	RFL	Roof Level
BB	Belisha Beacon	RS	Road Sign
BL	Bed Level	R/W	Retaining Wall
BLT	Basement Light	RWP	Rainwater Pipe
BS	Bus Stop	SC	Stop Cock
BT	British Telecom	SFL	Soffit Level
CATV	Cable Television	SV	Sluice Valve
CH	Coal Hole	SW	Surface Water
CL	Cover Level	TB	Telephone Box
CT	Cabinet	TCSU	Traffic Signal Cover
DC	Drainage Channel	THL	Threshold Level
E	Eaves Level	ToW	Top of Wall
EL	Electricity Cable Pit	TL	Traffic Light
EP	Electricity Pole	TM	Ticket Machine
ER	Earth Rod	TP	Telegraph Pole
F/B	Flower Bed	UC	Unknown Cover
FH	Fire Hydrant	UTL	Unable To Lift
FL	Floor Level	VP	Vent Pipe
FLT	Flood Light	WCP	Water Control Pillar
FP	Flag Pole	WL	Water Level
FW	Foul Water	WM	Water Meter
G	Gully	WO	Wash Out
GV	Gas Valve	SVP	Soil & Vent Pipe
h	Height		
GP	Guide Post		
IB	Illuminated Bollard		
IC	Inspection Cover		
IL	Invert Level		
KO	Kerb Outlet		
LB	Litter Bin		
LH	Lamp Hole		
LP	Lamp Post		
MH	Manhole		
Mkr	Marker		
OHW	Overhead Wire		
NB	Notice Board		
NP	Name Plate		
P	Post		
PB	Post Box		
PBU	Push Button Unit		
PM	Parking Meter		

FENCE DESCRIPTIONS

BWF	Barbed Wire Fence
CBF	Close Boarded Fence
CIF	Corrugated Iron Fence
CLF	Chain Link Fence
CPF	Chestnut Paling Fence
CSF	Concrete Slab Fence
GDF	Guardian Fence
MRF	Metal Railings
IWF	Interwoven Fence
LLF	Larch Lap Fence
OBF	Open Board Fence
PAF	Paling Fence
PRF	Post & Rail Fence
PWF	Post & Wire Fence
WMF	Wire Mesh Fence

NOTES

All levels are based on TBM Value 20.00m, Situated on Floor Level, as shown on Survey.



Survey Date: September 2018

Client: Latchmere Properties Ltd
Latchmere House
134-136 South Street
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RH4 2EU

enka surveys

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t : 01892 660459
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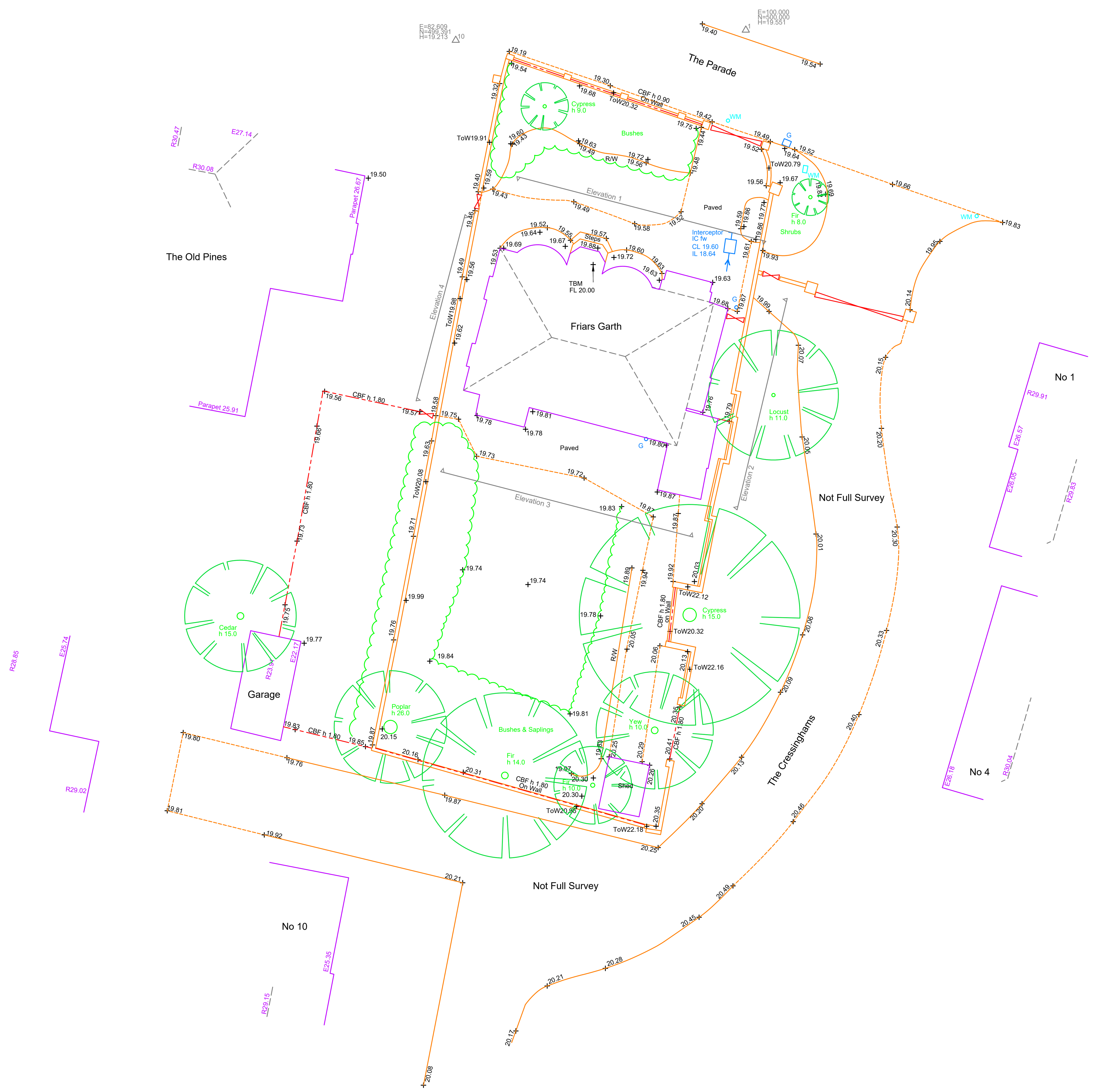
Job No: 2077

Job Name: Friars Garth
Epsom

Title: Topographical Survey

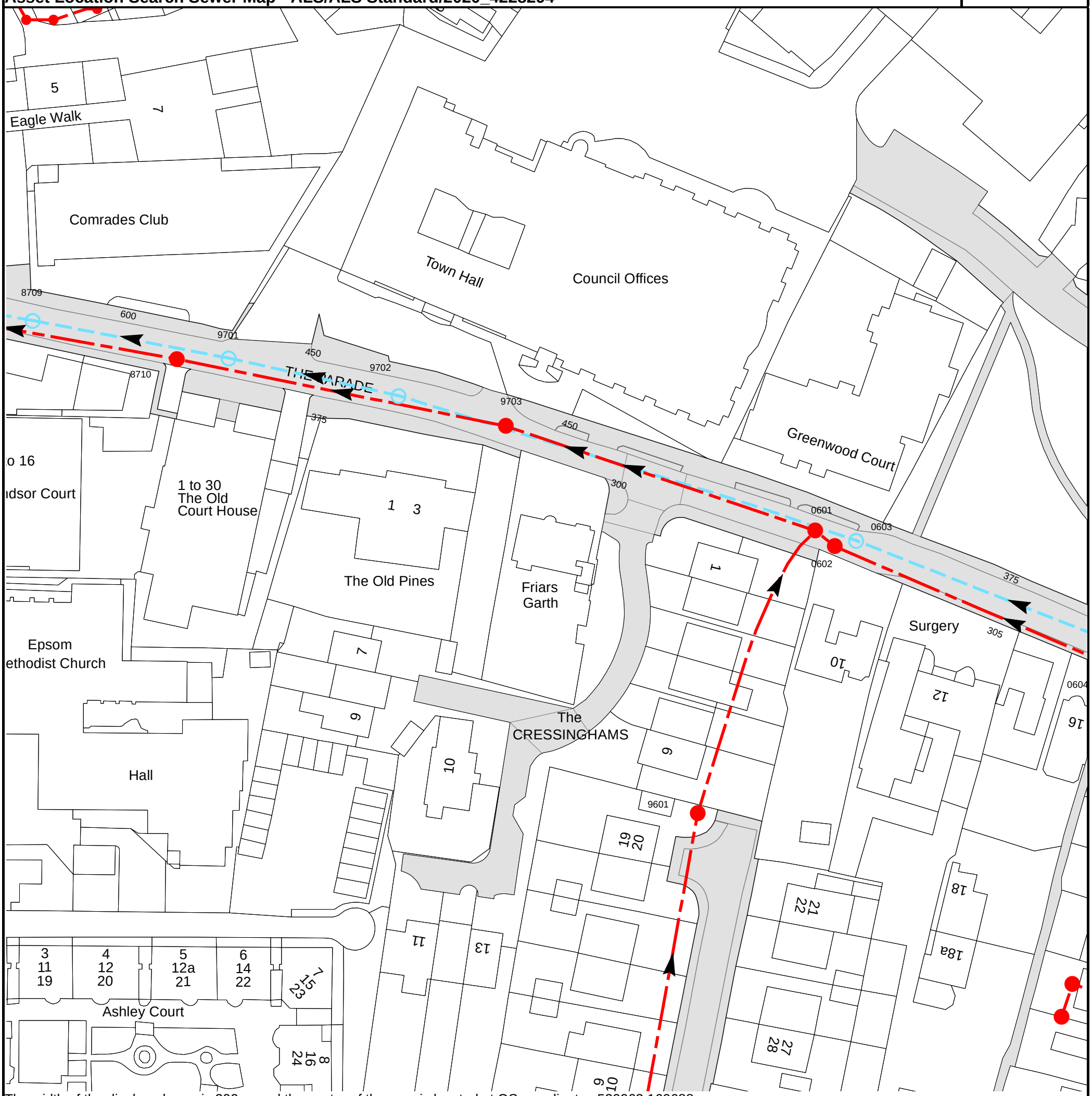
Scale: 1:200@A1

Sheet: 1



Appendix B: Thames Water Asset Search

Asset Location Search Sewer Map - ALS/ALS Standard/2020_4228294



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 520963,160688

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

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
06ZQ	n/a	n/a
06ZP	n/a	n/a
9601	n/a	n/a
0602	47.21	44.51
0603	47.24	45.44
0601	47.15	44.43
87XV	n/a	n/a
87XW	n/a	n/a
87XY	n/a	n/a
8709	46.51	42.73
8710	n/a	n/a
9701	46.03	43.39
9702	45.77	44.03
9703	n/a	n/a

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

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

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

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

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

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

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

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

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

Control Valve

Drop Pipe

Ancillary

Weir

End Items

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

Outfall

Undefined End

Inlet

Other Symbols

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

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

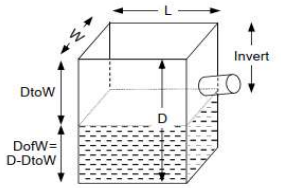
Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plans are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole level indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Appendix C: Site Investigation and Infiltration Tests

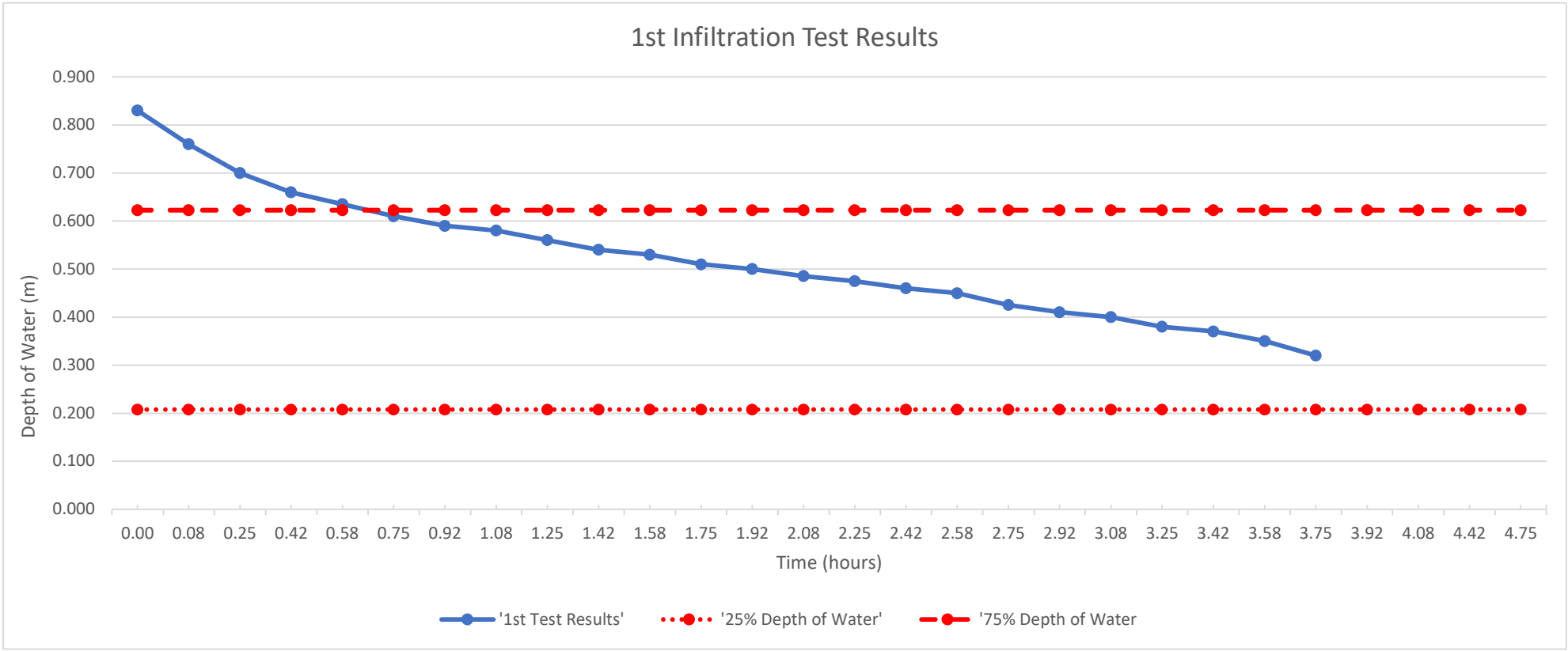
Aval Consulting Group.

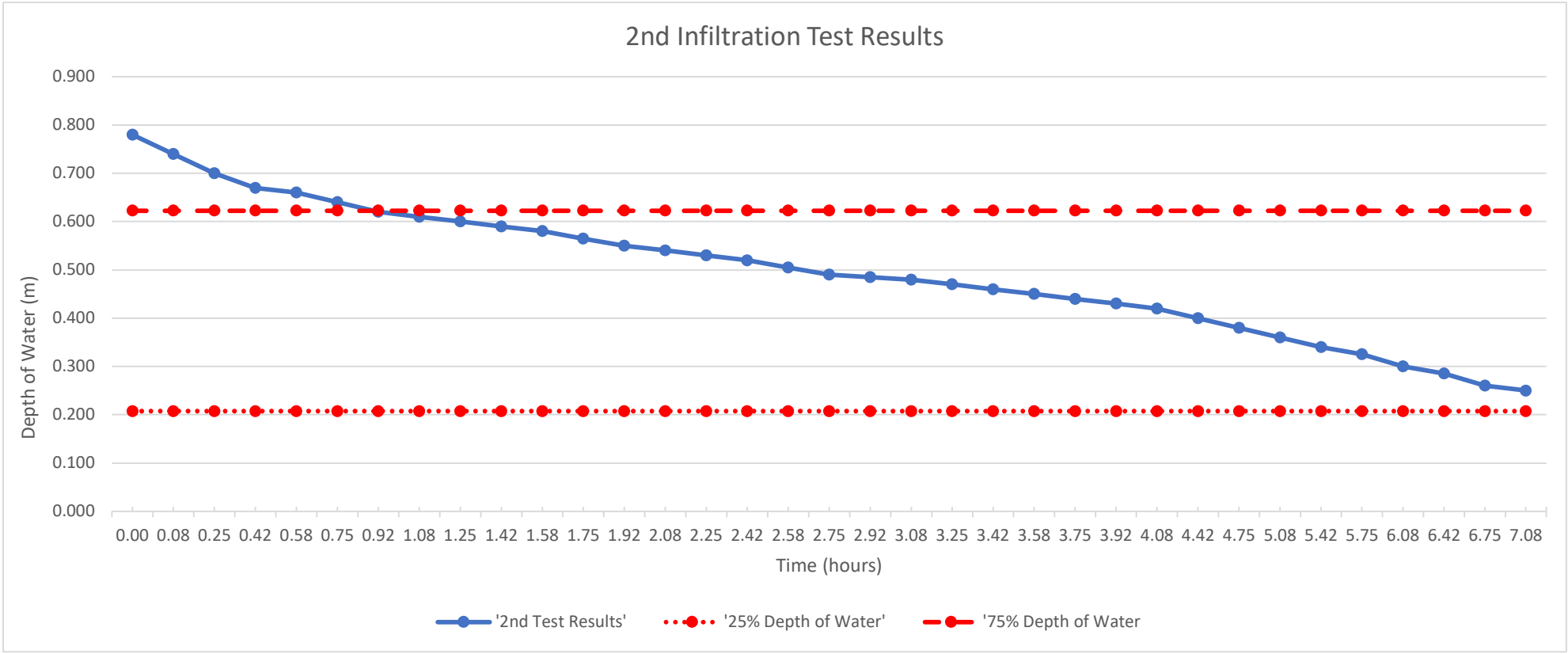
Site Location	Friars Garth, KT18 5DH	
Weather	Dry Sun + Cloudy	
Position on Site	Rear of Existing House	
Hole Number		
Hole Dimensions (m)	Length	1.000
	Width	0.300
	Depth	1.700

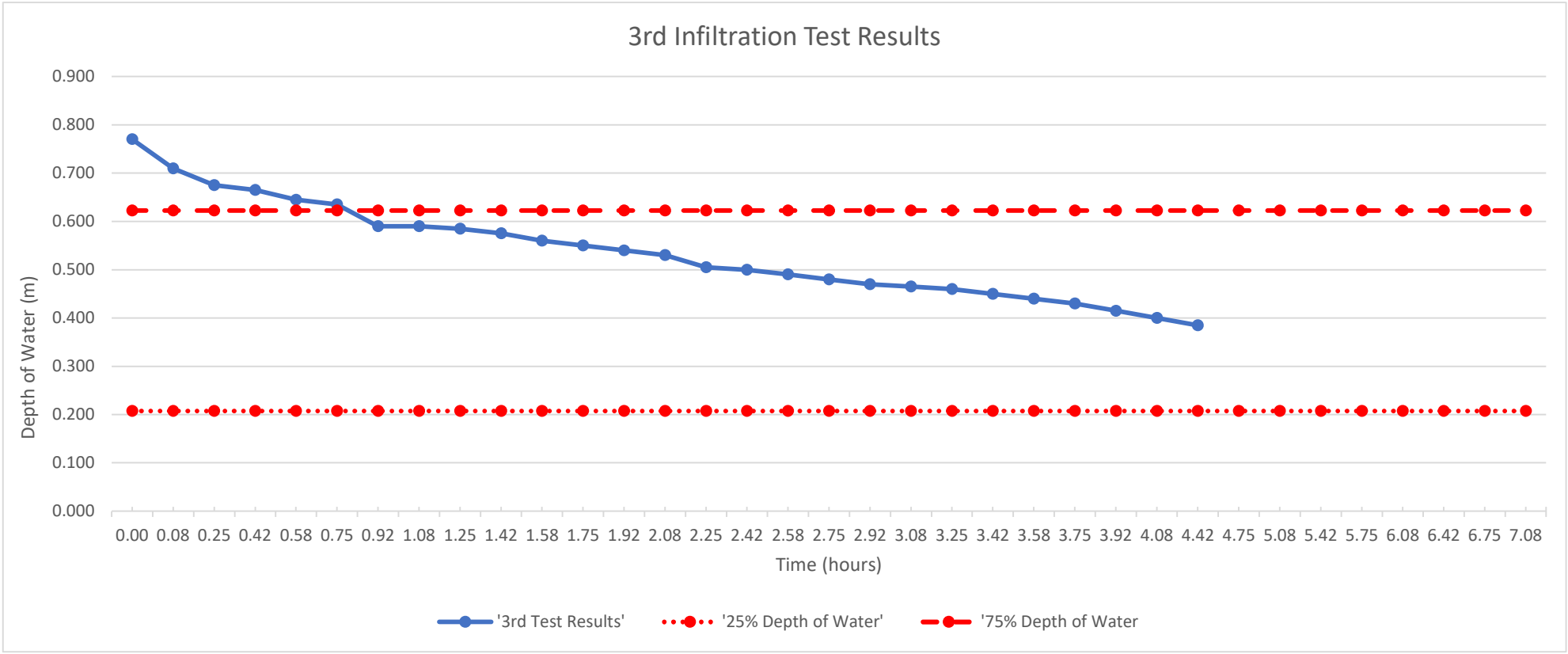


Depth to Water = DtoW
Depth of Water (DofW) = Depth (D) - DtoW

1st Test			2nd Test			3rd Test		
Depth To Water (DtoW)	Depth of Water (DofW)	Time Elapsed (hrs)	Depth To Water (DtoW)	Depth of Water (DofW)	Time Elapsed (hrs)	Depth To Water (DtoW)	Depth of Water (DofW)	Time Elapsed (hrs)
0.870	0.830	0.00	0.920	0.780	0.00	0.930	0.770	0.00
0.940	0.760	0.08	0.960	0.740	0.08	0.990	0.710	0.17
1.000	0.700	0.25	1.000	0.700	0.25	1.025	0.675	0.33
1.040	0.660	0.42	1.030	0.670	0.42	1.035	0.665	0.50
1.065	0.635	0.58	1.040	0.660	0.58	1.055	0.645	0.67
1.090	0.610	0.75	1.060	0.640	0.75	1.065	0.635	0.83
1.110	0.59	0.92	1.080	0.620	0.92	1.110	0.590	0.00
1.120	0.58	1.08	1.090	0.610	1.08	1.110	0.590	1.17
1.140	0.56	1.25	1.100	0.600	1.25	1.115	0.585	1.33
1.160	0.54	1.42	1.110	0.590	1.42	1.125	0.575	1.50
1.170	0.53	1.58	1.120	0.580	1.58	1.14	0.560	1.67
1.190	0.51	1.75	1.135	0.565	1.75	1.15	0.55	1.83
1.200	0.5	1.92	1.150	0.550	1.92	1.16	0.54	1.00
1.215	0.485	2.08	1.160	0.54	2.08	1.17	0.53	2.17
1.225	0.475	2.25	1.170	0.53	2.25	1.195	0.505	2.33
1.24	0.46	2.42	1.180	0.52	2.42	1.2	0.5	2.50
1.25	0.45	2.58	1.195	0.505	2.58	1.21	0.49	2.67
1.275	0.425	2.75	1.210	0.49	2.75	1.22	0.48	2.83
1.29	0.41	2.92	1.215	0.485	2.92	1.23	0.47	2.00
1.3	0.4	3.08	1.220	0.48	3.08	1.235	0.465	3.17
1.32	0.38	3.25	1.230	0.47	3.25	1.24	0.46	3.33
1.33	0.37	3.42	1.24	0.46	3.42	1.25	0.45	3.50
1.35	0.35	3.58	1.25	0.45	3.58	1.26	0.44	3.67
1.38	0.32	3.75	1.26	0.44	3.75	1.27	0.43	3.83
			1.27	0.43	3.92	1.285	0.415	4.00
			1.28	0.42	4.08	1.3	0.4	4.17
			1.3	0.4	4.42	1.315	0.385	4.33
			1.32	0.38	4.75			
			1.34	0.36	5.08			
			1.36	0.34	5.42			
			1.375	0.325	5.75			
			1.4	0.3	6.08			
			1.415	0.285	6.42			
			1.44	0.26	6.75			
			1.45	0.25	7.08			


1st Infiltration Test Results
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Depth of Water (m)
0.00 0.08 0.25 0.42 0.58 0.75 0.92 1.08 1.25 1.42 1.58 1.75 1.92 2.08 2.25 2.42 2.58 2.75 2.92 3.08 3.25 3.42 3.58 3.75 3.92 4.08 4.42 4.75
Time (hours)
'1st Test Results'
'25% Depth of Water'
'75% Depth of Water


2nd Infiltration Test Results
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Depth of Water (m)
0.00 0.08 0.25 0.42 0.58 0.75 0.92 1.08 1.25 1.42 1.58 1.75 1.92 2.08 2.25 2.42 2.58 2.75 2.92 3.08 3.25 3.42 3.58 3.75 3.92 4.08 4.42 4.75 5.08 5.42 5.75 6.08 6.42 6.75 7.08
Time (hours)
'2nd Test Results'
'25% Depth of Water'
'75% Depth of Water


3rd Infiltration Test Results
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Depth of Water (m)
0.00 0.08 0.25 0.42 0.58 0.75 0.92 1.08 1.25 1.42 1.58 1.75 1.92 2.08 2.25 2.42 2.58 2.75 2.92 3.08 3.25 3.42 3.58 3.75 3.92 4.08 4.42 4.75 5.08 5.42 5.75 6.08 6.42 6.75 7.08
Time (hours)
'3rd Test Results'
'25% Depth of Water'
'75% Depth of Water

Infiltration Rate for Test 1

Vp75-25	0.1245
ap50	2.51
tp75-25 (hour)	4.085

Infiltration Rate for Test 2

Vp75-25	0.1245
ap50	2.51
tp75-25 (hour)	6.16

Infiltration Rate for Test 3

Vp75-25	0.1245
ap50	2.51
tp75-25 (hour)	7.165

Soil Infiltration rate f (m/hr)	0.012142373		Soil Infiltration rate f (m/hr)	0.008052207		Soil Infiltration rate f (m/hr)	0.006922763
Soil Infiltration rate f (m/s)	3.37288E-06		Soil Infiltration rate f (m/s)	2.23672E-06		Soil Infiltration rate f (m/s)	1.92299E-06

Soil Infiltration rate to be used for calculations

0.006922763	m/hr
1.92299E-06	m/sec

PHASE 2 REPORT ON A SITE INVESTIGATION

Site

FRIARS GARTH,
THE PARADE, EPSOM,
SURREY KT18 5DH

Client

WELDIN BUILDERS LTD

Report Ref
22/12385/KJC

Issued
JUNE 2022

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DOCUMENT CONTROL			
Report Title	Phase 2 Report on a Site Investigation		
Contract	The Parade, Epsom		
Report Reference	22/12385/KJC		
Client	Weldin Builders Ltd		
Prepared by	**K J Clark** BSc Hons Director	[redacted]	
Reviewed by	**G C D Owens** BSc MSc FGS MIEnvSc Director		
Revision No.	Status	Date of Issue	Final Issue Check
0	Final	27/06/2022	[redacted]

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This Report is prepared for the specific purpose stated and in relation to the development proposals or usage indicated to Albury S.I. Limited at the time of preparation. The recommendations should not be used for adjacent schemes and may not be appropriate for alternative proposals.

The recommendations made and opinions expressed in this Report are based on the strata conditions revealed by the fieldworks as indicated on the exploratory records, together with an assessment of the data from in situ and laboratory tests. No liability can be accepted for conditions which have not been revealed by the fieldworks, for example, between exploratory positions. While this Report may offer opinions on the possible configuration of strata, both between the excavations and below the maximum depth achieved by the investigation, these comments are for guidance only and no liability can be accepted for their accuracy. The data obtained relate to the conditions which are relevant at the time of the investigation.

The groundwater observations entered on exploratory records are those noted at the time of the investigation. The normal rate of progress does not usually permit the recording of any equilibrium water level for any one water strike. It should be noted that groundwater levels are prone to seasonal variation and to changes in local drainage conditions. The word 'none' indicates that groundwater was sealed off by the borehole casing or that no water was observed in the exploratory hole upon completion.

REPORT REF: 22/12385/KJC
CONTRACT: THE PARADE, EPSOM

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FIGURES

APPENDICES

1 INTRODUCTION

The Client proposes to construct a block of flats with associated car parking following the demolition of the existing structures at Friars Garth, The Parade, Epsom ("the site"). Albury SI Ltd completed a Phase 1 Desk Study for the site, report reference 20/11876/KJC, issued in July 2020. Consequently, in order to assist with the discharge of planning conditions an intrusive site investigation has been undertaken to ascertain the nature and engineering properties of the soils underlying the proposed development site and to obtain data which will assist in the formulation of a safe and economical foundation solution. In addition, a geo-environmental appraisal of the site has also been carried out. At the time of the site works, the site was occupied and the existing buildings were present.

In accordance with the Client's requirements the programme of this investigation comprised the construction of a single deep cable percussive borehole and six boreholes using hand-held window sampling techniques. During this work samples were recovered for further examination and laboratory testing. In addition, a number of in situ tests were also performed.

This report describes the work undertaken, presents the information obtained and discusses the ground conditions with respect to foundation design, construction and potential contamination.

2 FIELDWORKS

The boreholes were constructed on 6th and 7th June 2022 at locations as shown on the site plan, drawing no. 22/12385/1, which is presented as Figure 1. The exploratory positions were located in order to provide adequate site coverage taking into account the presence of the existing house and the proposed layout.

The depths and descriptions of the strata encountered in the boreholes are given on the records which comprise Appendix 1 to this report. These records note the depths at which samples were taken, the results of in situ tests and the groundwater observations noted at the time of the fieldworks.

Photographs which give a general impression of the site at the time of the fieldworks are included below.

3 GROUND CONDITIONS

3.1 Geology

Reference has been made to the published 1:50,000 scale British Geological Survey (BGS) digital mapping of the area and the Phase 1 Desk Study. The site is indicated as being underlain by River Terrace Deposits of geologically recent age. These superficial deposits are underlain by the Lambeth Group of Eocene age.

3.2 Stratigraphy

Consideration of the borehole records indicates that made ground varying in composition from dark brown silty sand with brick fragments to paving over concrete was present at the investigatory locations and was shown to extend to depths of between 0.40m and 1.70m.

Granular soils ranging from brown clayey sand with gravel to brown sandy gravel were encountered beneath the made ground and were proved to depths of between 2.30m and 2.80m. These soils are thought to represent the River Terrace Deposits.

Light brown sandy clay to green-grey very sandy clay was observed upon penetration of the River Terrace Deposits and was exposed to the concluding depth of boreholes 2 to 7 at 3.10m and to 6.90m in borehole 1. A thin band of grey-brown sand was observed interbedded within the sandy clay at 5.00m to 5.40m. Dark blue-grey/brown clayey sand was noted beneath the sandy clay, which extended to 8.70m. At this level, blue-grey/brown very sandy clay was exposed and proved to 11.00m. Blue-grey sand was encountered upon penetration of the very sandy clay. This fine grained soil continued to the full depth of borehole 1 at 15.00m. The above soils are collectively considered to represent the Lambeth Group.

3.3 Groundwater

During the construction of the exploratory positions tentative groundwater strikes were estimated at depths of the order of 2.50m within boreholes 2 to 7. In borehole 1 water strikes were noted at 4.70m, 6.90m and 11.00m. Short-term standing water levels upon completion of the boreholes of 3.80m and 2.08m were recorded in boreholes 1 and 5. On completion of the remaining boreholes the excavations were noted to have collapsed in to 2.50m.

3.4 In Situ Testing

During the construction of borehole 1 in situ Standard Penetration Tests [SPT] were performed. The test results are presented in terms of the number of blows to achieve a seating drive for 150mm of penetration, recorded as two 75mm increments and the test drive over 300mm recorded as four 75mm increments. The test drive is used to derive the penetration resistance for that soil layer and is recorded as the uncorrected SPT N value. A penetration resistance or N value of 18 blows/300mm was recorded in the made ground. N values ranging between 9 blows/300mm to 34 blows/300mm were recorded in the upper levels of the Lambeth Group, which, using established correlations, infers a firm to very stiff condition in situ for a cohesive soil or medium dense to dense condition for a granular soil. Three tests were conducted within the soils at the base of the borehole and N values of 85-97 blows/300mm were recorded, which infer that the soils are very dense in nature.

4 LABORATORY TESTING

A programme of laboratory testing has been undertaken and the results are presented as Appendix 2 to this report. The geotechnical soil testing was undertaken by Albury S.I. Ltd, whilst representative samples were submitted for geochemical testing at the UKAS accredited laboratories operated by i2 Analytical Ltd. Each type of test is summarised below and the results obtained have been used to assist in the formulation of the discussion.

4.1 Water Content

The water contents of samples of the soils encountered at this site have been determined. Water contents within the range 15.5% to 20.3% have been recorded.

4.2 Index Properties

The liquid and plastic limits of samples of the clay soils have been determined. The results of this work indicate that the samples tested can generally be described as inorganic clays of low to intermediate plasticity and of low shrinkage potential. In one instance the test sample proved to be non-plastic.

4.3 Particle Size Distribution

Samples of the soils encountered at this site have been subjected to sieve analysis in order to determine the soils' particle size distribution. The results of this work are presented in the form of grading curves.

4.4 Triaxial Compression

The undrained shear strength characteristics of samples of the cohesive soils encountered at this site have been determined by testing 100mm diameter specimens in the triaxial compression apparatus. Under the conditions of this work cohesions of 40kPa and 75kPa were obtained, which is indicative of a firm to stiff condition for a cohesive soil.

4.5 Chemical Testing – Soluble Sulphates & pH

Samples of the soils and groundwater encountered at this site have been subjected to chemical analyses in order to determine their soluble sulphate contents and pH values. Under the conditions of this work low concentrations of soluble sulphate have been recorded in association with near neutral pH values.

4.6 Geochemical Testing

Selected samples of the made ground have been submitted to the UKAS accredited laboratories operated by i2 Analytical Ltd. The testing comprises a suite of typical inorganic and organic priority contaminants including metals, PAH, TPH CWG and an asbestos screen.

5 GEOTECHNICAL DISCUSSION

5.1 Foundations

The Client proposes to construct a new block of flats, which will not incorporate a basement. The proposed layout is shown in Figure 2. At the time of the preparation of this report no information had been provided with respect to the anticipated structural loads.

It cannot be recommended that major structural foundations be located within the made ground revealed by this investigation. Soils of this origin are frequently present in a weak and variable condition such that unacceptable settlement could occur even under the action of light loading intensities. Therefore, it will be necessary to continue foundation excavations through these undesirable materials where they are of less than 1.00m in thickness to this minimum depth in order to avoid that zone of soil which is subject to normal seasonal

moisture variation or frost action. The above precautions need not necessarily be applied to light ancillary structures, which will be formed structurally discrete from the main development and in which a greater degree of settlement can be tolerated.

It is known that a number of trees are present in the vicinity of the proposed structure. A discussion of the causes, effects and classification of desiccation in clay soils is included in Appendix 3 to this report. Consideration of the results of the laboratory testing indicates that moisture deficiency is not present within the cohesive soils encountered at this site. Nevertheless, it will be necessary to ensure that foundations comply with NHBC criteria on the basis that the cohesive soils are of low shrinkage potential.

Interpretation of the data derived from this investigation indicates that non-shrinkable granular soils will be present at a nominal depth of 1.25m beneath the made ground. Cohesive soils were noted to underlie the granular soils at depths of between 2.30m and 2.80m. It is possible that strip or spread foundations, constructed at a minimum depth of 1.00m, compliant with NHBC Criteria can be adopted. It is considered that the brown silty sand is competent to accept a maximum increase in load of 100kPa. At this loading intensity a factor of safety of 3 against general shear failure will be operative. Moreover, settlements should remain within tolerable limits for the type of structure proposed. These movements are likely to be sensibly complete during a normal construction period due to the free draining nature of the underlying soils.

An increased thickness of made ground was recorded to 1.70m depth at the location of borehole 1. Therefore, where required, local extension of foundation excavations should be undertaken to ensure that a consistent founding medium is achieved.

Should it be found that foundation depths do not comply with NHBC Criteria or a greater bearing is required then consideration should be given to use of piles. The design of piles lies outside the scope of this report as it is dependent upon the type of pile employed, its size and bearing capacity. Therefore, when the loadings are known it will be sensible to seek the advice of suitably experienced specialist piling contractors in order to provide a satisfactory solution to the problem. The information given in Appendices 1 and 2 of this report may be used in pile design.

5.2 Stability of Excavations

Excavations of less than 1.00m depth should not require temporary support to their sides. However, where foundation excavations are extended below this level, adequate temporary support or shoring should be provided in order to comply with current statutory safety regulations and to maintain the stability of the excavation sides.

5.3 Groundwater

The groundwater observations noted at the time of the fieldworks suggest that this phenomenon should not represent an engineering problem in respect of shallow depth excavation. Any seepages or surface water run-off accumulating in foundation excavations should be removed expeditiously by the construction of sumps from which the water can be pumped.

5.4 Drainage

The near surface drainage characteristics of the underlying granular soils have not been considered as part of this investigation. It is believed that these may act as a suitable drainage medium and this should be confirmed by carrying out full scale soakaway tests.

5.5 Ground Floor Slabs

The thickness of made ground revealed by this investigation, commonly in excess of 0.60m, infers that a system of fully suspended floor slabs should be incorporated within the proposed structure in accordance with NHBC criteria.

5.6 Buried Concrete

The information obtained from this investigation has been compared with the criteria proposed in BRE Special Digest 1, 2005 Edition, Concrete in Aggressive Ground. Using the information in Table C1 (natural ground) or C2 (brownfield locations) of this publication the Aggressive Chemical Environment for Concrete Classification (ACEC) is AC-1s, which coincides with a Design Sulphate Class DS-1. The ACEC Class above can be used to determine the Design Chemical Class for concrete for general cast-in-situ use as required Part D of the Digest.

6 GROUND CONTAMINATION

A Conceptual Site Model (CSM) was formulated for this site as part of the Phase 1 Desk Study. This report has been used to inform the current Phase 2 intrusive investigation. The CSM produced as part of the Desk Study noted a low risk of the presence of heavy metals and PAH's. The report also highlighted the need for the completion of an asbestos survey on the existing building.

6.1 Human Health

A generic assessment of the chronic or long-term risk to human health from soil contamination has been made using the available generic screening criteria. The screening

values include the Category 4 Screening Levels [C4SLs] (DEFRA, 2014) and Suitable for Use Levels [S4ULs] (LQM/CIEH, 2014) derived using the CLEA software. It should be appreciated that these do not consider the short-term or acute risks, such as to construction workers or SI personnel.

The results have been compared against the criteria for a Residential (with home-grown produce) end-use and appropriate SOM. A study of the data reveals elevated levels of PAH's, namely benzo(a)pyrene and dibenz(a,h)anthracene, which exceed the S4UL GAC in the test sample from borehole 5. Elevated levels of lead were also recorded at the locations of boreholes 1, 2, 3 and 5. Additional testing at these positions revealed elevated levels of lead at 0.50m depth in boreholes 1, 2 and 5. Acceptable PAH levels were recorded at 0.50m in borehole 5.

Remedial measures will need to be implemented as part of the redevelopment. It is recommended that 600mm of material should be removed from all soft landscaped areas. Thereafter, clean material should be placed comprising 450mm of granular subsoil, overlain by a minimum thickness of 150mm of clean topsoil. A formal Remediation Method Statement is likely to be required to satisfy the Local Authority and warranty provider with supplementary validation to confirm the measures have been implemented.

In areas of hard cover, i.e. parking and the proposed block of flats, remedial measures will not be required as the PAH contaminated soils will be removed and replaced as part of road and floor slab construction. Moreover, no viable pathway will exist where hard cover is present.

6.2 Preliminary Waste Assessment

Where excavated soils cannot be re-used or retained on site, then these surplus materials will require off-site disposal. It may be possible to divert the unwanted material to a soil treatment hub where it can be recycled. Where material cannot be re-used or recycled then disposal at a licensed landfill site can be considered. It will then be necessary to classify the spoil as inert, non-hazardous or hazardous. A discussion of the current regime for the classification and treatment of waste soils is included in Appendix 4.

An initial assessment of the geochemical results obtained from this investigation has been carried out to provide a preliminary classification of the surplus materials. The Atkins CAT-WASTE tool determines whether waste soil should be classified as being non-hazardous or hazardous. The output from the CAT-WASTE assessment is located in Appendix 4. Based on the output waste soil arisings from this site have been tentatively identified as being non-hazardous waste. The underlying soils are considered to be inert for disposal purposes. No asbestos was detected in any of the test samples.

This assessment is preliminary and based upon the information obtained from the investigation. Where made ground is excavated then these materials should be stockpiled and segregated. Further sampling, testing and characterisation to accurately classify waste soil arisings may be required. It should be appreciated that it is the responsibility of the waste producer to sufficiently characterise their waste. Moreover, the agreement of the waste acceptor should be sought.

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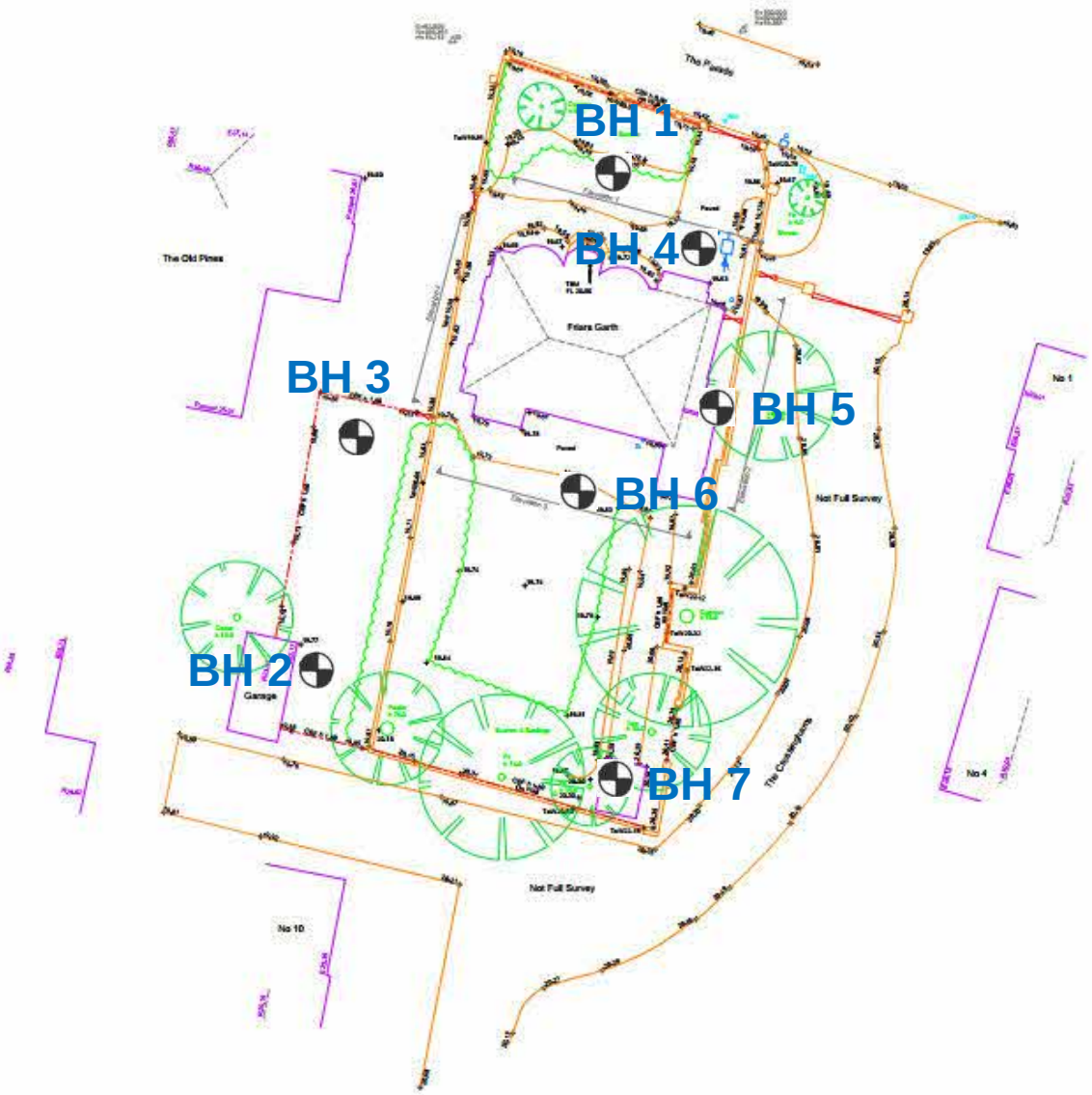
LIST OF ABBREVIATIONS

AOD	-	Above Ordnance Datum
ACM	-	Asbestos-containing Material
AST	-	Above-ground Storage Tank
BGS	-	British Geological Survey
BH	-	Borehole
BRE	-	Building Research Establishment
BSI	-	British Standards Institution
BS	-	British Standard
C4SL	-	Category Four Screening Level
CIRIA	-	Construction Industry Research and Information Association
CP	-	Cable Percussive
DPH	-	Dynamic Probing Heavy
DPSH	-	Dynamic Probing Super Heavy
EA	-	Environment Agency
GAC	-	Generic Assessment Criteria
LL	-	Liquid Limit
mAOD	-	Metres Above Ordnance Datum
mBGL	-	Metres Below Ground Level
mOD	-	Metres Ordnance Datum
OS	-	Ordnance Survey
PAH	-	Polycyclic Aromatic Hydrocarbons
PCB	-	Polychlorinated Biphenyl
PID	-	Photo Ionisation Detector
PL	-	Plastic Limit
PSD	-	Particle Size Distribution
SGV	-	Soil Guideline Value
SOM	-	Soil Organic Matter
SPT	-	Standard Penetration Test
SPZ	-	Source Protection Zone
SVOC	-	Semi-volatile Organic Compounds
TPH	-	Total Petroleum Hydrocarbon
UST	-	Underground Storage Tank
UXB	-	Unexploded Bombs
UXO	-	Unexploded Ordnance
VOC	-	Volatile Organic Compound

FIGURE 1

SITE LAYOUT PLAN



Legend:

Borehole Location

Title:	Site Layout Plan
Dwg No:	22/12385/1
Drawn by:	KJC
Client:	Weldin Builders Ltd
Contract:	The Parade, Epsom
Job Ref:	22/12385/KJC
Scale:	NTS
Revision:	0
Issue Date:	27/06/2022

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Witley, Surrey GU8 5LH
www.alburysi.co.uk

FIGURE 2

PROPOSED LAYOUT

Title:	Proposed Layout
Dwg No:	22/12385/2
Drawn by:	KJC
Client:	Weldin Builders Ltd
Contract:	The Parade, Epsom
Job Ref:	22/12385/KJC
Scale:	NTS
Revision:	0
Issue Date:	27/06/2022

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APPENDIX 1

EXPLORATORY RECORDS

ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH		BOREHOLE	1
Contract	The Parade, Epsom	Report Ref	22/12385/KJC
Client	Weldin Builders Ltd	Ground Level	mAOD
Site Address	Friars Garth, The Parade, Epsom, Surrey KT18 5DH	Date Commenced Date Completed	06/06/2022 06/06/2022
Type & Diameter of Boring	Light Cable Percussion: 150mm diameter	Sheet No	1 of 2

Water Strikes, m		Water levels recorded during boring, m						
1	4.70	Date	06/06/2022	06/06/2022	06/06/2022			
2	6.90	Hole Depth	5.10	15.00	15.00			
3	11.00	Casing Depth	none	12.50	none			
4		Water Level	4.00	11.00	3.80			

Remarks
Starter pit completed to clear services

Samples or Tests		Standard Penetration Tests			Depth m	Legend	Strata Description
Type	Depth, m	Seat	Test Drive	N			
D	0.30						MADE GROUND (dark brown/grey sand with gravel and roots)
B	0.50						
D	1.00				1.00		
D	1.20-1.65	4,4	5,5,4,4	18			MADE GROUND (grey sand and gravel)
D	1.75				1.70		
D	2.00-2.45	1,1	2,2,2,3	9			Loose brown clayey SAND with gravel; gravel reduces with depth
D	2.75				2.60		Firm orange-brown/grey sandy CLAY
U	3.00-3.45						
D	3.75				3.70		
D	4.00-4.45	5,7	7,8,9,10	34			Very stiff green-grey very sandy CLAY
D	5.00-5.45	4,6	7,8,9,8	32	5.00		Dense grey-brown SAND
					5.40		Pale blue-grey/brown very sandy CLAY
D	6.00						
U	6.50-6.95				6.50		Stiff green-grey/brown very sandy CLAY with gravel
					6.90		Medium dense dark blue-grey/brown clayey SAND
D	7.50						
D	8.00-8.45	4,5	6,8,8,7	29			
D	9.00				8.70		Blue-grey very sandy CLAY

Sample Code: U - Intact 100mm Ø B - Large Disturbed D - Small Disturbed W - Water Sample (U)* - Non-recovery of Intact 100mm Ø sample [+] - extrapolated SPT N value

BOREHOLE	1
Contract	The Parade, Epsom
Report Ref	22/12385/KJC

Samples or Tests		Standard Penetration Tests			Depth m	Legend	Strata Description
Type	Depth, m	Seat	Test Drive	N			
							Very stiff blue-grey very sandy CLAY (continued)
D	9.50-9.95	4,7	8,7,8,9	32			
D	10.50						
D	11.00-11.45	10,14	17,18,25,25	85	11.00		
							Very dense blue-grey SAND
D	12.00						
D	12.50-13.00	14,18	20,24,25,25	94			
D	13.50						
D	14.50-14.95	10,17	22,25,25,25	97			
					15.00		END OF BOREHOLE

Sample Code: U - Intact 100mm Ø B - Large Disturbed D - Small Disturbed W - Water Sample (U)* - Non-recovery of Intact 100mm Ø sample [+] - extrapolated SPT N value

ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH			BOREHOLE	2
Contract	The Parade, Epsom		Report Ref	22/12385/KJC
Client	Weldin Builders Ltd		Date	07/06/2022
Site Address	Friars Garth, The Parade, Epsom, Surrey KT18 5DH		Ground Level	
Type of excavator	Window Sampler	Water level after completion, m	blocked @ 2.50	
Water strikes, m	Dimensions, m	Ease of excavation, m		
1 2.60?	Diameter 0.06	Very easy	Difficult GL-1.50	
2		Moderate 1.50-3.10	Very hard	

Remarks
Obstruction at 0.70m on first attempted position

Samples or tests		Shear Strength kPa	Depth	Legend	Strata Description
Type	Depth, m				
D	0.10				MADE GROUND (grass over brown silty SAND with occasional brick fragments)
D	0.30				
D	0.50				
D	1.00				
			1.10		
D	1.30				Orange-brown silty SAND with seams of grey sandy clay with roots (1.30m)
D	1.50				
D	2.00				
			2.20		
					Brown SAND with rare gravel
D	2.50				
			2.60		
					Pale grey/brown sandy CLAY
D	3.00				
			3.10		END OF BOREHOLE

Sample Code: B - Large Disturbed D - Small Disturbed W - Water Sample R - Root Sample T - Tube Liner

ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH			BOREHOLE	3
Contract	The Parade, Epsom		Report Ref	22/12385/KJC
Client	Weldin Builders Ltd		Date	07/06/2022
Site Address	Friars Garth, The Parade, Epsom, Surrey KT18 5DH		Ground Level	
Type of excavator	Window Sampler	Water level after completion, m	blocked @ 2.50	
Water strikes, m	Dimensions, m	Ease of excavation, m		
1 2.50?	Diameter 0.06	Very easy	Difficult GL-1.00	
2		Moderate 1.00-3.10	Very hard	

Remarks

Samples or tests		Shear Strength kPa	Depth	Legend	Strata Description
Type	Depth, m				
D	0.10				MADE GROUND (grass over dark brown/grey silty SAND with extensive brick in the upper margins)
D	0.30				
D	0.50				
D	1.00		1.10		
					Orange-brown SAND with rare gravel
D	1.50				
			1.70		
					Brown/grey gravelly SAND
D	2.00				
D	2.50				
			2.60		
					Light brown very sandy CLAY
D	3.00				
			3.10		END OF BOREHOLE

Sample Code: B - Large Disturbed D - Small Disturbed W - Water Sample R - Root Sample T - Tube Liner

ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH		BOREHOLE	4
Contract	The Parade, Epsom	Report Ref	22/12385/KJC
Client	Weldin Builders Ltd	Date	07/06/2022
Site Address	Friars Garth, The Parade, Epsom, Surrey KT18 5DH	Ground Level	

Type of excavator	Window Sampler	Water level after completion, m	blocked @ 2.50

Water strikes, m		Dimensions, m		Ease of excavation, m			
1	2.50?	Diameter	0.06	Very easy		Difficult	GL-1.00
2				Moderate	1.00-3.10	Very hard	

Remarks

Samples or tests		Shear Strength kPa	Depth	Legend	Strata Description
Type	Depth, m				
			0.10		MADE GROUND (paving over concrete)
D	0.20				MADE GROUND (grey/brown silty SAND with gravel and brick/ concrete fragments)
D	0.50				
			0.70		MADE GROUND (dark grey-brown clayey SAND with occasional gravel at depth)
D	1.00				
			1.20		Orange-brown SAND with rare gravel
D	1.50				
D	2.00				
D	2.50				
			2.60		
D	2.70				Green-grey/brown sandy CLAY with rare gravel
D	3.00				
			3.10		END OF BOREHOLE

Sample Code: B - Large Disturbed D - Small Disturbed W - Water Sample R - Root Sample T - Tube Liner

ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH			BOREHOLE	5
Contract	The Parade, Epsom		Report Ref	22/12385/KJC
Client	Weldin Builders Ltd		Date	07/06/2022
Site Address	Friars Garth, The Parade, Epsom, Surrey KT18 5DH		Ground Level	
Type of excavator	Window Sampler	Water level after completion, m	2.08	

Water strikes, m		Dimensions, m		Ease of excavation, m			
1	2.50?	Diameter	0.06	Very easy		Difficult	GL-1.00
2				Moderate	1.00-3.10	Very hard	

Remarks

Samples or tests		Shear Strength kPa	Depth	Legend	Strata Description
Type	Depth, m				
			0.10		MADE GROUND (concrete)
D	0.20				MADE GROUND (grey becoming dark brown silty SAND with gravel and brick fragments)
D	0.50				
			0.90		
D	1.00				Orange-brown SAND with gravel (tiny amount of chalk present on boundary @ 2.8m)
D	1.50				
D	2.00				
D	2.50				
			2.80		
D	3.00				Green-grey/brown sandy CLAY
			3.10		END OF BOREHOLE
W	(2.08)				

Sample Code: B - Large Disturbed D - Small Disturbed W - Water Sample R - Root Sample T - Tube Liner

ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH			BOREHOLE	6
Contract	The Parade, Epsom		Report Ref	22/12385/KJC
Client	Weldin Builders Ltd		Date	07/06/2022
Site Address	Friars Garth, The Parade, Epsom, Surrey KT18 5DH		Ground Level	
Type of excavator	Window Sampler	Water level after completion, m	blocked @ 2.50	
Water strikes, m	Dimensions, m	Ease of excavation, m		
1 2.50?	Diameter 0.06	Very easy	Difficult	
2		Moderate 1.50-3.10	Very hard GL-1.50	

Remarks

Samples or tests		Shear Strength kPa	Depth	Legend	Strata Description
Type	Depth, m				
D	0.10				MADE GROUND (grass over dark grey/brown silty SAND with gravel and roots)
D	0.30				
D	0.50				
			0.80		
D	1.00				Brown sandy GRAVEL; becoming gravelly SAND
D	1.50				
D	2.00				
D	2.50				
			2.60		
D	2.75				Pale grey/orange-brown sandy CLAY
D	3.00				
			3.10		END OF BOREHOLE

Sample Code: B - Large Disturbed D - Small Disturbed W - Water Sample R - Root Sample T - Tube Liner

ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH				BOREHOLE	7
Contract	The Parade, Epsom			Report Ref	22/12385/KJC
Client	Weldin Builders Ltd			Date	07/06/2022
Site Address	Friars Garth, The Parade, Epsom, Surrey KT18 5DH			Ground Level	
Type of excavator	Window Sampler	Water level after completion, m		blocked @ 2.50	
Water strikes, m	Dimensions, m	Ease of excavation, m			
1 2.50?	Diameter 0.06	Very easy		Difficult	1.30-1.80
2		Moderate	1.80-3.10	Very hard	GL-1.30

Remarks

Samples or tests		Shear Strength kPa	Depth	Legend	Strata Description
Type	Depth, m				
D	0.10				MADE GROUND (grass over dark grey/brown silty SAND with fine gravel and roots)
D	0.30				
			0.40		
D	0.50				Brown SAND AND GRAVEL
D	1.00				
			1.20		
					Brown silty SAND with rare gravel
D	1.50				
D	2.00				
			2.30		
					Grey/brown sandy CLAY
D	2.50				
D	3.00				
			3.10		END OF BOREHOLE

Sample Code: B - Large Disturbed D - Small Disturbed W - Water Sample R - Root Sample T - Tube Liner

APPENDIX 2

LABORATORY TEST RESULTS

INDEX PROPERTIES & TRIAXIAL COMPRESSION TESTS

BS 1377 : Parts 2 & 7 : 1990

Report Ref	22/12385/KJC	Contract	The Parade, Epsom

BH/TP No.	Sample		INDEX PROPERTIES						TRIAXIAL COMPRESSION							Remarks
	Depth m	Description	Liquid Limit %	Plastic Limit %	Plasticity Index %	% Passing 425micron Sieve	Corrected Plasticity Index IP %	Soil Plasticity	Code	Lateral Pressure kPa	Compressive Strength kPa	Cohesion kPa	Angle of Friction °	Bulk Density kg/cu.m	Water Content % dry wt	
BH 1	2.00	Brown clayey sand with gravel				73		NP							15.8	Non-plastic
	3.00-3.45	Orange-brown/grey sandy clay							U100	70	75	40	0	2280	20.3	
	6.50-6.95	Green-grey/brown very sandy clay with gravel	31	20	11	76	8	CL	U100	140	150	75	0	2045	15.3	
BH 2	3.00	Pale grey/brown sandy clay	34	14	20	91	18	CL							19.6	
BH 4	2.70	Green-grey/brown sandy clay	30	15	15	91	14	CL							16.1	
BH 6	2.75	Pale grey/orange-brown sandy clay	35	15	20	94	19	CL/CI							16.6	

KEY:

Code: 38 - 38mm nominal diameter specimen; 100 - 100mm nominal diameter specimen; R - Remoulded; F - Functional; LV - Laboratory Vane

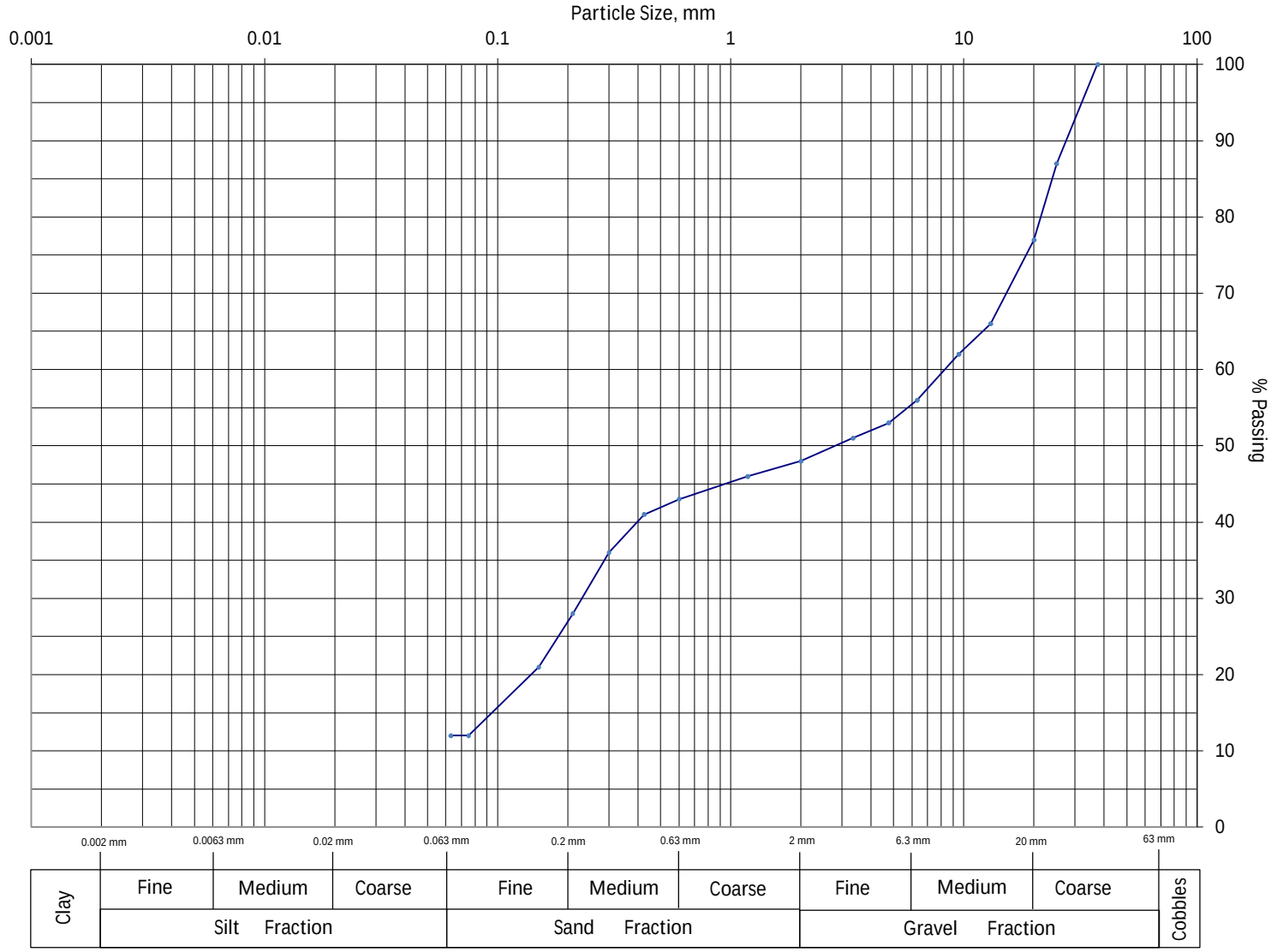
U - Undrained; CD - Consolidated Drained; CU - Consolidated Undrained; M - Multi Stage; S - Single Stage

Soil Type: C - Clay; M - Silt; O - Organic; NP - Non Plastic

Plasticity: L - Low; I - Intermediate; H - High; V - Very High; E - Extremely High

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 : Part 2 : Clauses 9.2, 9.3 : 1990 Particle Size Distribution by Wet/Dry Sieving Method



BS Test Sieve Aperture Size (mm)	Percentage Passing
75	
63	
50	
37.5	100
25	87
20	77
13	66
9.5	62
6.3	56
4.75	53
3.35	51
2	48
1.18	46
0.6	43
0.425	41
0.3	36
0.21	28
0.15	21
0.075	12
0.063	12

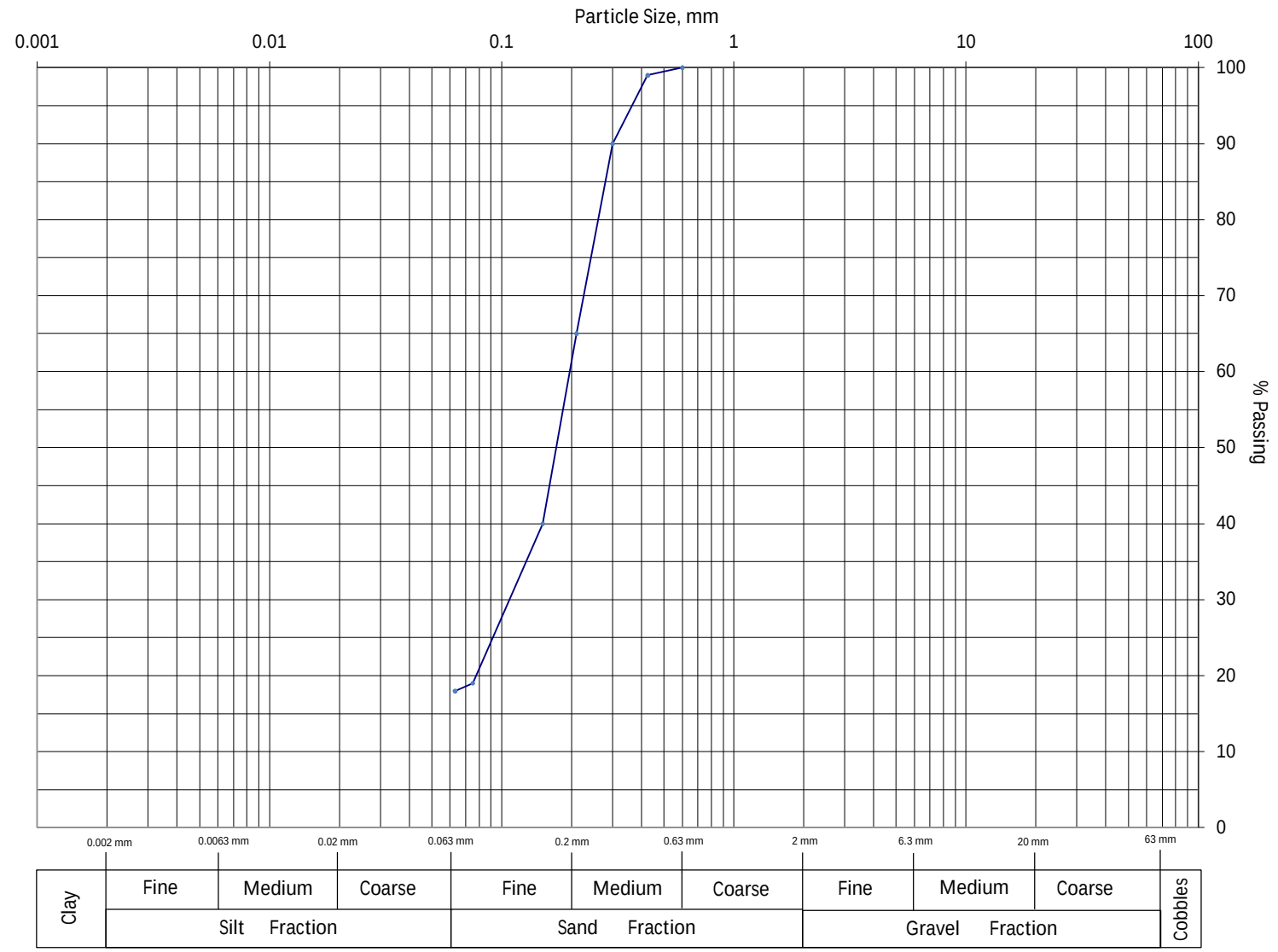
Particle Proportions (%)	
Cobbles	0
Gravel	52
Sand	36
Silt & Clay	12

BH/TP No.	1	Depth, m	1.20-1.65	Report Ref	22/12385/KJC
Visual Description	Made ground (grey sand and gravel)			Contract	The Parade, Epsom

ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 : Part 2 : Clauses 9.2, 9.3 : 1990 Particle Size Distribution by Wet/Dry Sieving Method



BS Test Sieve Aperture Size (mm)	Percentage Passing
75	
63	
50	
37.5	
25	
20	
13	
9.5	
6.3	
4.75	
3.35	
2	
1.18	
0.6	100
0.425	99
0.3	90
0.21	65
0.15	40
0.075	19
0.063	18

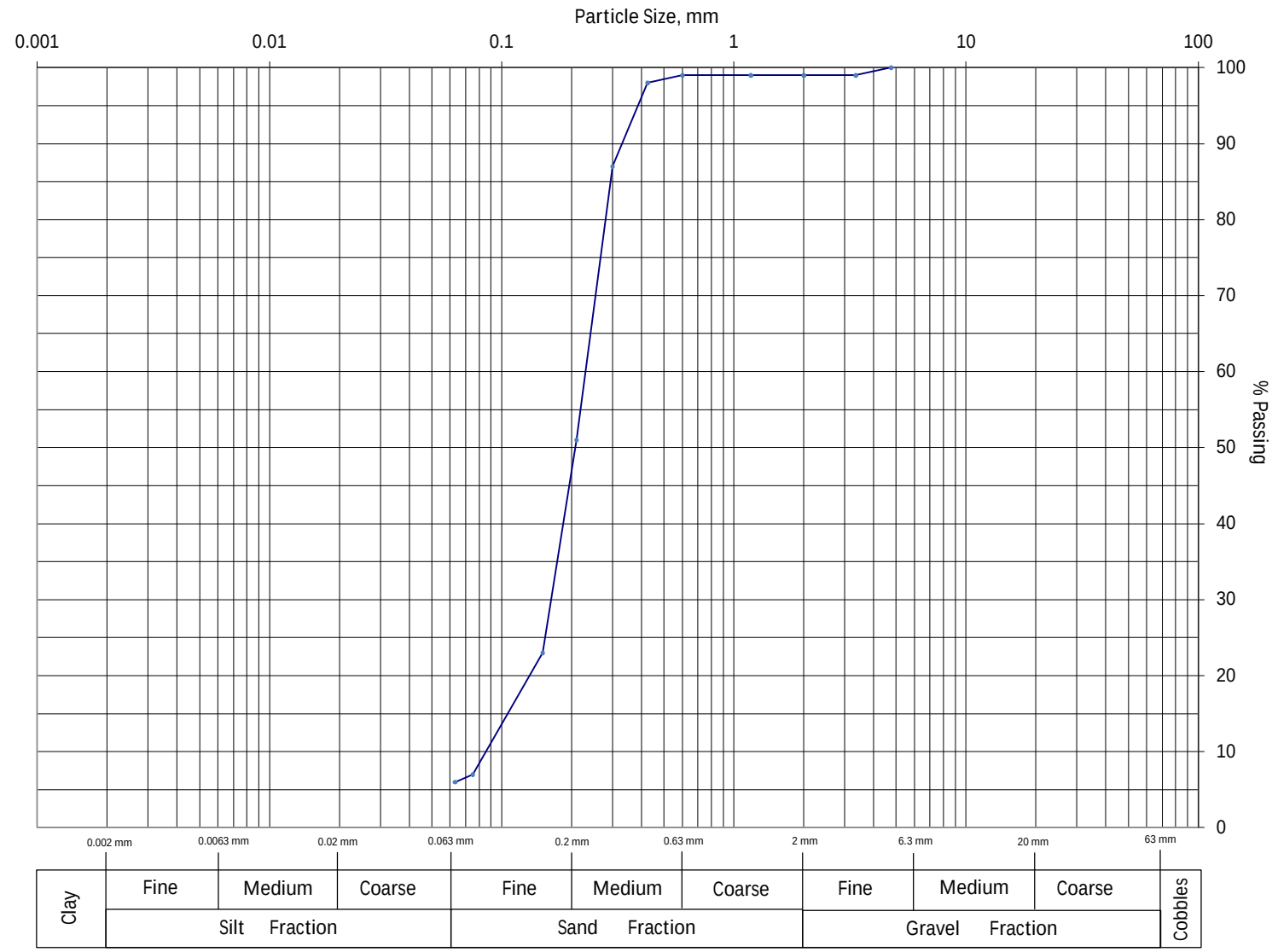
Particle Proportions (%)	
Cobbles	0
Gravel	0
Sand	82
Silt & Clay	18

BH/TP No.	2	Depth, m	1.30	Report Ref	22/12385/KJC
Visual Description	Orange-brown silty sand with rare seams of grey sandy clay			Contract	The Parade, Epsom

ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 : Part 2 : Clauses 9.2, 9.3 : 1990 Particle Size Distribution by Wet/Dry Sieving Method



BS Test Sieve Aperture Size (mm)	Percentage Passing
75	
63	
50	
37.5	
25	
20	
13	
9.5	
6.3	
4.75	100
3.35	99
2	99
1.18	99
0.6	99
0.425	98
0.3	87
0.21	51
0.15	23
0.075	7
0.063	6

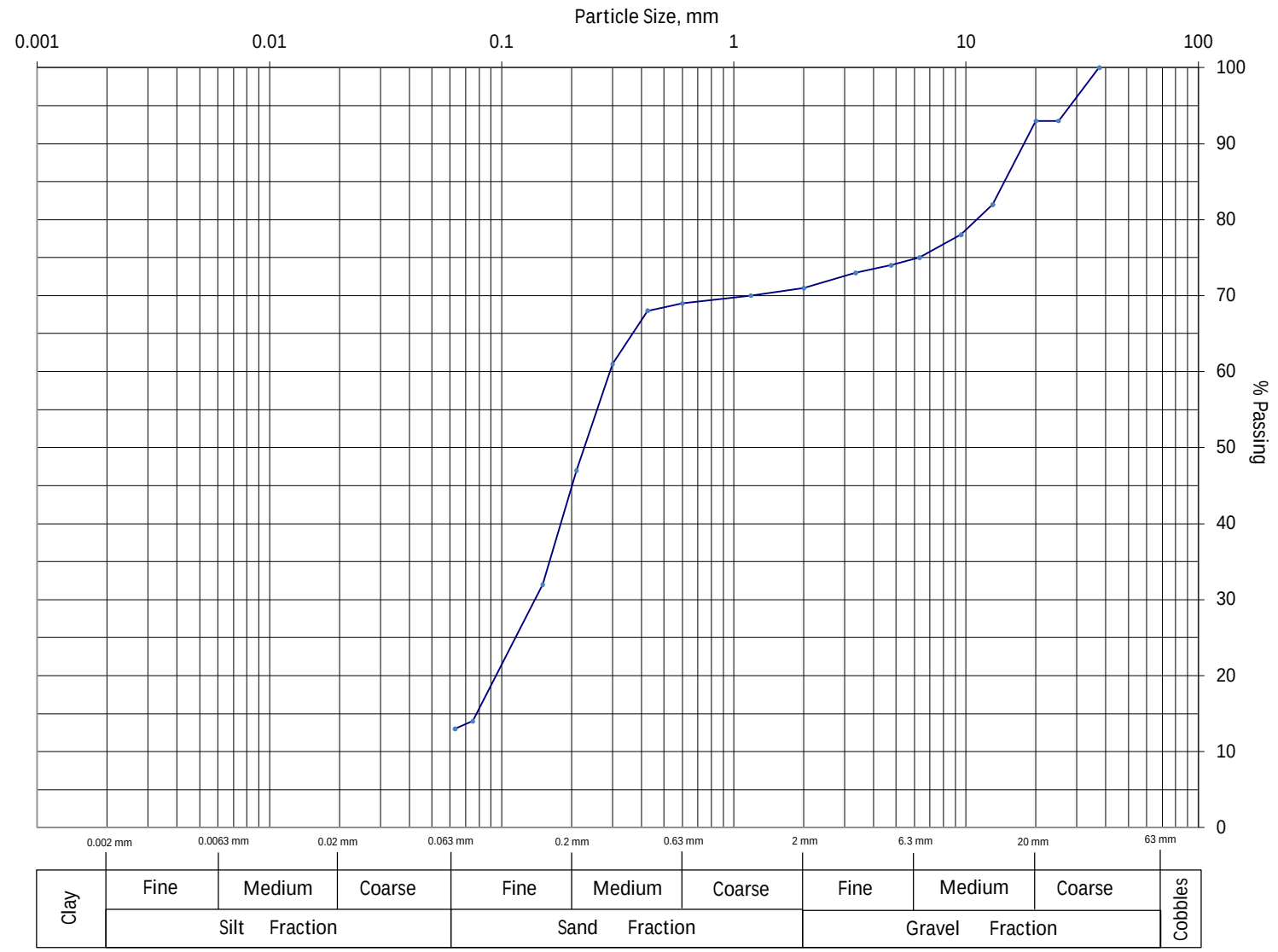
Particle Proportions (%)	
Cobbles	0
Gravel	1
Sand	93
Silt & Clay	6

BH/TP No.	3	Depth, m	1.50	Report Ref	22/12385/KJC
Visual Description	Orange-brown sand with rare gravel			Contract	The Parade, Epsom

ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 : Part 2 : Clauses 9.2, 9.3 : 1990 Particle Size Distribution by Wet/Dry Sieving Method



BS Test Sieve Aperture Size (mm)	Percentage Passing
75	
63	
50	
37.5	100
25	93
20	93
13	82
9.5	78
6.3	75
4.75	74
3.35	73
2	71
1.18	70
0.6	69
0.425	68
0.3	61
0.21	47
0.15	32
0.075	14
0.063	13

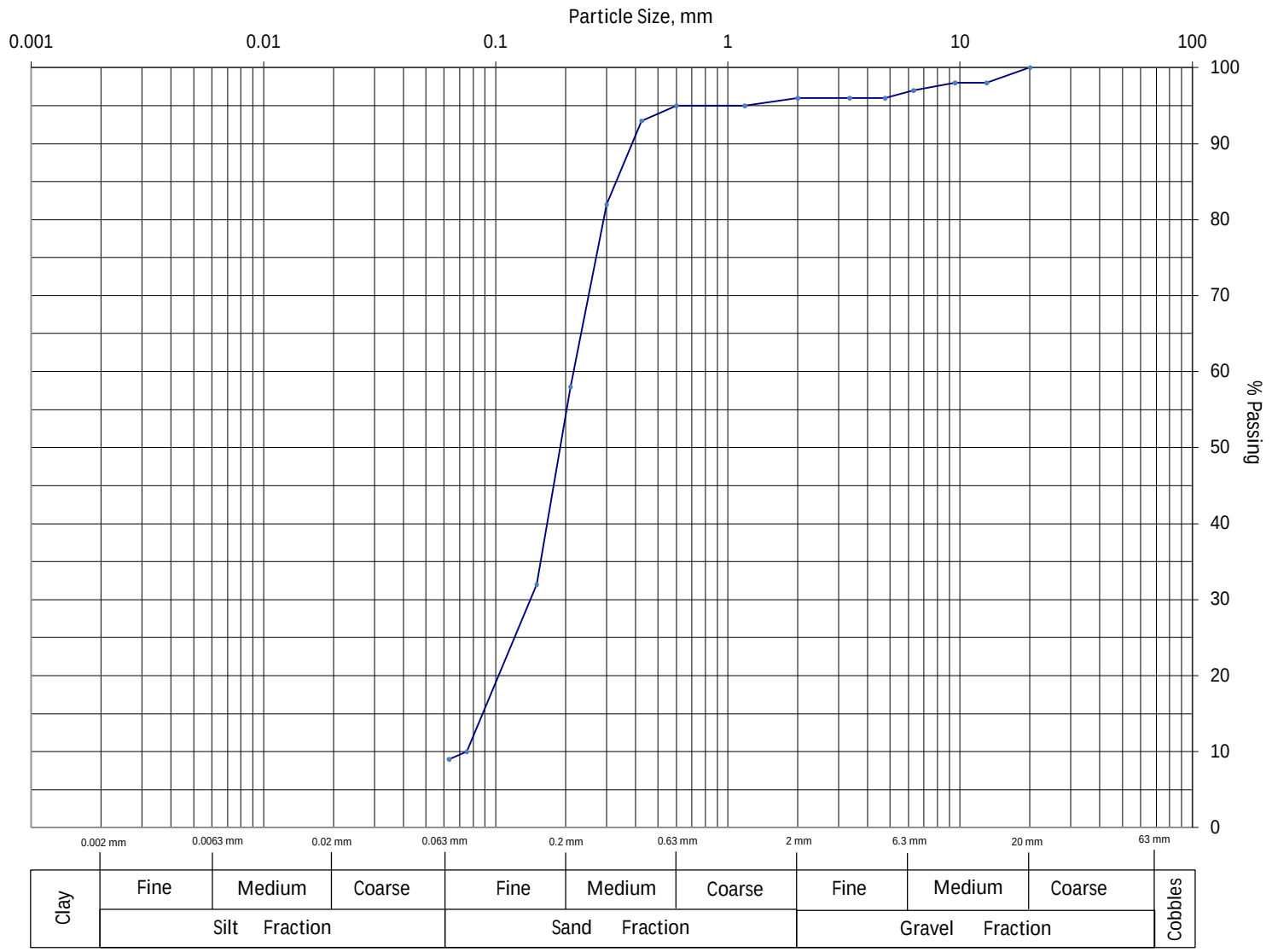
Particle Proportions (%)	
Cobbles	0
Gravel	29
Sand	58
Silt & Clay	13

BH/TP No.	3	Depth, m	2.50	Report Ref	22/12385/KJC
Visual Description	Brown/grey gravelly sand			Contract	The Parade, Epsom

ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 : Part 2 : Clauses 9.2, 9.3 : 1990 Particle Size Distribution by Wet/Dry Sieving Method



BS Test Sieve Aperture Size (mm)	Percentage Passing
75	
63	
50	
37.5	
25	
20	100
13	98
9.5	98
6.3	97
4.75	96
3.35	96
2	96
1.18	95
0.6	95
0.425	93
0.3	82
0.21	58
0.15	32
0.075	10
0.063	9

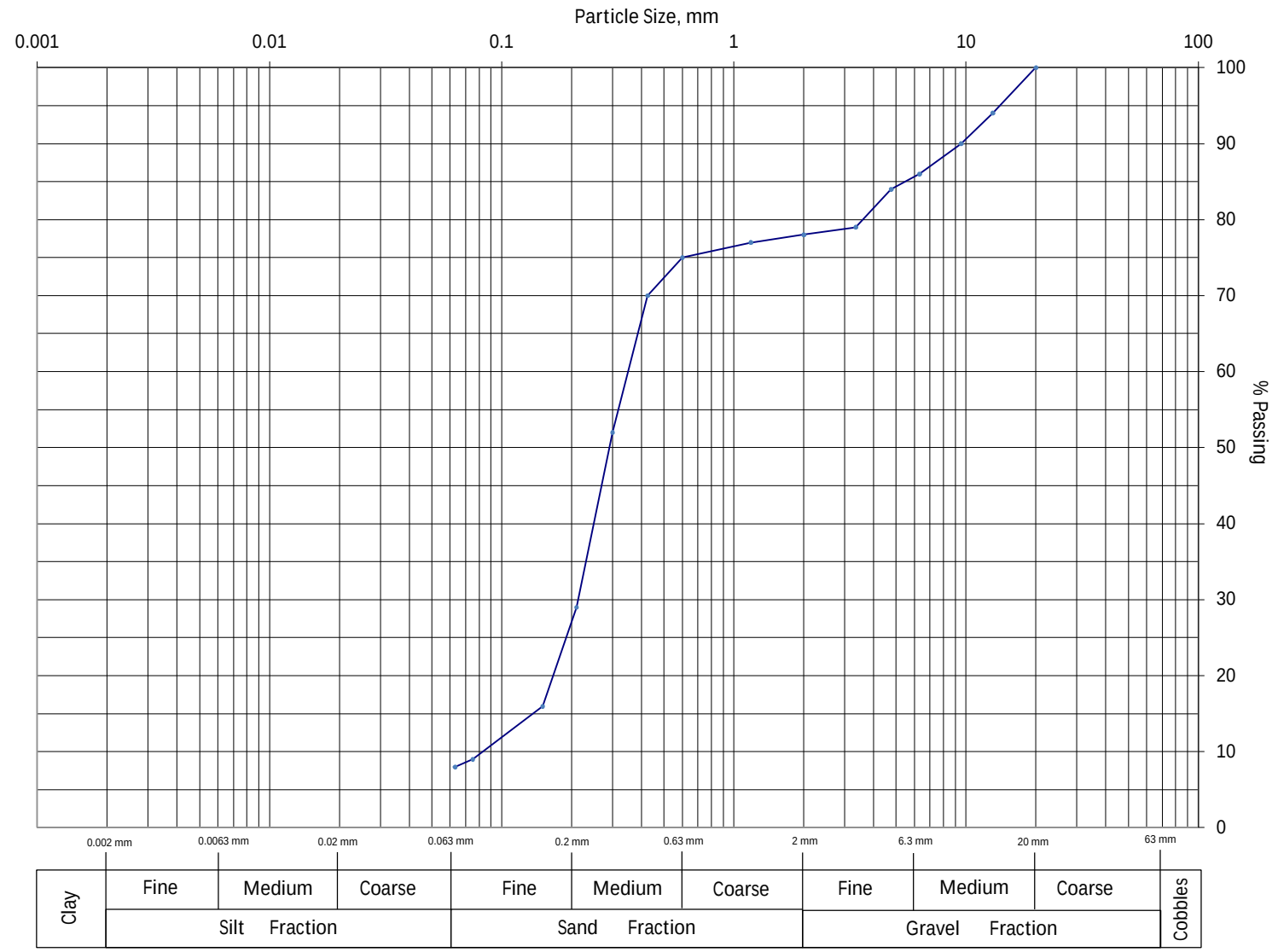
Particle Proportions (%)	
Cobbles	0
Gravel	4
Sand	87
Silt & Clay	9

BH/TP No.	4	Depth, m	1.50	Report Ref	22/12385/KJC
Visual Description	Orange-brown sand with rare gravel			Contract	The Parade, Epsom

ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 : Part 2 : Clauses 9.2, 9.3 : 1990 Particle Size Distribution by Wet/Dry Sieving Method



BS Test Sieve Aperture Size (mm)	Percentage Passing
75	
63	
50	
37.5	
25	
20	100
13	94
9.5	90
6.3	86
4.75	84
3.35	79
2	78
1.18	77
0.6	75
0.425	70
0.3	52
0.21	29
0.15	16
0.075	9
0.063	8

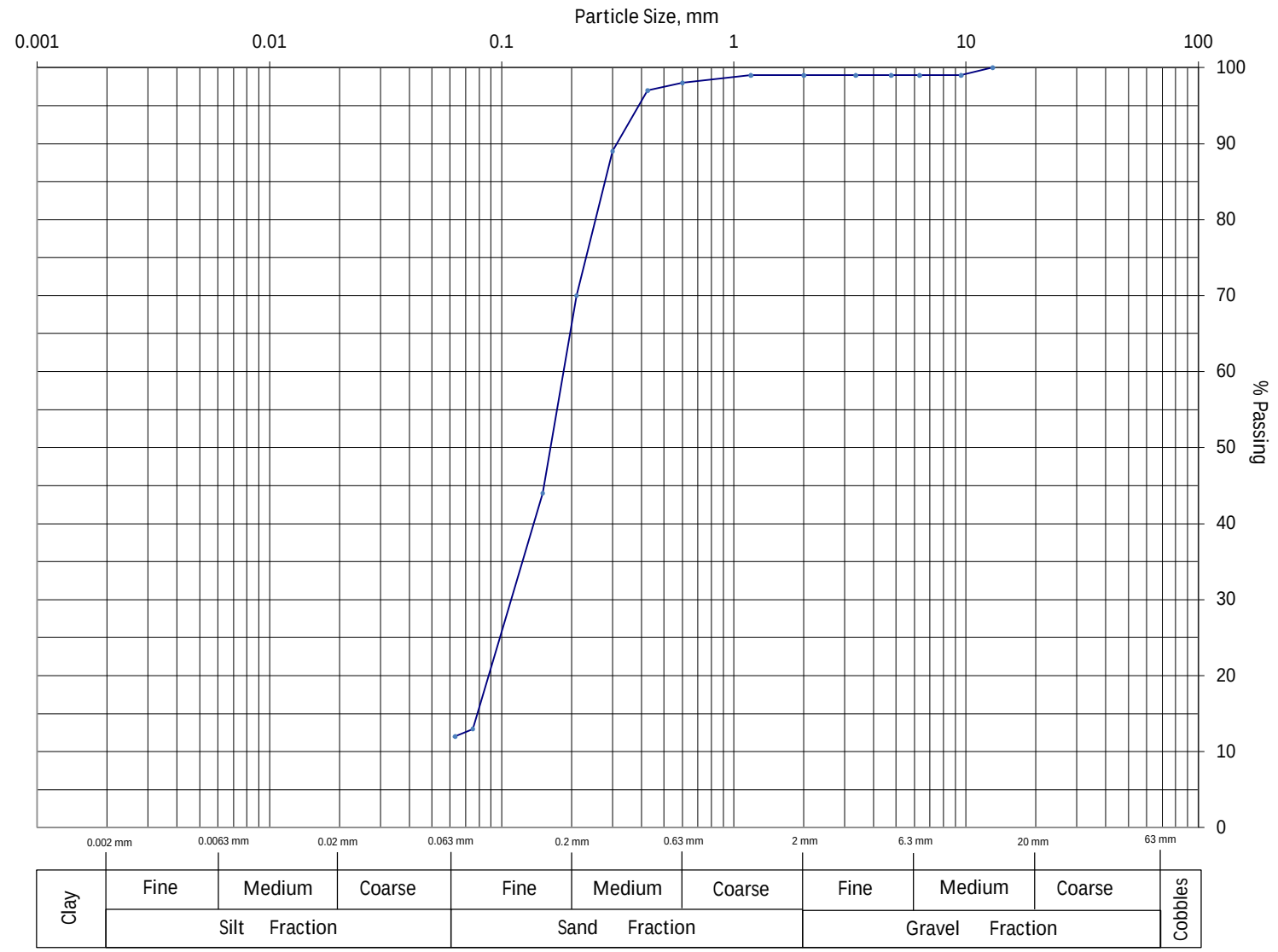
Particle Proportions (%)	
Cobbles	0
Gravel	22
Sand	70
Silt & Clay	8

BH/TP No.	5	Depth, m	1.00	Report Ref	22/12385/KJC
Visual Description	Orange-brown sand with gravel			Contract	The Parade, Epsom

ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 : Part 2 : Clauses 9.2, 9.3 : 1990 Particle Size Distribution by Wet/Dry Sieving Method



BS Test Sieve Aperture Size (mm)	Percentage Passing
75	
63	
50	
37.5	
25	
20	
13	100
9.5	99
6.3	99
4.75	99
3.35	99
2	99
1.18	99
0.6	98
0.425	97
0.3	89
0.21	70
0.15	44
0.075	13
0.063	12

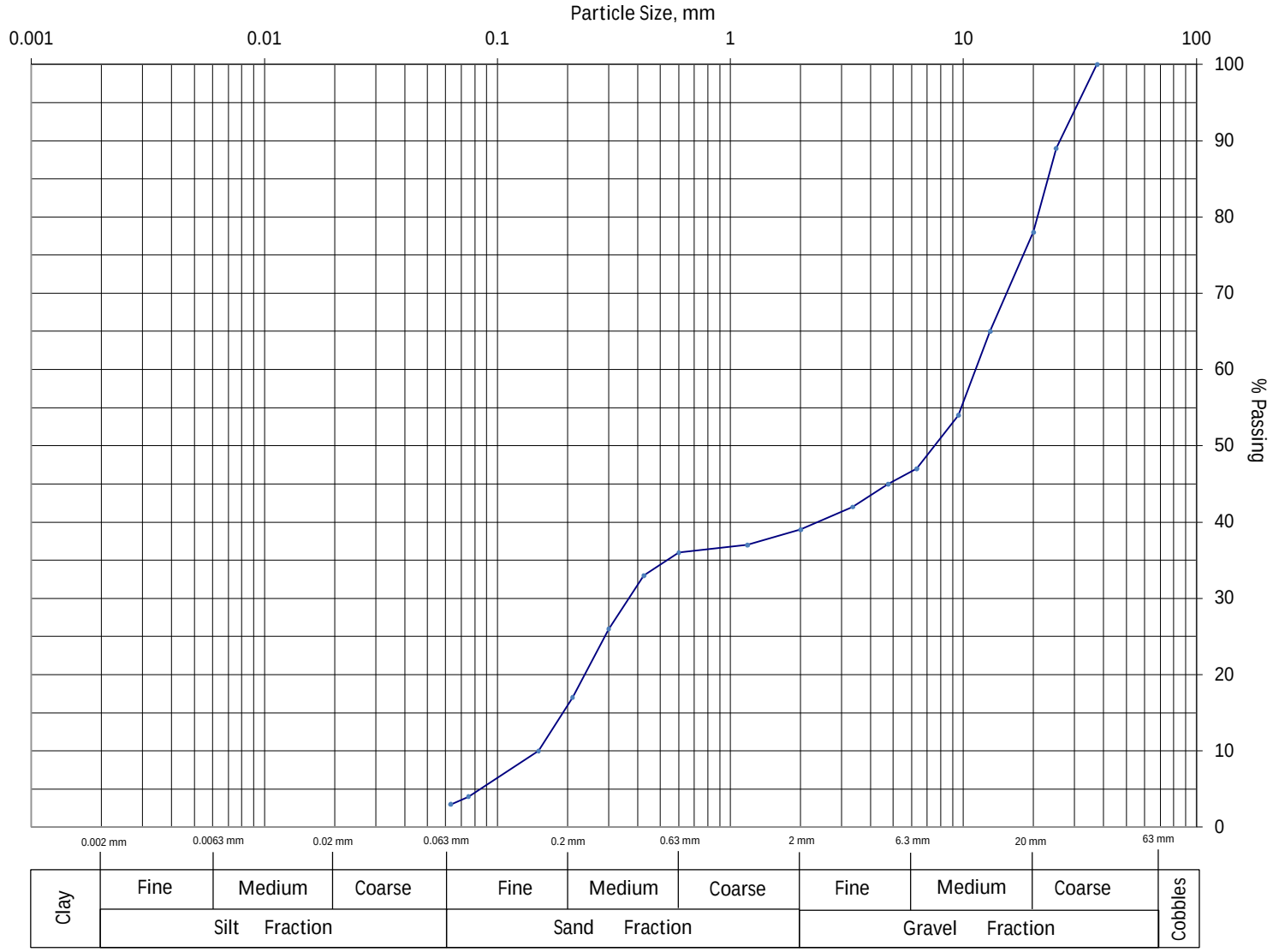
Particle Proportions (%)	
Cobbles	0
Gravel	1
Sand	87
Silt & Clay	12

BH/TP No.	5	Depth, m	2.00	Report Ref	22/12385/KJC
Visual Description	Orange-brown sand with rare gravel			Contract	The Parade, Epsom

ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 : Part 2 : Clauses 9.2, 9.3 : 1990 Particle Size Distribution by Wet/Dry Sieving Method



BS Test Sieve Aperture Size (mm)	Percentage Passing
75	
63	
50	
37.5	100
25	89
20	78
13	65
9.5	54
6.3	47
4.75	45
3.35	42
2	39
1.18	37
0.6	36
0.425	33
0.3	26
0.21	17
0.15	10
0.075	4
0.063	3

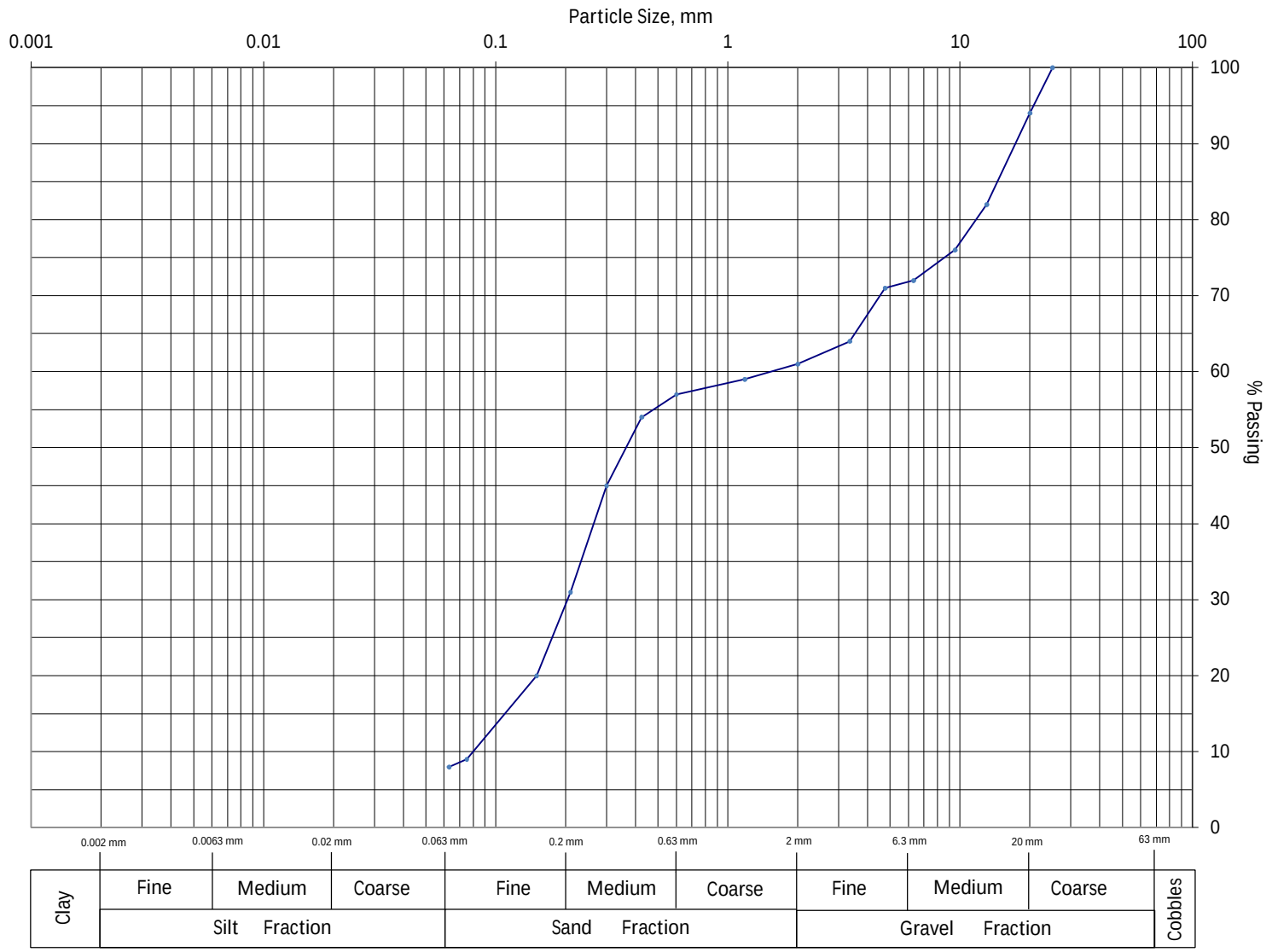
Particle Proportions (%)	
Cobbles	0
Gravel	61
Sand	36
Silt & Clay	3

BH/TP No.	6	Depth, m	1.00	Report Ref	22/12385/KJC
Visual Description	Brown sandy gravel			Contract	The Parade, Epsom

ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 : Part 2 : Clauses 9.2, 9.3 : 1990 Particle Size Distribution by Wet/Dry Sieving Method



BS Test Sieve Aperture Size (mm)	Percentage Passing
75	
63	
50	
37.5	
25	100
20	94
13	82
9.5	76
6.3	72
4.75	71
3.35	64
2	61
1.18	59
0.6	57
0.425	54
0.3	45
0.21	31
0.15	20
0.075	9
0.063	8

Particle Proportions (%)	
Cobbles	0
Gravel	39
Sand	53
Silt & Clay	8

BH/TP No.	6	Depth, m	2.00	Report Ref	22/12385/KJC
Visual Description	Brown gravelly sand			Contract	The Parade, Epsom

ALBURY S.I. LTD Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH

SUMMARY OF CHEMICAL ANALYSES

Determination of Soluble Sulphate Contents of Soil and Groundwater, Organic Matter Content and pH Value

Report Ref	22/12385/KJC	Contract	The Parade, Epsom

BH/TP No.	Sample			Concentration of Sulphates expressed as SO_4		pH Value	Organic Content %
	Depth m	Soil Type	% passing 2mm sieve	2:1 Water:Soil Extract mg/l	Groundwater mg/l		
BH1	0.50	Made ground	90	<250		7.2	
	1.20-1.65	Made ground	53	<250		7.6	
	3.00-3.45	Sandy clay	99	<250		7.7	
	6.50-6.95	Sandy clay with gravel	84	<250		8.1	
	11.00	Silty sand	100	436		6.1	
BH2	1.00	Made ground	47	<250		7.7	
	2.00	Silty sand with rare gravel	99	<250		7.9	
BH3	1.50	Silty sand and gravel	99	<250		7.9	
BH4	2.70	Sandy clay with rare gravel	98	<250		8.0	
BH5	1.00	Silty sand with gravel	78	<250		7.9	
	2.08	Water			<80	7.6	
BH6	2.00	Silty sand with gravel	61	<250		8.0	

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Analytical Report Number : 22-63376

Project / Site name:	The Parade Epsom	**Samples received on:**	08/06/2022
Your job number:	22 12385	**Samples instructed on/ Analysis started on:**	08/06/2022
Your order number:	14494	**Analysis completed by:**	15/06/2022
Report Issue Number:	1	**Report issued on:**	15/06/2022
Samples Analysed:	5 soil samples		

Signed [redacted]

Adam Fenwick
Technical Reviewer
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

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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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 22-63376
Project / Site name: The Parade Epsom
Your Order No: 14494

Lab Sample Number				2305142	2305143	2305144	2305145	2305146
Sample Reference				1	2	3	5	7
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.10	0.30	0.20	0.10
Date Sampled				07/06/2022	07/06/2022	07/06/2022	07/06/2022	07/06/2022
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	46	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	7.7	11	5.5	5.8	13
Total mass of sample received	kg	0.001	NONE	0.6	0.6	0.6	0.6	0.6
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	DSA	DSA	DSA	DSA	DSA
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	7.9	7.7	8.0	10.4	4.9
Total Cyanide	mg/kg	1	MCERTS	< 1.0	2.5	< 1.0	< 1.0	2.5
Total Sulphate as SO4	mg/kg	50	MCERTS	510	690	650	3000	790
Water Soluble Sulphate as SO4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	27	43	63	300	130
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.014	0.022	0.031	0.15	0.067
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	13.6	21.5	31.3	151	66.5
Sulphide	mg/kg	1	MCERTS	20	12	12	9.3	12
Elemental Sulphur	mg/kg	5	MCERTS	< 5.0	37	< 5.0	< 5.0	< 5.0
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	2.1	1.7	1.8	0.9	-
Total Organic Carbon (TOC) – Manual	%	0.1	MCERTS	-	-	-	-	10
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	3
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	0.2	< 0.05	0.86	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	1.2	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	1.5	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.96	0.92	1	12	0.45
Anthracene	mg/kg	0.05	MCERTS	0.22	0.26	0.25	2.5	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	2.7	2.6	2.2	11	1.1
Pyrene	mg/kg	0.05	MCERTS	2.3	2.4	2	8.9	1.1
Benzo(a)anthracene	mg/kg	0.05	MCERTS	2	1.6	1.5	4.9	0.86
Chrysene	mg/kg	0.05	MCERTS	1.5	1.7	1.1	4.2	0.7
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	2.1	2.1	1.7	3.6	0.82
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	1.2	1.1	0.82	1.8	0.51
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.9	1.8	1.4	3.3	0.64
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.1	1.2	0.81	1.6	0.5
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.24	0.28	0.22	0.41	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.2	1.4	1.1	1.9	0.57
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	17.3	17.5	14.1	59.4	7.28

Analytical Report Number: 22-63376
Project / Site name: The Parade Epsom
Your Order No: 14494

Lab Sample Number				2305142	2305143	2305144	2305145	2305146
Sample Reference				1	2	3	5	7
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.10	0.30	0.20	0.10
Date Sampled				07/06/2022	07/06/2022	07/06/2022	07/06/2022	07/06/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	21	21	22	16	11
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.89	0.8	0.9	0.66	0.58
Boron (water soluble)	mg/kg	0.2	MCERTS	0.7	0.6	0.4	0.9	1
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.2	NONE	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (III)	mg/kg	1	NONE	22	24	22	22	15
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	22	24	22	23	16
Copper (aqua regia extractable)	mg/kg	1	MCERTS	36	45	34	23	38
Lead (aqua regia extractable)	mg/kg	1	MCERTS	460	290	390	210	200
Manganese (aqua regia extractable)	mg/kg	1	MCERTS	340	290	370	260	170
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.9	1.3	0.6	0.6	0.6
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	16	20	18	15	10
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	38	40	41	38	26
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	170	130	190	160	72
Monoaromatics & Oxygenates								
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 C6 - C40 $_{EH\_CU+HS\_CU\_1D\_TOTAL}$	mg/kg	10	NONE	50	43	39	100	86
TPH-CWG - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 $_{EH\_CU\_1D\_AL}$	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 $_{EH\_CU\_1D\_AL}$	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC40 $_{EH\_CU\_1D\_AL}$	mg/kg	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic > EC35 - EC44 $_{EH\_CU\_1D\_AL}$	mg/kg	8.4	NONE	< 8.4	< 8.4	< 8.4	< 8.4	< 8.4
TPH-CWG - Aliphatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AL}$	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic (EC5 - EC44) $_{EH\_CU+HS\_1D\_AL}$	mg/kg	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 $_{EH\_CU\_1D\_AR}$	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 $_{EH\_CU\_1D\_AR}$	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	13	12
TPH-CWG - Aromatic >EC16 - EC21 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	12	13	13	31	20
TPH-CWG - Aromatic >EC21 - EC35 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	33	29	26	47	54
TPH-CWG - Aromatic >EC21 - EC40 $_{EH\_CU\_1D\_AR}$	mg/kg	10	NONE	38	29	26	55	54
TPH-CWG - Aromatic > EC35 - EC44 $_{EH\_CU\_1D\_AR}$	mg/kg	8.4	NONE	< 8.4	< 8.4	< 8.4	8.5	< 8.4
TPH-CWG - Aromatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AR}$	mg/kg	10	MCERTS	44	43	39	91	86
TPH-CWG - Aromatic (EC5 - EC44) $_{EH\_CU+HS\_1D\_AR}$	mg/kg	10	NONE	44	43	39	100	86

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

Analytical Report Number : 22-63376
Project / Site name: The Parade Epsom

* 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 *
2305142	1	None Supplied	0.3	Brown loam and clay with gravel and vegetation.
2305143	2	None Supplied	0.1	Brown loam and clay with gravel and vegetation.
2305144	3	None Supplied	0.3	Brown loam and clay with stones and vegetation.
2305145	5	None Supplied	0.2	Brown loam and clay with gravel and vegetation.
2305146	7	None Supplied	0.1	Brown loam and clay with gravel and vegetation.

Analytical Report Number : 22-63376
Project / Site name: The Parade Epsom

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	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
Elemental sulphur in soil	Determination of elemental sulphur in soil by extraction in acetonitrile followed by HPLC.	In-house method based on Secondsite Property Holdings Guidance for Assessing and Managing Potential	L021-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
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
Speciated EPA-16 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	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
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
Total cyanide in soil	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	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
TPH Chromatogram in Soil	TPH Chromatogram in Soil.	In-house method	L064-PL	D	NONE

Analytical Report Number : 22-63376
Project / Site name: The Parade Epsom

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	NONE
Total organic carbon in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L023-PL	D	MCERTS
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	NONE
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE
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.	L038-PL	D	MCERTS

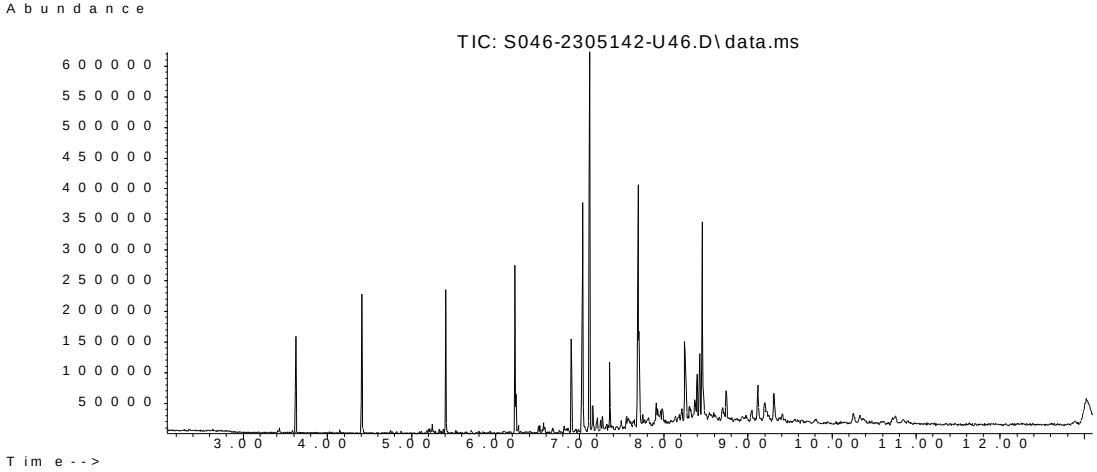
For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received 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.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total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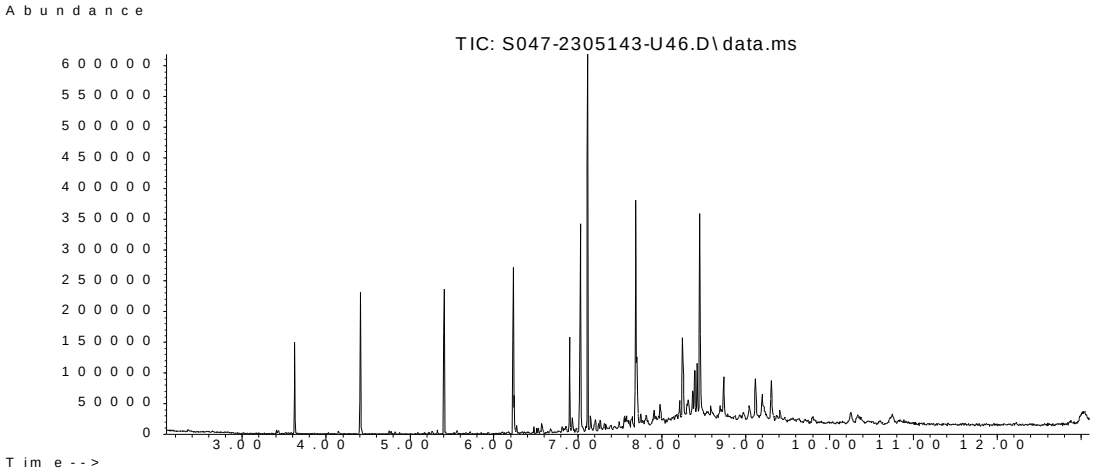
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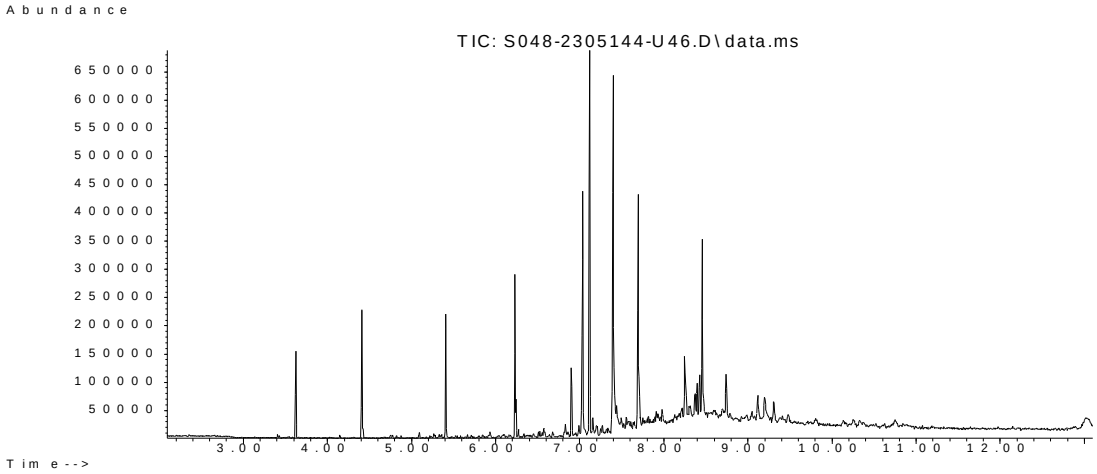
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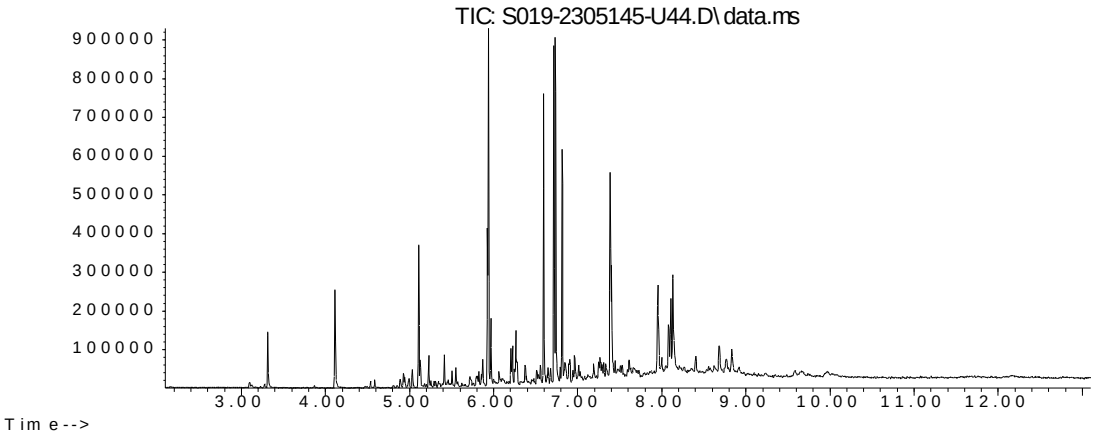
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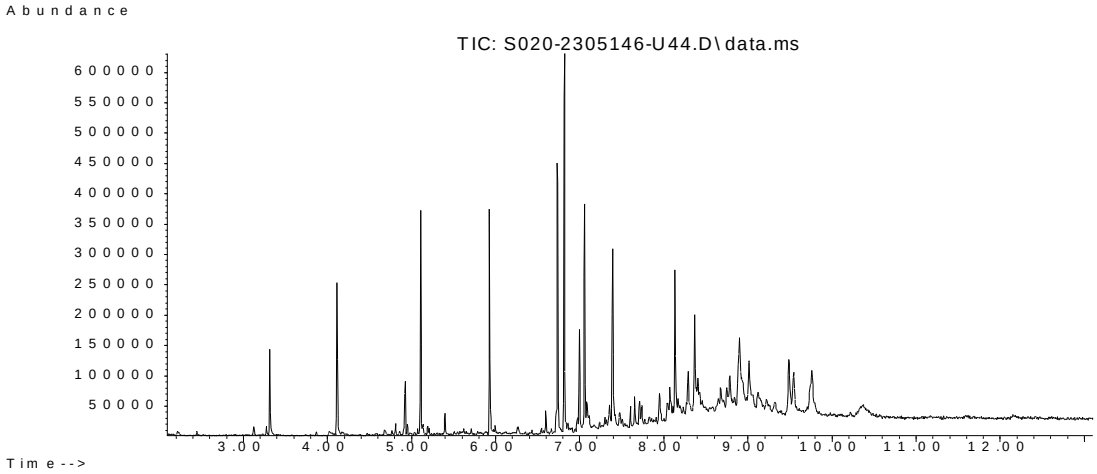
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Analytical Report Number : 22-65374

Project / Site name:	The Parade Epsom	**Samples received on:**	16/06/2022
Your job number:	22 12385 KJC	**Samples instructed on/ Analysis started on:**	16/06/2022
Your order number:	14494	**Analysis completed by:**	23/06/2022
Report Issue Number:	1	**Report issued on:**	23/06/2022
Samples Analysed:	4 soil samples		

Signed: [redacted]

Joanna Wawrzeczko
Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

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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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 22-65374
Project / Site name: The Parade Epsom
Your Order No: 14494

Lab Sample Number				2316380	2316381	2316382	2316383
Sample Reference				1	2	3	5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.30	0.50	0.50
Date Sampled				07/06/2022	07/06/2022	07/06/2022	07/06/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)							
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	7.1	6.4	8	8.8
Total mass of sample received	kg	0.001	NONE	1.3	0.5	0.6	0.5

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-	-	-	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	< 0.05
Fluorene	mg/kg	0.05	MCERTS	-	-	-	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	0.58
Anthracene	mg/kg	0.05	MCERTS	-	-	-	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	1.4
Pyrene	mg/kg	0.05	MCERTS	-	-	-	1.3
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	0.79
Chrysene	mg/kg	0.05	MCERTS	-	-	-	0.81
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	0.91
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	0.52
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	0.9
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	0.43
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	0.54

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	-	-	8.11

Heavy Metals / Metalloids

Lead (aqua regia extractable)	mg/kg	1	MCERTS	300	170	340	270

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

Analytical Report Number : 22-65374
Project / Site name: The Parade Epsom

* 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 *
2316380	1	None Supplied	0.5	Brown loam and sand with gravel.
2316381	2	None Supplied	0.3	Brown loam and sand with gravel and brick.
2316382	3	None Supplied	0.5	Brown loam and sand with gravel.
2316383	5	None Supplied	0.5	Brown loam and sand with gravel.

Analytical Report Number : 22-65374
Project / Site name: The Parade Epsom

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated EPA-16 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	MCERTS
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

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.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

APPENDIX 3

DESICCATION

DESICCATION

Classification

The removal of moisture from a soil as a result of external influences with a constant stress regime, results in shrinkage or settlement of the soil. The magnitude of shrinkage is dependent upon the geological stress history of the soil, its clay content and the composition of the clay minerals. Under normal climatic conditions, there is a seasonal cyclic variation in soil moisture and, hence, volume change, which extends to depths of approximately 1m. When the soil moisture deficit attains a critical value, the shrinkage of the soil can become significant. In these circumstances, the soil can be regarded as being present in a desiccated state.

Causes

A common cause of desiccation consists of the reduction in soil moisture by tree root action. In the absence of a water table at shallow depth, root action of trees will reduce the soil moisture level in order to maintain growth. In general terms, the increase in rainfall which occurs during winter periods will allow for some replacement of the moisture content of the soil, particularly where isolated or immature trees are concerned.

However, when drought summer conditions or limited winter rainfall occurs, desiccated zones will develop within the zone of influence of tree roots. In woodland, desiccation develops as it is not possible for rainfall to overcome the soil moisture deficit. Other causes of desiccation, which have created problems to structures, include incorrectly installed and insulated heating pipes or ducts and industrial processes, ie furnaces or brick kilns.

Effects

The development of desiccation in clay soils will result in an increase in strength of the material. In addition, negative pore water pressure or soil suction will develop. Any foundation system located within soil which is subject to a reduction in soil moisture can experience structural distress, which results from the loss in volume or shrinkage of the ground. Also, if the source of the desiccation is removed, there will be heave of the soils as a result of an increase in equilibrium water content

It is evident, therefore, that foundation systems founded in soils which are actively experiencing an increase or decrease in soil moisture, will be subject to either heave or settlement, which can induce stresses within the structure. It should also be appreciated that a desiccated soil, which is experiencing an increase in equilibrium water content, will attempt to increase its volume in a horizontal as well as vertical plane. It is important, therefore, to ensure that horizontal movements do not apply differential stresses to structural elements, by incorporating collapsible membranes within remedial works.

Identification

A soil in a state of equilibrium is present in a semi-solid state. At the onset of desiccation, the condition of the soil moves towards the boundary between a solid and semi-solid state, this boundary being defined as the plastic limit of the soil. It follows, therefore, that when the natural water content of a soil lies close to, or falls below, the value of the plastic limit, the soil can be considered to be desiccated.

An alternative proposal was made by Driscoll (1983), who related the soil suction induced by desiccation to a function of the liquid limit of the soil. In general terms, desiccation is assumed to be present when the moisture content falls below a level of 40% liquid limit. The arbitrary factor of 0.4 relates to a soil suction value proposed by Croney (1977) and may vary with the composition and mineralogy of different soil types. This approach is only considered to be valid over a limited depth range as the overburden effect will result in a natural reduction in soil moisture and result in the development of negative pore pressures.

A further approach, which considers the shear strength of the clay, Pugh et al (1995), recognises the fact that a reduction in soil moisture will result in an increase in undrained shear strength as well as the development of negative pore pressures. Whilst this approach has a considerable amount of merit, care is required in establishing the value of the soil's in situ shear strength, particularly if it is not possible to obtain representative "undisturbed" samples from cable percussion boreholes. The proposal made in the Pugh paper that the simple pocket penetrometer will provide accurate consistent results should be treated with care, as the pocket penetrometer can take no account of the effects of disturbance and remoulding that are inevitable when completing a trial pit with a mechanical excavator. It is for this reason that this Company attempts to establish the shear strength of clay soils by using the Geonor Field Vane. With this test equipment the appropriate-sized vane is pushed into the side of the pit, through the thin disturbed zone which is caused by the teeth of the bucket during excavation. Furthermore, by use of the 'blank' probe, it is possible to take account of any skin friction which builds up on the shaft of the vane and thus provide a more accurate assessment of the shear strength of the soils.

Hence, a combination of the methods discussed above should be considered in order to confirm whether the development of soil moisture reduction to achieve a desiccated state has occurred within a particular site. The data for affected areas should, where possible, be compared with soils which lie outside the influence of tree root bulbs and may, therefore, be considered to be present in a stable and equilibrium state.

References

Croney D (1977)	The Design and Performance of Road Pavements London HMSO pp 674
Driscoll R (1983)	The Influence of Vegetation on the Swelling and Shrinking of Clay Soils in Britain Geotechnique 33.4 pp 93-105
Pugh RS, Parnell PG and Parks RD (1995)	A rapid and reliable on site method of assessing desiccation in clay soils Geotechnical Engineering 13 Jan 1995 pp 25—30

APPENDIX 4

WASTE

WASTE CLASSIFICATION

The European Waste Framework Directive is implemented in the UK by the 2002 Landfill Regulations, together with a number of other acts and regulations. A key part of this process is to establish the hazardous properties of potential waste. The classification and definition of hazardous waste is interpreted within the Environment Agency guidance WM3 and all wastes require classifying in accordance with the European Waste Catalogue [EWC]. The EWC is a detailed list of typical industry waste types and each has a 6 digit code. Typically the appropriate EWC codes for excavated soil being disposed off site are:

17 05 03* soil and stones containing dangerous substances, or
17 05 04 soil and stones other than those mentioned in 17 05 03

If excavated soils are to be discarded or exported from site then they would be considered controlled waste and require classification. However, if soils can be re-used on site then they are not considered to be controlled waste. A Desk Study, soil descriptions, laboratory chemical analysis and risk assessment can all contribute to basic waste characterisation. Depending upon the chemical composition or levels of contaminants in the waste (e.g. metals, TPH, asbestos), soil and stones can either be hazardous or non-hazardous. Waste Acceptance Criteria [WAC] test results are used to determine the suitability of the waste intended for disposal against the acceptance criteria for a particular class of landfill site. WAC tests are not used for the classification of waste soils and are only required for inert or hazardous excavated material which is destined for landfill.

Wastes containing asbestos with a concentration of >0.10% weight/weight (w/w) are generally considered to be hazardous. While waste with <0.10% w/w of asbestos are considered non-hazardous. Where free fibres or fibrous asbestos is present at concentrations of >0.001% then these are considered to pose a risk to human health and are deemed hazardous waste. These waste materials also require a suitably licensed company to handle them.

Waste Treatment

It is a requirement of the 2002 Landfill Regulations that all wastes must undergo some form of pre-treatment prior to disposal at an appropriately licensed landfill. Treatment is defined using a 'three-point test' and can include physical, chemical, biological or thermal processes, which must change the characteristics of the waste in order to:

- reduce its volume, or
- reduce its hazardous nature, or
- facilitate its handling, or
- enhance its recovery.

The exceptions to this are:

- inert waste for which treatment is not technically feasible.
- it is waste other than inert waste and treatment would not reduce its quantity or its hazards to human health or the environment.

The waste producer should either treat their own waste or ensure that the waste will be treated by a subsequent handler. The waste producer should record the type and amount of pre-treatment undertaken prior to disposal.

Examples of treatment include mechanical segregation or sorting, compositing, soil treatment hubs and incineration. This can include physical sorting of waste soil types into separate stockpiles at the producer site, e.g. topsoil, made ground and natural clay, sand or gravels.

ATKINS CatWasteSoil

Classification Assessment Tool of Soil Wastes - Hazard Summary Sheet

Site Name	The Parade
Location	Epsom
Site ID	
Job Number	22/12385/KJC
Date	27/06/2022
User Name	
Company Name	Albury S.I Ltd

Hole ID	Sample Depth	Hazardous Waste Y/N	HP1	HP2	HP3	HP4	HP5	HP6	HP7	HP8	HP9	HP10	HP11	HP12	HP13	HP14	HP15	HP16
1	0.30	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
2	0.10	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
3	0.30	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
5	0.20	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
7	0.10	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

ATKINS CatWasteSoil

Classification Assessment Tool of Soil Wastes - Individual Compound Information

Site Name	The Parade
Location	Epsom
Site ID	
Job Number	22/12385/KJC
Date	27/06/2022
User Name	
Company Name	Albury S.I Ltd

Hole ID	Sample Depth	Contaminant	Contaminant Concentration (%)	Hazardous Waste Y/N	Hazard Property	Individual Hazard Statements Exceeded	Cumulative Hazard Statements Exceeded	Additional Hazard Statements (see notes section)
1	0.30	pH	0.00000	N				
1	0.30	Benzene	0.00010	N				H225 test
1	0.30	Toluene	0.00010	N				H225 test
1	0.30	Ethylbenzene	0.00010	N				H225 test
1	0.30	m,p-xylene	0.00010	N				H226 test
1	0.30	o-xylene	0.00000	N				H226 test
1	0.30	Naphthalenene	0.00001	N				H228 test
1	0.30	Acenaphthylene	0.00001	N				
1	0.30	Acenaphthene	0.00001	N				
1	0.30	Fluorene	0.00001	N				
1	0.30	Phenanthrene	0.00010	N				
1	0.30	Anthracene	0.00002	N				
1	0.30	Fluoranthene	0.00027	N				
1	0.30	Pyrene	0.00023	N				
1	0.30	Benzo(a)anthracene	0.00020	N				
1	0.30	Chrysene	0.00015	N				
1	0.30	Benzo(b)fluoranthene	0.00021	N				
1	0.30	Benzo(k)fluoranthene	0.00012	N				
1	0.30	Benzo(a)pyrene	0.00019	N				
1	0.30	Indeno(1,2,3-cd)pyrene	0.00011	N				
1	0.30	Di-benz(a,h,)anthracene	0.00002	N				
1	0.30	Benzo(g,h,i)perylene	0.00012	N				
1	0.30	Phenol	0.00010	N				
1	0.30	hydrocarbon/oil with marker	0.00500	N				H225 test
1	0.30	Arsenic	0.00322	N				
1	0.30	Boron	0.00162	N				
1	0.30	Cadmium	0.00004	N				
1	0.30	Hexavalent Chromium	0.00012	N				
1	0.30	Chromium (Total)	0.00304	N				
1	0.30	Copper	0.00904	N				
1	0.30	Lead	0.00000	N				
1	0.30	Leadx	0.04600	N				
1	0.30	Manganese	0.09346	N				
1	0.30	Mercury	0.00009	N				
1	0.30	Nickel	0.00422	N				
1	0.30	Selenuim	0.00038	N				
1	0.30	Zinc	0.00000	N				
1	0.30	Zincx	0.04198	N				
1	0.30	Vanadium	0.00678	N				
2	0.10	pH	0.00000	N				
2	0.10	Benzene	0.00010	N				H225 test
2	0.10	Toluene	0.00010	N				H225 test
2	0.10	Ethylbenzene	0.00010	N				H225 test
2	0.10	m,p-xylene	0.00010	N				H226 test
2	0.10	o-xylene	0.00000	N				H226 test
2	0.10	Naphthalenene	0.00001	N				H228 test
2	0.10	Acenaphthylene	0.00002	N				

ATKINS CatWasteSoil

Classification Assessment Tool of Soil Wastes - Individual Compound Information

Site Name	The Parade
Location	Epsom
Site ID	
Job Number	22/12385/KJC
Date	27/06/2022
User Name	
Company Name	Albury S.I Ltd

Hole ID	Sample Depth	Contaminant	Contaminant Concentration (%)	Hazardous Waste Y/N	Hazard Property	Individual Hazard Statements Exceeded	Cumulative Hazard Statements Exceeded	Additional Hazard Statements (see notes section)
2	0.10	Acenaphthene	0.00001	N				
2	0.10	Fluorene	0.00001	N				
2	0.10	Phenanthrene	0.00009	N				
2	0.10	Anthracene	0.00003	N				
2	0.10	Fluoranthene	0.00026	N				
2	0.10	Pyrene	0.00024	N				
2	0.10	Benzo(a)anthracene	0.00016	N				
2	0.10	Chrysene	0.00017	N				
2	0.10	Benzo(b)fluoranthene	0.00021	N				
2	0.10	Benzo(k)fluoranthene	0.00011	N				
2	0.10	Benzo(a)pyrene	0.00018	N				
2	0.10	Indeno(1,2,3-cd)pyrene	0.00012	N				
2	0.10	Di-benz(a,h,)anthracene	0.00003	N				
2	0.10	Benzo(g,h,i)perylene	0.00014	N				
2	0.10	Phenol	0.00010	N				
2	0.10	hydrocarbon/oil with marker	0.00430	N				H225 test
2	0.10	Arsenic	0.00322	N				
2	0.10	Boron	0.00139	N				
2	0.10	Cadmium	0.00004	N				
2	0.10	Hexavalent Chromium	0.00012	N				
2	0.10	Chromium (Total)	0.00333	N				
2	0.10	Copper	0.01130	N				
2	0.10	Lead	0.00000	N				
2	0.10	Leadx	0.02900	N				
2	0.10	Manganese	0.07971	N				
2	0.10	Mercury	0.00013	N				
2	0.10	Nickel	0.00527	N				
2	0.10	Selenuim	0.00038	N				
2	0.10	Zinc	0.00000	N				
2	0.10	Zincx	0.03210	N				
2	0.10	Vanadium	0.00714	N				
3	0.30	pH	0.00000	N				
3	0.30	Benzene	0.00000	N				H225 test
3	0.30	Toluene	0.00000	N				H225 test
3	0.30	Ethylbenzene	0.00000	N				H225 test
3	0.30	m,p-xylene	0.00000	N				H226 test
3	0.30	o-xylene	0.00000	N				H226 test
3	0.30	Naphthalenene	0.00001	N				H228 test
3	0.30	Acenaphthylene	0.00001	N				
3	0.30	Acenaphthene	0.00001	N				
3	0.30	Fluorene	0.00001	N				
3	0.30	Phenanthrene	0.00010	N				
3	0.30	Anthracene	0.00003	N				
3	0.30	Fluoranthene	0.00022	N				
3	0.30	Pyrene	0.00020	N				
3	0.30	Benzo(a)anthracene	0.00015	N				
3	0.30	Chrysene	0.00011	N				

ATKINS CatWasteSoil

Classification Assessment Tool of Soil Wastes - Individual Compound Information

Site Name	The Parade
Location	Epsom
Site ID	
Job Number	22/12385/KJC
Date	27/06/2022
User Name	
Company Name	Albury S.I Ltd

Hole ID	Sample Depth	Contaminant	Contaminant Concentration (%)	Hazardous Waste Y/N	Hazard Property	Individual Hazard Statements Exceeded	Cumulative Hazard Statements Exceeded	Additional Hazard Statements (see notes section)
3	0.30	Benzo(b)fluoranthene	0.00017	N				
3	0.30	Benzo(k)fluoranthene	0.00008	N				
3	0.30	Benzo(a)pyrene	0.00014	N				
3	0.30	Indeno(1,2,3-cd)pyrene	0.00008	N				
3	0.30	Di-benz(a,h,)anthracene	0.00002	N				
3	0.30	Benzo(g,h,i)perylene	0.00011	N				
3	0.30	Phenol	0.00010	N				
3	0.30	hydrocarbon/oil with marker	0.00390	N				H225 test
3	0.30	Arsenic	0.00337	N				
3	0.30	Boron	0.00093	N				
3	0.30	Cadmium	0.00004	N				
3	0.30	Hexavalent Chromium	0.00012	N				
3	0.30	Chromium (Total)	0.00304	N				
3	0.30	Copper	0.00854	N				
3	0.30	Lead	0.00000	N				
3	0.30	Leadx	0.03900	N				
3	0.30	Manganese	0.10170	N				
3	0.30	Mercury	0.00006	N				
3	0.30	Nickel	0.00475	N				
3	0.30	Selenuim	0.00038	N				
3	0.30	Zinc	0.00000	N				
3	0.30	Zincx	0.04691	N				
3	0.30	Vanadium	0.00732	N				
5	0.20	pH	0.00000	N				
5	0.20	Benzene	0.00000	N				H225 test
5	0.20	Toluene	0.00000	N				H225 test
5	0.20	Ethylbenzene	0.00000	N				H225 test
5	0.20	m,p-xylene	0.00000	N				H226 test
5	0.20	o-xylene	0.00000	N				H226 test
5	0.20	Naphthalenene	0.00001	N				H228 test
5	0.20	Acenaphthylene	0.00009	N				
5	0.20	Acenaphthene	0.00012	N				
5	0.20	Fluorene	0.00015	N				
5	0.20	Phenanthrene	0.00120	N				
5	0.20	Anthracene	0.00025	N				
5	0.20	Fluoranthene	0.00110	N				
5	0.20	Pyrene	0.00089	N				
5	0.20	Benzo(a)anthracene	0.00049	N				
5	0.20	Chrysene	0.00042	N				
5	0.20	Benzo(b)fluoranthene	0.00036	N				
5	0.20	Benzo(k)fluoranthene	0.00018	N				
5	0.20	Benzo(a)pyrene	0.00033	N				
5	0.20	Indeno(1,2,3-cd)pyrene	0.00016	N				
5	0.20	Di-benz(a,h,)anthracene	0.00004	N				
5	0.20	Benzo(g,h,i)perylene	0.00019	N				
5	0.20	Phenol	0.00010	N				
5	0.20	hydrocarbon/oil with marker	0.01000	N				H225 test

ATKINS CatWasteSoil

Classification Assessment Tool of Soil Wastes - Individual Compound Information

Site Name	The Parade
Location	Epsom
Site ID	
Job Number	22/12385/KJC
Date	27/06/2022
User Name	
Company Name	Albury S.I Ltd

Hole ID	Sample Depth	Contaminant	Contaminant Concentration (%)	Hazardous Waste Y/N	Hazard Property	Individual Hazard Statements Exceeded	Cumulative Hazard Statements Exceeded	Additional Hazard Statements (see notes section)
5	0.20	Arsenic	0.00245	N				
5	0.20	Boron	0.00208	N				
5	0.20	Cadmium	0.00004	N				
5	0.20	Hexavalent Chromium	0.00012	N				
5	0.20	Chromium (Total)	0.00319	N				
5	0.20	Copper	0.00578	N				
5	0.20	Lead	0.00000	N				
5	0.20	Leadx	0.02100	N				
5	0.20	Manganese	0.07147	N				
5	0.20	Mercury	0.00006	N				
5	0.20	Nickel	0.00395	N				
5	0.20	Selenuim	0.00038	N				
5	0.20	Zinc	0.00000	N				
5	0.20	Zincx	0.03951	N				
5	0.20	Vanadium	0.00678	N				
7	0.10	pH	0.00000	N				
7	0.10	Benzene	0.00010	N				H225 test
7	0.10	Toluene	0.00010	N				H225 test
7	0.10	Ethylbenzene	0.00010	N				H225 test
7	0.10	m,p-xylene	0.00010	N				H226 test
7	0.10	o-xylene	0.00010	N				H226 test
7	0.10	Naphthalenene	0.00001	N				H228 test
7	0.10	Acenaphthylene	0.00001	N				
7	0.10	Acenaphthene	0.00001	N				
7	0.10	Fluorene	0.00001	N				
7	0.10	Phenanthrene	0.00005	N				
7	0.10	Anthracene	0.00001	N				
7	0.10	Fluoranthene	0.00011	N				
7	0.10	Pyrene	0.00011	N				
7	0.10	Benzo(a)anthracene	0.00009	N				
7	0.10	Chrysene	0.00007	N				
7	0.10	Benzo(b)fluoranthene	0.00008	N				
7	0.10	Benzo(k)fluoranthene	0.00005	N				
7	0.10	Benzo(a)pyrene	0.00006	N				
7	0.10	Indeno(1,2,3-cd)pyrene	0.00005	N				
7	0.10	Di-benz(a,h,)anthracene	0.00001	N				
7	0.10	Benzo(g,h,i)perylene	0.00006	N				
7	0.10	Phenol	0.00030	N				
7	0.10	hydrocarbon/oil with marker	0.00860	N				H225 test
7	0.10	Arsenic	0.00169	N				
7	0.10	Boron	0.00231	N				
7	0.10	Cadmium	0.00004	N				
7	0.10	Hexavalent Chromium	0.00012	N				
7	0.10	Chromium (Total)	0.00216	N				
7	0.10	Copper	0.00955	N				
7	0.10	Lead	0.00000	N				
7	0.10	Leadx	0.02000	N				

ATKINS CatWasteSoil

Classification Assessment Tool of Soil Wastes - Individual Compound Information

Site Name	The Parade
Location	Epsom
Site ID	
Job Number	22/12385/KJC
Date	27/06/2022
User Name	
Company Name	Albury S.I Ltd

Hole ID	Sample Depth	Contaminant	Contaminant Concentration (%)	Hazardous Waste Y/N	Hazard Property	Individual Hazard Statements Exceeded	Cumulative Hazard Statements Exceeded	Additional Hazard Statements (see notes section)
7	0.10	Manganese	0.04673	N				
7	0.10	Mercury	0.00006	N				
7	0.10	Nickel	0.00264	N				
7	0.10	Selenuim	0.00038	N				
7	0.10	Zinc	0.00000	N				
7	0.10	Zincx	0.01778	N				
7	0.10	Vanadium	0.00464	N				

Notes - Additional Information on Hazard Properties

Hazardous Property	Description	Hazard Statement	Note
HP1	Explosive	H200, H201, H202, H203, H204, H240 and H241	A waste is assessed for HP1 via test methods, rather than a concentration limit. If you have substances or a mixture containing explosive properties the waste should be tested in accordance with the European Chemical Agency's guidance on the application of the CLP Criteria.
HP2	Oxidising	H270, H271, H272	A waste is assessed for HP2 via test methods, rather than a concentration limit. If you have substances or a mixture containing oxidising properties the waste should be tested in accordance with the European Chemical Agency's guidance on the application of the CLP Criteria.
HP3	Flammable	H220 to H226, H228, H242, H250, H251m H252, H260, H261	A waste is assessed for HP3 via test methods, rather than a concentration limit. If you have substances or a mixture containing flammable properties the waste should be tested in accordance with the European Chemical Agency's guidance on the application of the CLP Criteria. If a waste contains either H220, H221, H260 or H261 a calculation can be performed to identify the minimum amount of that substance that will trigger HP3.
HP5	Specific Target Organ Toxicity (STOT)	H304	Should a waste contain two or more compounds displaying H304 (Asp. Tox 1) and equal or exceed its specific concentration limit of 10%, then a waste will be hazardous by HP5 if its kinematic viscosity exceeds 20.5 mm^2/s. Guidance should be sought from the CLP Criteria.
HP9	Infectious	N/A	A waste is assessed for HP9 via further testing, rather than a concentration limit. In cases where there is the potential for toxins to be present, further testing will be required. For healthcare waste reference should be made to the Department of health guidance: Safe management of healthcare waste.
HP12	Release of acute toxic gas	EUH029, EUH031, EUH032, H260 or H261	A waste is assessed for HP12 via test methods, rather than a concentration limit. If you have substances or a mixture that may release acute toxic gas the waste should be tested in accordance with the European Chemical Agency's guidance on the application of the CLP Criteria.
HP15	Explosive or explosive properties	H205, EUH001, EUH019 or EUH044	A waste is assessed for HP15 via test methods, rather than a concentration limit. If you have substances or a mixture that may exhibit explosive or explosive properties the waste should be tested in accordance with the European Chemical Agency's guidance on the application of the CLP Criteria.
HP16	Persistent organic pollutants	N/A	A waste is considered hazardous if the concentration of one or more compound (persistent organic pollutant) as listed in Appendix C of Environment Agency guidance WM3 is above its assigned concentration limit. For reference for dioxins and furans, this assessment incorporates the use of specific toxicity equivalent factors.

Appendix D: Proposed Drainage Strategy and Calculations

PROPOSED INDICATIVE JUNCTION CONNECTION INTO EXISTING THAMES WATER SURFACE WATER ASSET
CL 19.450 (TBC)
IL 17.645 (TBC)
SUBJECT TO THAMES WATER APPROVAL
LOCATION AND DEPTH OF ASSET TO BE CONFIRMED PRIOR TO COMMENCEMENT OF WORKS.

INDICATIVE LOCATION OF EXISTING JUNCTION CONNECTION INTO THAMES WATER FOUL WATER ASSET
LOCATION AND DEPTH OF CONNECTION TO BE CONFIRMED PRIOR TO COMMENCEMENT OF WORKS.

FW-IC-07
CL:TBC
IL:TBC

SW-MH-07
CL 19.500m
IL 18.041m
Depth 1.459m

FW-IC-06
CL:TBC
IL:TBC

PROPOSED INDICATIVE INDIRECT CONNECTION INTO EXISTING PRIVATE FOUL WATER MANHOLE

SUBJECT TO THAMES WATER APPROVAL
LOCATION AND DEPTH OF MANHOLE TO BE CONFIRMED PRIOR TO COMMENCEMENT OF WORKS.

PROVIDE A VORTEX FLOW CONTROL DEVICE (HYDROBRAKE OPTIMUM OR EQUIVALENT) TO RESTRICT FLOWS TO 2.0l/s, DESIGNED FOR 1.4m HEAD.
TO BE CONSTRUCTED WITHIN THE MANHOLE

FW-IC-05
CL:TBC
IL:TBC

SW-IC-06
CL 19.800m
IL 18.225 m
Depth 1.575m

SW-IC-01
CL 19.650m
IL 18.715m
Depth 0.935m

FW-IC-04
CL:TBC
IL:TBC

FW-IC-03
CL:TBC
IL:TBC

SW-IC-02
CL 19.750m
IL 18.609m
Depth 1.141m

FW-IC-01
CL:TBC
IL:TBC

FW-IC-02
CL:TBC
IL:TBC

SW-IC-05
CL 19.850m
IL 18.280m
Depth 1.570m

PROVIDE 0.4m DEEP, 9m LONG AND 6m WIDE CELLULAR ATTENUATION TANK (APPROX 13.68m³, POROSITY 0.95).
AQUACELL STORAGE CRATES OR EQUIVALENT
CL= 20.00m - 19.850m (MIN-VARIES)
SL= 18.680m
IL= 18.280m

PROVIDE A 40mmØ ORIFICE PLATE FLOW CONTROL DEVICE TO RESTRICT
FLOWS TO 2.5l/s, DESIGNED FOR 0.8m HEAD.
TO BE CONSTRUCTED WITHIN THE OUTLET CHAMBER

SW-MH-03
CL 19.840m
IL 18.508m
Depth 1.652m

SW-MH-04
CL 20.00m
IL 18.418m
Depth 1.582m

PERMEABLE PAVING
AREA: 300m²
DEPTH: 0.600m
POROSITY: 30%

PROPOSED PERMEABLE PAVING:
AREA: 300m²
DEPTH: 0.600m (0.400m SUB-BASE)
POROSITY: 30%

M5-60: 20
Ratio 'r': 0.4

Scale 1:100 @ A1 - 1:200 @ A3
2m 0 2m 4m 6m 8m 10m

NOTES

1) ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE
1) THE DEVELOPER HAS SELF VETTED THE DESIGN CRITERIA, MATERIAL STANDARDS AND WORKMANSHIP SPECIFICATION FOR THE PROPOSED ADOPTABLE SEWERS IN ACCORDANCE WITH SEWERS FOR ADOPTION 7TH EDITION AND THE REQUIREMENTS OF DCWW AS THE STATUTORY UNDERTAKER.
2) ALL PRIVATE DRAINAGE WORKS TO BE CONSTRUCTED IN ACCORDANCE WITH PART H OF THE CURRENT BUILDING REGULATIONS AND OR NHBC GUIDANCE.
3) THE POSITION AND DEPTH OF EXISTING STATUTORY UNDERTAKERS EQUIPMENT AFFECTED BY THE PROPOSED WORKS ARE TO BE CHECKED FOR ACCURACY ON SITE PRIOR TO COMMENCEMENT OF ANY OTHER WORKS.
4) ALL WORKS TO BE CONSTRUCTED MUST COMPLY WITH THE CURRENT HEALTH & SAFETY AT WORK ACT.
5) THE INVERT LEVELS OF EXISTING MANHOLES AND SEWER SPUR PIPES INTENDED FOR FUTURE CONNECTION BY THE PROPOSED DEVELOPMENT ARE TO BE CHECKED FOR ACCURACY ON SITE BY THE CONTRACTOR PRIOR TO THE COMMENCEMENT OF ANY OTHER WORKS.
6) POSITION OF SOIL PIPE & BACK INLET GULLY CONNECTION POINTS TO BE CHECKED AGAINST ARCHITECTS HOUSE TYPE PLANS PRIOR TO COMMENCEMENT OF WORKS.
7) THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERING, ARCHITECTS AND LANDSCAPING DRAWINGS. ANY DISCREPANCIES IS TO BE REPORTED TO THE ENGINEER IMMEDIATELY TO SEEK CLARIFICATION.
8) ALL PRIVATE SURFACE WATER AND FOUL WATER SEWERS TO BE 100mm DIA UNLESS OTHERWISE SHOWN.
9) ALL LATERAL CONNECTIONS INTO ADOPTABLE MANHOLES TO BE 150mm DIA. UNLESS OTHERWISE SHOWN.
10) AVAL ACCEPTS NO RESPONSIBILITY FOR THE DESIGN AND SPECIFICATION OF THE RAINWATER HARVESTING SYSTEM. THE CLIENT SHOULD VERIFY THE ACCURACY AND COMPLETENESS OF THE DESIGN, INCLUDING COMPATIBILITY WITH THE M&E DESIGN.
11) ALL PIPES TO BE EITHER STRENGTH V.C. TO BS 65 OR PVC TO BS 4660 OR BS 5481 'UPONOR ULTRARIB' OR CONCRETE CLASS 120 TO BS 5911.
12) CONCRETE BED AND SURROUND IS REQUIRED TO ALL GULLY LEADS AND TO ALL PIPES IN HIGHWAYS/HARDSTANDING WHERE COVER TO PIPE <1200MM.

KEY

- SITE BOUNDARY
- PROPOSED SURFACE WATER SEWER
- PROPOSED FOUL WATER SEWER
- EXISTING THAMES WATER SURFACE WATER
- EXISTING THAMES WATER FOUL WATER
- PROPOSED SURFACE WATER MANHOLE
- PROPOSED SURFACE WATER PPIC
- PROPOSED FOUL WATER PPIC
- PROPOSED HYDROBRAKE
- PROPOSED PERMEABLE PAVING OUTLET CHAMBER WITH ORIFICE PLATE
- PROPOSED PERMEABLE PAVING

REVISIONS

REV	DESCRIPTION	DATE	BY
–	FIRST ISSUE AS DRAFT	12/07/22	PR
A	FIRST ISSUE FOR PLANNING	13/07/22	PR
B	ADDITION OF PERMEABLE PAVING	27/09/22	PR

Aval Consulting Group
Transportation Planning : Environmental Consultants
www.aval-group.co.uk, Email: contact@aval-group.co.uk
Company Number: 11622039

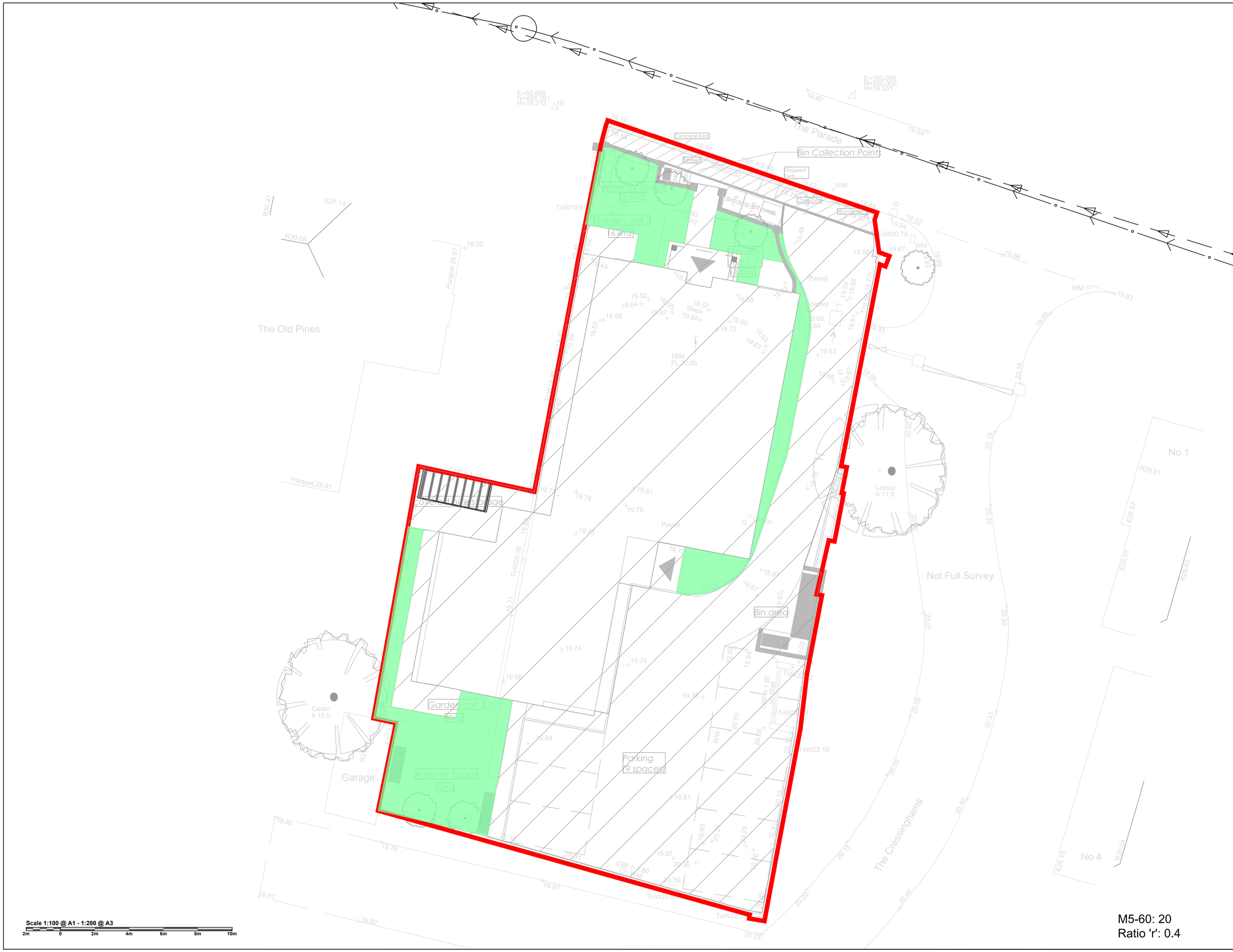
Client Name: WELDIN BUILDERS LTD

Project Title: FRIARS GARTH, EPSOM KT18 5DH

Drawing Title: PROPOSED DRAINAGE DESIGN

Date:	27.09.2022	Drawn By:	PR
Scale:	1:100 @ A1 1:200 @ A3	Checked:	WR
Status:	PLANNING	Approved:	AC

Drawing No. AVAL/91833/DR/001 | Rev. B



Scale 1:100 @ A1 - 1:200 @ A3

2m 0 2m 4m 6m 8m 10m

M5-60: 20
Ratio 'r': 0.4

NOTES

1) ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE

1) THE DEVELOPER HAS SELF VETTED THE DESIGN CRITERIA, MATERIAL STANDARDS AND WORKMANSHIP SPECIFICATION FOR THE PROPOSED ADOPTABLE SEWERS IN ACCORDANCE WITH SEWERS FOR ADOPTION 7TH EDITION AND THE REQUIREMENTS OF DCWW AS THE STATUTORY UNDERTAKER.

2) ALL PRIVATE DRAINAGE WORKS TO BE CONSTRUCTED IN ACCORDANCE WITH PART H OF THE CURRENT BUILDING REGULATIONS AND OR NHBC GUIDANCE.

3) THE POSITION AND DEPTH OF EXISTING STATUTORY UNDERTAKERS EQUIPMENT AFFECTED BY THE PROPOSED WORKS ARE TO BE CHECKED FOR ACCURACY ON SITE PRIOR TO COMMENCEMENT OF ANY OTHER WORKS.

4) ALL WORKS TO BE CONSTRUCTED MUST COMPLY WITH THE CURRENT HEALTH & SAFETY AT WORK ACT.

5) THE INVERT LEVELS OF EXISTING MANHOLES AND SEWER SPUR PIPES INTENDED FOR FUTURE CONNECTION BY THE PROPOSED DEVELOPMENT ARE TO BE CHECKED FOR ACCURACY ON SITE BY THE CONTRACTOR PRIOR TO THE COMMENCEMENT OF ANY OTHER WORKS.

6) POSITION OF SOIL PIPE & BACK INLET GULLY CONNECTION POINTS TO BE CHECKED AGAINST ARCHITECTS HOUSE TYPE PLANS PRIOR TO COMMENCEMENT OF WORKS.

7) THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERING, ARCHITECTS AND LANDSCAPING DRAWINGS. ANY DISCREPANCIES IS TO BE REPORTED TO THE ENGINEER IMMEDIATELY TO SEEK CLARIFICATION.

8) ALL PRIVATE SURFACE WATER AND FOUL WATER SEWERS TO BE 100mm DIA UNLESS OTHERWISE SHOWN.

9) ALL LATERAL CONNECTIONS INTO ADOPTABLE MANHOLES TO BE 150mm DIA. UNLESS OTHERWISE SHOWN.

10) AVAL ACCEPTS NO RESPONSIBILITY FOR THE DESIGN AND SPECIFICATION OF THE RAINWATER HARVESTING SYSTEM. THE CLIENT SHOULD VERIFY THE ACCURACY AND COMPLETENESS OF THE DESIGN, INCLUDING COMPATIBILITY WITH THE M&E DESIGN.

11) ALL PIPES TO BE EITHER STRENGTH V.C. TO BS 65 OR PVC TO BS 4660 OR BS 5481 'UPONOR ULTRARIB' OR CONCRETE CLASS 120 TO BS 5911.

12) CONCRETE BED AND SURROUND IS REQUIRED TO ALL GULLY LEADS AND TO ALL PIPES IN HIGHWAYS/HARDSTANDING WHERE COVER TO PIPE <1200MM.

KEY

SITE BOUNDARY

TOTAL SITE AREA: 874m²

PROPOSED IMPERMEABLE AREA 704m²

PROPOSED PERMEABLE AREA 170m²

REVISIONS

REV	DESCRIPTION	DATE	BY
–	FIRST ISSUE AS DRAFT	12/07/22	PR
A	FIRST ISSUE FOR PLANNING	13/07/22	PR

Aval Consulting Group.
Transportation Planning : Environmental Consultants
www.aval-group.co.uk, Email: contact@aval-group.co.uk
Company Number: 11922039

Client Name:

WELDIN BUILDERS LTD

Project Title:

FRIARS GARTH, EPSOM KT18 5DH

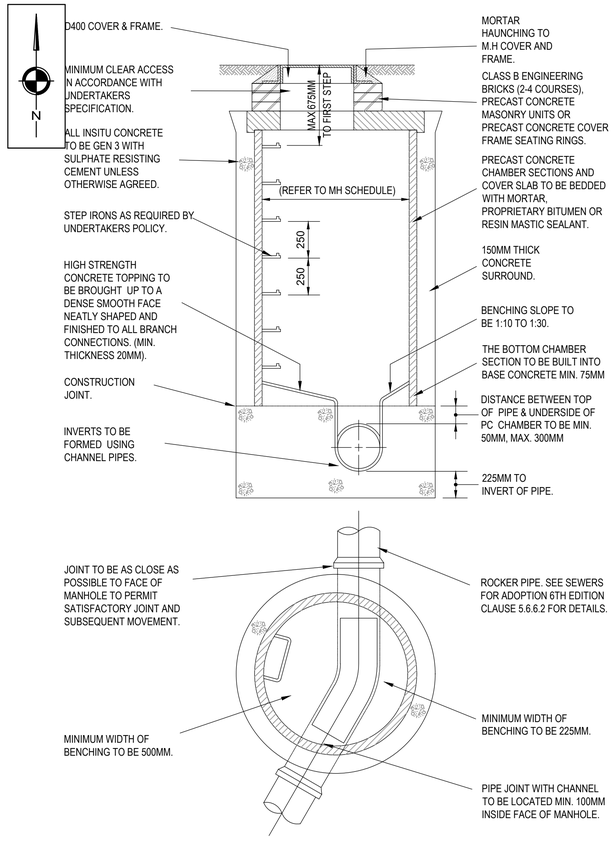
Drawing Title:

PROPOSED DRAINAGE DESIGN

Date:	27.09.2022	Drawn By:	PR
Scale:	1:100 @ A1 1:200 @ A3	Checked:	WR
Status:	PLANNING	Approved:	AC

Drawing No.: AVAL/91833/DR/002

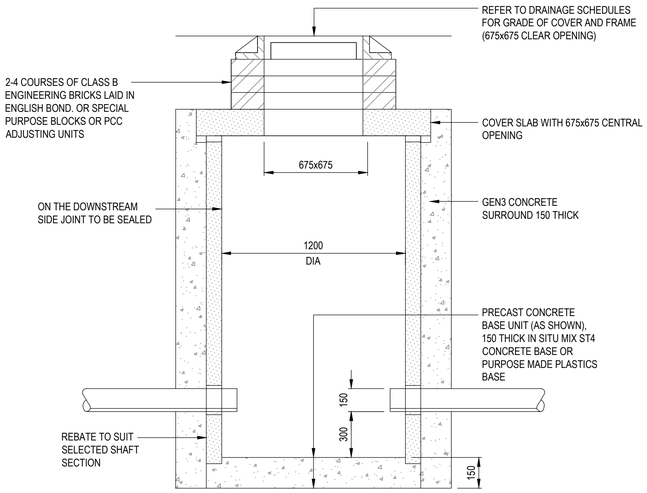
Rev.: A



TYPICAL MANHOLE DETAIL

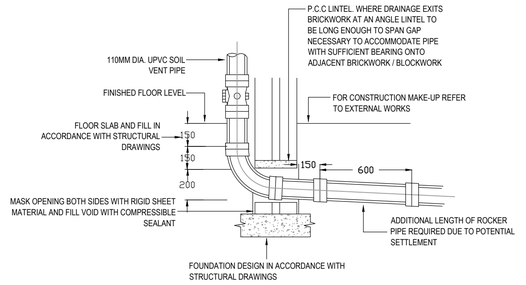
(MAX. DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE 3.0m)

SCALE - 1:20



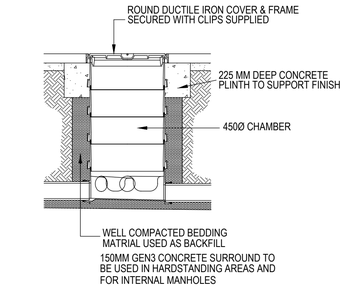
CATCHPIT MANHOLE DETAIL

SCALE - 1:20



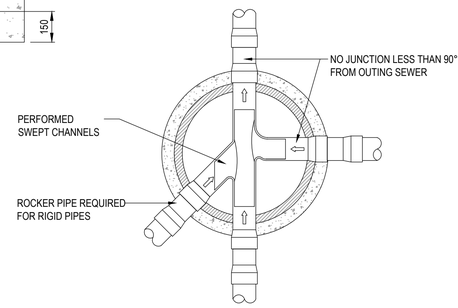
SOIL VENT PIPE CONNECTION

SCALE - 1:20



POLYPROPYLENE INSPECTION CHAMBER (MAX DEPTH 1.2m)

SCALE - N.T.S.



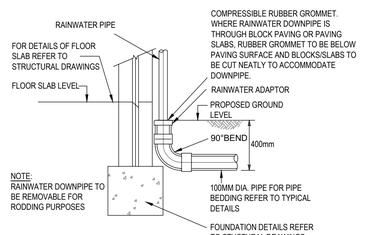
NOMINAL DIAMETER (mm)	MAXIMUM EFFECTIVE LENGTH (m)
150-600	0.6
601-750	1.00
OVER 750	1.25

RIGID PIPES BUILT INTO MANHOLE SHOULD HAVE A FLEXIBLE JOINT AS CLOSE AS FEASABLE TO THE EXTERNAL FACE OF THE STRUCTURE AND THE LENGTH OF THE NEXT ROCKER PIPE SHOULD BE AS SHOWN.

ALL PIPES ENTERING THE BOTTOM OF THE MANHOLE SHOULD HAVE SOFFITS LEVEL

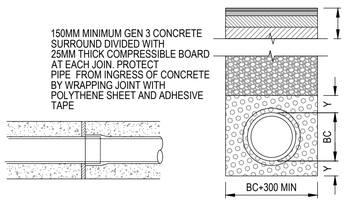
TYPICAL ARRANGEMENT OF PIPE JUNCTIONS WITH MANHOLES

SCALE - N.T.S.



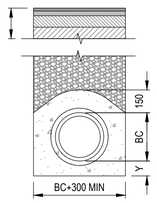
RAINWATER PIPE CONNECTION

SCALE - 1:20



PRIVATE DRAINAGE GRANULAR BED AND SURROUND CLASS `S'

WHERE DEPTH 1200mm OR GREATER



PRIVATE DRAINAGE CONCRETE BED AND SURROUND CLASS `Z'

WHERE DEPTH OF COVER TO PIPE SOFFIT IS LESS THAN 1200mm

DIMENSION Y

CLASS	MACHINE DUG UNIFORM SOIL	ROCK OR MIXED SOILS
S	NOTE (i)	NOTE (ii)
Z	NOTE (ii)	NOTE (ii)

(i) Y=BC/6, WITH MIN 100 UNDER BARRELS (50 FOR SLEEVE JOINTED) AND MIN 50 UNDER SOCKETS, WHICHEVER IS THE GREATER, WITH MAX OF 400.

(ii) Y=BC/4, WITH MIN 200 UNDER BARRELS (150 FOR SLEEVE JOINTED) AND MIN 150 UNDER SOCKETS, WHICHEVER IS THE GREATER, WITH A MAX OF 400.

KEY

TYPE 1 SUB BASE MATERIAL BACKFILL TO FORMATION LEVEL

SINGLE SIZE GRANULAR MATERIAL.

GEN3 CONCRETE BED AND SURROUND.

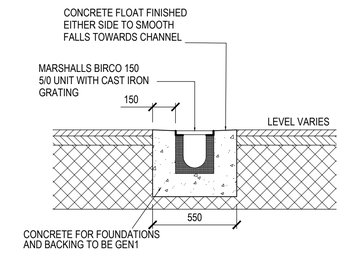
DN = NOMINAL INTERNAL DIAMETER OF PIPE.
BC = OUTSIDE DIAMETER OF PIPE.

SUITABLE FILL

THE SUITABLE FILL SHALL BE SUITABLE FOR THE LOCATION AND SHALL BE CAREFULLY COMPACTED TO PROVIDE A STABLE FILL WITHOUT DAMAGING THE PIPE. FILL UNDER CAR PARKING AREAS, SHARED DRIVES AND PRIVATE ROADS SHALL BE WELL COMPACTED GRADED GRANULAR MATERIAL. FILL UNDER ADOPTABLE ROADS MAY NEED TO BE TYPE 1 GRANULAR SUB-BASE MATERIAL

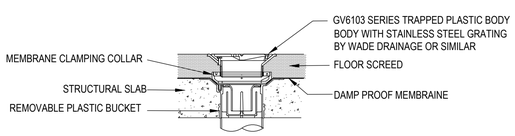
TYPICAL TRENCH BEDDING DETAILS

SCALE - 1:20



TYPICAL BIRCO 150 CHANNEL DETAIL

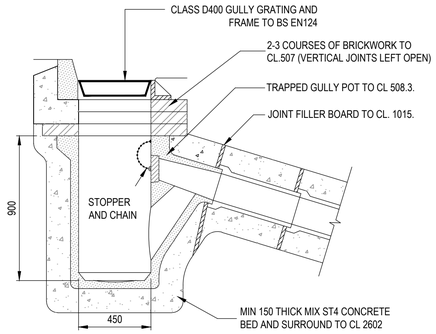
SCALE - N.T.S.



INTERNAL TRAPPED FLOOR GULLY DETAIL

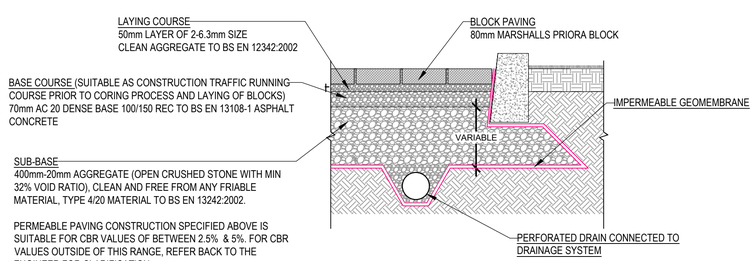
(TO M&E/ARCHITECTS SPECIFICATION)

SCALE - 1:20



TRAPPED ROAD GULLY

SCALE - 1:20



CONSTRUCTION SPECIFICATION FOR TANKED PERMEABLE BLOCK PAVING

SCALE - 1:20

NOTES

1) THE DEVELOPER SHOULD TAKE ALL NECESSARY PRECAUTIONS TO AVOID CAUSING ANY DAMAGE TO, OR INTERFERENCE WITH FLOW IN EXISTING SEWERS AND SHALL ENSURE THAT DEBRIS, SILT, MUD ETC. DO NOT ENTER WHERE WORKS ARE TO BE CARRIED OUT ON SEWERS.
2) THE CONTRACTOR MUST CARRY OUT THEIR WORKS IN ACCORDANCE WITH "THE CLASSIFICATION AND MANAGEMENT OF CONFINED SPACES" PUBLISHED BY WATER UK. THEY MUST ALSO COMPLY WITH ALL OTHER RELEVANT HEALTH AND SAFETY LEGISLATION/ DOCUMENTATION.
3) ALL MATERIALS ARE TO BE STORED IN SUCH A MANNER AS TO PRESERVE THEIR QUALITY AS TO THE STANDARD SPECIFIED IN THE SPECIFICATION.
4) ALL CONCRETE TO BE PRODUCED ON SITE MUST BE MIXED WITH ONLY POTABLE WATER, TO ENSURE THAT IT IS CLEAN FROM DIRT AND AGGREGATES FOR CONCRETES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 12620 AND PD 6682-1.
5) SANDS FOR MORTAR AND GROUTS SHALL BE WASHED SAND, COMPLYING WITH BS EN 13139 AND PD 6682-3. ALL OTHER SANDS ARE TO COMPLY WITH BS EN 12620 AND PD 6682-1 OR BS EN 13139 AND PD 6682-3.
6) PULVERISED-FUEL ASH (PFA) FOR USE AS A COMPONENT MATERIAL IN CEMENTITIOUS GROUT OUR NON STRUCTURAL CONCRETE SHALL COMPLY VIRTIFIED CLAY PIPES AND FITTINGS FOR SEWERS SHALL HAVE FLEXIBLE MECHANICAL JOINTS.
7) PIPES FOR FOUL SEWERS AND SURFACE WATER SEWERS SHALL COMPLY WITH THE RELEVANT REQUIREMENTS OF BS EN295 AND BS65 (SURFACE WATER PIPES ONLY) PRE-CAST CONCRETE MANHOLE UNITS OF CIRCULAR CROSS SECTION FOR MANHOLES, CHAMBERS AND WET WELLS SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 1917 AND BS 5911-3.
8) LADDERS FOR MANHOLES IN A VERTICAL PLANE ARE TO BE MILD STEEL AND COMPLY WITH BS4211, CLASS A AND PD 970. GRP LADDERS SHALL BE MANUFACTURED IN ACCORDANCE WITH BS EN 131, AND FROM GLASS-REINFORCED POLYESTER USING AN APPROPRIATE RESIN FOR THE LADDER LOCATION. UNIDIRECTION REINFORCEMENT SHALL BE PROVIDED IN THE GRP MATRIX TO MAXIMISE STRENGTH.
9) MANHOLE COVERS AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 124, BS 7903 AND HIGHWAYS AGENCY GUIDANCE DOCUMENT HA 104/02. THEY SHALL BE OF A NON-ROCKING DESIGN WHICH DO NOT RELY ON THE USE OF CUSHION INSERTS.
10) CLAY BRICKS TO BE USED WITHIN MANHOLES ARE TO BE SOLID, CLASS B ENGINEERING BRICKS COMPLYING TO BS 3921. ALL BRICKS SHALL BE FROST RESISTANT CATEGORY F. STANDARD CONCRETE MIXES SHOULD BE IN ACCORDANCE WITH BS EN 206-1 AND BS 8500 AND SHALL BE USED WITH A 20MM NOMINAL MAXIMUM SIZE OF AGGREGATE AND A SLUMP CLASS OF S2 FOR A TARGET OF 70MM.
11) GEN1 CONCRETE TO BE USED FOR; FILLINGS, BLINDINGS, SOFT SPOTS AND DRAINAGE SLUMPS. GEN3 CONCRETE TO BE USED FOR; ALL OTHER APPLICATIONS. U.N.O. ADMIXTURES (INCLUDING CALCIUM CHLORIDE AND PIGMENTS) SHALL NOT BE USED IN THE PRODUCTION OF CONCRETE.
12) HIGH STRENGTH CONCRETE TOPPING SHALL BE PRODUCED, LAID AND FINISHED IN ACCORDANCE WITH THE RELEVANT PROVISIONS OF BS 8204: PART 2 AND THE FOLLOWING APPROXIMATE MIX PROPORTIONS SHALL BE USED: 1PART CEMENT, 1 PART NATURAL SAND AND 2 PARTS SINGLE-SIZED COARSE AGGREGATE.
13) ALL MORTAR MIXES SHALL BE IN ACCORDANCE WITH BS 5628-1:2005. ALL PIPES TO BE EITHER EXTRA STRENGTH VC TO BS 65 OR PVC TO BS 4660 OR BS 5481 "UPONOR ULTRARIB"

REVISIONS

REV	DESCRIPTION	DATE	BY
–	FIRST ISSUE AS DRAFT	12/07/22	WR
A	FIRST ISSUE FOR PLANNING	13/07/22	WR
B	SECOND ISSUE FOR PLANNING	27/07/22	WR

Aval Consulting Group
Transportation Planning : Environmental Consultants
www.aval-group.co.uk, Email: contact@aval-group.co.uk
Company Number: 11922039

Client Name: WELDIN BUILDERS LTD

Project Title: FRIARS GARTH, KT18 5DH

Drawing Title: PROPOSED STANDARD DRAINAGE DETAILS

Date:	Drawn By:
13.07.2022	PR
Scale: 1:20 @ A1, 1:40 @ A3	Checked: WR
Status: PLANNING	Approved: AC

Drawing No.: AVAL/91833/0500/001

Rev.: A

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.840	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
IC-01	0.008	5.00	19.650	750	0.935
IC-02	0.005	5.00	19.750	750	1.141
IC-03	0.005	5.00	20.160	750	1.652
IC-04			20.000	750	1.582
IC-05	0.005	5.00	19.850	750	1.570
IC-06	0.005	5.00	19.800	750	1.575
MH-07	0.013	5.00	19.500	1200	1.459
Junc_Prop			19.450		1.805
Carpark	0.036	5.00	19.800	750	1.250

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.001	IC-01	IC-02	10.600	0.600	18.715	18.609	0.106	100.0	150	5.18	50.0
1.002	IC-02	IC-03	10.100	0.600	18.609	18.508	0.101	100.0	150	5.34	50.0
1.003	IC-03	IC-04	9.000	0.600	18.508	18.418	0.090	100.0	150	5.49	50.0
1.004	IC-04	IC-05	13.800	0.600	18.418	18.280	0.138	100.0	150	5.72	50.0
1.005	IC-05	IC-06	5.500	0.600	18.280	18.225	0.055	100.0	150	5.81	50.0
1.006	IC-06	MH-07	18.400	0.600	18.225	18.041	0.184	100.0	150	6.12	50.0
1.007	MH-07	Junc_Prop	7.000	0.600	18.041	17.645	0.396	17.7	150	6.17	50.0
1.008	Carpark	IC-03	2.000	0.600	18.550	18.530	0.020	100.0	150	5.03	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.001	1.005	17.8	1.2	0.785	0.991	0.008	0.0	27	0.576
1.002	1.005	17.8	2.0	0.991	1.502	0.013	0.0	34	0.663
1.003	1.005	17.8	8.2	1.502	1.432	0.054	0.0	72	0.986
1.004	1.005	17.8	8.2	1.432	1.420	0.054	0.0	72	0.986
1.005	1.005	17.8	9.0	1.420	1.425	0.059	0.0	75	1.006
1.006	1.005	17.8	9.7	1.425	1.309	0.064	0.0	79	1.028
1.007	2.407	42.5	11.7	1.309	1.655	0.077	0.0	54	2.058
1.008	1.005	17.8	5.5	1.100	1.480	0.036	0.0	57	0.886

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.001	10.600	100.0	150	Circular	19.650	18.715	0.785	19.750	18.609	0.991
1.002	10.100	100.0	150	Circular	19.750	18.609	0.991	20.160	18.508	1.502
1.003	9.000	100.0	150	Circular	20.160	18.508	1.502	20.000	18.418	1.432
1.004	13.800	100.0	150	Circular	20.000	18.418	1.432	19.850	18.280	1.420
1.005	5.500	100.0	150	Circular	19.850	18.280	1.420	19.800	18.225	1.425
1.006	18.400	100.0	150	Circular	19.800	18.225	1.425	19.500	18.041	1.309
1.007	7.000	17.7	150	Circular	19.500	18.041	1.309	19.450	17.645	1.655
1.008	2.000	100.0	150	Circular	19.800	18.550	1.100	20.160	18.530	1.480

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.001	IC-01	750	Manhole	Adoptable	IC-02	750	Manhole	Adoptable
1.002	IC-02	750	Manhole	Adoptable	IC-03	750	Manhole	Adoptable
1.003	IC-03	750	Manhole	Adoptable	IC-04	750	Manhole	Adoptable
1.004	IC-04	750	Manhole	Adoptable	IC-05	750	Manhole	Adoptable
1.005	IC-05	750	Manhole	Adoptable	IC-06	750	Manhole	Adoptable
1.006	IC-06	750	Manhole	Adoptable	MH-07	1200	Manhole	Adoptable
1.007	MH-07	1200	Manhole	Adoptable	Junc_Prop		Junction	
1.008	Carpark	750	Manhole	Adoptable	IC-03	750	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
IC-01	19.650	0.935	750	0	1.001	18.715	150
IC-02	19.750	1.141	750	1	1.001	18.609	150
				0	1.002	18.609	150
IC-03	20.160	1.652	750	1	1.008	18.530	150
				2	1.002	18.508	150
				0	1.003	18.508	150
IC-04	20.000	1.582	750	1	1.003	18.418	150
				0	1.004	18.418	150
IC-05	19.850	1.570	750	1	1.004	18.280	150
				0	1.005	18.280	150
IC-06	19.800	1.575	750	1	1.005	18.225	150
				0	1.006	18.225	150

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
MH-07	19.500	1.459	1200		1	1.006	18.041	150
					0	1.007	18.041	150
Junc_Prop	19.450	1.805			1	1.007	17.645	150
Carpark	19.800	1.250	750		0	1.008	18.550	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
100	40	0	0

Node Carpark Online Orifice Control

Flap Valve	x	Design Depth (m)	1.250	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Flow (l/s)	4.0		
Invert Level (m)	18.550	Diameter (m)	0.040		

Node MH-07 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	18.041	Product Number	CTL-SHE-0062-2000-1400-2000
Design Depth (m)	1.400	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node Carpark Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	19.000	Slope (1:X)	350.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	20.000	Inf Depth (m)	
Porosity	0.30	Length (m)	15.000		

Node IC-05 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	18.280
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	36.0	0.0	0.400	36.0	0.0	0.401	0.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	109.521	30.991
1 year 15 minute winter	76.857	30.991
1 year 30 minute summer	71.439	20.215
1 year 30 minute winter	50.133	20.215
1 year 60 minute summer	48.435	12.800
1 year 60 minute winter	32.179	12.800
1 year 120 minute summer	30.053	7.942
1 year 120 minute winter	19.966	7.942
1 year 180 minute summer	23.233	5.979
1 year 180 minute winter	15.102	5.979
1 year 240 minute summer	18.475	4.882
1 year 240 minute winter	12.274	4.882
1 year 360 minute summer	14.169	3.646
1 year 360 minute winter	9.210	3.646
1 year 480 minute summer	11.185	2.956
1 year 480 minute winter	7.431	2.956
1 year 600 minute summer	9.182	2.511
1 year 600 minute winter	6.274	2.511
1 year 720 minute summer	8.203	2.199
1 year 720 minute winter	5.513	2.199
1 year 960 minute summer	6.768	1.782
1 year 960 minute winter	4.483	1.782
1 year 1440 minute summer	4.949	1.326
1 year 1440 minute winter	3.326	1.326
1 year 2160 minute summer	3.574	0.988
1 year 2160 minute winter	2.462	0.988
1 year 2880 minute summer	2.986	0.800
1 year 2880 minute winter	2.007	0.800
1 year 4320 minute summer	2.276	0.595
1 year 4320 minute winter	1.499	0.595
1 year 5760 minute summer	1.885	0.483
1 year 5760 minute winter	1.220	0.483
1 year 7200 minute summer	1.609	0.410
1 year 7200 minute winter	1.038	0.410
1 year 8640 minute summer	1.409	0.359
1 year 8640 minute winter	0.910	0.359
1 year 10080 minute summer	1.260	0.322
1 year 10080 minute winter	0.813	0.322
100 year +40% CC 15 minute summer	488.233	138.153
100 year +40% CC 15 minute winter	342.620	138.153
100 year +40% CC 30 minute summer	320.551	90.705
100 year +40% CC 30 minute winter	224.948	90.705
100 year +40% CC 60 minute summer	214.603	56.713

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +40% CC 60 minute winter	142.577	56.713
100 year +40% CC 120 minute summer	129.587	34.246
100 year +40% CC 120 minute winter	86.094	34.246
100 year +40% CC 180 minute summer	97.729	25.149
100 year +40% CC 180 minute winter	63.526	25.149
100 year +40% CC 240 minute summer	75.977	20.078
100 year +40% CC 240 minute winter	50.477	20.078
100 year +40% CC 360 minute summer	56.677	14.585
100 year +40% CC 360 minute winter	36.841	14.585
100 year +40% CC 480 minute summer	43.979	11.622
100 year +40% CC 480 minute winter	29.219	11.622
100 year +40% CC 600 minute summer	35.604	9.738
100 year +40% CC 600 minute winter	24.327	9.738
100 year +40% CC 720 minute summer	31.433	8.424
100 year +40% CC 720 minute winter	21.125	8.424
100 year +40% CC 960 minute summer	25.432	6.697
100 year +40% CC 960 minute winter	16.847	6.697
100 year +40% CC 1440 minute summer	18.055	4.839
100 year +40% CC 1440 minute winter	12.134	4.839
100 year +40% CC 2160 minute summer	12.630	3.490
100 year +40% CC 2160 minute winter	8.702	3.490
100 year +40% CC 2880 minute summer	10.319	2.766
100 year +40% CC 2880 minute winter	6.935	2.766
100 year +40% CC 4320 minute summer	7.609	1.989
100 year +40% CC 4320 minute winter	5.011	1.989
100 year +40% CC 5760 minute summer	6.145	1.573
100 year +40% CC 5760 minute winter	3.978	1.573
100 year +40% CC 7200 minute summer	5.137	1.311
100 year +40% CC 7200 minute winter	3.316	1.311
100 year +40% CC 8640 minute summer	4.424	1.129
100 year +40% CC 8640 minute winter	2.855	1.129
100 year +40% CC 10080 minute summer	3.897	0.994
100 year +40% CC 10080 minute winter	2.515	0.994

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.09%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	IC-01	11	18.740	0.025	1.1	0.0155	0.0000	OK
15 minute winter	IC-02	11	18.641	0.032	1.8	0.0170	0.0000	OK
15 minute winter	IC-03	11	18.563	0.055	4.7	0.0277	0.0000	OK
15 minute winter	IC-04	10	18.477	0.059	4.7	0.0261	0.0000	OK
60 minute winter	IC-05	51	18.378	0.098	4.5	3.3860	0.0000	OK
60 minute winter	IC-06	52	18.377	0.152	3.0	0.0770	0.0000	SURCHARGED
60 minute winter	MH-07	50	18.376	0.335	3.0	0.4386	0.0000	SURCHARGED
15 minute summer	Junc_Prop	29	17.665	0.020	1.6	0.0000	0.0000	OK
15 minute winter	Carpark	14	19.023	0.473	5.1	1.0190	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	IC-01	1.001	IC-02	1.1	0.468	0.062	0.0250	
15 minute winter	IC-02	1.002	IC-03	1.8	0.422	0.101	0.0437	
15 minute winter	IC-03	1.003	IC-04	4.7	0.773	0.263	0.0552	
15 minute winter	IC-04	1.004	IC-05	4.7	1.191	0.267	0.0691	
60 minute winter	IC-05	1.005	IC-06	2.7	0.611	0.152	0.0818	
60 minute winter	IC-06	1.006	MH-07	2.1	0.168	0.117	0.3239	
60 minute winter	MH-07	1.007	Junc_Prop	1.6	1.149	0.038	0.0099	8.3
15 minute winter	Carpark	1.008	IC-03	2.2	0.639	0.124	0.0069	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.09%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	IC-01	128	19.161	0.446	1.2	0.2733	0.0000	SURCHARGED
180 minute winter	IC-02	128	19.161	0.552	2.1	0.2920	0.0000	SURCHARGED
180 minute winter	IC-03	128	19.162	0.654	4.8	0.3283	0.0000	SURCHARGED
180 minute winter	IC-04	128	19.161	0.743	4.7	0.3283	0.0000	SURCHARGED
180 minute winter	IC-05	128	19.160	0.880	5.7	14.1416	0.0000	SURCHARGED
180 minute winter	IC-06	128	19.160	0.935	2.8	0.4722	0.0000	SURCHARGED
180 minute winter	MH-07	128	19.159	1.118	2.4	1.4640	0.0000	SURCHARGED
180 minute winter	Junc_Prop	128	17.666	0.021	1.8	0.0000	0.0000	OK
120 minute winter	Carpark	120	19.158	0.608	7.2	12.9364	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	IC-01	1.001	IC-02	1.2	0.486	0.068	0.1866	
180 minute winter	IC-02	1.002	IC-03	1.9	0.437	0.107	0.1778	
180 minute winter	IC-03	1.003	IC-04	4.7	0.807	0.267	0.1584	
180 minute winter	IC-04	1.004	IC-05	4.4	0.851	0.246	0.2429	
180 minute winter	IC-05	1.005	IC-06	2.5	0.573	0.142	0.0968	
180 minute winter	IC-06	1.006	MH-07	1.7	0.184	0.097	0.3239	
180 minute winter	MH-07	1.007	Junc_Prop	1.8	1.184	0.042	0.0106	37.4
120 minute winter	Carpark	1.008	IC-03	2.3	0.644	0.128	0.0352	

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.400	2.000
Flush-Flo™	0.272	1.618
Kick-Flo®	0.553	1.316
Mean Flow		1.572

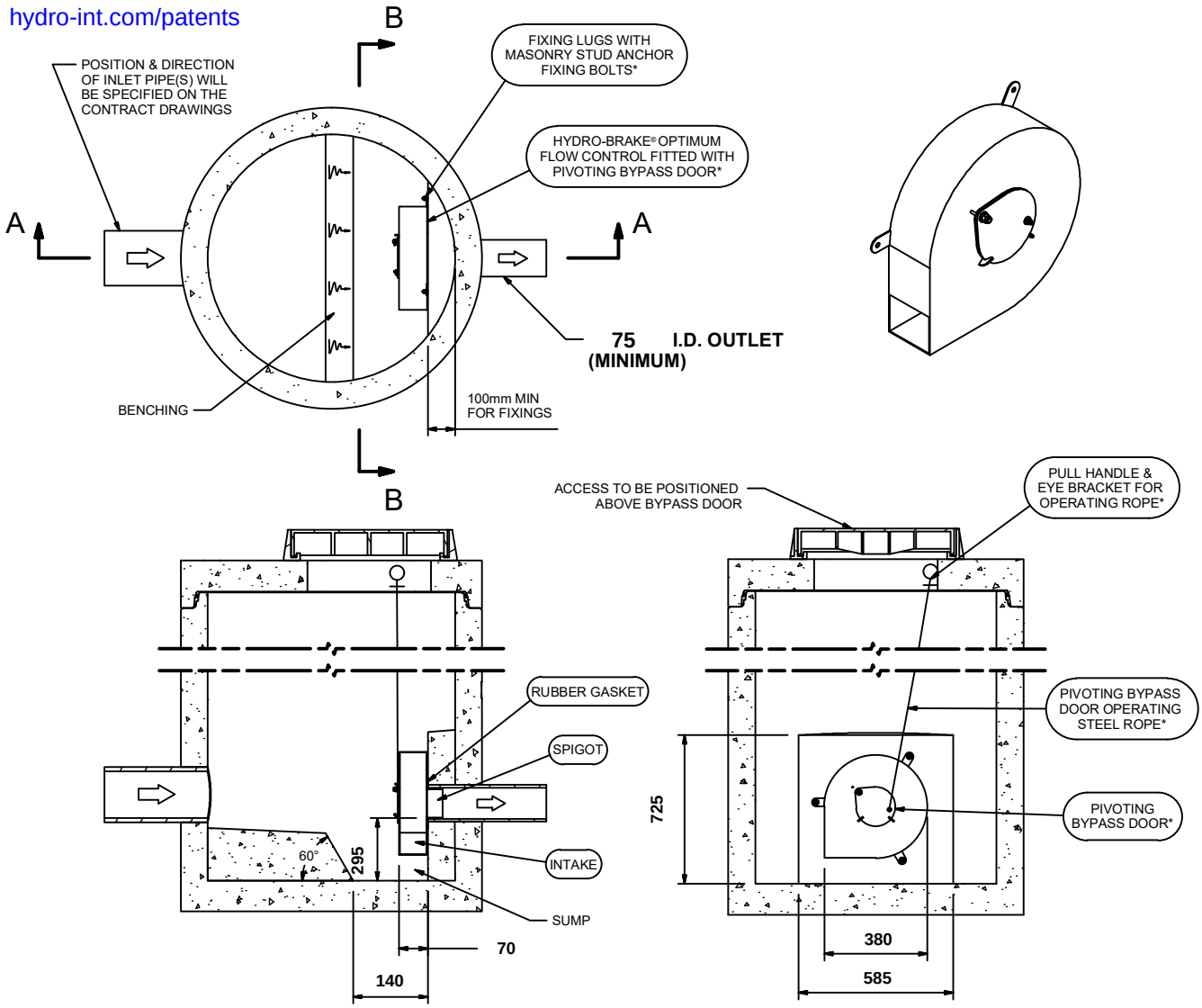
Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 67 kg

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE 08/4596

WRC Approved PT/329/0412

hydro-int.com/patents



SECTION A-A

SECTION B-B

IMPORTANT: ⬭ LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE

The head/flow characteristics of this SHE-0062-2000-1400-2000 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International®

DATE	28/09/2022 07:51
SITE	Friars Garth, Epsom KT18 5DH
DESIGNER	Pratheek Ramesh
REF	91833 / 22_21_4097

SHE-0062-2000-1400-2000
Hydro-Brake® Optimum

pratheek.ramesh@aval-group.co.uk

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.400	2.000
Flush-Flo	0.272	1.618
Kick-Flo®	0.553	1.316
Mean Flow		1.572

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412

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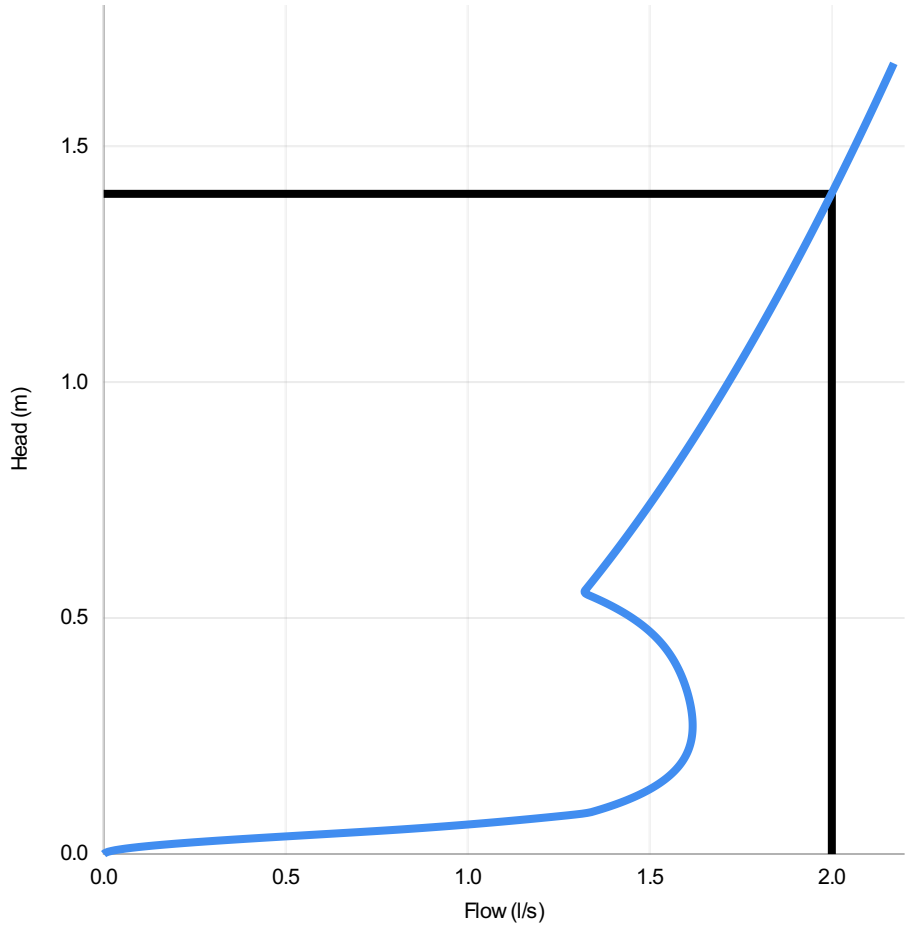

Head (m)	Flow (l/s)
0.000	0.000
0.048	0.735
0.097	1.372
0.145	1.516
0.193	1.586
0.241	1.614
0.290	1.617
0.338	1.605
0.386	1.582
0.434	1.545
0.483	1.484
0.531	1.383
0.579	1.343
0.628	1.392
0.676	1.439
0.724	1.484
0.772	1.528
0.821	1.570
0.869	1.611
0.917	1.650
0.966	1.689
1.014	1.727
1.062	1.763
1.110	1.799
1.159	1.834
1.207	1.868
1.255	1.902
1.303	1.935
1.352	1.967
1.400	1.999

DESIGN ADVICE

The head/flow characteristics of this SHE-0062-2000-1400-2000 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

! **The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.**

Hydro International®

DATE	28/09/2022 07:51
Site	Friars Garth, Epsom KT18 5DH
DESIGNER	Pratheek Ramesh
Ref	91833 / 22_21_4097

SHE-0062-2000-1400-2000

Hydro-Brake Optimum®

Appendix E: Proposed Exceedance Flow Route and CEMP

Scale 1:100 @ A1 - 1:200 @ A3

2m 0 2m 4m 6m 8m 10m

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT SPECIALIST DETAILS AND SPECIFICATIONS.
2. ALL DIMENSIONS ARE IN METERS UNLESS STATED OTHERWISE.

KEY

- SITE BOUNDARY
- PROPOSED EXCEEDANCE FLOW ROUTE

REVISIONS

REV	DESCRIPTION	DATE	BY
–	FIRST ISSUE PLANNING	31/08/22	WR

Aval Consulting Group

Transportation Planning : Environmental Consultants

www.aval-group.co.uk, Email: contact@aval-group.co.uk

Company Number: 11622039

Client Name:

WELDIN BUILDERS LTD

Project Title:

FRIARS GARTH, EPSOM KT18 5DH

Drawing Title:

PROPOSED EXCEEDANCE FLOW ROUTE

Date:	13.07.2022	Drawn By:	PR
Scale:	1:100 @ A1 1:200 @ A3	Checked:	WR
Status:	PLANNING	Approved:	AC

Drawing No.	Rev.
AVAL/91833/DR/004	-

CEMP for protection of drainage system

Friars Garth

The Parade
Epsom
Surrey

Liquids Management

To eliminate the risk of any potential ground, water course or drainage contamination from the various liquids which are used on site and from generated effluents the following control measures will be implemented on site

Liquids Control Measures

• All diesel fuel for the site plant will be stored on site within double skinned fuel bowsers located at predetermined points on site for easy access by plant but away from any drainage access point. The refuelling lines will be fitted with automatic shut off devices and unattended refuelling will not be allowed at any time. Lorries and other vehicles normally used on public roads will not be refuelled on site.

• The plant refuelling areas will be on a hard stand area and have a quantity of absorbent materials (Anti Spill Kit) available in case of any diesel spillage, which will be cleaned up immediately.

• Other items requiring storage on site such as hydraulic oils etc. will be in the appropriate storage drums stored in a provided secure container located at the appropriate position within the plant and material area shown in method of construction drawing

• All site welfare facilities effluent and sewage discharge will be via connections to the public drainage system.

• All wastewater from the site welfare facilities shall flow through fixed connections to the appropriate drains. At no time will any effluent be allowed to discharge directly onto the ground or surrounding.

• All active drainage points within and adjacent to the site will be clearly identified and where necessary a means of water filtration installed around them.

• All waste water from the onsite asbestos personnel de-contamination units will pass through installed propriety waste water filters before entering the drainage system. (No asbestos detected)

- At the onset of demolition existing hardstanding's and unsuitable sub-base material where necessary will be removed and replaced with a temporary permeable hard standing constructed of crushed concrete, hard-core or type 1 road stone and maintained as necessary for the duration of the project. Creating a permeable surface within the site allowing for natural drainage and removing the risk of surface water run-off.
- In addition to the above a concrete bund (sleeping policeman type hump) will be constructed across the existing entrance of the site on The Parade with a gully inside the site falling to the "filtration trench and silt settlement tank/pond

• At no time will any dust control water sprays be allowed to generate a flow of runoff water.

• All such water spray operations will always be controlled and managed by appointed site personnel in attendance. Filters will be installed over drain outlets.

• Demolition site damping down water run-off and all other wastewaters will be disposed of in accordance with the requirements of the Environmental Agency.

• The company will identify then regularly inspect all on-site drainage systems and those adjacent to the site boundary and will ensure that they are maintained in an efficient state of repair and remain free of contamination and are not providing a potential means of rodent access.

• A specialist waste contractor will be employed to dispose of any hazardous liquid wastes found on site and disposed of in accordance with those regulations

Ground Contamination

To minimise the risk of ground contamination on site the following control measures will be implemented which will be actioned by designated site personnel using liquid absorbent materials such as granules, Anti Spill Kits and fine sand, which will be stored at a designated location on site. All such wastes from clearing a spillage incident will be placed into the appropriate waste container such as an oil drum which will then be removed from site for disposal as Hazardous Waste under consignment note.

To ensure ground contamination is kept at a minimum the following standards will be actioned:

• All diesel storage and refuelling areas will be on a hard stand which will be covered in absorbent granules and have their own fire points & Anti Spill Kits.

• An area on site will be designated the plant service and maintenance area where it will be covered in absorbent granules with Anti Spill Kits located nearby.

• Any liquid escape or spillage such as an oil leak will be cleaned up immediately by the designated site personnel acting as a site spillage team

• All standing plant will have drip trays placed underneath them

• Silt run off Land, water borne Measures to be put in place to prevent run off, filtration trench and silt settlement tank / pond.

In the event of a significant environmental pollution occurrence, Environment Agency and the Corporation of London will be advised immediately.

Appendix F: Maintenance Plan

Aval Consulting Group.

Drainage Strategy – Maintenance Plan

Friars Garth, Epsom KT18 5DH

Weldin Builders Ltd

February 2024

Project Information

Title	Drainage Strategy – Maintenance Plan
Job Code	91833
Sector	Drainage
Report Type	DS
Client	Weldin Builders Ltd
Revision	B
Status	Final
Date of Issue	27 February 2024

Revision History

Revision	Date	Author	Reviewer	Approver	Status
A	28 September 2022	PR	WR	AC	Final
B	27 February 2024	PR	WR	AC	Final

Disclaimer

1. Introduction

Aval Consulting Limited has been commissioned by Weldin Builders Ltd ('the client') to provide a Drainage Infrastructure Maintenance Plan in relation to a planning application for the proposed development of a residential flat block with associated gardens, public open spaces, new road and associated infrastructure located at Friars Garth, Epsom KT18 5DH.

The purpose of the report is to set out the maintenance plan of various SuDS used within the site. Maintenance programmes will be provided to ensure optimal performance of the SuDS proposed within the site to prevent any unforeseen risks of flooding within the site or elsewhere.

The maintenance and inspection programme are standard to the proposed SuDS. However, suppliers of the SuDS may request additional maintenance and inspections if necessary. It is therefore recommended to adjust the maintenance and inspection programme in order to maximise the performance efficiency of the SuDS.

The contractor/company in charge of the maintenance and inspection is expected to follow the proposed maintenance and inspection plans.

2. Proposed SuDS as Part of Proposed Development

The proposed development includes the following SuDS within the design:

- Permeable Paving
- Attenuation Storage
- Flow Controls (Hydrobrake and Orifice Plate)

Permeable paving is proposed to be used within the driveway/carpark area of the site. The surface water from the driveway/carpark will be discharged using the sub-base as a tank into the surface water drainage network, via an Orifice Plate being used to restrict the surface water discharge from the permeable paving sub-base.

It is proposed to have a 0.4m sub-base to temporarily store and discharge surface water.

Attenuation Storage is proposed to be placed at the rear of the site to allow for any additional surface water from the proposed building and the permeable paving to be temporarily stored prior to discharge to the public surface water sewer.

A Hydrobrake will be used to restrict the discharge of surface water prior to discharge into the public surface water sewer.

3. SuDS Maintenance Plan

There are three types of maintenance that may be required to be undertaken:

- Regular Maintenance
- Occasional Maintenance
- Remedial Maintenance

Regular maintenance is a frequent and planned maintenance/inspection schedule. This can include but is not limited to basic tasks such as debris removal, vegetation clearance/management, etc.

Occasional maintenance is a much less frequent and predictable schedule. It is mostly done periodically. This can include but is not limited to sediment removal.

Remedial maintenance is where maintenance is done to fix or repair faults within the system. This can be in the form of restricting the attenuation tanks, repairing flow controls, etc.

In all cases, all maintenance and inspections carried out should be recorded by the contractor/company in charge of the maintenance of the system. This should include information about the status of the system and the actions taken during any maintenance tasks.

Table 1 is the Maintenance Plan for the permeable paving.

Table 1: Maintenance Plan for Permeable Paving

Type of Maintenance	Action Required	Frequency
Monitoring/Inspection	Inspection of plant growth	Quarterly
	Review surface for any evidence of displacement/misshape/damage of paving blocks	Quarterly
	Review of clogging within joints of paving blocks	Quarterly
Regular Maintenance	Cleaning of the surface with brush and vacuum	Annually (preferably during autumn)
	Removing any silt/dirt	Annually

Occasional Maintenance	To clean off contributing areas	As required
	Removing any plant growth or managing the growth of plants	As required
Remedial Actions	To restore landscape where vegetation has raised to above 50mm from paving surface	As required
	To lift/replace any damaged blocks and to repair joints	As required
	Repair of inner structure	As required

Table 2 contains the maintenance plans of the attenuation storage.

Table 2: Maintenance Plan for Attenuation Storage

Type of Maintenance	Action Required	Frequency
Monitoring/Inspection	Inspection of inlet and outlet pipes	Quarterly
	Review of water levels within the system	Quarterly
Regular Maintenance	CCTV survey of the tank to inspect the condition	Annually
	Removing any silt/dirt	Bi-annually
Occasional Maintenance	Flushing of system to remove any dirt/silt	As required
Remedial Actions	To replace/repair damaged components	As required

Table 3 contains the maintenance plans of the flow controls.

Table 3: Maintenance Plan for Flow Controls

Type of Maintenance	Action Required	Frequency
Regular Maintenance	Inspection of flow control from the surface	Monthly
	Removing any silt/dirt	Monthly
Occasional Maintenance	Checking connection features of flow control to ensure parts such as bolts are not loose	Annually unless required
Remedial Actions	To replace and repair damaged components	As required