



Powell Tolner & Associates Ltd

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

Project: Milton Place, Gravesend

PTA Project No: 10109

Document Ref: 10109-PTA-XX-XX-RP-C-9071

Status: Issue for Planning

Revision: P02

Date: February 2025

Client: Gravesham Community Investment Partnership LLP



Issued by

PTA
29 Red Lion Street
Chesham
Buckinghamshire
United Kingdom
HP5 1EJ
Tel: + 44 1494 772721
central@ptaconsult.co.uk

	Name	Position	Signature	Date
Prepared by:	Tom Aldridge	Senior Civil Engineer	TA	05.02.2025
Reviewed by:	Alex Herman	Director	AH	05.02.2025
For and on behalf of Powell Tolner & Associates Limited				

Revision	Date	Description	Prepared	Reviewed
P01	21.02.25	Issued for Planning	DH	AH
P02	16.04.25	Issued for Planning	DH	AH

This report has been produced by Powell Tolner & Associates Ltd for exclusive use by the client named on the document. This report may not be relied upon by any other party without written consent from Powell Tolner & Associates Ltd. Powell Tolner & Associates Ltd accept no liability for any costs, liabilities or losses arising as a result of the use or reliance upon the contents of this report by any person other than the named client.

All comments and conclusions in this report are based on our reliance on the sourced data and Powell Tolner & Associates Ltd accept no liability for any inaccuracy in that information.

©This report is the copyright of PTA.

Any unauthorised reproduction or usage by any person other than the addressee is strictly prohibited.

TABLE OF CONTENTS

1	INTRODUCTION	1
2	DEVELOPMENT DESCRIPTION.....	2
2.1	Location	2
2.2	Existing Site.....	3
2.3	Development Proposals	3
3	FLOOD RISK.....	4
3.1	National Planning Policy Framework.....	4
3.2	Flood Vulnerability Classification	4
3.3	Flood Zone Compatibility	4
3.4	Flood Risk Sources	5
3.4.1	Rivers and Tidal.....	5
3.4.2	Ground Water.....	5
3.4.3	Overland Flows.....	6
3.4.4	Sewers	7
3.4.5	Other Sources.....	7
3.5	Climate Change.....	8
3.6	Residual Risk	8
4	FLOOD RISK MANAGEMENT	9
4.1	Existing Surface Water Runoff.....	9
4.2	Floor Levels.....	9
4.3	Sustainable Drainage Techniques.....	9
4.3.1	Living Roofs.....	10
4.3.2	Basins and Ponds	10
4.3.3	Filter Strips and Swales.....	10
4.3.4	Infiltration Devices	10
4.3.5	Permeable Paving.....	11
4.3.6	Tanked Systems.....	11
4.4	Surface Water Discharge Hierarchy Assessment.....	11
4.4.1	Discharge Through Infiltration	11
4.4.2	Discharge into Surface Water Body.....	11
4.4.3	Discharge to Surface Water Sewers	11

4.4.4	Discharge to Combined Sewer	11
4.5	Proposed Drainage	11
4.5.1	Kent County Council's LLFA Correspondence	11
4.5.2	Proposed Surface Water Drainage	12
4.5.3	Drainage Model	12
4.5.4	Proposed Surface Water Treatment	12
4.5.5	Proposed Foul Water Drainage	12
4.5.6	Drainage Maintenance Strategy	13
5	OFFSITE IMPACT	14
6	CONCLUSION	15
	APPENDIX A – Architectural Site Plan	16
	APPENDIX B – Topographic Survey	17
	APPENDIX C – Phase 2 Geo-Environmental Assessment	18
	APPENDIX D – Groundwater Risk Areas	19
	APPENDIX E – Southern Water Asset Plans	20
	APPENDIX F – Southern Water Pre-Planning Enquiry Response	21
	APPENDIX G – Kent County Council's LLFA Correspondence	22
	APPENDIX H – Post Development Drainage Calculations	23
	APPENDIX I – Proposed Drainage Layout	24
	APPENDIX J – Below Ground Drainage Maintenance Plan	25

1 INTRODUCTION

Powell Tolner and Associates Limited (PTA) have been appointed by Gravesham Community Investment Partnership LLP to undertake a Flood Risk Assessment (FRA) and Drainage Strategy (DS) to support the full planning application for the development at Milton Place.

The National Planning Policy Framework (NPPF) states that ‘a site-specific FRA is required for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more’. As the site area is over 1 hectare, a site-specific FRA is required.

This FRA investigates both the onsite and offsite flood risk from all sources for the development and sets out mitigation measures within the drainage strategy to ensure the sustainability and safety of the proposed development over its lifetime.

This FRA and drainage strategy has been produced in line with the requirements of the National Planning Policy Framework (NPPF 2021) and the Environment Agency’s (EA) Standing Advice.

2 DEVELOPMENT DESCRIPTION

2.1 Location

This site is located on the east side of Milton Place, Gravesend, Kent, DA12 2BT at National Grid reference TQ652740 with an Easting of 565273 and Northing of 174099. The site is bounded by Milton Place running along the west and Ordnance Road south of the site with a footpath located at the north of the site with New Tavern Fort beyond. See Figure 1 and Figure 2 showing the Site location.



Figure 1: Site Location – Extract from Open Street Map

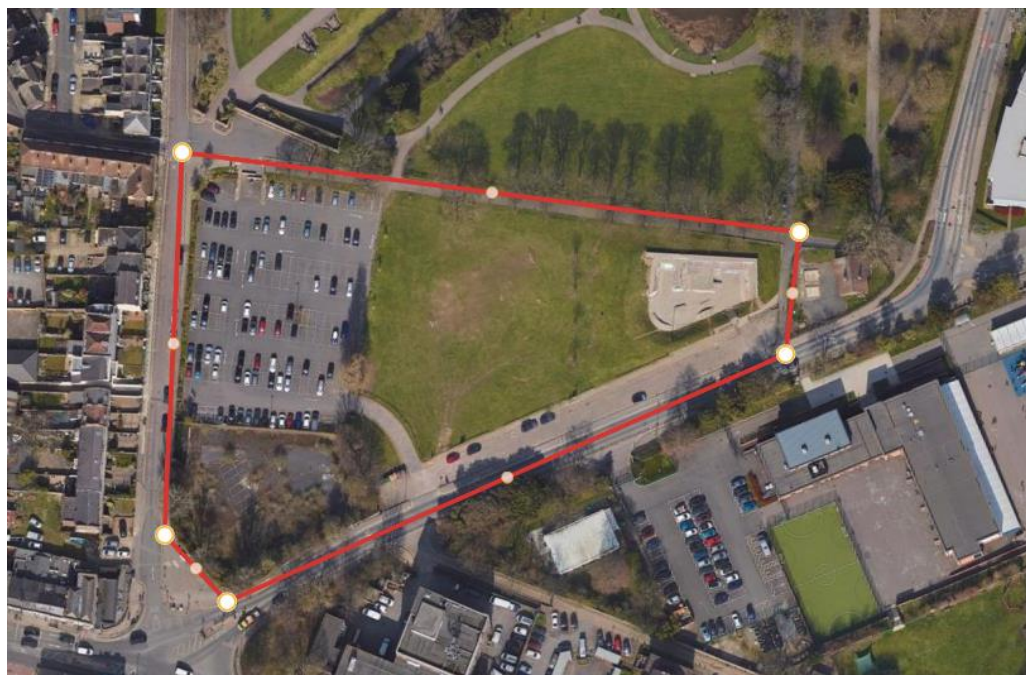


Figure 2: Aerial Photo – Extract from Google Maps

2.2 Existing Site

The existing site is comprised of a car park (currently in use), a skate park, an area of open space and an area of brownfield land (former BT depot).

A Church building was previously situated on the southwest corner of the site, along with a former swimming pool, municipal buildings and the old school.

A topographical survey taken by Survey Solutions dated 25/04/2023 is included within Appendix B of this report.

A breakdown of the existing site area can be seen in Table 1 below.

Total Site Area		14,326 m²
Permeable Areas (soft landscaping)		6,096 m ²
Impermeable Area	Hardstanding Areas	8,230 m ²
	Roof Areas	0 m ²
	Total Imp. Area	8,230 m ²

Table 1: Existing Site Areas

2.3 Development Proposals

The proposed development will consist of the construction of 76 units, a split of 15 houses and 61 flats of a 4-storey apartment complex. The entirety of the project will be completed in a single phase.

The existing skatepark will be retained post development with the existing carpark bays being reduced from 148 spaces to 84 spaces.

The proposed site architectural layout is included within Appendix A.

A breakdown of the proposed site area can be seen in Table 2 below.

Total Site Area		14,326 m²
Permeable Areas (soft landscaping)		3,744 m ²
Impermeable Area	Hardstanding Areas	8,575 m ²
	Roof Areas	2,007 m ²
	Total Imp. Area	10,582 m ²

Table 2: Proposed Site Areas

3 FLOOD RISK

3.1 National Planning Policy Framework

The NPPF and the supporting Planning Practice Guidance (PPG) for Flood Risk and Coastal Change Allowance Guidance (EA, 2020) provides guidelines on how flood risk should be considered at all stages of the planning and development process. The NPPF states that the planning system should ensure that new developments are safe and not exposed unnecessarily to the risks associated with flooding. This FRA sets out the planning and wider context within which the development needs to be considered along with the flood risk from all sources in accordance with the NPPF.

3.2 Flood Vulnerability Classification

The EA's flood risk map below shows the entire site is located within Flood Zone 1, which is defined as having a less than 1:1000 (<0.1%) annual probability of flooding from rivers and seas. See extract from the EA's Flood Map for Planning in Figure 3 below.

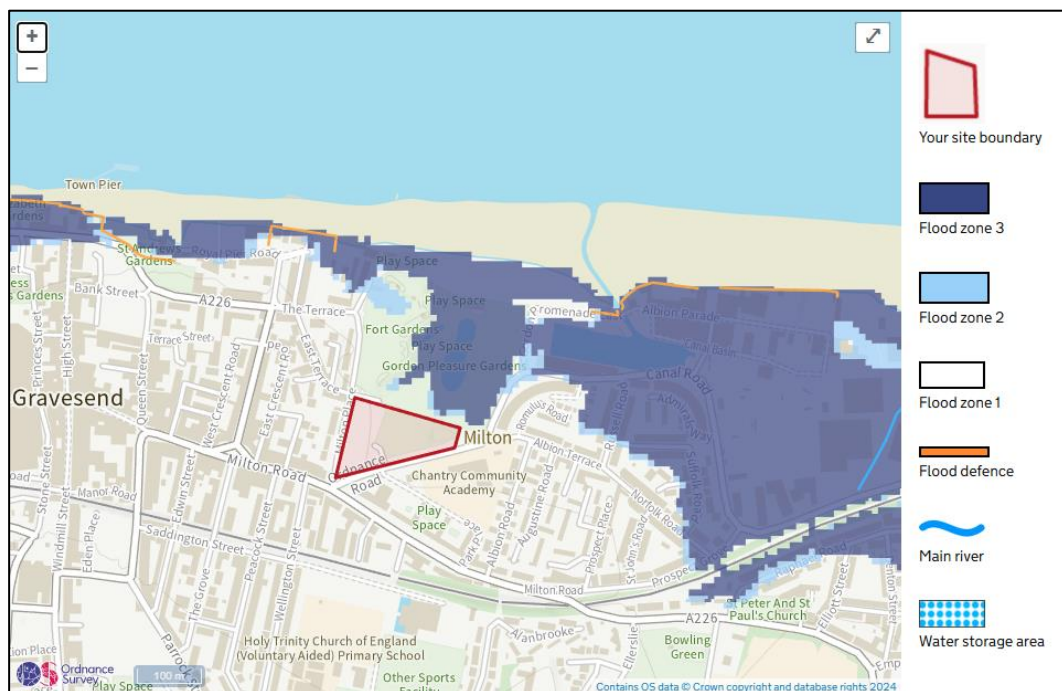


Figure 3: EA's Flood map for planning

3.3 Flood Zone Compatibility

The NPPF's Planning Practice Guidance, provides guidance on the suitability of land for varying uses depending on the flood zone it is located within. NPPF's PPG classifies the vulnerability classification for the proposed sites residential use as 'more vulnerable'.

Consulting Table 3 below, extracted from the NPPF, the proposed land use for the development is deemed appropriate due to being located within flood zone 1, and an exception test is not required, and the sequential tests requirements are met.

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓ *

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Table 3: Flood risk vulnerability and Flood Zone Compatibility

3.4 Flood Risk Sources

In accordance with the NPPF and its Technical Guidance document the risk of flooding from all sources needs to be considered.

3.4.1 Rivers and Tidal

The River Thames (a tidal river) is located approximately 250m north to the site. As the site is located entirely within flood zone 1 there is less than 0.1% annual probability of flooding from rivers, refer to the map shown in Figure 3. Therefore, the site is at a very low risk of flooding from rivers and tides.

3.4.2 Ground Water

The Geo-Environmental Assessment by Create Consulting Engineers, July 2023 states that the groundwater level at 9.0m bgl and based on the site geology can be described as 'static'. An extract of the Geo-Environmental Assessment is included within Appendix C.

Kent County Council's Groundwater Risk Areas map, as seen in Figure 4 below and included in Appendix D, the risk of ground water flooding can be deemed negligible. With this information, as well as the ground water being monitored at 9m bgl as stated in the Geo-Environmental Assessment, the overall flood risk of groundwater can be considered very low.

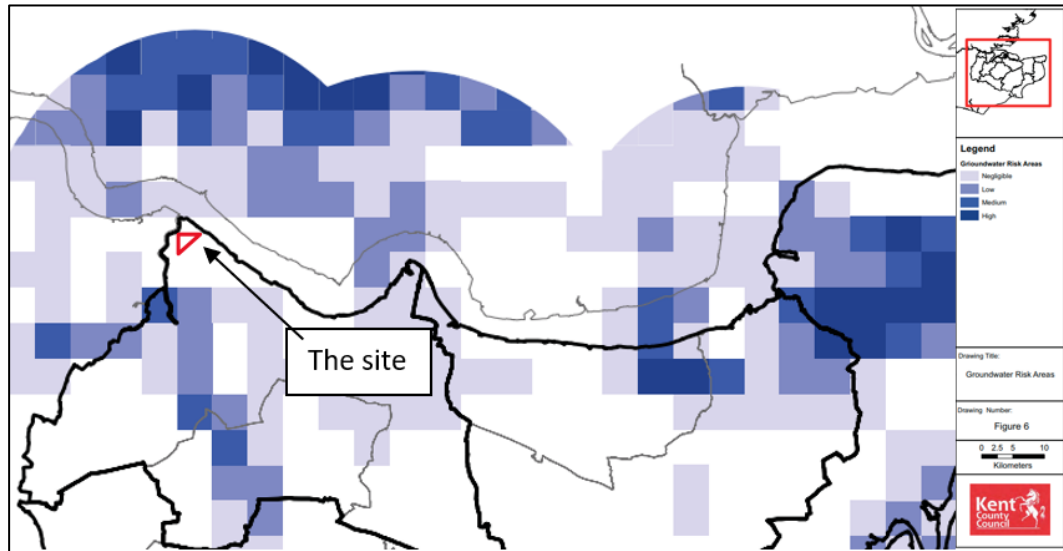


Figure 4: Groundwater Risk Area from Kent County Council's Preliminary flood risk assessment

3.4.3 Overland Flows

The site levels generally fall from the northwest to the southeast from approx. 12.0 mAOD to 7.0 mAOD, refer to the Topographic Survey included in Appendix B for existing levels.

The EA's Surface Water Flood Risk Map, Figure 5 below, shows that the Site is predominantly at a very low risk of flooding from surface water with localised areas of low and medium risk to the North of The Site.

The proposed drainage layout and proposed levels are designed to ensure that surface water is directed towards low points away from buildings where gullies/channel drains area located and towards the proposed infiltration pond.

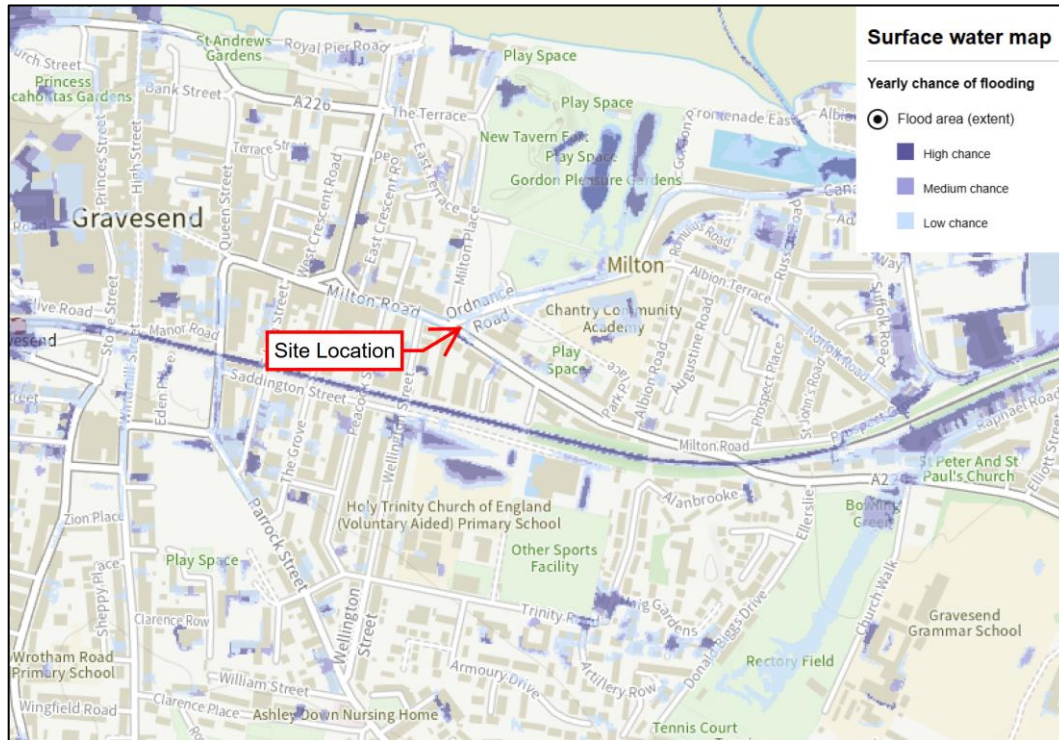


Figure 5: EA Flood Map – Surface Water Flood Risk Map

3.4.4 Sewers

Surface water, foul and combined sewers and manholes are located on the roads North, West and South of the site. A 225mm diameter surface water sewer crosses the site, refer to the existing sewers shown on the Proposed Drainage Layout drawing included in Appendix I.

Refer to Appendix B which includes a topographic survey indicating drainage sewers within the vicinity of The Site, and Appendix E which includes an asset location map from Southern Water.

As explained in Section 3.4.3, the levels around the site would direct overland flows onto roads and locations downstream in the event of the existing sewers beyond the site flooding.

3.4.5 Other Sources

The EA flood map shown in Figure 6 below does not indicate that The Site is at risk of flooding from reservoirs.

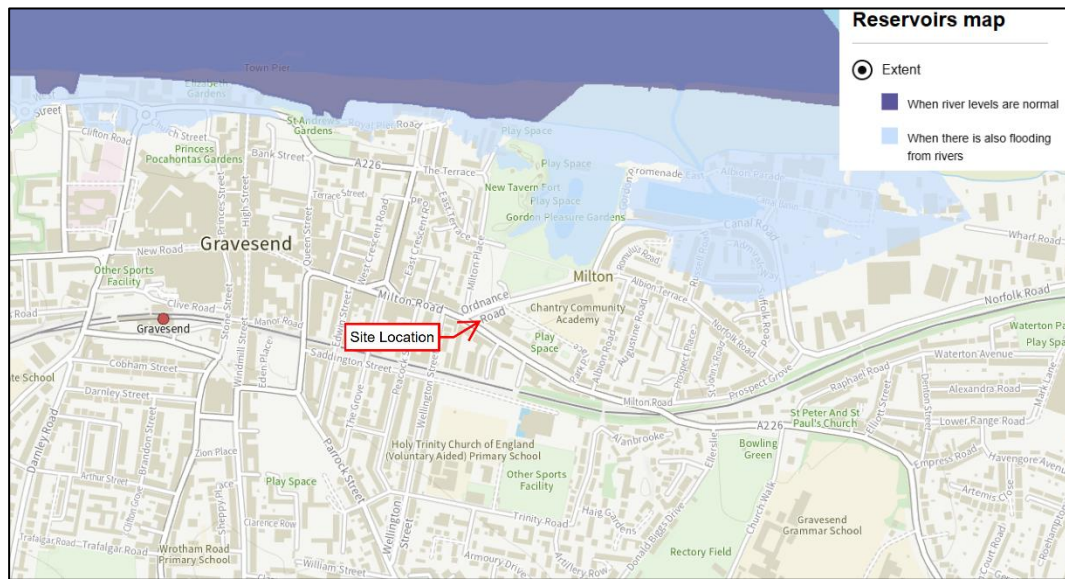


Figure 6: EA Flood Map –Reservoir Flood Risk Map

3.5 Climate Change

The projected effects of climate change are expected to lead to increased rainfall, river flows, raised sea level and tidal fluctuations. The pertinent effects to this development are the increased rainfall, and its effect on drainage systems and river flows.

The increased flood risk from overland flows can be mitigated by designing the development's drainage networks to accommodate the 1 in 100-year storms with an additional 45% climate change allowance without causing onsite or offsite flooding.

3.6 Residual Risk

There are no other known residual flood risks to the development.

4 FLOOD RISK MANAGEMENT

4.1 Existing Surface Water Runoff

The existing site is a mix of open space and brown field sites, the surface water runoff will follow the topographic gradient falling towards Ordnance Road to the southeast of the site.

There are various surface, foul and combined drainage pipes and manholes located just outside the site boundary; these can be seen within the Southern Water Asset Map Included within Appendix D. Existing drainage infrastructure is also shown within the Topographic Survey included within Appendix B.

4.2 Floor Levels

The external floor (ground) levels have been designed to fall away from the buildings to provide flood routes away from the building, this has been done to mitigate flood risk in storms outside the design requirements, or due to burst water mains etc.

4.3 Sustainable Drainage Techniques

The use of various sustainable drainage techniques has been investigated with respect to their potential to be used within the development to control storm water as close to the source as possible and reduce the potential increased flood risk from the development. They are reviewed in order of most to least sustainable based upon the SuDS Hierarchy table from the EA.

Most Sustainable	SUDS technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit
	Living roofs	✓	✓	✓
	Basins and ponds - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✓	✓	✓
	Filter strips and swales	✓	✓	✓
	Infiltration devices - soakaways - infiltration trenches and basins	✓	✓	✓
	Permeable surfaces and filter drains - gravelled areas - solid paving blocks - porous paviers	✓	✓	
	Tanked systems - over-sized pipes/tanks - storms cells	✓		
	Least Sustainable			

Table 4: The SuDS Hierarchy

4.3.1 Living Roofs

Living / Green roofs are not recommended for this development due to severe implications of adopting these systems on the proposed units:

- Structural: Even an extensive green roof system with a 100mm thick growing media will impose considerable loading and the dwellings proposed are not designed to sustain this extra load that the green roofs would propose.
- Maintenance: Any regular or irregular maintenance to the proposed unit's roofs is likely to require trained personnel. As these dwellings will be private properties, proper maintenance by the owners cannot be guaranteed.
- Damage & leaks: Although these systems are waterproof, extreme weather factors or human error can result in a leak in the roof. In these restricted conditions, finding and repairing such failure in a complex roof system would be a challenging process.

Although a green roof should always be considered, on this development the complexity, and disadvantages of implementing a green roof are far greater than the potential benefits.

4.3.2 Basins and Ponds

An infiltration pond will be used on site, this will help with:

- The pond will act as natural filtration system this will remove pollutants such as oil from runoff before the water enters a larger body of water.
- The pond will produce an increase of biodiversity supporting plants and insects as well as aquatic life.
- The pond will add an aesthetic appeal to the area, and this will add to the recreational value of the area and make it a public amenity.
- This will allow storm water to discharge into the pond and drain into the soil at a rate of $2.82 \times 10^{-4} \text{m/s}$ and thus will reduce the flood risk on site.

4.3.3 Filter Strips and Swales

A largescale open SuDS feature is proposed, therefore filter strips and swales will not be explored further.

4.3.4 Infiltration Devices

The site's infiltration rate has been verified by the Phase 2 Geo-Environmental report, as shown in Appendix C. The soakage test at the location of the proposed pond gives an infiltration rate of $2.82 \times 10^{-4} \text{m/s}$. As described in 4.3.2 above, an infiltration pond will be implemented.

4.3.5 Permeable Paving

Permeable paving will not be used as the water will be draining into an infiltrating pond on site and so the increase of infiltration using permeable paving is not a necessity.

4.3.6 Tanked Systems

This will not be implemented as the site already has an open landscaped area available that will be used as an infiltration pond instead of a tanked system. This solution is better for the environment and adds value to the area by supplying an amenity. Therefore, this option will not be explored further.

4.4 Surface Water Discharge Hierarchy Assessment

4.4.1 Discharge Through Infiltration

As described above the project will be infiltrating into the soil at a rate of 2.82×10^{-4} m/s as verified by the Phase 2 Geo-Environmental report into an infiltration pond volume of 208.7m³. This pond is located where chalk is present and meets the storage requirement for a 1 in 100 year +45% climate change event.

4.4.2 Discharge into Surface Water Body

The closest surface water body (the River Thames) is approximately 65m north of the site. This has not been considered further as the surface water will be discharging by infiltration, as this is higher on the SuDS hierarchy.

4.4.3 Discharge to Surface Water Sewers

Surface water sewers operated by Southern Water are located East and South to the site, these will not be considered due to the viability of other preferable options for surface water disposal.

4.4.4 Discharge to Combined Sewer

There are no combined sewers in the proximity of the site.

4.5 Proposed Drainage

4.5.1 Kent County Council's LLFA Correspondence

PTA have been in correspondence with Kent County Council's LLFA regarding the approval of the proposed drainage strategy. Correspondence emails are included within Appendix G. The drainage strategy has been designed in accordance with the discussions and advice from the LLFA.

4.5.2 Proposed Surface Water Drainage

The surface water runoff from the development's hardstanding areas and units' roofs will be collected via rainwater pipes, drainage channels and road gullies before being conveyed via underground pipework before out falling into the proposed infiltrating pond in the soft landscaped area of the site.

4.5.3 Drainage Model

Causeway Flow software was used to model the proposed drainage system up to the critical 1 in 100+45% CC storm event. The drainage network has been modelled using the latest FEH-22 rainfall data. The results from the Flow model are included in Appendix H.

The results show that in the more critical storm events some manholes are prone to 'flood risk' however this means that the system is working efficiently by filling up fully.

The summer and winter CV values have been set to a value of 1. An urban creep allowance of 10% has been applied to all buildings.

Refer to Appendix I for the Proposed Drainage Strategy Layout and Appendix H for the Causeway Flow drainage calculations.

4.5.4 Proposed Surface Water Treatment

The proposed development is comprised of residential units with roads, and driveways and is therefore classified as having a low pollution hazard level as defined by the CIRIA SuDS Manual. To adequately treat the surface water runoff from these areas in line with the SuDS Manual's recommendations, the surface water treatment will be required to meet pollution mitigation indices of 0.5, 0.4, 0.4 for total suspended solids (TSS), metals and hydrocarbons respectively.

The proposed infiltration pond will allow for water to drain through its surface, this will mitigate total suspended solids (TSS) metals and hydrocarbons respectively up to 0.7, 0.7, 0.5. According to the SuDS Manual this is higher than the mitigation needed for this low pollution hazard that is required for this project. The location of the pond is shown in the Proposed Drainage Layout included in Appendix I.

4.5.5 Proposed Foul Water Drainage

The foul drainage for this development will flow by gravity in an underground pipe network that runs through the development. This will then discharge into Southern Water's public sewer that exists under Ordnance Road which to the south of the development. Southern Water assets can be seen on the Southern Water asset map included in Appendix E.

Southern Water have responded to a pre-planning enquiry confirming that the sewer located on Ordnance Road does have sufficient capacity for the development's foul water discharge. Correspondence with Southern Water is included in Appendix F.

4.5.6 Drainage Maintenance Strategy

A below ground drainage maintenance plan document has been produced and sets out the required maintenance actions and their frequency for all the drainage components. This has been appended to this report within Appendix J.

5 OFFSITE IMPACT

The proposed redevelopment of this site results in a decrease in impermeable site area and an equivalent decrease in surface water runoff volume.

In addition to this, all surface water is proposed to be discharged via infiltration, mitigating the flood risk to adjacent sewers.

6 CONCLUSION

The FRA has considered the potential flood risk to the proposed development and its potential impact on flood risk:

- The development is located entirely in Flood Zone 1.
- The development has a low risk of flooding from all sources.
- The development drainage system and levels are to be designed to accommodate the 100-year rainfall event with a 45% allowance for climate change.
- On site levels are designed to reduce the risk of surface water entering residential dwellings and convey water away from thresholds during exceedance events.

The drainage strategy aims to collate all surface water runoff from the site via a network of pipes and manholes and discharge into an infiltration pond located on site where the runoff can naturally infiltrate into the ground. As the surface water is being discharged via infiltration, the drainage strategy conforms to SuDS practises.

The infiltration pond will be designed to attenuate runoff from the hard landscaped areas of the site for a 100-year rainfall event with a 45% climate change allowance.

Therefore, the development has an overall low flood risk both on and offsite.

APPENDIX A – Architectural Site Plan



Notes

Do not scale from this drawing.
All contractors must visit the site and be responsible for taking and checking dimensions.
All construction information should be taken from figured dimensions only.
Any discrepancies between drawings, specifications and site conditions must be brought to the attention of the supervising officer.
This drawing & the works depicted are the copyright of JTP.

This drawing is prepared for the specific project stage in the Drawing Status section below and it is not intended to be used for any other purpose. Whilst all reasonable efforts are used to ensure drawings are accurate, JTP accept no liability for any reliance placed on, or use made of, this plan by anyone for purposes other than those stated in the Drawing Status below.

 Site Ownership Boundary

— — — Gun Sight Lines

Independent Living Accommodation Schedule Summary

Name	Count	NIA
1B2P	53	2696.30 m ²
1B2P M4(3)	8	500.55 m ²
	61	3196.85 m ²

Residential Accommodation Schedule Summary

Name	Count	Unit GIA
2B4P_Galloway	2	144.78 m ²
3B5P_Kings	1	97.85 m ²
3B5P_Lewis	1	99.37 m ²
3B6P_Abney	6	662.74 m ²
3B6P_Walbury	5	613.64 m ²
	15	1618.36 m ²

Parking Schedule

Parking Space	Count
Independent Living	8
Public	84
Residential	19
	111

[illegible]

Rev	Date	Description	Drawn	Chkd
-----	------	-------------	-------	------

Drawing Status

Draft

Client 

JTP Studios, Unit 5
The Rum Warehouse
Pennington Street
London, E1W 2AP
+44 (0) 20 7017 1780
www.jtp.co.uk

Project
Milton Place

Drawing Title
Sitewide GA Plan - Level 00

Drawing No.
02324-JTP-MP-00-DR-A-10001

Scale @A2 1 : 500 Job Ref. 02324

Drawing No. 10001

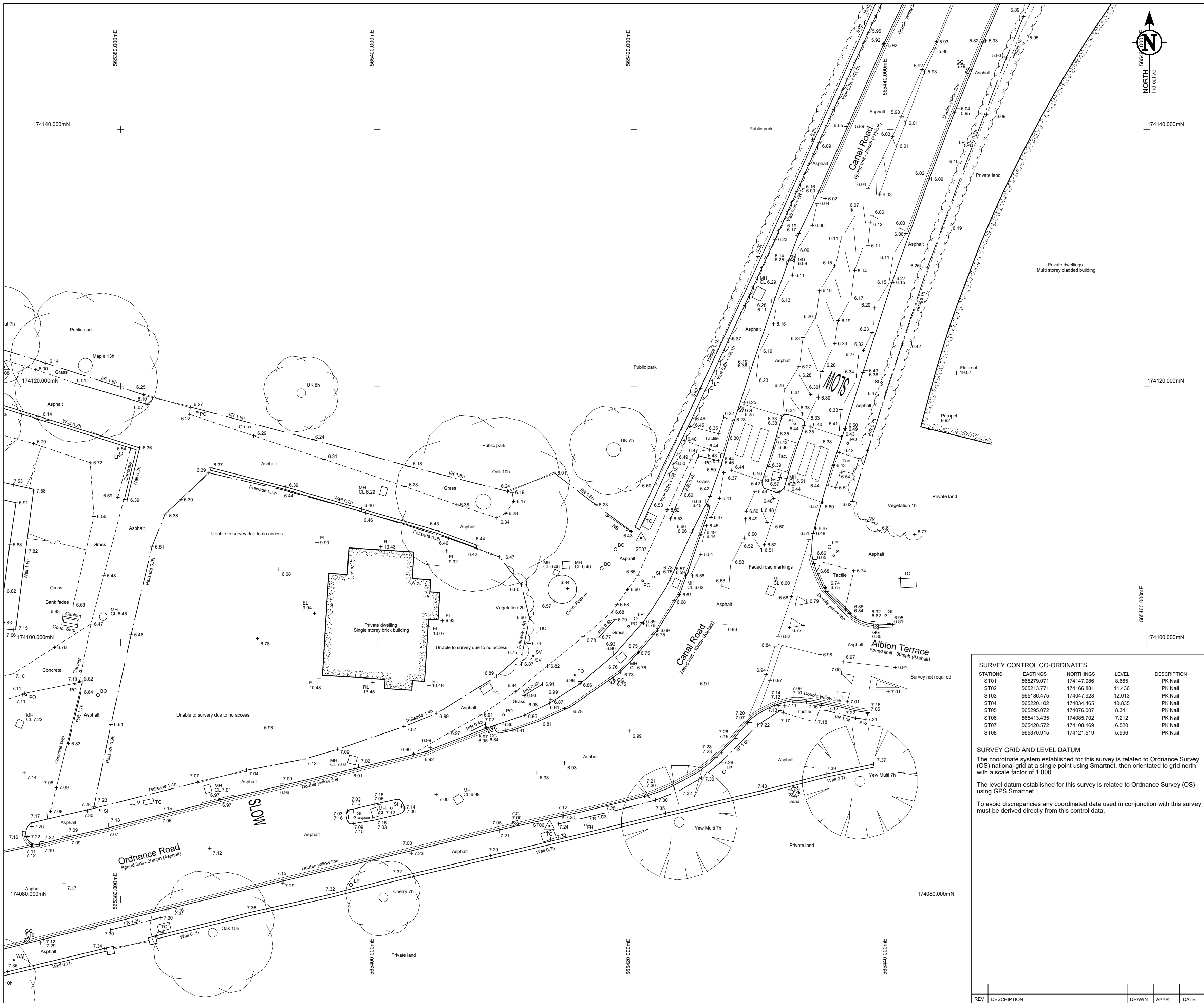
Scale Bar

0 5 10 15 m



Revision. D7

APPENDIX B – Topographic Survey



TOPOGRAPHICAL & MEASURED BUILDING SURVEYS

ABBREVIATIONS & SYMBOLS

AH	Arch Head Height	ER	Earth Rod	RSD	Roller Shutter Door
A/B	Air Brick	ET	EP+Transformer	RSJ	Rolled Steel Joist
AR	Assumed Route	FB	Flower Bed	SI	Sign Post
AV	Air Valve	FBD	Floor Board Direction	SP	Arch Spring Point Height
BB	Beltsha Beason	FH	Fire Hydrant	SV	Stop Valve
BH	Bore Hole	FL	Floor Level	SW	Surface Water
BL	Bed Level	FP	Flag Pole	SY	Cable Stay
BO	Bollard	FW	Foul Water	Tac	Tactile Paving
BrP	Brace Post	GG	Gully Grate	TC	Telecom Cover
BS	Bus Stop	GV	Gas Valve	TH	Trail Pit
BU	Bush	HH	Head Height	THL	Threshold Level
B/W	Barbed Wire Fence	IC	Inspection Cover	TL	Traffic Light
BX	Box (Utilities)	IL	Invert Level	ToW	Top of Wall
C/B	Close Board Fence	IR	Iron Railings	TP	Telegraph Pole
CH	Cill Height	KO	Kerb Outlet	TS	Traffic Signal Cover
CL	Cover Level	LP	Lamp Post	TV	Cable TV Cover
C/L	Chain Link Fence	MH	Manhole	UB	Universal Beam
C-Lev	Ceiling Level	MP	Marker Post	UC	Unknown Cover
Col	Column	NB	Name Board	UK	Unknown Tree
CIP	Chestnut Paling Fence	OHL	Overhead Line (approx)	UMG	Unmade Ground
CR	Cable Riser	Par	Panel Fence	USB	Under Side Beam
C/W	Chicken Wire	PB	Post Box	UTL	Unable To Lift
DC	Drainage Channel	PM	Parking Meter	UTS	Unable To Survey
DH	Door Head Height	PO	Post	VP	Vent Pipe
DI	Disipated	PR	Post & Rail Fence	WB	Waste Bin
DP	Down Pipe	P/W	Post & Wire Fence	WH	Weep Hole
DR	Drain	P/Wall	Partition Wall	WL	Water Level
EBx	Electric Box	RE	Rodding Eye	WM	Water Meter
EC	Electric Supply Cover	RL	Ridge Level	WO	Wash Out
EL	Eaves Level	RP	Reflector Post	WC	Floor to Ceiling Height
EP	Electric Pole	RS	Road Sign	W/C	Floor to False Ceiling HT
				W/C	Floor to False Ceiling HT
				W/C	Floor to False Ceiling HT

DRAWING NOTES

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including: sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Surveyed physical features may not necessarily represent the legal boundary line.

Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

Cill heights are measured as floor to the cill and head heights are measured from cill to the top of window.

General

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The survey control listed is only to be used for topographical surveys at the stated scale. All control must be checked and verified prior to use.

© Land Survey Solutions Limited holds the copyright to all the information contained within this document and their written consent must be obtained before copying or using the data other than for the purpose it was originally supplied.

Do not scale from this drawing.

SURVEY CONTROL CO-ORDINATES

STATIONS	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
ST01	565279.071	174147.986	8.665	PK Nail
ST02	565213.771	174166.881	11.436	PK Nail
ST03	565186.475	174047.928	12.013	PK Nail
ST04	565220.102	174034.465	10.835	PK Nail
ST05	565295.072	174076.007	8.341	PK Nail
ST06	565413.435	174085.702	7.212	PK Nail
ST07	565420.572	174108.169	6.520	PK Nail
ST08	565370.915	174121.519	5.996	PK Nail

SURVEY GRID AND LEVEL DATUM

The coordinate system established for this survey is related to Ordnance Survey (OS) national grid at a single point using Smartnet, then orientated to grid north with a scale factor of 1.000.

The level datum established for this survey is related to Ordnance Survey (OS) using GPS Smartnet.

To avoid discrepancies any coordinated data used in conjunction with this survey must be derived directly from this control data.



LAND SURVEYING
BUILDING SURVEYING
UNDERGROUND SURVEYING
SITE ENGINEERING
MONITORING

0845 040 5969
survey-solutions.co.uk

IPSWICH BEDFORD COVENTRY GLASGOW LONDON MANCHESTER NORWICH
NOTTINGHAM YEOVIL

PROJECT TITLE
MILTON PLACE CAR PARK, GRAVESHAM,
KENT, DA12 2PQ

DRAWING DETAIL
TOPOGRAPHICAL SURVEY
Sheet 2 of 2

CLIENT
THE HILL GROUP

SCALE
1:200

SURVEYOR
GB

SURVEY DATE
13/04/2023

CHECKED BY
RH

APPROVED BY
ADK

DWG STATUS
FINAL

DRAWING NUMBER
47661BWLS-02

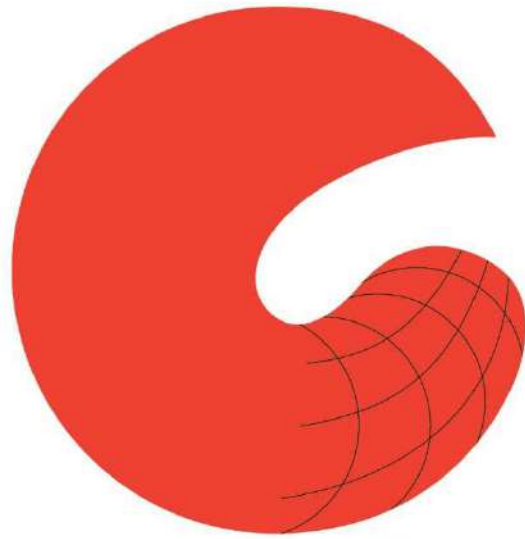
REVISION

ISSUE DATE
25/04/2023



APPENDIX C – Phase 2 Geo-Environmental Assessment

Phase 2 geo-environmental assessment, reference number AW/CS/P23/2862/02 DRAFT,
dated: July 2023.



create
CONSULTING
ENGINEERS LTD

MILTON PLACE, GRAVESEND
Phase 2 Geo-Environmental Assessment

MILTON PLACE, GRAVESEND

Phase 2 Geo-Environmental Assessment

Client: Hill Partnerships Ltd

Engineer: Create Consulting Engineers Limited
109-112 Temple Chambers
3-7 Temple Avenue
London
EC4Y 0HP

Tel: 02078 222300
Email: enquiries@createconsultingengineers.co.uk
Web: www.createconsultingengineers.co.uk

Report By: Andrew Warren BSc, (Hons), MSc, FGS

Approved By: Colin Buchanan BSc (Hons), FGS

Reference: AW/CS/P23/2862/02 DRAFT

Date: July 2023

MILTON PLACE, GRAVESEND
Phase 2 Geo-Environmental Assessment - DRAFT

MILTON PLACE, GRAVESEND

Phase 2 Geo-Environmental Assessment

Contents

- 1.0 Introduction
- 2.0 Site Location and Description
- 3.0 Environmental Setting
- 4.0 Review of Existing Information
- 5.0 Ground Investigation
- 6.0 Ground Conditions
- 7.0 Contamination Assessment
- 8.0 Geotechnical Appraisal
- 9.0 Soakage Assessment
- 10.0 Conclusions & Recommendations
- 11.0 References

Figures

- 1.1 Proposed Development Layout
- 2.1 Site Location Plan

Tables

- 6.1 Summary of Laboratory Geotechnical Testing – Made Ground
- 6.2 Summary of Laboratory Geotechnical Testing – Head Deposits
- 6.3 Summary of Laboratory Geotechnical Testing – Chalk
- 7.1 Updated Conceptual Site Model
- 8.1 Geotechnical design parameters
- 8.2 Low-density Chalk design parameters
- 8.3 Total Pile Resistances: 8.0m bgl
- 8.4 In situ and Laboratory DCP Results
- 9.1 Summary of permeable paving soakage test results
- 9.2 Summary of sustainable drainage soakage test results

Appendices

- A Drawings
- B Exploratory Hole Logs
- C Photos
- D Chemical Laboratory Test Certificates & Comparison against SSAC
- E Geotechnical Laboratory Test Certificates
- F Geotechnical Plots
- G Ground Gas Monitoring
- H Soakage Test Results
- I DCP Test Results

Registration of Amendments

Revision and Date	Amendment Details	Revision Prepared By	Revision Approved By

1.0 INTRODUCTION

Brief

- 1.1 Create Consulting Engineers Ltd (CCE) was instructed by the Hill Partnerships Ltd to undertake a Phase 2 Geo-Environmental Assessment of land off Milton Place (the 'Site') for residential end-use.

Project Context

- 1.2 The Client plans to submit a planning application to Gravesham Borough Council for development of the Site with 2No. five-storey and 2No. four-storey apartment blocks and 10No. 2/3-storey houses, with private gardens, associated car parking and areas of soft landscaping.
- 1.3 The proposed development layout is illustrated in Figure 1.1, below:



Figure 1.1: Proposed Development Layout

- 1.4 A Phase 1 Contamination Land Assessment was carried out by CCE in May 2023 (Ref: TB/VL/P23/2863/01) which highlighted a number of issues to be addressed.

Objectives

- 1.5 The objectives of the site investigation were as follows:
- Undertake a site investigation to quantify the potential source-receptor pollutant pathways as set out in the Phase 1 Contaminated Land Assessment report;

- Provide geotechnical parameters for the proposed development of the Site; and
- Assess the suitability for using soakaways for surface water disposal.

1.6 The geo-environmental investigation works were carried out in accordance with best practice and planning guidance such as that set out in the National Planning Policy Framework (2020), Environment Agency's Land Contamination Risk Management guidance (2021), BS5930:2015+A1:2020 - Code of practice for ground investigations, Eurocode 7: Geotechnical design and NHBC Standards 2011 Chapter 4.1: Land quality – managing ground conditions.

Scope of Work

1.7 The scope of works proposed for this assessment was as follows:

Geo-Environmental Site Investigation

- Drilling of 2No. cable percussive boreholes to 25.45m below ground level (or refusal) with hand-dug excavation pits to 1.0m for each borehole;
- Drilling of 5No. windowless sample boreholes to a maximum depth of 5.45m below ground level (or refusal) with hand-dug excavation pits to 1.0m for each borehole;
- During drilling of the boreholes, *in situ* (SPT) testing and disturbed sampling undertaken for laboratory analysis;
- Standpipes to be installed in the windowless sample boreholes to allow subsequent groundwater level and gas monitoring;
- Excavation 6No. machine excavated trial pits to help determine the potential for sustainable drainage (SUDS) across the Site;
- Excavation of 2No. machine excavated trial pits to help determine the former swimming pool wall location;
- Excavation of 2No. hand dug trial pits to obtain soil samples from areas inaccessible to the machine excavator;
- Undertaking of 3No. dynamic cone penetrometer (DCP) tests across the areas of the Site proposed for future access roads/gar parking to establish the strength profile of the soils;
- Soil samples collected and submitted to UKAS accredited testing laboratory for classification, strength, CBR and aggressiveness to concrete tests;
- Soil samples collected and submitted to an M-CERTS accredited testing laboratory for chemical testing for a standard suite or organic and inorganic parameters;
- Ground Gas and groundwater level monitoring to be undertaken on completion of the site works on 3No. occasions; and
- A summary interpretative report prepared on completion of the works and subsequent laboratory testing.

Constraints and Limitations

- 1.8 The copyright of this report is vested in Create Consulting Engineers Limited and the Client, Hill Partnerships Limited. The Client, or their appointed representatives, may copy the report for purposes in connection with the development described herein. It shall not be copied by any other party or used for any other purposes without the written consent of Create Consulting Engineers Limited or the Client.
- 1.9 Create Consulting Engineers Limited accepts no responsibility whatsoever to other parties to whom this report, or any part thereof, is made known. Any such other parties rely upon the report at their own risk.
- 1.10 Create Consulting Engineers Limited has endeavoured to assess all information provided to them during this appraisal. Should additional information become available which may affect the opinions expressed in this report, Create Consulting reserves the right to review this information and, if warranted, to modify the opinions presented in the report accordingly.
- 1.11 The report summarises information from a number of external sources and is unable to offer any guarantees or warranties for the completeness or accuracy of information relied upon. Information from third parties has not been verified by Create Consulting Engineers Limited unless otherwise stated in this report.
- 1.12 The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the site.

2.0 SITE LOCATION AND DESCRIPTION

Site Location

- 2.1 The Site is located approximately 620m east of Gravesend mainline train station and 260m south of the River Thames. The Site can be centred at National Grid reference 565285.3, 174113.5 and the nearest postcode is DA12 2BT.
- 2.2 The approximate location of the Site is provided as Figure 2.1 below:

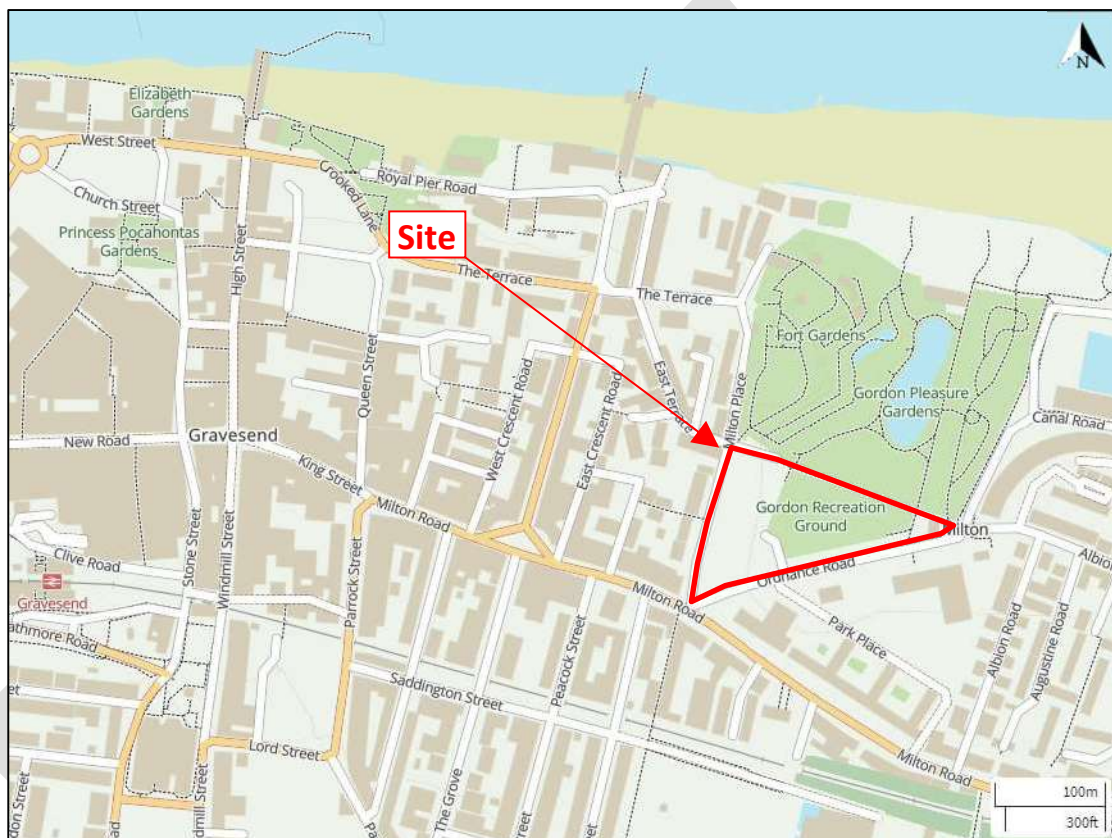


Figure 2.1: Site Location Plan (Geoindex, 2019)

Site Description

- 2.3 Access to the Site was gained off Ordnance Road to the south, via the strip of hardstanding utilised for car parking within the southern boundary.
- 2.4 The Site comprised several distinct areas: parking strip within the southern boundary; skate park within the eastern corner; playing field within the central section of the Site, area of mounded earth between the skate park and playing field; recycling bins adjacent to the Site entrance; car park within the northwest section of the Site and fenced area of hardstanding (former car parking) within the southwest corner.

- 2.5 The Site was generally level. However, the skate park was set approximately 1.0m below Site level. The mounded earth adjacent to the skate park was approximately 1.0m to 1.5m above Site level. The car park within the northwest section of the Site was approximately 0.5m below the level of Milton Road to the west.
- 2.6 A row of mature sycamore trees were located within the Site's northern boundary. A row of immature sycamore trees were located between the mounded earth and the central playing field. A mature poplar tree was located between the central playing field and the car park and mature trees and shrubs were located around the perimeter of the fenced off area of hardstanding in the southwest corner of the Site.
- 2.7 The Site was bound to the north by parkland, to the east and west by a residential areas, with a derelict building adjacent to the eastern corner of the Site. High street shops, restaurants and a petrol filling station were located to the southwest. Beyond Ordnance Road to the south were Chantry Community Academy, a nursery (Little Pebbles Childrens Centre) and Gravesend telephone exchange.

3.0 ENVIRONMENTAL SETTING

Geology

- 3.1 Reference has been made to the British Geological Survey (BGS) plans of the area (Sheet 271, Dartford, solid and drift edition, dated 1998), which indicates the Site is underlain by superficial deposits of 'Head'. The superficial deposits are indicated to be underlain by solid strata of the Lewis Nodular Chalk Formation.
- 3.2 Made ground is recorded 40m north of the Site. Superficial deposits of 'Alluvium' are recorded 40m north of the Site. No faults are indicated within influencing distance of the Site.

Hydrogeology

- 3.3 The Head deposits are classified by the Environment Agency (EA) as A '*Secondary Undifferentiated*', where possible assigned to Category A or B. This an aquifer of varying characteristics, previously designated as either major or minor aquifer.
- 3.4 The Lewis Nodular Chalk Formation is classed as a '*Principal Aquifer*' with high level of water storage and may support water supply/river base flow on a strategic scale.
- 3.5 The Site does not fall within a Source Protection Zone with regards to groundwater. A single active potable groundwater abstraction (785m south) was located within a 2km radius of the Site.

Hydrology and Flooding

- 3.6 The River Thames was located 250m north of the Site. A dock linked to the River Thames was located 190m northeast of the Site. A pond was located 55m north of the Site.
- 3.7 The EA Flood Maps indicate the Site is at '*moderate to high*' risk of flooding from groundwater, rivers or the sea.

Sensitivity

- 3.8 The sensitivity of each of the identified receptors is rated depending upon the environmental setting of the Site, the likelihood for pollutant linkages to be present and potential consequence of those potential pollutant linkages. The assessment approach adopted is based on guidance set out in the *Guidance for the Safe Development of Housing on Land Affected by Contamination R&D 66* document.

- 3.9 The site sensitivity with regards to groundwater within the superficial Head and bedrock Chalk is designated as **M1 (Moderately High)**, described as a '*Recognised major or minor aquifer, moderately vulnerable, with probable use (either direct or via baseflow to a sensitive watercourse). Within formal protection zone or catchment of authorised abstractions for potable or other high quality uses. Minor, short-term releases of contaminants may be tolerable*'. This reflects the vulnerability of the underlying bedrock aquifer as well as the use of groundwater within influencing distance of the Site.
- 3.10 The Site sensitivity to surface water is designated as **L1 (Low)**, described as '*Within catchment of and over 250m from generally poor quality watercourse (GQA E or F) that is unlikely to improved by current or foreseeable surface water quality objectives or at distance (over 1000m) from a good quality watercourse with no interconnecting drains or baseflow from fissured strata.*'. This reflects the distance of the Site from the River Thames and potential to influence surface water catchment.

4.0 REVIEW OF EXISTING INFORMATION

Phase 1 Contaminated Land Assessment, CCE (Ref: TB/VL/P23/2863/01) dated May 2023.

- 4.1 A Phase 1 Contaminated Land Assessment was carried out by CCE to support a planning proposal for the redevelopment of the Site to residential end-use.
- 4.2 The environmental sensitivity of the site has been assessed as moderately high with respect to groundwater and low with respect to surface water.
- 4.3 A number of potential pollutant linkages were identified associated with the proposed end-use. The key potential contamination sources identified in the Conceptual Site Model were:
- Potential poor quality Made Ground from former Site-use (swimming pools/structures including church/school/swimming pool structures);
 - Potential for ground gas to be present (infilled former swimming pool);
 - Potential for PCBs and hydrocarbons to be present from former substation;
 - Potential for off-site sources of contamination (works/garages/smithy/industrial estates);
 - Potential presence of Radon Gas; and
 - Potential presence of Unexploded Ordnance (UXO) beneath the Site.
- 4.4 The potential presence of contamination arising from the historical/current use of the Site is considered to be low and to pose a **moderate/low risk** to future end-users and buildings and services (water supply pipes).
- 4.5 The potential presence of contamination migrating onto Site from historical and current land-use in the surrounding area is considered to be unlikely and to pose a **low risk** to future end-users.
- 4.6 The risk to end-users from the potential presence of ground gas from underlying poor quality Made Ground present nearby infilled land is considered to be **moderate/low**.
- 4.7 Any exposure risk to construction workers associated with contamination has been assessed as **low** on the basis that the use of standard PPE would mitigate any exposure risk.
- 4.8 The risk posed to groundwater and surface water from potential on-site contamination is considered to be **very low** on the basis that there are no identified mobile contaminants on Site and given the historical Site-use.

- 4.9 In order to manage the uncertainty associated with these potential ground contamination sources, a site investigation was recommended to include any Made Ground and shallow soils and, depending on the findings, ground gas monitoring.

DRAFT

5.0 GROUND INVESTIGATION

5.1 Ground investigation works were undertaken at the Site between the 22nd and 25th May 2023, as outlined in the following paragraphs.

5.2 The borehole locations were selected to provide information on ground conditions in each area of the Site as well as to target specific areas of potential ground contamination, as follows:

- To establish the ground conditions beneath each of the former / current car parking areas in the northwest and southwest;
- To establish the nature and extent of Made Ground across the soft landscaped areas in the east;
- Establish the nature and extent of fill materials used to infill the former swimming pool;
- Establish the nature of the mounded material adjacent to the skate park; and
- Establish the ground conditions in the vicinity of the former electricity substation in the eastern corner of the Site.

Description of Fieldwork

5.3 The scope of initial works undertaken was as follows:

- Drilling of 2No. cable percussive boreholes (BH01 and BH02) to a depth of 25.45m bgl to determine ground and groundwater conditions, provide *in situ* soil strength information (SPTs) and enable the collection of soils samples for chemical and geotechnical testing, installation of groundwater and ground gas monitoring standpipe (BH02);
- Drilling of 6No. windowless sample boreholes (WS01, WS01A to WS05) to a maximum depth of 5.45m bgl to determine ground and groundwater conditions, provide *in situ* soil strength information (SPTs), enable the collection of soils samples for chemical and geotechnical testing and the installation of groundwater and ground gas monitoring standpipes (WS01A, WS02 and WS04);
- Excavation 6No. machine excavated trial pits (TP01 to TP06) to help determine the potential for sustainable drainage (SUDS) across the Site;
- Excavation 2No. machine excavated trial pits (TP07 and TP08) to locate the former swimming pool wall;
- Excavation of 2No. hand-dug pits to collect samples for laboratory chemical analysis (HP01 and HP02);
- Undertaking of 3No. dynamic cone penetrometer (DCP) tests across the areas of the Site (TP02, TP04 and TP05) proposed for access roads and car parking;
- Chemical laboratory testing of Made Ground and natural soils beneath the Site;
- Geotechnical laboratory testing of soil samples beneath the Site; and

- Ground gas monitoring on 3No. occasions (using an infrared gas analyser GA5000 and MiniRae 3000) to assess for the presence of ground gas.

- 5.4 An Exploratory Hole Location Plan is presented within Appendix A.
- 5.5 The soil arisings from each borehole and trial pit were logged by a suitably qualified Engineer, in line with the relevant British Standard (BS 5930 and Eurocode 7). The exploratory hole logs are included within Appendix B.
- 5.6 All works were undertaken in accordance with the CCE Health and Safety Policy and within the framework of a Health and Safety plan.

Environmental Laboratory Testing

- 5.7 Soil samples were collected from the Made Ground and underlying natural soils at various locations and depths across the site and submitted for chemical and aggressiveness to concrete testing (BRE SD1 Suite – Greenfield) at a UKAS/MCERTS accredited laboratory.
- 5.8 Samples for contamination analysis were collected in suitable amber glass 250ml jars and 60ml vials as well as 1ltr plastic tubs using clean nitrile gloves to avoid any cross-contamination between samples.
- 5.9 All samples were transported under chain of custody documentation and tested for a range of inorganic and organic compounds. Cool boxes were kept cool (<4°C) with ice packs during sample collection and subsequent transportation by courier to the testing laboratory.
- 5.10 The chemical testing comprised (total and leachate testing for a range of organic and inorganic parameters including asbestos, metals, petroleum hydrocarbons (TPH CWG) and speciated polyaromatic hydrocarbons (PAHs). In addition, two samples of made ground (outside the infilled swimming pool) were submitted for Waste Acceptance Criteria (WAC) testing.
- 5.11 The laboratory test certificates are included as Appendix D.

Geotechnical Laboratory Testing

- 5.12 Selected soil samples were subjected to testing within a UKAS accredited geotechnical laboratory. The results of this testing, along with laboratory certificates are included as Appendix E. Testing included:
- Moisture content;
 - Plasticity index;
 - Point load index;
 - Saturation moisture content;

- Intact dry density; and
- California Bearing Ratio (CBR).

Ground Gas Monitoring

- 5.13 On completion of the fieldwork, a ground gas monitoring visit was undertaken on 3No. occasions to determine the presence of ground gas at the Site and to assess whether the deeper infilled ground of the former swimming pool had the potential to generate ground gas.
- 5.14 Measurements of methane, carbon dioxide, oxygen as well as gas flow were taken from each monitoring well using a GA5000 infra-red gas analyser with flow pod.
- 5.15 Following measurement of ground gas concentration and flow levels, standing groundwater levels and the total depth of selected monitoring wells were recorded using a dipmeter.
- 5.16 The ground gas monitoring and groundwater level measurements are presented in Appendix G and discussed in Section 7.

6.0 GROUND CONDITIONS

- 6.1 The encountered ground conditions are summarised below and provided in detail within the exploratory hole logs (Appendix B), photographs of exploratory holes (Appendix C) laboratory geotechnical test results (Appendix E) and geotechnical plots (Appendix F).

General

- 6.2 The ground investigation comprised a total of 18No. exploratory holes (BH01 and BH02, WS01, WS01A to WS05, TP01 to TP08 and HP01 to HP02), formed in accessible locations across the Site and targeting the proposed development. An exploratory hole location plan (drawing ref. P23-2863-10) is presented within Appendix A.
- 6.3 The ground investigation was designed to provide a general indication of ground conditions across the Site, collect samples for laboratory geotechnical and chemical testing, undertake soakage testing to assess the potential for sustainable drainage (TP01, TP04 and TP06) and permeable paving (TP02, TP03 and TP05) and install monitoring standpipes to enable ground gas and groundwater monitoring (BH02, WS01A, WS02 and WS04).
- 6.4 The following paragraphs provide a summary of ground conditions encountered during the ground investigation.

Hardstanding

- 6.5 Tarmacadam hardstanding was encountered during the formation of 2No. exploratory holes: BH02 and WS02 to depths of 0.10m and 0.05m below ground level (m bgl), respectively.

Topsoil

- 6.6 Within areas of soft landscaping, Topsoil was recorded to a maximum depth of 0.15m bgl, but generally to 0.10m bgl. The base of the Topsoil was marked with a layer of brown fine to medium sand.

Made Ground

- 6.7 Made Ground was recorded across the Site to depths of between 0.20m and 3.45m bgl, but generally to depths of less than 1.0m bgl. The Made Ground was generally described as '*brown slightly silty slightly sandy angular to subrounded fine to medium flint and chalk gravel with concrete and brick. Trace ash*'. Brick and glass were also encountered in the shallow Made Ground in the centre of the Site (TP01, TP02 and WS04).
- 6.8 A total of 4No. *in situ* SPT test were carried out within the Made Ground recording N-values in the range of N = 16 to N= 54, as detailed in the SPT depth plot, Appendix F.

- 6.9 Laboratory geotechnical tests undertaken on recovered Made Ground samples included 3No. CBRs, 3No. bulk density tests, 4No. moisture content tests, 1No. saturation moisture content (SMC) tests and 1No. dry density tests, as summarised in Table 6.1, below.

Table 6.1: Summary of Laboratory Geotechnical Testing – Made Ground

Laboratory test	No. of Tests	Result Range
Moisture Content	4	17% to 23%
Dry Density (Chalk material)	1	1.51Mg/m ³
Saturation Moisture Content (Chalk material)	1	29%
Bulk Density	3	1.81Mg/m ³ , 1.89Mg/m ³ and 2.04Mg/m ³
CBR	3	2.4%, 3.2% and 7.1%
Ph	8	6.1 to 11
SO ₄	8	15mg/l to 140mg/l

Former Swimming Pool

- 6.10 The former swimming pool was located within the central section of the Site, see Constraints Plan (P23-2863-11, Appendix A). Exploratory holes WS01, WS01A were used to determine the depth to base of the former pool, while exploratory holes TP07 and TP08 were positioned to determine whether the former pool walls remained in place.
- 6.11 Exploratory hole WS01 refused on reinforced concrete at 0.40m bgl, possibly the former swimming pool wall, see Plate P1, Appendix C.
- 6.12 Exploratory hole WS01A recorded backfill material to 2.90m bgl, where a flat concrete surface was encountered, interpreted as being the base of the former pool. WS01A recorded a refusal at 3.45m bgl, within the Made Ground.
- 6.13 TP07 did not locate the pool wall. Hence, TP08 was undertaken, encountering concrete at 0.50m, which stepped down, as detailed in Plate P2, Appendix C.
- 6.14 The Made Ground within the infilled swimming pool predominantly comprised demolition materials, presumably the former municipal building material formerly surveyed on the Site when the swimming pool was operational. The infilled material generally comprised fine to coarse gravel sized concrete and brick fragments with further cobbles and boulders of concrete in a brown silty sandy matrix. The deeper materials comprised brown red and back chalk, brick and concrete fragments with trace ash and dark grey clay horizons.

Head

- 6.15 Soils considered to represent Head were recorded to depths of between 0.35m and 2.40m bgl, within the central and southern sections of the Site. These deposits increased in depth towards the eastern half of the Site.
- 6.16 The Head deposits were generally described as '*soft brown silty clay, with occasional fine to medium flint subrounded gravel*'. A total of 3No. in-situ SPT strength tests were undertaken within the Head, recording N-values in the range of N=3 to N=11, confirming the very soft to soft nature of the material.
- 6.17 Laboratory geotechnical testing of Head samples included 3No. moisture content and 3No. plasticity tests, as summarised in Table 6.2, below.

Table 6.2: Summary of Laboratory Geotechnical Testing – Head Deposits

Laboratory test	No. of Tests	Result Range
Moisture Content	3	16.4% to 18.1%
Modified Plasticity	3	17% to 24%
Ph	1	8.1
SO ₄	1	12mg/l

Lewis Nodular Chalk Formation

- 6.18 The Made Ground / Head deposits were underlain by the Lewis Nodular Chalk Formation, across the Site, to the maximum extent of the boreholes (25.45m bgl). The Chalk was generally described as a '*structureless Chalk, recovered as cream, mottled white, silty subrounded to angular fine to coarse flint and Chalk gravel. With occasional cobbles of flint.*'. Light brown silt infill of fissures was noted to depths of between 2.0m and 3.90m bgl.
- 6.19 A total of 46No. SPT tests were undertaken within the Chalk, with corrected SPT N-values in the range of N₆₀ = 7 to N₆₀ = 63, but were generally greater than N=10 and were seen to increase in strength with depth, as detailed in the SPT depth plot, Appendix F.
- 6.20 Laboratory geotechnical test results of Site won Lewis Nodular Chalk Formation are summarised in Table 6.1, below, with laboratory test certificates presented in Appendix E.

Table 6.3: Summary of Laboratory Geotechnical Testing – Chalk

Laboratory test	No. of Tests	Result Range
Moisture Content	8	27.1% to 35.6%
Dry Density (Chalk material)	8	1.42Mg/m ³ to 1.57Mg/m ³
Saturation Moisture Content	8	27% to 33%
Point Load Index I ₅₍₅₀₎	9	0.06MPa to 0.14MPa
Ph	9	8.1 to 9.8
SO ₄	9	10mg/l to 43mg/l

- 6.21 The laboratory geotechnical test results indicate the Chalk is of '**low density**', becoming medium dense at depths of greater than twenty metres below ground level.

Groundwater

- 6.22 During exploratory hole groundwater strikes were recorded within the Chalk from 7.0m bgl. Subsequent monitoring of installed standpipes, on 3No. occasions, recorded standing groundwater levels at a depth of approximately 9.0m bgl.

Visual and Olfactory Observations of Contamination

- 6.23 No visual or olfactory evidence of contamination was identified during exploratory hole formation across the Site.

7.0 CONTAMINATION ASSESSMENT

Soil Contamination

- 7.1 The soil characteristics have been assessed with reference to Land Quality Management (LQM)/Chartered Institute of Environmental Health (CIEH) 'Suitable 4 Use Levels' (S4ULs) for human health risk assessment 2015). In the case of lead a DEFRA Category 4 Screening Level has been adopted.
- 7.2 A Tier 1 (semi-quantitative) risk assessment has been undertaken comparing soil chemical testing results against current and appropriate published guidelines for residential end-use with home grown produce and as a conservative measure, using the minimum soil organic matter (SOM) result (minimum recorded value from across the Site was 0.6%) for quantifying the assessment criteria for organic components. In the case of heavy metals, the 1.0% SOM criteria has been utilised.
- 7.3 This assessment, along with the laboratory test certificates, are provided in Appendix D.

Tier 1 Human Health Assessment

- 7.4 All of the contaminants of concern underlying the Site were confirmed as being less than the assessment criteria (SSAC) in the samples collected and tested, with the exception of the following a concentration of Lead within the infilled swimming pool materials. No asbestos was detected within any of the samples collected and tested.
- 7.5 A more detailed assessment of the ground conditions in each area are provide below.

Soft Landscaped Area (East)

- 7.6 Made Ground encountered across the soft landscaped area in the east of the Site generally comprised reworked natural ground materials Head and Chalk) along with anthropogenic materials such as brick and concrete fragments. However, fragments of glass and metals were encountered in the shallow Made Ground in the western part of this area (TP01, TP02 and WS04).
- 7.7 All of the contaminants of concern underlying this area of the Site were confirmed as being less than SSACs and asbestos was not detected within any of the samples collected and tested. Trace concentrations of Polyaromatic Hydrocarbons were identified in the Made Ground materials.
- 7.8 A hand pit (HP01) was formed in the mounded area to the west of the skate park and identified the material as reworked natural ground materials (gravelly sandy silt with chalk gravel) with

brick fragments. All of the contaminants of concern were confirmed as being less than SSACs and asbestos was not detected in the sample collected from this material.

- 7.9 A hand pit (HP02) was formed in the vicinity of the former electrical substation in the eastern corner of the Site. The Made Ground material present comprised reworked natural ground materials (gravelly sandy silt with chalk gravel) with brick and clinker fragments. The sample collected was submitted for Total Petroleum Hydrocarbons and Polychlorinated Biphenyls and neither were detected above laboratory detection limits.

Hard Landscaped Parking Areas (West)

- 7.10 Made Ground across the current / former car parking areas in the west of the Site generally brick / limestone gravel hard core over reworked Made Ground. Borehole BH02, located in the centre of the southwest area, encountered deeper Made Ground and cobbles of brick, limestone and concrete to a depth of 2m bgl. It is likely that this represents remnant foundations of the old church formerly present in this area.
- 7.11 All of the contaminants of concern were confirmed as being less than SSACs and asbestos was not detected in the sample collected from this material. No evidence of Total Petroleum Hydrocarbons were identified and only trace concentrations of Polyaromatic Hydrocarbons were detected.

Infilled Swimming Pool

- 7.12 The below ground swimming pool formerly occupying the central area of the Site was visibly still present through the back of the grass that now covers this area. A number of exploratory holes were formed across the area (WS01, WS101A, TP07 and TP08) and confirmed that the structure remains in-situ with a depth of at least 3m.
- 7.13 The Made Ground materials identified within the of the structure generally comprised demolition material (presumably the former municipal buildings present at the time of the swimming pool across this area) comprising concrete and brick fragments, cobbles and boulders in a brown sandy silty soil matrix. Traces of ash and clay lenses were also encountered.
- 7.14 All of the contaminants of concern identified within this infilled material were less than the assessment criteria (SSAC) in the sample collected and tested from this material, with the exception of Lead. Lead was present at a concentration of 550 mg/kg, which exceeds the residential end-use SSAC of 200 mg/kg. In addition, elevated concentrations of Petroleum Hydrocarbons (Aromatic & Aliphatic, C12-C35) were identified (300 mg/kg) although not at concentrations that exceeded the respective SSACs.

- 7.15 No asbestos was detected within the sample collected and tested from this material. However, the buildings formerly present on this Site were constructed in c. 1950s and would likely have incorporated asbestos-containing materials (ACMs). If these buildings are the origin of the demolition materials currently present in the swimming pool structure, it is considered likely that they will contain ACMs.

Controlled Water Health Assessment

- 7.16 A sample collected from the general Made Ground (BH01) encountered across the Site and the infill materials identified within the former swimming pool structure (WS01A) were submitted for soil leachate testing for a range of organic and inorganic determinants.
- 7.17 A GQRA has been undertaken comparing the soil leachate chemical testing results against current and appropriate published guidelines for Water Supply (Water Quality) Regulations, 2000 and this is provided in Appendix D.
- 7.18 Neither of the samples collected exceeded the respective SSACs available with the exception of Petroleum Hydrocarbons (Aliphatic C5-C8) which was present at a concentration of 820µg/l and exceeded the drinking water standard of 300µg/l. This represents petrol range hydrocarbons, and although not the same sample depth is different to the hydrocarbons identified in the soil total test which was heavier chain hydrocarbons (C12-C35).
- 7.19 Negligible / trace leachable concentrations of Polyaromatic Hydrocarbons were confirmed to be present in the sample tested.

Waste Acceptance Criteria

- 7.20 Waste acceptance criteria (WAC) testing was undertaken on 2No. samples of general Made Ground across the Site, collected from TP04 and WS04.
- 7.21 A slightly elevated percentage of total organic carbon (3.2%) was recorded on one of the samples, which exceeds the limit value of 3.0% and would classify this as Stable Non-Reactive Hazardous Waste (SNRHW). However, the other sample was confirmed to be 1.6%.
- 7.22 Prior to off-site disposal, further test results should be presented to the receiving landfill of all the materials including the swimming pool infill materials and confirming the waste classification. It is considered likely, however, that most materials would be classified as either Inert or SNRHW.

Ground Gas Monitoring

- 7.23 On the basis of the Conceptual Site Model prepared in the Phase 1 Assessment, a low to moderate potential ground gas risk was identified related potential poor quality Made Ground across the Site.
- 7.24 Historical records indicate the former swimming pool was backfilled by 1982. Exploratory hole WS01A located within the former swimming pool recorded Made Ground to a depth of 3.40m bgl, terminating due to a refusal, still within the Made Ground. No organic material was recorded within exploratory holes formed within the former swimming pool.
- 7.25 Outwith the former swimming pool, BH02 encountered foundations associated with the former Church, recording Made Ground to 2.0m bgl. Generally, Made Ground soils were recorded to depths of less than 1.0m bgl across the Site.
- 7.26 Ground gas monitoring visit was undertaken between 9th and 29th June 2023, to provide an assessment of the ground gas at the Site.
- 7.27 The ground gas monitoring recorded the following:
- Methane (CH₄) recorded at 0.0% by volume;
 - Carbon dioxide (CO₂) recorded at between 0.2% and 2.3% by volume;
 - Oxygen (O₂) recorded at 20.3% to 17.7% by volume; and
 - Gas flows recorded from 0.0l/hr to 0.3l/hr.
- 7.28 The results of the ground gas monitoring visits are provided in Appendix G.

Ground Gas Risk Assessment

- 7.29 The assessment of gas risk uses the gas concentrations present and the flow rate measured, which gives a gas screening value (GSV). Using this method and the worst-case measurements (Ref: BS 8485: 2015+A1:2019), the GSV for the areas identified across this Site have been established and a gas risk rating assigned in accordance with the 'traffic light' system outlined in the NHBC Guidance on Evaluation of Development Proposals on sites where Methane and Carbon Dioxide are present (March 2007).
- 7.30 The 'traffic light' system enables the assessment of derived GSVs against pre-determined gas screening values, as well as consideration to typical maximum concentrations, for methane and carbon dioxide. The screening values and typical maximum concentrations along with the gas protection measures required are outlined in Table 1 and 2 in Appendix G.

- 7.31 The worst case GSVs have been determined using the highest gas concentrations detected and the highest gas flow measured (0.3l/hr) on the site using the monitoring results and the worst case GSVs are:
- Methane (0.0%) x gas flow (0.3l/hr) gives a GSV of 0.00; and
 - Carbon Dioxide (2.3%) x gas flow (0.3l/hr) gives a GSV of 0.0069.
- 7.32 These GSVs, which represent the worst-case ground gas risk on the Site, indicate an NHBC 'green' classification (and Characteristic Situation 1, BS 8485:2019) with the GSVs an order of magnitude lower than the triggers for ground gas protection measures (Amber 1/Characteristic Situation 2), see Table 1 in Appendix G.
- 7.33 Current guidance for ground gas monitoring is to provide a minimum of 6No. measurements over a period of three months, with at least one of the visits undertaken during low (<1005mb) or falling atmospheric conditions to establish ground gas regime. However, with very low flows and negligible concentrations of ground gas recorded, it is considered that no further gas monitoring is required and that ground gas protections are not required for this development.

Updated Conceptual Site Model

- 7.34 Based on the intrusive investigation and subsequent contamination sampling and ground gas monitoring undertaken at the Site, the Conceptual Site Model from the Phase 1 Contaminated Land Assessment can be updated with proven pollutant linkages, as per Table 7.1, below with risk tables included in Appendix D.

Table 7.1: Updated Conceptual Site Model

Source	Pollutant	Pathway	Receptor	Likelihood of Occurrence	Consequence (severity)	Potential Risk	Comment	Further action
Historical and current site-use (School/ Church/Swimming Pools/Substation/ Recreation Ground) and earth mounds	Poor quality Made Ground (asbestos metals, hydrocarbons, volatiles etc.).	Possible direct contact with contaminated soils and accidental ingestion/inhalation of contaminated dust or volatile vapours. Plant uptake in residential garden areas.	Future residential end-users	Likely	Medium	Moderate	Elevated concentration of lead recorded within infill materials within swimming pool. Glass fragments identified in shallow Made Ground materials present on Site. No asbestos fibres identified, although given likely origin of demolition material in swimming pool, ACMs likely to be present. Further investigation and / or remediation will be required to mitigate exposure risk.	Yes
		Direct contact and ingestion of contamination in shallow soils during enabling works. Exposure likely to be short term.	Construction, demolition and ground workers	Unlikely	Mild	Very Low	Standard PPE during construction process would mitigate any potential exposure risk.	-
		Migration of any contaminants within infill materials via leaching/lateral migration down hydraulic gradient.	Controlled waters (groundwater and surface water)	Low likelihood	Mild	Very Low	Leachable concentration of petrol range hydrocarbons identified in swimming pool infill materials evidence. Controlled water receptors not considered sensitive in historical/current surrounding area land-use context. No action necessary.	-
		Direct contact. Permeation of mobile contaminants through water supply pipes	Buildings and services (water supply)	Low Likelihood	Medium	Moderate/ Low	Trace concentrations of hydrocarbons recorded in Made Ground during Site investigation works. Barrier pipe and/or clean corridors may be required to mitigate permeation risk to water supply pipes	Yes
	Polychlorinated Biphenyls (PCBs) from electrical substation	Possible direct contact with contaminated soils and accidental ingestion/inhalation of contaminated dust or volatile vapours. Plant uptake in residential garden areas.	Future residential end-users	Unlikely	Medium	Low	Testing of soils adjacent to sub-station did not record any PCBs.	-
	Ground gas (methane and carbon dioxide)	Possible lateral migration of ground gas contaminants onto Site and inhalation of harmful (asphyxiant) ground gases or accumulation of explosive gases.	Future residential end-users	Low Likelihood	Medium	Moderate/ Low	No elevated concentrations of ground gas recorded.	-
Nearby historical/ current industrial site uses (Sawmill, Tanks, Chemical Works, Garages, Smithy, Industrial Estates)	Asbestos, metals, hydrocarbons, VOCs	Possible lateral migration of volatile contaminants onto Site and inhalation of harmful (asphyxiant) volatile vapours or accumulation of explosive gases at ground floor level.	Future residential end-users	Unlikely	Medium	Low	Groundwater confirmed at depth (9 metres below ground level), negligible exposure risk potential by on-site migrating volatile contamination.	-
			Construction, demolition and ground workers	Unlikely	Mild	Very Low		-
Radon Gas	Radon	Possible harm from radon gas.	Future residential end-users	Unlikely	Medium	Low	Site not in a Radon affected area, no action required.	-
WW2 Bombs	UXO	Risk from unexploded ordnance	Future residential end-users	Unlikely	Severe	Low	No action necessary.	-

Source	Pollutant	Pathway	Receptor	Likelihood of Occurrence	Consequence (severity)	Potential Risk	Comment	Further action
			Construction, demolition and ground workers	Unlikely	Severe	Low / Moderate	Detailed UXO risk assessment confirmed low/moderate UXO risk and UXO Risk Management Plan and Awareness briefings prepared for below ground works.	Yes

8.0 GEOTECHNICAL APPRAISAL

General

8.1 This section of the report should be read in conjunction with Section 6.0 (Ground Conditions), which indicates the Site is directly underlain by Made Ground soils, superficial deposits of Head and solid geology of the Lewis Nodular Chalk Formation. Groundwater levels were recorded at 9.0m bgl.

8.2 It is understood the proposed development is to include:

- 2No. 5-storey apartment blocks;
- 2No. 4-storey apartment blocks;
- 10No. 2/3-storey houses;
- private gardens;
- hardstanding for access and car parking; and
- areas of soft landscaping

Ground Model

8.3 Based on the material descriptions, *in situ* strength tests and geotechnical laboratory test results, the following ground model has been determined. Design parameters used for geotechnical analysis are presented in Table 8.1, below:

Table 8.1: Geotechnical design parameters

Material	Depth to base (m bgl)	γ (kN/m ³)	Design N-value	Φ (°)	I_p (%)	C_u (kN/m ²)
Made Ground	0.50	19	-	1	-	1
Head	1.0	17 [†]	N=7	20 [†]	20	20
Low-Density Chalk	>25.5	19.3	N=10 to N=40	-	-	-
Groundwater	9.0m bgl					

† - BS8002

Shallow Strip Foundations

8.4 Shallow strip foundations are feasible for the low-rise (2-3 storey) residential dwellings outwith the area of the former swimming pool (see Constraints Drawing P23/2863/11, Appendix A), where low density Chalk bedrock was encountered at depths of between 0.35m and 0.60m bgl.

8.5 Following the guidance of CIRIA guidance 'Engineering in Chalk', C574, a low-density chalk of Grade B and C, will have the following parameters:

Table 8.2: Low-density Chalk design parameters

Element	Low Density
E_s (secant modulus)	200MN/m ²
q_y (yield stress)	250kN/m ²
E_y (yield modulus)	15MN/m ²
q_u (ultimate bearing capacity)	1.5MN/m ²

- 8.6 Foundations should be a minimum of 1.20m bgl, with a minimum embedment of 350mm within the Chalk. With a conventional factor of safety of 3, an allowable bearing pressure of **83kN/m²** is calculated. Were the allowable bearing pressure insufficient and result in unacceptably large foundations or a piled foundation solution, a more precise estimate of settlements can be calculated following plate load bearing tests at formation level.
- 8.7 Formation level should be proof-rolled and soft spots should be excavated out and backfilled to a suitable earthworks specification.
- 8.8 Foundations constructed on this basis would limit settlements to approximately 25mm.

Piles

- 8.9 For buildings located within areas of deep Made Ground (former swimming pool and former church areas) and where the depth to Chalk head is greater than 1.50m (4-5 storey buildings) and for buildings where shallow foundations are not suitable, a piled foundation solution is recommended. Pile resistances have been calculated following the guidance of Engineering in Chalk (C574), ref. XVII, as outlined in the following paragraphs.
- 8.10 It is recommended piles are taken to a maximum of 8.0m bgl, 1.0m above the water table. Table 8.3 details resistances of 8.0m bored, continuous flight auger (CFA) and large displacement (closed end tubes and all pre-cast concrete, as per BS8004, 1986) piles.

Table 8.3 Total Pile Resistances: 8.0m bgl

	Bored piles	CFA piles	Large displacement piles (PL)
200mm diameter	157kN/m ²	132kN/m ²	201kN/m ²
300mm diameter	282kN/m ²	258kN/m ²	358kN/m ²

Pile Considerations

Bored piles

- little or no vibration;
- only noise of rig power pack;
- base difficult to clean;
- boring through thick superficial deposits will require extensive casing; and

- boring under water may require drilling mud, which can penetrate into dissolution features.

Continuous Flight Auger

- full base resistance can be assumed;
- little or no vibration;
- comparatively quiet;
- neither casing nor drilling mud required;
- impossible to judge solution feature penetrated during construction;

Driven cast-in-place

- high shaft resistance in chalk;
- full base resistance can be assumed;
- causes strong ground vibrations;
- noisy; and
- driven temporary casing restricts length.

Driven pre-formed

- higher base resistances possible by driving to hard layers;
- pile length can be increased by adding segmental sections;
- unaffected by superficial deposits or high water table;
- low shaft resistance;
- causes ground vibrations; and
- noisy.

Floor Slabs

- 8.11 Based on the ground conditions recorded, slabs should be suspended.

Pavements

- 8.12 A total of 3No. samples were subject to soaked CBR testing and a total of 3No. *in situ* Dynamic Cone Penetrometer (DCP) tests were undertaken during the Site investigation works.
- 8.13 The DCP tests were carried out according to the methodology set out in the Design Manual for Roads and Bridges (2008), where a CBR value for the soil profile is calculated by:

$$CBR (\%) = 10^{(2.48 - 1.057 \times \log_{10} P)}$$

Where:

P = The penetration rate in mm per blow (average)

8.14 The subgrade surface modulus is calculated by:

$$E = 17.6(\text{CBR})^{0.64}$$

8.15 Where calculated CBR values are below 10%, the accuracy of this relationship is reduced. The interpreted DCP results are provided in Appendix I. A summary of the *in situ* DCP and laboratory CBR tests is provided in Table 8.4, below:

Table 8.4: *In situ* and Laboratory DCP Results

DCP Location	Laboratory Test Result		DCP Test Result	
	CBR (%)	Subgrade Surface Modulus (MPa)	CBR (%)	Subgrade Surface Modulus (MPa)
TP02 / DCP02	3.2	37	21.2	124
TP04 / DCP04	2.4	30	8.8	70
DCP05			18.6	114
WS04	7.1	61		

- 8.16 The high DCP results of DCP02 and DCP05 are attributed to grain sizes >20mm, which will result in an artificially high CBR value. Also, both of these tests recorded refusals before the full test was completed.
- 8.17 Using the laboratory test results and following the guidance of CD 255 Design for new pavement foundations, Revision 1 (April, 2020), the laboratory test results do not meet the minimum subgrade surface modulus requirement of 50MPa. Therefore, some form of ground improvement will be required prior to pavement construction.
- 8.18 Ground improvement may take the form of lime/cement stabilization or the use of a geogrid in proposed areas of pavement. Following ground improvement, it is recommended a series of in-situ CBRs are undertaken to inform pavement design.

Excavations and Earthworks

- 8.19 In general, shallow cohesive soils should remain freestanding over the short to medium term. Where granular soils are encountered, shoring should be used.
- 8.20 The constraints drawing (ref. P23-2863-11, Appendix A) details the proposed development in relation to former Site structures. Foundations associated with former Site structures: swimming pool (TP08, WS01 and WS01A) and church (BH02) were encountered during the ground investigation. Further remnant below ground structures / foundations may also be

present associated with other historical buildings on the Site, as identified in the constraints drawing, These will need to be grubbed out prior to development.

- 8.21 Were earthworks required, a site specific earthworks specification should be prepared and should include details of earthworks validation and testing.

Buried Concrete

- 8.22 Design/mix of buried concrete should be undertaken in accordance with the appropriate ACEC classification, of BRE Special Digest 1: 2005 (Concrete in Aggressive Ground). On this basis the Site is deemed to classify as “greenfield” and on the basis of the Site history, the geological setting, and observations during the formation of exploratory holes, the Site is not considered to be one that may contain pyrite (i.e. sulphide).
- 8.23 A total of 18No. samples from the Made Ground and natural deposits were subject to pH and SO₄ analysis. Results indicate soluble sulphate concentrations in soil samples of 10mg/l to 140mg/l, with the mean of the highest 20% (4No. results) calculated as 90mg/l. On the basis of these chemical test results, the Design Sulphate Class for the Site is considered to be “DS-1”.
- 8.24 Based on the Site geology, the groundwater conditions can be described as ‘static’. Recorded soil pH values were in the range of 6.1 to 11.0. On this basis, the “Aggressive Chemical Environment for Concrete (ACEC)” class for concrete in the ground is indicated to be AC-1s. Design/mix of buried concrete should be undertaken in accordance with these classifications.

9.0 SOAKAGE ASSESSMENT

- 9.1 A total of 6No. test pits were excavated to establish the potential for using soakaways for surface water drainage with 3No. shallow soakage tests (TP02, TP03 and TP05) and 3No. deeper soakage tests (TP01, TP04 and TP06).
- 9.2 The soakage test results are presented in full in Appendix H and the Trial Pit logs are provided in Appendix B. The results of the soakage testing are summarised in Table 9.1, below:

Table 9.1 Summary of permeable paving soakage test results

Loc.	Pass / Fail	Lithology	Test Range (m bgl)	Soil infiltration rate (ms ⁻¹)
TP02	Pass	Chalk	0.40m to 1.00m	3.64E-04 4.35E-04 2.82E-04
TP03	Pass	Chalk	0.40m to 1.00m	8.11E-06 8.29E-06 7.89E-06
TP05	Pass	Made Ground: gravelly silt. Gravel of brick and concrete. With cobbles of brick.	0.40m to 1.00m	3.80E-06 3.89E-06 3.14E-06

Table 9.2 Summary of sustainable drainage soakage test results

Loc.	Pass / Fail	Lithology	Test Range (depth, m)	Soil infiltration rate (ms ⁻¹)
TP01	Pass	Chalk	0.60m to 1.60m	3.94E-04 4.31E-04 4.59E-04
TP04	Pass	Chalk	1.00m to 2.00m	5.14E-04 4.48E-04 2.95E-04
TP06	Fail	Head: slightly silty Clay	1.00m to 2.00m	-

- 9.3 A general requirement for soakaway/infiltration testing is that the excavation should drain half the volume over a period of 24 hours. This was not achieved at TP06, where the test horizon comprised Head deposits. The test results indicate permeable paving and sustainable drainage are feasible where the drainage medium comprises Chalk. Outwith the areas of former buildings and swimming pool, the depth to Chalk increases to the east of the Site, with Head deposits at TP06 recorded to >1.90m.
- 9.4 Where SUDS are positioned within the Chalk, there is the potential to create solution features. Therefore, all SUDS should be located away from proposed structures.

10.0 CONCLUSIONS & RECOMMENDATIONS

Conclusions

- 10.1 A Phase 2 Geo-Environmental Assessment of land off Ordnance Road and Milton Place was undertaken to support the development for residential end-use.
- 10.2 The site investigation comprised 22No. exploratory holes to establish the ground conditions and determine the potential for ground, groundwater and ground gas contamination across the Site.
- 10.3 The ground conditions generally comprise hardstanding/Topsoil, underlain by Made Ground generally to 1.0m. However, deeper areas of Made Ground were recorded within the footprint of the former church structure (2.0m bgl) and former swimming pool (c. 3.45m bgl). The Made Ground generally comprised reworked natural deposits with brick and concrete fragments although metal and glass fragments were encountered in the central area of the Site. The structure of the former swimming pool was confirmed to remain in-situ and the infill materials comprised predominantly demolition waste, likely arising from the demolition of the buildings formerly present on the Site and associated with the former swimming pool.
- 10.4 The Made Ground was locally underlain by cohesive deposits of Head, which were seen to increase in thickness within the eastern section of the Site. The Made Ground and Head deposits were underlain by solid strata of the Lewis Nodular Chalk Formation. Standing groundwater was recorded at a depth of 9.0m bgl.
- 10.5 Chemical testing identified an elevated concentration of Lead within the infill materials in the former swimming pool structure in the centre of the Site (WS01A), which exceeded residential end-use criteria with home grown produce. No other human health exceedances were identified across the Site although the shallow Made Ground in the central areas (TP01, TP02 and WS04) included fragments of glass and metal.
- 10.6 No other concentrations of heavy metals, polyaromatic or petroleum hydrocarbons were recorded in shallow soils that exceeded the residential end-use criteria with home grown although elevated concentrations of Petroleum Hydrocarbons (C12-C35) were identified within the infill materials within the former swimming pool. No asbestos was detected within Site soils or Made Ground, although it is likely that ACMs are present within the infill material within the swimming pool given the likely origin of this material (c.1950s constructed municipal buildings).
- 10.7 No leachable concentrations of contaminants exceeded available SSACs except for Petroleum Hydrocarbons (C5-C8, Aliphatic) present within the infill materials within the former swimming pool structure. This marginally exceeds the drinking water standard, although is not

- considered to pose a risk given its current containment within a concrete below ground structure and low sensitivity of groundwater in this former industrial area.
- 10.8 The general Made Ground soils destined for off-site disposal are likely to be classified as either Inert or Stable Non-Reactive Hazardous Waste although chemical test results should be presented to the receiving landfill prior to disposal.
- 10.9 Ground gas monitoring confirmed no detectable presence of methane and very low concentrations of carbon dioxide (max 2.3% by volume) although with low/negligible gas flow rates of (0.3l/hr). On the basis of the calculated worst case gas screening values, and low/negligible gas flows, it is considered that there is a low ground gas risk and no ground gas protection measures are necessary for this development.
- 10.10 Shallow strip foundations should be taken down to 1.20m and a minimum of 350mm into the Chalk, which will give an allowable bearing pressure of **83kN/m²**. Where ground conditions result in deeper foundations or where a higher allowable bearing pressure is required, a pile foundation solution is recommended.
- 10.11 The piling process destroys and remoulds the Chalk as the pile is advanced, resulting in a shear surface along the length of the pile. Consequently, resistances from piles within Chalk are predominantly end bearing. Piles taken below the water table result in a higher factor of safety. Therefore, if sufficient resistances are achievable, it is recommended piles are taken down to a maximum of 8.0m, 1.0m above the water table.
- 10.12 Based on the ground conditions recorded, slabs should be suspended.
- 10.13 For any proposed new pavements, due to the low subgrade surface modulus results obtained, some form of ground improvement is required. This may take the form of cement/lime stabilization or the use of a geogrid. Following ground improvement, it is recommended a series of in-situ CBR tests are undertaken to guide pavement design.
- 10.14 Buried concrete should be classified as DS-1, with an ACEC classification of AC-1s.
- 10.15 Shallow excavations within cohesive soils may offer short to medium-term stability. Were earthworks required as part of the proposed development, an earthworks strategy, including validation testing should be prepared.
- 10.16 Soakage testing indicates permeable paving and sustainable drainage are feasible in areas of Chalk. However, the Head deposits are not a suitable drainage medium. In addition, with the potential to create solution features within the Chalk, any SUDS should be located a suitable distance from any proposed structures, in accordance with current guidance.

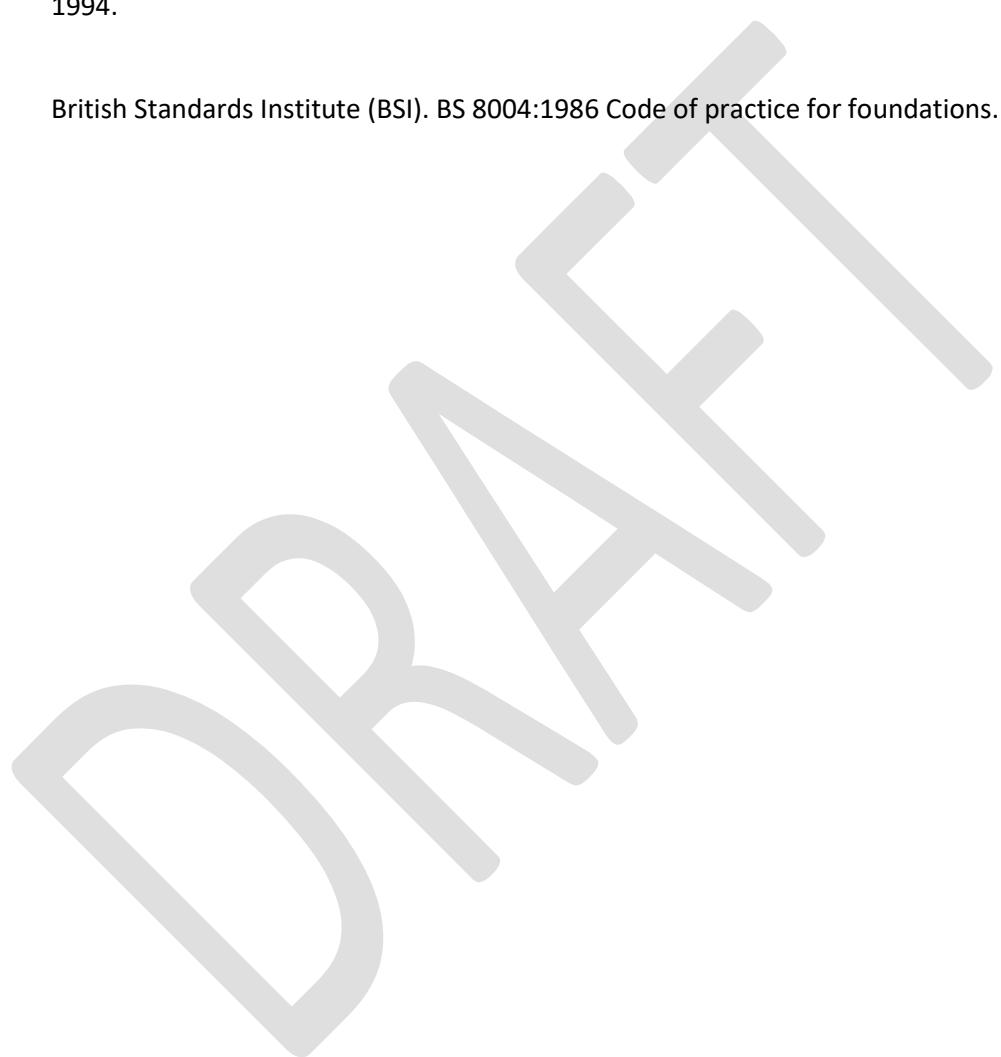
Recommendations

10.17 Based on the findings of the site investigation works undertaken, we would recommend the following:

- Given the presence of demolition materials, contaminants of concern (Lead and Petroleum Hydrocarbons) and the likely presence of asbestos-containing materials within the former swimming pool structure, further site investigation should be undertaken to determine the nature and extent of any deleterious materials and contamination present. This should include sufficient information to enable quantitative risk assessment to support the retention of this material on site (if appropriate) or to classify the material for off-site disposal, if required.
- If the material is to be retained, remediation works will be required to mitigate exposure risk to future site residents, particularly in private gardens and soft landscaped areas. Remediation works would also need to address areas of the site where further deleterious materials were encountered in shallow Made Ground (in the form of glass and metal fragments).
- A Remediation Method Statement will need to be prepared to detail the proposed remediation works and outline the validation process to render the Site suitable for residential end-use.
- Some form of ground improvement in areas of proposed hardstanding may be required, in the form lime/cement stabilisation or the use of a geogrid.
- On removal of any below ground structures, if significant earthworks are required, targeted laboratory geotechnical testing would be recommended and a detailed earthworks specification prepared.

11.0 REFERENCES

- I. Addison, J, Davies, L, Robertson A and Willey, R. 1988. The release of dispersed asbestos fibres from soils. Research Report TM/88/14. Institute of Occupational Medicine, Edinburgh.
- II. British Standards Institute (BSI). BS 5930:2015 Code of practice for ground investigations. 2015.
- III. British Standards Institute (BSI). BS 8485:2015+A1:2019 Code of practice for the design of protective measures for methane and carbon dioxide ground gases in new buildings. 2019.
- IV. British Standards Institute (BSI). BS 10175:2011+A2:2017 – Investigation of potentially contaminated sites. 2017.
- V. CIRIA. 2014. Asbestos in Soil and Made Ground: A Guide to Understanding and Managing the Risks. CIRIS C733. CIRIA, London.
- VI. Contaminated Land: Applications in Real Environments (CL:AIRE). 2014. SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination.
- VII. DEFRA, Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance, April 2012
- VIII. Department for Communities and Local Government. National Planning Policy Framework. February 2019.
- IX. Department of the Environment, Transport and the Regions, Environment Agency and Institute of Environmental Health. Guidelines for Environmental Risk Assessment and Management. HMSO July 2000.
- X. ENVIRONMENT AGENCY. Guidance for the Safe Development of Housing on Land Affected by Contamination R&D Publication 66, 2008.
- XI. ENVIRONMENT AGENCY. Land Contamination Risk Management guidance. October 2020
- XII. EN 1997: Eurocode 7: Geotechnical design. 1997.
- XIII. HIGHWAYS ENGLAND. 2020. Design Manual for Roads and Bridges. CD 225 Design for new pavement foundations. Revision 1. April 2020.
- XIV. NHBC and Environment Agency. Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008 Volume 1.

-
- XV. NHBC guidance on evaluation of development proposals on sites where methane and carbon dioxide are present, Report Edition No. 04, March 2007.
- XVI. NHBC Standards (2011) Chapter 4.1: Land quality – managing ground conditions. 2011.
- XVII. Lord et al. CIRIA. 2002 Engineering In Chalk. C574, London.
- XVIII. British Standards Institute (BSI). BS 8002:1994 Code of practice for earth retaining structures. 1994.
- XIX. British Standards Institute (BSI). BS 8004:1986 Code of practice for foundations. 1986.
- 

APPENDICES

APPENDIX A

DRAWINGS



create
CONSULTING ENGINEERS LTD

Legend

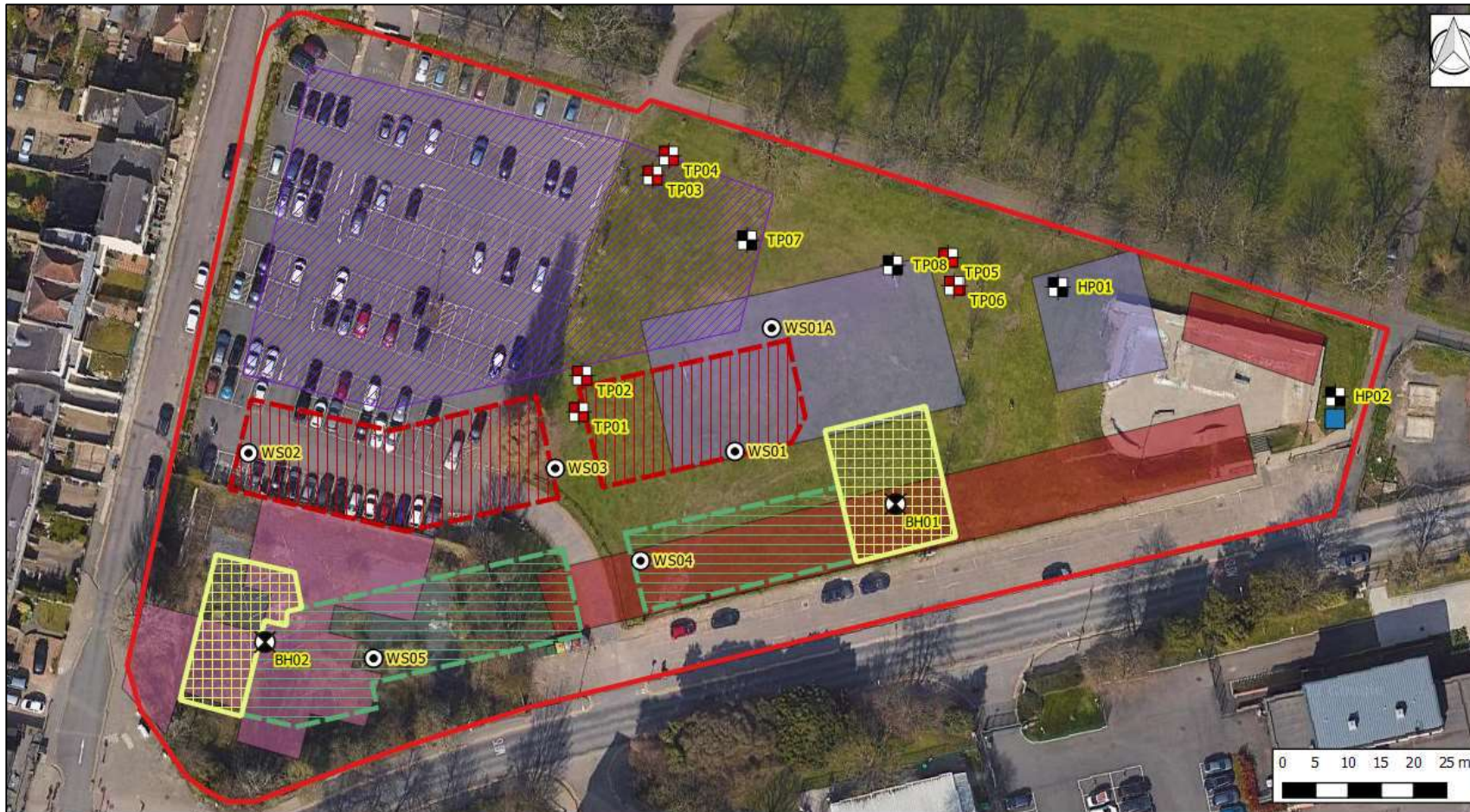
-  Site boundary
-  CP Borehole
-  WS Borehole
-  Trial Pit

Project: Milton Place, Gravesend

Drawing Title: Exploratory Hole Location Plan

Drawing No.: P23-2863-10

Date: 05/07/2023



create
CONSULTING ENGINEERS LTD

Legend

- Site boundary
- ✕ CP Borehole
- WS Borehole
- ◻ Trial Pit

Proposed Development Historic Development

- | | |
|--|--|
| 5-storey buildings | Swimming pools |
| 4-storey buildings | Church and school |
| 3-storey buildings | Municipal buildings |
| | El. Sub Station |

Project: Milton Place, Gravesend

Drawing Title: Exploratory Hole Location and Constraints Plan

Drawing No.: P23-2863-11

Date: 05/07/2023

APPENDIX B

EXPLORATORY HOLE LOGS

Stability : Stable

Trial Pit Log

Trial Pit No.

TP01

Sheet 1 of 1

Project: Milton Place

Project No: P23-2863

Co-ords: E565262.00 N174102.90

Level: 8.30m AoD

Date

22/05/2023

Location: Gravesend

Dimensions (m): 1.60

Scale

1:20

Client: Hill Partnerships

Depth:
1.60

0.30

Logged
TB

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth (m)	Type	Results					
	0.05 - 0.10	ES		0.13 0.20 0.35	8.17 8.10 7.95	  	Grass over dark brown slightly gravelly silty fine to medium sand. Gravel is subangular to rounded fine to medium flint with fragments of glass and brick. MADE GROUND . Yellow brown slightly silty gravelly fine to medium sand. Gravel is subangular to rounded fine to medium flint. MADE GROUND . Brown mottled light brown friable slightly sandy slightly gravelly silty CLAY. Gravel is subrounded fine to coarse flint and subangular fine to medium chalk. HEAD .	
	1.00 - 1.50	D		0.70 0.90 1.60	7.60 7.40 6.70	   	Structureless CHALK recovered as cream mottled white gravelly SILT. Gravel is subrounded fine to coarse flint and subangular fine chalk. With occasional subrounded flint cobbles. UNDIFFERENTIATED CHALK becoming white mottled orange ...becoming white silty GRAVEL. Gravel is subangular to subrounded fine to coarse chalk and subrounded fine to coarse flint. Grade Dc End of Trial Pit at 1.60m	1 2 3 4

Remarks

- TP01 terminated at 1.6m target depth.
- No groundwater encountered.



Stability : Stable

Stability : Stable

Trial Pit Log

Trial Pit No.

TP04

Sheet 1 of 1

Project: Milton Place

Project No: P23-2863

Co-ords: E565275.80 N174142.40

Level: 8.50m AoD

Date

22/05/2023

Location: Gravesend

Dimensions (m): 1.70

Scale

1:20

Client: Hill Partnerships

Depth:
2.00

0.30

Logged
AW

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth (m)	Type	Results					
	0.15 0.20			0.15 0.20	8.35 8.30		Grass over brown slightly gravelly silty fine to medium sand. Gravel is subangular to rounded fine to medium flint. TOPSOIL	
							Buff-brown fine sand. MADE GROUND.	
							Brown slightly gravelly silt. Gravel is subrounded fine chalk and brick. Trace clay. MADE GROUND.	
	0.50 0.50	B ES		0.60	7.90		Structureless CHALK recovered as cream mottled white gravelly SILT. Gravel is very weak subrounded fine to coarse flint and subangular fine chalk. With occasional subrounded flint cobbles. UNDIFFERENTIATED CHALK.	1
	1.80	B		2.00	6.50		End of Trial Pit at 2.00m	2
								3
								4

Remarks

- TP04 terminated at 2.0m target depth.
- No groundwater encountered.



Stability : Stable

Trial Pit Log

Trial Pit No.

TP05

Sheet 1 of 1

Project: Milton Place

Project No: P23-2863

Co-ords: E565318.30 N174126.80

Level: 7.25m AoD

Date

22/05/2023

Location: Gravesend

Dimensions (m): 1.70

Scale

1:20

Client: Hill Partnerships

Depth:
1.00

0.30

Logged
AW

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth (m)	Type	Results					
				0.10	7.15		Grass over brown slightly gravelly silty fine to medium sand. Gravel is subangular to subrounded fine to medium flint. TOPSOIL.	
				0.20	7.05		Buff-brown fine sand. MADE GROUND.	
				0.20	7.05		Brown slightly gravelly silt. Gravel is angular to subrounded fine to coarse concrete and brick. With cobbles of brick. With boulders of concrete. Trace clay. MADE GROUND. ...with 5-10mm roots to 0.80m	
				1.00	6.25		End of Trial Pit at 1.00m	1
								2
								3
								4

Remarks

- TP05 terminated at 1.0m target depth.
- No groundwater encountered.



Stability : Stable

Trial Pit Log

Trial Pit No.

TP06

Sheet 1 of 1

Project: Milton Place

Project No: P23-2863

Co-ords: E565319.30 N174122.40

Level: 7.25m AoD

Date

22/05/2023

Location: Gravesend

Dimensions (m): 1.70

Scale

1:20

Client: Hill Partnerships

Depth:
1.90

0.30

Logged
AW

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth (m)	Type	Results					
	0.10			0.10	7.15		Grass over brown slightly gravelly silty fine to medium sand. Gravel is subangular to subrounded fine to medium flint. TOPSOIL.	
	0.20			0.20	7.05		Buff-brown fine sand. MADE GROUND.	
	0.30	ES		0.40	6.85		Brown silty subangular to subrounded fine to coarse brick concrete and chalk gravel. With cobbles of brick. With boulders of concrete. MADE GROUND.	
	0.50	B		0.40	6.85		White silty subrounded fine to medium chalk gravel. MADE GROUND. ...with <5mm roots to 1.50m	
				0.70	6.55		Soft brown slightly silty CLAY. Trace rounded fine to medium flint gravel. HEAD.	1
				1.90	5.35		End of Trial Pit at 1.90m	2
								3
								4

Remarks

- TP06 terminated at 1.9m target depth.
- No groundwater encountered.



Stability : Stable

Trial Pit Log

Trial Pit No.

TP07

Sheet 1 of 1

Project: Milton Place

Project No: P23-2863

Co-ords: E565287.60 N174129.70

Level: 7.60m AoD

Date

25/05/2023

Location: Gravesend

Dimensions (m):

Depth:

0.70

Scale

1:20

Logged

AW

Client: Hill Partnerships

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth (m)	Type	Results					
				0.15 0.20	7.45 7.40		Grass over brown slightly gravelly silty fine to medium sand. Gravel is subangular to subrounded fine to medium flint. TOPSOIL.	
							Buff-brown fine sand. MADE GROUND.	
							Brown silty subangular to subrounded fine to coarse brick concrete and chalk gravel. With cobbles of concrete. MADE GROUND.	
				0.60 0.70	7.00 6.90		White silty subrounded fine to medium chalk gravel. MADE GROUND.	
							End of Trial Pit at 0.70m	

1

2

3

4

Remarks

- TP07 terminated at 0.70m target depth.
- No groundwater encountered.



Stability :

Trial Pit Log

Trial Pit No.

TP08

Sheet 1 of 1

Project: Milton Place

Project No: P23-2863

Co-ords: E565310.00 N174125.60

Level: 7.40m AoD

Date

25/05/2023

Location: Gravesend

Dimensions (m):

Depth:

1.50

Scale

1:20

Logged

AW

Client: Hill Partnerships

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth (m)	Type	Results					
				0.10	7.30		Grass over brown slightly gravelly silty fine to medium sand. Gravel is subangular to subrounded fine to medium flint. TOPSOIL.	
				0.20	7.20		Buff-brown fine sand. MADE GROUND.	
				0.30	7.10		Very soft brown silty clay. MADE GROUND.	
				0.50	6.90		Brown slightly silty slightly sandy subangular to subrounded fine to coarse concrete and brick. Trace clay. With cobbles fo concrete. With boulders of concrete. MADE GROUND.	
				0.50	6.90		Brown white slightly gravelly slightly silty sand. Gravel is angular to subrounded fine to coarse flint chalk brick and concrete. With cobbles of concrete and brick. With horizons of clay. MADE GROUND.	
				1.50	5.90		End of Trial Pit at 1.50m	

Remarks

- TP08 terminated at 1.5m target depth.
- No groundwater encountered.



Stability :

Borehole Log

Borehole No.

WS01A

Sheet 1 of 1

Project: Milton Place

Project No: P23-2863

Co-ords: E565291.50 N174115.70

Hole Type
WS

Location: Gravesend

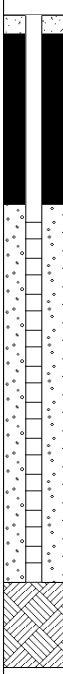
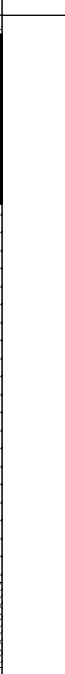
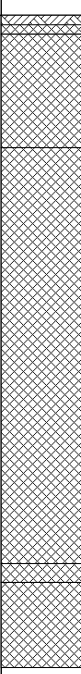
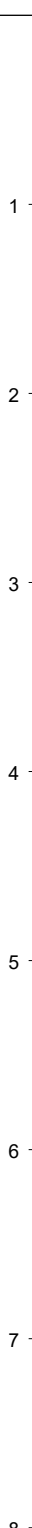
Level: 7.50m aOD

Scale
1:40

Client: Hill Partnerships

Date: 24/05/2023

Logged
AW

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.05	7.45		Grass over brown slightly gravelly silty fine to medium sand. Gravel is subangular to subrounded fine to medium flint. TOPSOIL.	
					0.10	7.40		Buff-brown fine sand. MADE GROUND.	
					0.70	6.80		Brown slightly silty slightly sandy subangular to subrounded fine to coarse concrete and brick. Trace clay. With cobbles fo concrete. With boulders of concrete. MADE GROUND.	
		1.00	SPT	N=29 (4,5/5,10,8,6)				Brown red black subangular to subrounded fine to coarse chalk brick and concrete. Trace ash. MADE GROUND.	
		1.50	ES		1.40	6.10		1.40m - ...with horizons of firm dark grey clay	
		2.00	SPT	N=22 (5,5/5,3,4,10)					
		3.00	SPT	N=54 (6,9/9,8,13,24)	2.90	4.60		Brown very weak concrete. MADE GROUND.	
					2.90	4.60		2.90m - ...flat concrete surface identified, possible base of swimming pool	
					3.00	4.50		Black silty subangular fine flint gravel. MADE GROUND.	
					3.45	4.05		End of Borehole at 3.45m	
Borehole Diameter		Casing Diameter		Chiselling					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration			

Remarks

- WS01A terminated at 3.45m, due to refusal.
- No groundwater encountered.

Borehole Log

Borehole No.

WS02

Sheet 1 of 1

Project: Milton Place

Project No: P23-2863

Co-ords: E565211.60 N1744096.80

Hole Type
WS

Location: Gravesend

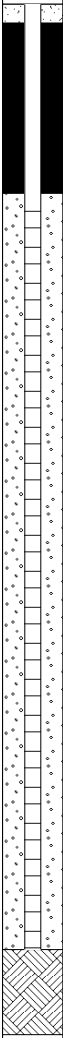
Level: 9.60m aOD

Scale
1:40

Client: Hill Partnerships

Date: 24/05/2023

Logged
AW

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description																												
		Depth (m)	Type	Results																																
		0.50	ES		0.05	9.55		MACADAM.	1																											
					0.25	9.35		Brown black silty subangular fine to coarse brick concrete limestone gravel. With cobbles of brick.																												
					0.60	9.00		MADE GROUND.																												
		1.00 - 1.45 1.00	D SPT	N=15 (6,7/5,4,3,3)	1.30	8.30			Structureless CHALK recovered as brown white gravelly SILT. Gravel is very weak subrounded fine to coarse flint and subangular medium chalk. Brown silt infill of fissures. UNDIFFERENTIATED CHALK.	2																										
									Structureless CHALK recovered as cream mottled white gravelly SILT. Gravel is very weak subrounded fine to coarse flint and subangular fine chalk. With occasional subrounded flint cobbles. UNDIFFERENTIATED CHALK.																											
		2.00 - 2.45 2.00	D SPT	N=8 (2,2/2,2,2,2)						3																										
		3.00 - 3.45 3.00	D SPT	N=17 (3,3/4,4,4,5)						4																										
		4.00 - 4.45 4.00	D SPT	N=16 (3,2/4,4,3,5)						5																										
		5.00 - 5.45 5.00	D SPT	N=11 (2,2/2,3,3,3)	5.45	4.15				6																										
End of Borehole at 5.45m								7																												
								8																												
<table><tr><th colspan="3">Borehole Diameter</th><th colspan="3">Casing Diameter</th><th colspan="3">Chiselling</th></tr><tr><th>Depth Base</th><th>Diameter</th><th></th><th>Depth Base</th><th>Diameter</th><th></th><th>Depth Top</th><th>Depth Base</th><th>Duration</th></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>										Borehole Diameter			Casing Diameter			Chiselling			Depth Base	Diameter		Depth Base	Diameter		Depth Top	Depth Base	Duration									
Borehole Diameter			Casing Diameter			Chiselling																														
Depth Base	Diameter		Depth Base	Diameter		Depth Top	Depth Base	Duration																												

Borehole Diameter		Casing Diameter		Chiselling		Duration
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	

Remarks

- WS02 terminated at 5.45m, target depth.
- No groundwater encountered.

Borehole Log

Borehole No.

WS03

Sheet 1 of 1

Project: Milton Place

Project No: P23-2863

Co-ords: E565258.50 N174094.30

Hole Type
WS

Location: Gravesend

Level: 8.50m aOD

Scale
1:40

Client: Hill Partnerships

Date: 24/05/2023

Logged
AW

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10			0.10	8.40		Grass over brown slightly gravelly silty fine to medium sand. Gravel is subangular to subrounded fine to medium flint. TOPSOIL.	1
		0.40	ES		0.50	8.00		Brown slightly sandy slightly gravelly silt. Gravel is subangular to subrounded fine to medium flint and brick. Trace clay. Trace ash. MADE GROUND.	
		0.80	D		1.30	7.20		Structureless CHALK recovered as brown white gravelly SILT. Gravel is very weak subrounded fine to coarse flint and subangular medium chalk. Brown silt infill of fissures. UNDIFFERENTIATED CHALK.	
		1.00 - 1.45	D		1.50	7.00		Structureless CHALK recovered as brown white slightly silty slightly gravelly CLAY. Gravel is very weak subrounded fine to medium chalk. UNDIFFERENTIATED CHALK.	2
		1.00	SPT	N=10 (3,4/3,3,2,2)	2.00	6.50		Structureless CHALK recovered as brown white gravelly SILT. Gravel is very weak subrounded fine to coarse flint and subangular medium chalk. Brown silt infill of fissures. UNDIFFERENTIATED CHALK.	
		2.00 - 2.45	D					Structureless CHALK recovered as white slightly silty slightly gravelly CLAY. Gravel is very weak subrounded fine to medium chalk. UNDIFFERENTIATED CHALK.	3
		2.00	SPT	N=8 (2,2/2,2,2,2)				Structureless CHALK recovered as white slightly silty slightly gravelly CLAY. Gravel is very weak subrounded fine to medium chalk. UNDIFFERENTIATED CHALK.	
		3.00 - 3.45	D						4
		3.00	SPT	N=17 (3,3/4,4,4,5)					
		4.00 - 4.45	D						5
		4.00	SPT	N=25 (7,7/6,7,6,6)					
		5.00 - 5.45	D						6
		5.00	SPT	N=11 (3,2/2,2,3,4)					
					5.45	3.05		End of Borehole at 5.45m	7
									8

Borehole Diameter		Casing Diameter		Chiselling		Duration
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	

Remarks

- WS03 terminated at 5.45m, target depth.
- No groundwater encountered.

Borehole Log

Borehole No.

WS04

Sheet 1 of 1

Project: Milton Place

Project No: P23-2863

Co-ords: E565271.40 N174080.20

Hole Type
WS

Location: Gravesend

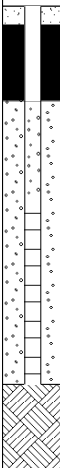
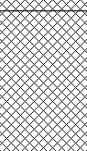
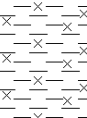
Level: 8.40m aOD

Scale
1:40

Client: Hill Partnerships

Date: 24/05/2023

Logged
AW

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.12	8.28		Grass over brown slightly gravelly silty fine to medium sand. Gravel is subangular to subrounded fine to medium flint. TOPSOIL.	1	
					0.20	8.20				
		0.40	B							
		0.60	ES		0.50	7.90		Brown white gravelly silt. Gravel is very weak subrounded fine to medium chalk. MADE GROUND. Soft brown slightly silty clay. Trace subangular fine brick. Trace glass. MADE GROUND.		
		1.00	SPT	N=7 (1,1/2,2,1,2)						
					1.30	7.10		Soft brown slightly silty CLAY. Trace rounded fine to medium flint gravel. HEAD.		
		1.50	D							
		2.00	SPT	N=63 (3,4/7,12,18,26)	2.00	6.40		Structureless CHALK recovered as brown white gravelly SILT. Gravel is very weak subrounded fine to coarse flint and subangular medium chalk. Brown silt infill of fissures. UNDIFFERENTIATED CHALK. Structureless CHALK recovered as white slightly silty slightly gravelly CLAY. Gravel is very weak subrounded fine to medium chalk. UNDIFFERENTIATED CHALK. End of Borehole at 2.45m		
		2.30 - 2.45	D		2.30	6.10				
			2.45	5.95				3		
									4	
									5	
									6	
									7	
									8	
Borehole Diameter		Casing Diameter		Chiselling		Duration				
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base					

Remarks

- WS04 terminated at 2.45m due to refusal.
- No groundwater encountered.



Borehole Log

Borehole No.

WS05

Sheet 1 of 1

Project: Milton Place

Project No: P23-2863

Co-ords: E565226.90 N174066.00

Hole Type
WS

Location: Gravesend

Level: 9.70m aOD

Scale
1:40

Client: Hill Partnerships

Date: 24/05/2023

Logged
AW

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.30	ES	N=11 (1,2/1,2,3,5)	0.25	9.45		Brown silty subangular fine to coarse brick and concrete gravel. With cobbles of brick. MADE GROUND.	1	
					0.50	9.20		Brown white slightly sandy slightly silty subangular to subrounded chalk and concrete gravel. MADE GROUND.		
		0.80	D					Soft to firm brown silty CLAY. Trace subangular fine to medium flint gravel. HEAD.		
		1.00 - 1.40	D							
		1.00	SPT							
		1.60	D	N=54 (9,12/13,13,12,16)	1.40	8.30		Structureless CHALK recovered as brown white silty very weak subrounded medium chalk gravel. Brown silt infill of fissures. UNDIFFERENTIATED CHALK.	2	
		2.00 - 2.30	D							
		2.00	SPT							
					2.30	7.40		Structureless CHALK recovered as white silty very weak subrounded medium chalk gravel. Silt infill of fissures. UNDIFFERENTIATED CHALK.		
					2.45	7.25		End of Borehole at 2.45m		
										3
										4
										5
								6		
								7		
								8		
Borehole Diameter				Casing Diameter				Chiselling		
Depth Base		Diameter		Depth Base		Diameter		Depth Top	Duration	

Remarks

- WS05 terminated at 2.45m due to refusal.
- No groundwater encountered.

Borehole Log

Borehole No.

BH01

Sheet 1 of 3

Project: Milton Place

Project No: P23-2863

Co-ords: E565310.40 N174088.80

Hole Type
BH

Location: Gravesend

Level: 7.20m aOD

Scale
1:50

Client: Hill Partnerships

Date: 22/05/2023 - 23/05/2023

Logged
AW

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10			0.10	7.10		Grass over brown slightly gravelly silty fine to medium sand. Gravel is subangular to subrounded fine to medium flint. TOPSOIL.	
		0.20			0.20	7.00		Buff-brown fine sand. MADE GROUND.	
		0.30	B					Brown slightly silty slightly sandy angular to subrounded fine to medium flint concrete and brick gravel. MADE GROUND.	1
		0.50	ES						
		0.80	B						
		1.00	ES		1.10	6.10			
		1.20	D		1.30	5.90			
		1.40	D						
		1.50 - 1.95	D						
		1.50	SPT	N=3 (1,0/0,1,1,1)					
		2.00 - 2.45	D						2
		2.50 - 3.00	B		2.40	4.80		Structureless CHALK recovered as brown white gravelly SILT. Gravel is very weak subrounded fine to coarse flint and subangular medium chalk. Brown silt infill of fissures. UNDIFFERENTIATED CHALK.	3
		2.50	SPT	N=36 (6,7/9,8,9,10)					
		3.50	D						
		3.50	SPT	N=27 (3,5/6,7,7,7)					
		4.00	D		3.90	3.30		Structureless CHALK recovered as cream mottled white silty subrounded fine to coarse flint and subangular fine chalk GRAVEL. With occasional subangular flint cobbles. UNDIFFERENTIATED CHALK.	4
		4.00 - 4.45	B						
		4.50 - 4.95	D						5
		4.50	SPT	N=9 (1,2/2,3,2,2)					
		5.50	D						
		6.00 - 6.45	D						6
		6.00	SPT	N=11 (2,3/3,2,3,3)					
		7.00 - 7.45	D		7.00	0.20			7
		7.50	SPT	N=26 (4,6/7,6,6,7)					
		8.50	D						
		9.00 - 9.45	D						9
		9.00	SPT	N=19 (3,3/4,4,5,6)					
		10.00	D						10

Borehole Diameter

Casing Diameter

Chiselling

Depth Base

Diameter

Depth Base

Diameter

Depth Top

Depth Base

Duration

Remarks

- BH01 terminated at 25.45m, target depth.
- Groundwater strikes from 7.50m.



Borehole Log

Borehole No.

BH01

Sheet 2 of 3

Project: Milton Place

Project No: P23-2863

Co-ords: E565310.40 N174088.80

Hole Type
BH

Location: Gravesend

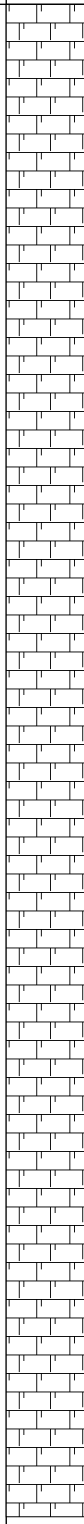
Level: 7.20m aOD

Scale
1:50

Client: Hill Partnerships

Date: 22/05/2023 - 23/05/2023

Logged
AW

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
		10.50 - 10.95 10.50	D SPT	N=19 (3,4/4,5,5,5)				Structureless CHALK recovered as cream mottled white silty subrounded fine to coarse flint and subangular fine chalk GRAVEL. With occasional subangular flint cobbles. UNDIFFERENTIATED CHALK.	11		
		11.50	D								
		12.00 - 12.45 12.00	D SPT	N=18 (3,4/4,4,5,5)							12
		13.00	D								13
		13.50 - 13.95 13.50	D SPT	N=18 (2,4/4,5,5,4)							14
		14.50	D								
		15.00 - 15.95 15.00	D SPT	N=21 (3,5/5,5,5,6)							15
		16.00	D								16
		16.50 - 16.95 16.50	D SPT	N=21 (4,4/5,5,5,6)							17
		17.50	D								
		18.00 - 18.45 18.00	D SPT	N=28 (7,6/6,7,7,8)							18
		19.00	D								19
		19.50 - 19.95 19.50	D SPT	N=31 (6,7/6,7,9,9)							20
Borehole Diameter		Casing Diameter		Chiselling							
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration					

Remarks

- BH01 terminated at 25.45m, target depth.
- Groundwater strikes from 7.50m.

Borehole Log

Borehole No.

BH01

Sheet 3 of 3

Project: Milton Place

Project No: P23-2863

Co-ords: E565310.40 N174088.80

Hole Type
BH

Location: Gravesend

Level: 7.20m aOD

Scale
1:50

Client: Hill Partnerships

Date: 22/05/2023 - 23/05/2023

Logged
AW

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		20.50	D					Structureless CHALK recovered as cream mottled white silty subrounded fine to coarse flint and subangular fine chalk GRAVEL. With occasional subangular flint cobbles. UNDIFFERENTIATED CHALK.	
		21.00 - 21.45	D						21
		21.00	SPT	N=36 (6,7/8,9,9,10)					
		22.00	D						22
		22.50 - 22.95	D						
		22.50	SPT	N=37 (7,8/8,9,10,10)					23
		23.00	D						
		24.00	SPT	N=42 (6,6/8,8,13,13)					24
		24.50 - 24.95	D					End of Borehole at 25.45m	25
		25.00	D						
		25.00	SPT	N=39 (6,8/9,9,9,12)					26
		25.10 - 25.45	D		25.45	-18.25			27
									28
									29
									30

Borehole Diameter		Casing Diameter		Chiselling		Duration
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	

Remarks

- BH01 terminated at 25.45m, target depth.
- Groundwater strikes from 7.50m.



Borehole Log

Borehole No.

BH02

Sheet 1 of 3

Project: Milton Place

Project No: P23-2863

Co-ords: E565214.10 N174067.80

Hole Type
BH

Location: Gravesend

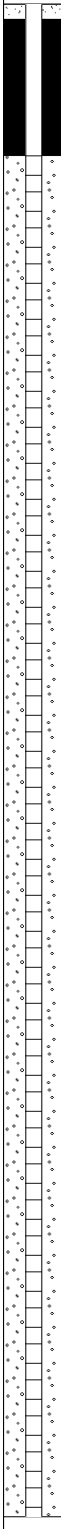
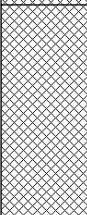
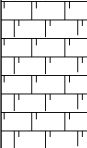
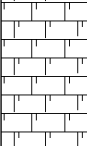
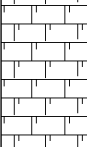
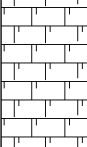
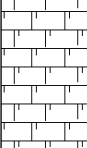
Level: 10.20m aOD

Scale
1:50

Client: Hill Partnerships

Date: 23/05/2023 - 24/05/2023

Logged
AW

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.10	10.10		MACADAM.	1	
		0.40	B		0.60	9.60		Brown slightly silty slightly sandy angular to subrounded fine to coarse concrete and brick gravel. With cobbles of brick and concrete. MADE GROUND.		
		0.90	B					Brown grey subangular fine to coarse slightly sandy slightly clayey brick and concrete gravel. With cobbles of brick concrete and limestone. MADE GROUND.	2	
		1.50 - 1.95 1.50	D SPT	N=16 (9,12/4,4,4,4)	2.00	8.20		Structureless CHALK recovered as brown white gravelly SILT. Gravel is very weak subrounded fine to coarse flint and subangular medium chalk. Trace subangular fine to coarse flint gravel. Brown silt infill of fissures. UNDIFFERENTIATED CHALK.		
		1.55 - 2.00	B		3.00	7.20		Structureless CHALK recovered as cream mottled white silty subrounded fine to coarse flint and subangular fine chalk GRAVEL. With occasional subangular flint cobbles. UNDIFFERENTIATED CHALK.	3	
		2.50 - 2.95 2.50	D SPT	N=9 (2,2/2,3,2,2)						
		3.00 - 3.50	B						4	
		3.50 - 3.95 3.50	D SPT	N=7 (1,2/1,2,2,2)						
		4.00	D						5	
		4.50 - 4.95 4.50	D SPT	N=11 (1,2/3,3,2,3)						
		5.50	D						6	
		6.00 - 6.45 6.00	D SPT	N=11 (2,3/3,2,3,3)						
		7.00	D						7	
		7.50 - 7.95 7.50	D SPT	N=14 (2,3/3,3,4,4)						
		8.50	D						8	
		9.00 - 9.45 9.00	D SPT	N=15 (3,3/3,4,4,4)						
						9.80	0.40			9
										10
Borehole Diameter		Casing Diameter				Chiselling				
Depth Base		Diameter		Depth Base		Diameter		Duration		

Borehole Diameter		Casing Diameter		Chiselling		Duration
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	

Remarks

- BH02 terminated at 25.45m, target depth.
- Groundwater strikes from 7.0m.



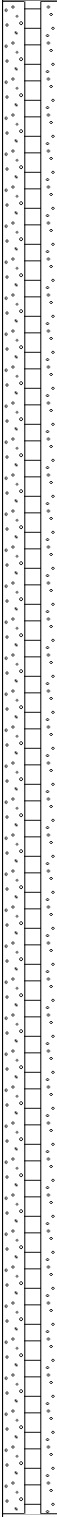
Borehole Log

Borehole No.

BH02

Sheet 2 of 3

Project: Milton Place	Project No: P23-2863	Co-ords: E565214.10 N174067.80	Hole Type BH
Location: Gravesend		Level: 10.20m aOD	Scale 1:50
Client: Hill Partnerships		Date: 23/05/2023 - 24/05/2023	Logged AW

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.50 - 10.95 10.50	D SPT	N=20 (3,4/4,5,5,6)				Structureless CHALK recovered as cream mottled white silty subrounded fine to coarse flint and subangular fine chalk GRAVEL. With occasional subangular flint cobbles. UNDIFFERENTIATED CHALK.	11
		11.00	D						
		12.00 - 12.45 12.00	D SPT	N=17 (3,4/3,4,4,6)					12
		13.00	D						13
		13.50 - 13.95 13.50	D SPT	N=20 (3,4/5,5,5,5)					14
		14.50	D						
		15.00 - 15.95 15.00	D SPT	N=29 (4,9/10,6,6,7)					15
		16.00	D						16
		16.50 - 16.95 16.50	D SPT	N=22 (4,4/5,6,5,6)					17
		17.00	D						
		18.00 - 18.45 18.00	D SPT	N=20 (4,4/7,6,5,2)					18
		19.00	D						19
		19.50 - 19.95 19.50	D SPT	N=25 (4,6/7,6,6,6)					20

Borehole Diameter		Casing Diameter		Chiselling		Duration
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	

Remarks	
1. BH02 terminated at 25.45m, target depth. 2. Groundwater strikes from 7.0m.	

Borehole Log

Borehole No.

BH02

Sheet 3 of 3

Project: Milton Place

Project No: P23-2863

Co-ords: E565214.10 N174067.80

Hole Type
BH

Location: Gravesend

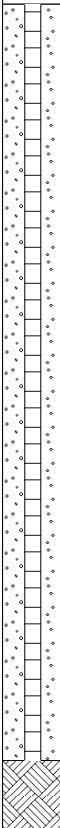
Level: 10.20m aOD

Scale
1:50

Client: Hill Partnerships

Date: 23/05/2023 - 24/05/2023

Logged
AW

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		20.50	D	N=26 (4,6/6,6,7,7)	25.45	-15.25		Structureless CHALK recovered as cream mottled white silty subrounded fine to coarse flint and subangular fine chalk GRAVEL. With occasional subangular flint cobbles. UNDIFFERENTIATED CHALK.	21	
		21.00 - 21.45	D							
		21.00	SPT							
		22.00	D	N=27 (4,5/6,7,7,7)						22
		22.10 - 22.45	D							
		22.50	SPT							
		23.00	D	N=26 (5,6/4,8,8,6)						23
		24.00	SPT							
				25.00						SPT
		25.00	D							

Remarks

- BH02 terminated at 25.45m, target depth.
- Groundwater strikes from 7.0m.

KEY SHEET

SAMPLING

D	Small disturbed sample
B	Bulk disturbed sample
ES	Environmental sample*
HVR	Hand Shear Vane Test (KPa)

TESTING

N=x	SPT blow count 'N' given as the sum of the blows required to drive the sampler across the test length (300mm)
(x,x/y,y,y,y)	Blows per increment during the standard penetration test (SPT). The initial two readings, 'x' relate to the seating drive (150mm of test) whilst the remaining blows, 'y', relate to the number of blows per 75mm increment of the test length (total of 300mm)
x (x,x for z)	Incomplete SPT test where seating drive blow count (x) totals 50 for length of seating drive (z) (penetration in mm)
x (x,x/y for z)	Incomplete SPT test where seating drive was completed but full test length could not be achieved (z) (penetration in mm).

All measurements are given in metres (m), unless otherwise specified

* Sample comprises: 1ltr plastic tub, 250ml amber glass vial and 60ml amber glass vial

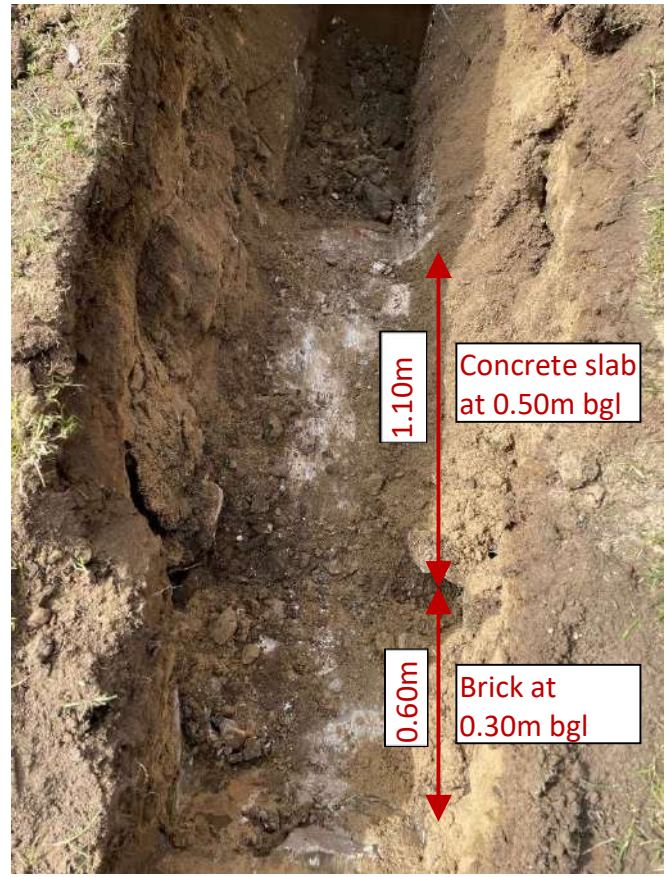
APPENDIX C

PHOTOGRAPHS

**Plate 1: WS01 – refusal on possible reinforced
concrete wall of former swimming pool**



Plate 2: TP08 – concrete at 0.50m steps down



APPENDIX D

CHEMICAL LABORATORY TEST CERTIFICATES COMPARISON OF RESULTS AGAINST SSAC



Certificate of Analysis

Certificate Number 23-12673

Issued: 15-Jun-23

Client Create Consulting Engineers LTD
15 Princess Street
Norwich
NR3 1AF

Our Reference 23-12673

Client Reference P23-2863

Order No PO5086

Contract Title Milton Place, Gravesend

Description 21 Soil samples, 4 Leachate samples.

Date Received 30-May-23

Date Started 30-May-23

Date Completed 15-Jun-23

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Kirk Bridgewood
General Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 23-12673

Client Ref P23-2863

Contract Title Milton Place, Gravesend

Lab No	2178417	2178418	2178419	2178420	2178421	2178422
Sample ID	TP06	BH01	BH01	BH02	BH02	WS01A
Depth	0.30	0.50	1.00	10.00	21.00	0.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	23/05/2023	22/05/2023	22/05/2023	23/05/2023	23/05/2023	24/05/2023
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	8.4	11				7.5
Barium	DETSC 2301#	1.5	mg/kg	68	65				310
Beryllium	DETSC 2301#	0.2	mg/kg	0.7	0.4				0.3
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.7	0.5				1.0
Cadmium	DETSC 2301#	0.1	mg/kg	0.3	0.2				0.5
Chromium	DETSC 2301#	0.15	mg/kg	14	15				14
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0				< 1.0
Copper	DETSC 2301#	0.2	mg/kg	24	16				76
Lead	DETSC 2301#	0.3	mg/kg	61	37				540
Mercury	DETSC 2325#	0.05	mg/kg	0.11	0.07				< 0.05
Nickel	DETSC 2301#	1	mg/kg	17	15				11
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5				< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	42	30				24
Zinc	DETSC 2301#	1	mg/kg	56	51				280
Inorganics									
pH	DETSC 2008#		pH	8.5	10.5	10.1	9.8	8.1	11.0
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.1	0.2				< 0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	0.1				< 0.1
Organic matter	DETSC 2002#	0.1	%	1.6	1.6				0.6
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l	42	79	89	31	43	140
Sulphide	DETSC 2024*	10	mg/kg	43	31				35
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.07	0.14				0.82
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	0.10	< 0.01				< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01				< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01				< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5				< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2				14
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5				85
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4				48
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10				150
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01				< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01				< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01				< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9				< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5				4.4
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6				66
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4				64
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10				130
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10				280

Summary of Chemical Analysis

Soil Samples

Our Ref 23-12673

Client Ref P23-2863

Contract Title Milton Place, Gravesend

Lab No	2178417	2178418	2178419	2178420	2178421	2178422
Sample ID	TP06	BH01	BH01	BH02	BH02	WS01A
Depth	0.30	0.50	1.00	10.00	21.00	0.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	23/05/2023	22/05/2023	22/05/2023	23/05/2023	23/05/2023	24/05/2023
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03				< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03				0.04
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03				< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03				< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.11	0.13				0.47
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03				0.16
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.30	0.17				0.68
Pyrene	DETSC 3303#	0.03	mg/kg	0.27	0.14				0.55
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.12	0.08				0.28
Chrysene	DETSC 3303	0.03	mg/kg	0.09	0.06				0.15
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.14	0.11				0.24
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.03	< 0.03				0.06
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.12	0.09				0.19
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.04	0.04				0.17
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03				0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.05	0.05				0.50
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	1.3	0.87				3.6
PCBs									
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg						
PCB 52	DETSC 3401#	0.01	mg/kg						
PCB 101	DETSC 3401#	0.01	mg/kg						
PCB 118	DETSC 3401#	0.01	mg/kg						
PCB 153	DETSC 3401#	0.01	mg/kg						
PCB 138	DETSC 3401#	0.01	mg/kg						
PCB 180	DETSC 3401#	0.01	mg/kg						
PCB 7 Total	DETSC 3401#	0.01	mg/kg						
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	0.4				< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 23-12673

Client Ref P23-2863

Contract Title Milton Place, Gravesend

Lab No	2178423	2178424	2178425	2178426	2178427	2178428
Sample ID	WS01A	WS02	WS03	WS03	WS03	WS03
Depth	3.00-3.45	0.50	0.80	1.00-1.45	3.00-3.45	4.00-4.45
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	24/05/2023	24/05/2023	24/05/2023	24/05/2023	24/05/2023	24/05/2023
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg		8.2				
Barium	DETSC 2301#	1.5	mg/kg		77				
Beryllium	DETSC 2301#	0.2	mg/kg		0.4				
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg		0.9				
Cadmium	DETSC 2301#	0.1	mg/kg		0.4				
Chromium	DETSC 2301#	0.15	mg/kg		14				
Chromium, Hexavalent	DETSC 2204*	1	mg/kg		< 1.0				
Copper	DETSC 2301#	0.2	mg/kg		33				
Lead	DETSC 2301#	0.3	mg/kg		110				
Mercury	DETSC 2325#	0.05	mg/kg		0.57				
Nickel	DETSC 2301#	1	mg/kg		12				
Selenium	DETSC 2301#	0.5	mg/kg		< 0.5				
Vanadium	DETSC 2301#	0.8	mg/kg		27				
Zinc	DETSC 2301#	1	mg/kg		71				
Inorganics									
pH	DETSC 2008#		pH	6.1	9.1	9.2	8.9	8.9	8.7
Cyanide, Total	DETSC 2130#	0.1	mg/kg		0.1				
Cyanide, Free	DETSC 2130#	0.1	mg/kg		< 0.1				
Organic matter	DETSC 2002#	0.1	%		2.1				
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l	51	52	19	24	13	15
Sulphide	DETSC 2024*	10	mg/kg		31				
Sulphate as SO4, Total	DETSC 2321#	0.01	%		0.10				
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg		< 0.01				
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg		< 0.01				
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg		< 0.01				
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg		< 1.5				
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg		< 1.2				
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg		< 1.5				
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg		< 3.4				
Aliphatic C5-C35	DETSC 3072*	10	mg/kg		< 10				
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg		< 0.01				
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg		< 0.01				
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg		< 0.01				
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg		< 0.9				
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg		< 0.5				
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg		< 0.6				
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg		< 1.4				
Aromatic C5-C35	DETSC 3072*	10	mg/kg		< 10				
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg		< 10				

Summary of Chemical Analysis

Soil Samples

Our Ref 23-12673

Client Ref P23-2863

Contract Title Milton Place, Gravesend

Lab No	2178423	2178424	2178425	2178426	2178427	2178428
Sample ID	WS01A	WS02	WS03	WS03	WS03	WS03
Depth	3.00-3.45	0.50	0.80	1.00-1.45	3.00-3.45	4.00-4.45
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	24/05/2023	24/05/2023	24/05/2023	24/05/2023	24/05/2023	24/05/2023
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg		< 0.03				
Acenaphthylene	DETSC 3303#	0.03	mg/kg		< 0.03				
Acenaphthene	DETSC 3303#	0.03	mg/kg		< 0.03				
Fluorene	DETSC 3303	0.03	mg/kg		< 0.03				
Phenanthrene	DETSC 3303#	0.03	mg/kg		0.47				
Anthracene	DETSC 3303	0.03	mg/kg		0.12				
Fluoranthene	DETSC 3303#	0.03	mg/kg		0.97				
Pyrene	DETSC 3303#	0.03	mg/kg		0.89				
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg		0.48				
Chrysene	DETSC 3303	0.03	mg/kg		0.32				
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg		0.67				
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg		0.17				
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg		0.62				
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg		0.20				
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg		0.04				
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg		0.29				
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg		5.2				
PCBs									
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg						
PCB 52	DETSC 3401#	0.01	mg/kg						
PCB 101	DETSC 3401#	0.01	mg/kg						
PCB 118	DETSC 3401#	0.01	mg/kg						
PCB 153	DETSC 3401#	0.01	mg/kg						
PCB 138	DETSC 3401#	0.01	mg/kg						
PCB 180	DETSC 3401#	0.01	mg/kg						
PCB 7 Total	DETSC 3401#	0.01	mg/kg						
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg		< 0.3				

Summary of Chemical Analysis

Soil Samples

Our Ref 23-12673

Client Ref P23-2863

Contract Title Milton Place, Gravesend

Lab No	2178429	2178430	2178432	2178433	2178434	2178435
Sample ID	WS03	WS03	WS04	WS05	WS05	HP01
Depth	5.00-5.45	2.00-2.45	1.50	0.30	1.60	0.20-0.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	24/05/2023	24/05/2023	24/05/2023	24/05/2023	24/05/2023	24/05/2023
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg				5.6		9.4
Barium	DETSC 2301#	1.5	mg/kg				47		81
Beryllium	DETSC 2301#	0.2	mg/kg				0.3		0.6
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg				< 0.2		0.7
Cadmium	DETSC 2301#	0.1	mg/kg				0.2		0.4
Chromium	DETSC 2301#	0.15	mg/kg				9.8		18
Chromium, Hexavalent	DETSC 2204*	1	mg/kg				< 1.0		< 1.0
Copper	DETSC 2301#	0.2	mg/kg				13		31
Lead	DETSC 2301#	0.3	mg/kg				130		82
Mercury	DETSC 2325#	0.05	mg/kg				0.11		0.23
Nickel	DETSC 2301#	1	mg/kg				8.9		15
Selenium	DETSC 2301#	0.5	mg/kg				< 0.5		< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg				18		32
Zinc	DETSC 2301#	1	mg/kg				30		82
Inorganics									
pH	DETSC 2008#		pH	8.7	8.8	8.1	6.9	8.3	8.6
Cyanide, Total	DETSC 2130#	0.1	mg/kg				< 0.1		0.2
Cyanide, Free	DETSC 2130#	0.1	mg/kg				< 0.1		< 0.1
Organic matter	DETSC 2002#	0.1	%				0.7		2.2
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l	15	15	12	15	< 10	31
Sulphide	DETSC 2024*	10	mg/kg				51		12
Sulphate as SO4, Total	DETSC 2321#	0.01	%				0.05		0.06
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg				0.13		< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg				< 0.01		< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg				< 0.01		< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg				< 1.5		< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg				< 1.2		< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg				< 1.5		< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg				< 3.4		< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg				< 10		< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg				< 0.01		< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg				< 0.01		< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg				< 0.01		< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg				< 0.9		< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg				< 0.5		< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg				< 0.6		< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg				< 1.4		< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg				< 10		< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg				< 10		< 10

Summary of Chemical Analysis

Soil Samples

Our Ref 23-12673

Client Ref P23-2863

Contract Title Milton Place, Gravesend

Lab No	2178429	2178430	2178432	2178433	2178434	2178435
Sample ID	WS03	WS03	WS04	WS05	WS05	HP01
Depth	5.00-5.45	2.00-2.45	1.50	0.30	1.60	0.20-0.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	24/05/2023	24/05/2023	24/05/2023	24/05/2023	24/05/2023	24/05/2023
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg				< 0.03		< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg				< 0.03		< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg				< 0.03		< 0.03
Fluorene	DETSC 3303	0.03	mg/kg				< 0.03		< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg				< 0.03		0.17
Anthracene	DETSC 3303	0.03	mg/kg				< 0.03		< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg				0.04		0.49
Pyrene	DETSC 3303#	0.03	mg/kg				0.04		0.44
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg				0.03		0.21
Chrysene	DETSC 3303	0.03	mg/kg				< 0.03		0.16
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg				0.04		0.27
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg				< 0.03		0.07
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg				< 0.03		0.22
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg				< 0.03		0.08
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg				< 0.03		< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg				< 0.03		0.09
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg				0.12		2.2
PCBs									
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg						
PCB 52	DETSC 3401#	0.01	mg/kg						
PCB 101	DETSC 3401#	0.01	mg/kg						
PCB 118	DETSC 3401#	0.01	mg/kg						
PCB 153	DETSC 3401#	0.01	mg/kg						
PCB 138	DETSC 3401#	0.01	mg/kg						
PCB 180	DETSC 3401#	0.01	mg/kg						
PCB 7 Total	DETSC 3401#	0.01	mg/kg						
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg				< 0.3		< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 23-12673

Client Ref P23-2863

Contract Title Milton Place, Gravesend

Lab No	2178436
Sample ID	HP02
Depth	0.30-0.40
Other ID	
Sample Type	SOIL
Sampling Date	24/05/2023
Sampling Time	n/s

Test	Method	LOD	Units	
Metals				
Arsenic	DETSC 2301#	0.2	mg/kg	
Barium	DETSC 2301#	1.5	mg/kg	
Beryllium	DETSC 2301#	0.2	mg/kg	
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	
Cadmium	DETSC 2301#	0.1	mg/kg	
Chromium	DETSC 2301#	0.15	mg/kg	
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	
Copper	DETSC 2301#	0.2	mg/kg	
Lead	DETSC 2301#	0.3	mg/kg	
Mercury	DETSC 2325#	0.05	mg/kg	
Nickel	DETSC 2301#	1	mg/kg	
Selenium	DETSC 2301#	0.5	mg/kg	
Vanadium	DETSC 2301#	0.8	mg/kg	
Zinc	DETSC 2301#	1	mg/kg	
Inorganics				
pH	DETSC 2008#		pH	
Cyanide, Total	DETSC 2130#	0.1	mg/kg	
Cyanide, Free	DETSC 2130#	0.1	mg/kg	
Organic matter	DETSC 2002#	0.1	%	
Sulphate Aqueous Extract as SO ₄ (2:1)	DETSC 2076#	10	mg/l	
Sulphide	DETSC 2024*	10	mg/kg	
Sulphate as SO ₄ , Total	DETSC 2321#	0.01	%	
Petroleum Hydrocarbons				
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	< 10

Summary of Chemical Analysis

Soil Samples

Our Ref 23-12673

Client Ref P23-2863

Contract Title Milton Place, Gravesend

Lab No	2178436
Sample ID	HP02
Depth	0.30-0.40
Other ID	
Sample Type	SOIL
Sampling Date	24/05/2023
Sampling Time	n/s

Test	Method	LOD	Units	
PAHs				
Naphthalene	DETSC 3303#	0.03	mg/kg	
Acenaphthylene	DETSC 3303#	0.03	mg/kg	
Acenaphthene	DETSC 3303#	0.03	mg/kg	
Fluorene	DETSC 3303	0.03	mg/kg	
Phenanthrene	DETSC 3303#	0.03	mg/kg	
Anthracene	DETSC 3303	0.03	mg/kg	
Fluoranthene	DETSC 3303#	0.03	mg/kg	
Pyrene	DETSC 3303#	0.03	mg/kg	
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	
Chrysene	DETSC 3303	0.03	mg/kg	
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	
PCBs				
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg	< 0.01
PCB 52	DETSC 3401#	0.01	mg/kg	< 0.01
PCB 101	DETSC 3401#	0.01	mg/kg	< 0.01
PCB 118	DETSC 3401#	0.01	mg/kg	< 0.01
PCB 153	DETSC 3401#	0.01	mg/kg	< 0.01
PCB 138	DETSC 3401#	0.01	mg/kg	< 0.01
PCB 180	DETSC 3401#	0.01	mg/kg	< 0.01
PCB 7 Total	DETSC 3401#	0.01	mg/kg	< 0.01
Phenols				
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	

Summary of Chemical Analysis

Leachate Samples

Our Ref 23-12673

Client Ref P23-2863

Contract Title Milton Place, Gravesend

Lab No	2178439	2178440
Sample ID	BH01	WS01A
Depth	1.00	1.50
Other ID		
Sample Type	LEACHATE	LEACHATE
Sampling Date	22/05/2023	24/05/2023
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
Preparation					
BS EN 12457 10:1	DETS 1009*			Y	N
Metals					
Arsenic, Dissolved	DETS 2306	0.16	ug/l	1.1	3.2
Barium, Dissolved	DETS 2306	0.26	ug/l	7.5	6.7
Beryllium, Dissolved	DETS 2306*	0.1	ug/l	< 0.1	< 0.1
Boron, Dissolved	DETS 2306*	12	ug/l	< 12	< 12
Cadmium, Dissolved	DETS 2306	0.03	ug/l	< 0.03	< 0.03
Chromium, Dissolved	DETS 2306	0.25	ug/l	5.3	2.2
Chromium, Hexavalent	DETS 2203	0.007	mg/l	< 0.007	< 0.007
Copper, Dissolved	DETS 2306	0.4	ug/l	4.7	1.3
Lead, Dissolved	DETS 2306	0.09	ug/l	0.81	0.64
Mercury, Dissolved	DETS 2306	0.01	ug/l	0.01	0.02
Nickel, Dissolved	DETS 2306	0.5	ug/l	0.8	< 0.5
Selenium, Dissolved	DETS 2306	0.25	ug/l	0.26	< 0.25
Vanadium, Dissolved	DETS 2306	0.6	ug/l	4.9	13
Zinc, Dissolved	DETS 2306	1.3	ug/l	3.3	< 1.3
Inorganics					
pH	DETS 2008		pH	10.9	8.6
Cyanide, Total	DETS 2130	40	ug/l	< 40	< 40
Cyanide, Free	DETS 2130	20	ug/l	< 20	< 20
Cyanide, Complex	DETS 2130*	40	ug/l	< 40	< 40
Sulphate as SO4	DETS 2055	0.1	mg/l	4.4	5.1
Sulphide	DETS 2208	10	ug/l	32	36
Total Organic Carbon	DETS 2085	1	mg/l	3.8	4.0
Petroleum Hydrocarbons					
Aliphatic C5-C6	DETS 3322	0.1	ug/l	< 0.1	800
Aliphatic C6-C8	DETS 3322	0.1	ug/l	< 0.1	12
Aliphatic C8-C10	DETS 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C10-C12	DETS 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C12-C16	DETS 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C16-C21	DETS 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C21-C35	DETS 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C35-C40	DETS 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C5-C40	DETS 3072*	10	ug/l	< 10	820
Aromatic C5-C7	DETS 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C7-C8	DETS 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C8-C10	DETS 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C10-C12	DETS 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C12-C16	DETS 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C16-C21	DETS 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C21-C35	DETS 3072*	1	ug/l	< 1.0	< 1.0

Summary of Chemical Analysis

Leachate Samples

Our Ref 23-12673

Client Ref P23-2863

Contract Title Milton Place, Gravesend

Lab No	2178439	2178440
Sample ID	BH01	WS01A
Depth	1.00	1.50
Other ID		
Sample Type	LEACHATE	LEACHATE
Sampling Date	22/05/2023	24/05/2023
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
Aromatic C35-C40	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C5-C40	DETSC 3072*	10	ug/l	< 10	< 10
TPH Ali/Aro C5-C40	DETSC 3072*	10	ug/l	< 10	820
EPH (C10-C35)	DETSC 3311	10	ug/l	34	74
PAHs					
Naphthalene	DETSC 3304	0.05	ug/l	0.05	< 0.05
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	0.01	0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	0.02	0.02
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	0.01	< 0.01
Pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(a)anthracene	DETSC 3304*	0.01	ug/l	< 0.01	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
PAH Total	DETSC 3304	0.2	ug/l	< 0.20	< 0.20
Phenols					
Phenol - Monohydric	DETSC 2130	100	ug/l	< 100	< 100

WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref 23-12673

Client Ref P23-2863

Contract Title Milton Place, Gravesend

Sample Id TP04 0.50

Sample Numbers 2178416 2178437

Date Analysed 09/06/2023

Test Results On Waste			WAC Limit Values		
Determinand and Method Reference	Units	Result	Inert Waste	SNRHW	Hazardous Waste
DETS 2084# Total Organic Carbon	%	3.2	3	5	6
DETS 2003# Loss On Ignition	%	5.5	n/a	n/a	10
DETS 3321# BTEX	mg/kg	< 0.04	6	n/a	n/a
DETS 3401# PCBs (7 congeners)	mg/kg	< 0.01	1	n/a	n/a
DETS 3311# TPH (C10 - C40)	mg/kg	12.0	500	n/a	n/a
DETS 3301 PAHs	mg/kg	3.8	100	n/a	n/a
DETS 2008# pH	pH Units	8.0	n/a	>6	n/a
DETS 2073* Acid Neutralisation Capacity (pH4)	mol/kg	< 1.0	n/a	TBE	TBE
DETS 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1.0	n/a	TBE	TBE

Test Results On Leachate			WAC Limit Values		
Determinand and Method Reference	Conc in Eluate ug/l	Amount Leached* mg/kg	Limit values for LS10 Leachate		
	10:1	LS10	Inert Waste	SNRHW	Hazardous Waste
DETS 2306 Arsenic as As	0.75	< 0.01	0.5	2	25
DETS 2306 Barium as Ba	34	0.34	20	100	300
DETS 2306 Cadmium as Cd	< 0.030	< 0.02	0.04	1	5
DETS 2306 Chromium as Cr	3	< 0.1	0.5	10	70
DETS 2306 Copper as Cu	3.4	0.034	2	50	100
DETS 2306 Mercury as Hg	0.025	< 0.002	0.01	0.2	2
DETS 2306 Molybdenum as Mo	18	0.18	0.5	10	30
DETS 2306 Nickel as Ni	< 0.50	< 0.1	0.4	10	40
DETS 2306 Lead as Pb	7.3	0.07	0.5	10	50
DETS 2306 Antimony as Sb	0.31	< 0.05	0.06	0.7	5
DETS 2306 Selenium as Se	1.4	< 0.03	0.1	0.5	7
DETS 2306 Zinc as Zn	15	0.15	4	50	200
DETS 2055 Chloride as Cl	1300	< 100	800	15,000	25,000
DETS 2055* Fluoride as F	240	2.4	10	150	500
DETS 2055 Sulphate as SO4	31000	310	1000	20,000	50,000
DETS 2009* Total Dissolved Solids	47000	470	4000	60,000	100,000
DETS 2130 Phenol Index	< 100	< 1	1	n/a	n/a
DETS 2085 Dissolved Organic Carbon	2200	< 50	500	800	1000

Additional Information	
DETS 2008 pH	9.1
DETS 2009 Conductivity uS/cm	66.7
* Temperature*	18.0
Mass of Sample Kg*	0.110
Mass of dry Sample Kg*	0.096
Stage 1	
Volume of Leachant L2*	0.947
Volume of Eluate VE1*	0.9

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive
Hazardous Waste

Disclaimer: The WAC limit values are provided for guidance only. DETS does not accept responsibility for errors or omissions. Values are correct at time of issue.

* DETS are accredited for the testing of leachates and not the leachate preparation stage which is unaccredited.

WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref 23-12673

Client Ref P23-2863

Contract Title Milton Place, Gravesend

Sample Id WS04 0.60

Sample Numbers 2178431 2178438

Date Analysed 08/06/2023

Test Results On Waste			WAC Limit Values		
Determinand and Method Reference	Units	Result	Inert Waste	SNRHW	Hazardous Waste
DETSC 2084# Total Organic Carbon	%	1.6	3	5	6
DETSC 2003# Loss On Ignition	%	4.7	n/a	n/a	10
DETSC 3321# BTEX	mg/kg	< 0.04	6	n/a	n/a
DETSC 3401# PCBs (7 congeners)	mg/kg	< 0.01	1	n/a	n/a
DETSC 3311# TPH (C10 - C40)	mg/kg	11.0	500	n/a	n/a
DETSC 3301 PAHs	mg/kg	3.7	100	n/a	n/a
DETSC 2008# pH	pH Units	8.3	n/a	>6	n/a
DETSC 2073* Acid Neutralisation Capacity (pH4)	mol/kg	< 1.0	n/a	TBE	TBE
DETSC 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1.0	n/a	TBE	TBE

Test Results On Leachate			WAC Limit Values		
Determinand and Method Reference	Conc in Eluate ug/l	Amount Leached* mg/kg	Limit values for LS10 Leachate		
	10:1	LS10	Inert Waste	SNRHW	Hazardous Waste
DETSC 2306 Arsenic as As	0.77	< 0.01	0.5	2	25
DETSC 2306 Barium as Ba	7	< 0.1	20	100	300
DETSC 2306 Cadmium as Cd	< 0.030	< 0.02	0.04	1	5
DETSC 2306 Chromium as Cr	< 0.25	< 0.1	0.5	10	70
DETSC 2306 Copper as Cu	1.1	< 0.02	2	50	100
DETSC 2306 Mercury as Hg	< 0.010	< 0.002	0.01	0.2	2
DETSC 2306 Molybdenum as Mo	1.2	< 0.1	0.5	10	30
DETSC 2306 Nickel as Ni	< 0.50	< 0.1	0.4	10	40
DETSC 2306 Lead as Pb	0.46	< 0.05	0.5	10	50
DETSC 2306 Antimony as Sb	0.58	< 0.05	0.06	0.7	5
DETSC 2306 Selenium as Se	< 0.25	< 0.03	0.1	0.5	7
DETSC 2306 Zinc as Zn	1.4	0.014	4	50	200
DETSC 2055 Chloride as Cl	1100	< 100	800	15,000	25,000
DETSC 2055* Fluoride as F	< 100	< 0.1	10	150	500
DETSC 2055 Sulphate as SO4	2600	< 100	1000	20,000	50,000
DETSC 2009* Total Dissolved Solids	45000	450	4000	60,000	100,000
DETSC 2130 Phenol Index	< 100	< 1	1	n/a	n/a
DETSC 2085 Dissolved Organic Carbon	3700	< 50	500	800	1000

Additional Information	
DETSC 2008 pH	8.7
DETSC 2009 Conductivity uS/cm	64.0
* Temperature*	18.0
Mass of Sample Kg*	0.110
Mass of dry Sample Kg*	0.096
Stage 1	
Volume of Leachant L2*	0.949
Volume of Eluate VE1*	0.9

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive
Hazardous Waste

Disclaimer: The WAC limit values are provided for guidance only. DETS does not accept responsibility for errors or omissions. Values are correct at time of issue.

* DETS are accredited for the testing of leachates and not the leachate preparation stage which is unaccredited.

Summary of Asbestos Analysis

Soil Samples

Our Ref 23-12673

Client Ref P23-2863

Contract Title Milton Place, Gravesend

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2178417	TP06 0.30	SOIL	NAD	none	Josh Best
2178418	BH01 0.50	SOIL	NAD	none	Josh Best
2178422	WS01A 0.30	SOIL	NAD	none	Josh Best
2178424	WS02 0.50	SOIL	NAD	none	Josh Best
2178433	WS05 0.30	SOIL	NAD	none	Josh Best
2178435	HP01 0.20-0.30	SOIL	NAD	none	Josh Best

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 23-12673
 Client Ref P23-2863
 Contract Milton Place, Gravesend

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2178416	TP04 0.50 SOIL	23/05/23	GJ 250ml, PT 1L		BTEX
2178417	TP06 0.30 SOIL	23/05/23	GJ 250ml, PT 1L		BTEX
2178418	BH01 0.50 SOIL	22/05/23	GJ 250ml, PT 1L	pH + Conductivity (7 days)	BTEX
2178419	BH01 1.00 SOIL	22/05/23	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
2178420	BH02 10.00 SOIL	23/05/23	PG		
2178421	BH02 21.00 SOIL	23/05/23	PG		
2178422	WS01A 0.30 SOIL	24/05/23	GJ 250ml, PT 1L		BTEX
2178423	WS01A 3.00-3.45 SOIL	24/05/23	PG		
2178424	WS02 0.50 SOIL	24/05/23	GJ 60ml x2, PT 1L		
2178425	WS03 0.80 SOIL	24/05/23	PG		
2178426	WS03 1.00-1.45 SOIL	24/05/23	PG		
2178427	WS03 3.00-3.45 SOIL	24/05/23	PG		
2178428	WS03 4.00-4.45 SOIL	24/05/23	PG		
2178429	WS03 5.00-5.45 SOIL	24/05/23	PG		
2178430	WS03 2.00-2.45 SOIL	24/05/23	PG		
2178431	WS04 0.60 SOIL	24/05/23	GJ 60ml x2, PT 1L x2		
2178432	WS04 1.50 SOIL	24/05/23	PG		
2178433	WS05 0.30 SOIL	24/05/23	GJ 250ml, PT 1L		BTEX
2178434	WS05 1.60 SOIL	24/05/23	PG		
2178435	HP01 0.20-0.30 SOIL	24/05/23	GJ 250ml, PT 1L		BTEX
2178436	HP02 0.30-0.40 SOIL	24/05/23	GJ 250ml, PT 1L		BTEX
2178437	TP04 0.50 LEACHATE	23/05/23	GJ 250ml, PT 1L		
2178438	WS04 0.60 LEACHATE	24/05/23	GJ 60ml x2, PT 1L x2		
2178439	BH01 1.00 LEACHATE	22/05/23	GJ 250ml, PT 1L		
2178440	WS01A 1.50 LEACHATE	24/05/23	GJ 250ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub G-Bag

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

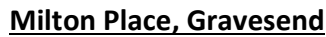
The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report



Milton Place, Gravesend

Comparison of Samples vs Site Specific Assessment Criteria

Scenario: Residential with plant uptake (2.5% SOM)

Sample ID

WS05

WS05

HP01

HP02

LoD

Metals (Based on 6% SOM)

SSAC

Depth

0.30

5.6

1.60

0.20-0.30

9.4

81

0.60

0.70

0.40

18

< 1.0

31

82

0.23

15

< 0.5

32

0.2mg/kg

Arsenic

37

47

0.30

< 0.2

0.20

0.40

18

< 1.0

31

82

0.23

15

< 0.5

32

3700

30

8.3

8.6

0.20

< 0.1

< 0.1

2.2

31

12

1.5mg/kg

Barium

-

47

0.30

< 0.2

0.20

0.40

18

< 1.0

31

82

0.23

15

< 0.5

32

3700

30

8.3

8.6

0.20

< 0.1

< 0.1

2.2

31

12

0.2mg/kg

Beryllium

1.7

0.30

< 0.2

0.20

0.40

18

< 1.0

31

82

0.23

15

< 0.5

32

3700

30

8.3

8.6

0.20

< 0.1

< 0.1

2.2

31

12

0.2mg/kg

Boron, Water Soluble

290

< 0.2

0.20

0.40

18

< 1.0

31

82

0.23

15

< 0.5

32

3700

30

8.3

8.6

0.20

< 0.1

< 0.1

2.2

31

12

0.1mg/kg

Cadmium

11

0.20

0.40

18

< 1.0

31

82

0.23

15

< 0.5

32

3700

30

8.3

8.6

0.20

< 0.1

< 0.1

2.2

31

12

0.15mg/kg

Chromium

910

9.8

< 0.2

0.20

0.40

18

< 1.0

31

82

0.23

15

< 0.5

32

3700

30

8.3

8.6

0.20

< 0.1

< 0.1

2.2

31

12

1mg/kg

Chromium, Hexavalent

6

< 1.0

0.20

0.40

18

< 1.0

31

82

0.23

15

< 0.5

32

3700

30

8.3

8.6

0.20

< 0.1

< 0.1

2.2

31

12

0.2mg/kg

Copper

2400

13

130

0.11

0.23

15

< 0.5

32

3700

30

8.3

8.6

0.20

< 0.1

< 0.1

2.2

31

12

0.3mg/kg

Lead

200

130

0.11

0.23

15

< 0.5

32

3700

30

8.3

8.6

0.20

< 0.1

< 0.1

2.2

31

12

0.05mg/kg

Mercury

40

0.11

0.23

15

< 0.5

32

3700

30

8.3

8.6

0.20

< 0.1

< 0.1

2.2

31

12

1mg/kg

Nickel

130

8.9

0.11

0.23

15

< 0.5

32

3700

30

8.3

8.6

0.20

< 0.1

< 0.1

2.2

31

12

0.5mg/kg

Selenium

250

< 0.5

0.23

15

< 0.5

32

3700

30

8.3

8.6

0.20

< 0.1

< 0.1

2.2

31

12

0.8mg/kg

Vanadium

410

18

0.11

0.23

15

&

			Milton Place, Gravesend									
Comparison of Samples vs Site Specific Assessment Criteria												
Criteria: PoCWTest 2 (Groundwater Impact in Surface Water) - Maximum												
LoD	Metals	SSAC	Sample ID Depth	BH01 1.00	WS01A 1.50							
0.16ug/l	Arsenic, Dissolved	199		1.1	3.2							
0.26ug/l	Barium, Dissolved	-		7.5	6.7							
0.1ug/l	Beryllium, Dissolved	-		< 0.1	< 0.1							
12ug/l	Boron	-		< 12	< 12							
0.03ug/l	Cadmium, Dissolved	1.1		< 0.03	< 0.03							
0.25ug/l	Chromium, Dissolved	27.6		5.3	2.2							
0.007ug/l	Chromium, Hexavalent	-		< 0.007	< 0.007							
0.4ug/l	Copper, Dissolved	57.8		4.7	1.3							
0.09ug/l	Lead, Dissolved	39.8		0.81	0.64							
0.01ug/l	Mercury, Dissolved	-		0.01	0.02							
0.5ug/l	Nickel, Dissolved	116		0.80	< 0.5							
0.25ug/l	Selenium, Dissolved	-		0.26	< 0.25							
0.6ug/l	Vanadium, Dissolved	-		4.9	13							
1.3ug/l	Zinc, Dissolved	414		3.3	< 1.3							
	Inorganics											
	pH	-		11	8.6							
40ug/l	Cyanide, Total	-		< 40	< 40							
20ug/l	Cyanide, Free	-		< 20	< 20							
40ug/l	Cyanide, Complex	-		< 40	< 40							
0.1mg/l	Sulphate as SO4	-		4.4	5.1							
10ug/l	Sulphide	-		32	36							
1mg/l	Total Organic Carbon	-		3.8	4.0							
	Petroleum Hydrocarbons											
0.1ug/l	Aliphatic C5-C6	-		< 0.1	800							
0.1ug/l	Aliphatic C6-C8	-		< 0.1	12							
0.1ug/l	Aliphatic C8-C10	-		< 0.1	< 0.1							
1ug/l	Aliphatic C10-C12	-		< 1.0	< 1.0							
1ug/l	Aliphatic C12-C16	-		< 1.0	< 1.0							
1ug/l	Aliphatic C16-C21	-		< 1.0	< 1.0							
1ug/l	Aliphatic C21-C35	-		< 1.0	< 1.0							
1ug/l	Aliphatic C35-C40	-		< 1.0	< 1.0							
10ug/l	Aliphatic C5-C40	-		< 10	820.00							
0.1ug/l	Aromatic C5-C7	-		< 0.1	< 0.1							
0.1ug/l	Aromatic C7-C8	-		< 0.1	< 0.1							
0.1ug/l	Aromatic C8-C10	-		< 0.1	< 0.1							
1ug/l	Aromatic C10-C12	-		< 1.0	< 1.0							
1ug/l	Aromatic C12-C16	-		< 1.0	< 1.0							
1ug/l	Aromatic C16-C21	-		< 1.0	< 1.0							
1ug/l	Aromatic C21-C35	-		< 1.0	< 1.0							
1ug/l	Aromatic C35-C40	-		< 1.0	< 1.0							
10ug/l	Aromatic C5-C40	-		< 10	< 10							
10ug/l	TPH Ali/Aro Total	-		< 10	820							
10ug/l	EPH (C10-C35)	-		34	74							
1ug/l	Benzene	55.2		-	-							
1ug/l	Toluene	276		-	-							
1ug/l	Ethylbenzene	-		-	-							
1ug/l	Xylene	30.3		-	-							
	PAHs											
0.05ug/l	Naphthalene	13.2		0.05	< 0.05							
0.01ug/l	Acenaphthylene	-		< 0.01	< 0.01							
0.01ug/l	Acenaphthene	-		0.01	0.01							
0.01ug/l	Fluorene	-		< 0.01	< 0.01							
0.01ug/l	Phenanthrene	-		0.02	0.02							
0.01ug/l	Anthracene	0.55		< 0.01	< 0.01							
0.01ug/l	Fluoranthene	0.6		0.01	< 0.01							
0.01ug/l	Pyrene	-		< 0.01	< 0.01							
0.01ug/l	Benzo(a)anthracene	-		< 0.01	< 0.01							
0.01ug/l	Chrysene	-		< 0.01	< 0.01							
0.01ug/l	Benzo(b)fluoranthene	-		< 0.01	< 0.01							
0.01ug/l	Benzo(k)fluoranthene	-		< 0.01	< 0.01							
0.01ug/l	Benzo(a)pyrene	-		< 0.01	< 0.01							
0.01ug/l	Indeno(1,2,3-c,d)pyrene	-		< 0.01	< 0.01							
0.01ug/l	Dibenzo(a,h)anthracene	-		< 0.01	< 0.01							
0.01ug/l	Benzo(g,h,i)perylene	-		< 0.01	< 0.01							
0.2ug/l	PAH, Total	-		< 0.20	< 0.20							
	Phenols											
100ug/l	Phenol - Monohydric	82.8		< 100	< 100							
						</						

Comparison of Samples vs Site Specific Assessment Criteria

Scenario: Residential with plant uptake (2.5% SOM)

LoD	Metals (Based on 6% SOM)	SSAC	Sample ID Depth	TP06	BH01	BH01	BH02	BH02	WS01A	WS01A	WS02
0.2mg/kg	Arsenic	37		0.30	0.50	1.00	10.00	21.00	0.30	3.00-3.45	0.50
1.5mg/kg	Barium	-		8.4	11				7.5		8.2
0.2mg/kg	Beryllium	1.7		68	65				310		77
0.2mg/kg	Boron, Water Soluble	290		0.7	0.4				0.3		0.40
0.1mg/kg	Cadmium	11		0.7	0.5				1		0.90
0.15mg/kg	Chromium	910		0.3	0.2				0.5		0.40
1mg/kg	Chromium, Hexavalent	6		14	15				14		14
0.2mg/kg	Copper	2400		<1	<1				<1		<1
0.3mg/kg	Lead	200		24	16				76		33
0.05mg/kg	Mercury	40		61	37				540		110
1mg/kg	Nickel	130		0.11	0.07				< 0.05		0.57
0.5mg/kg	Selenium	250		17	15				11		12
0.8mg/kg	Vanadium	410		< 0.5	< 0.5				< 0.5		< 0.5
1mg/kg	Zinc	3700		42	30				24		27
				56	51				280		71
	Inorganics										
	pH	-		8.5	10.5	10.1	9.8	8.1	11	6.1	9.1
0.1mg/kg	Cyanide, Total	-		0.1	0.2				<0.1		0.10
0.1mg/kg	Cyanide, Free*	34		<0.1	0.1				<0.1		<0.1
0.50%	Total Organic Carbon	-									
0.10%	Organic matter	-		1.6	1.6				0.6		2.1
10mg/l	Sulphate Aqueous Extract as SO4	-		42	79	89	31	43	140	51	52
10mg/kg	Sulphide	-		43	31				35		31
0.01%	Sulphate as SO4, Total	-		0.07	0.14				0.82		0.10
	Petroleum Hydrocarbons										
0.01mg/kg	Aliphatic C5-C6	78		0.10	<0.01				<0.01		<0.01
0.01mg/kg	Aliphatic C6-C8	230		<0.01	<0.01				<0.01		<0.01
0.01mg/kg	Aliphatic C8-C10	65		<0.01	<0.01				<0.01		<0.01
1.5mg/kg	Aliphatic C10-C12	330		<1.5	<1.5				<1.5		<1.5
1.2mg/kg	Aliphatic C12-C16	2400		<1.2	<1.2				14.00		<1.2
1.5mg/kg	Aliphatic C16-C21	92000		<1.5	<1.5				85.00		<1.5
3.4mg/kg	Aliphatic C21-C35	92000		<3.4	<3.4				48.00		<3.4
10mg/kg	Aliphatic C5-C35	-		<10	<10				150.00		<10
0.01mg/kg	Aromatic C5-C7	140		<0.01	<0.01				<0.01		<0.01
0.01mg/kg	Aromatic C7-C8	290		<0.01	<0.01				<0.01		<0.01
0.01mg/kg	Aromatic C8-C10	83		<0.01	<0.01				<0.01		<0.01
0.9mg/kg	Aromatic C10-C12	180		<0.9	<0.9				<0.9		<0.9
0.5mg/kg	Aromatic C12-C16	330		<0.5	<0.5				4.40		<0.5
0.6mg/kg	Aromatic C16-C21	540		<0.6	<0.6				66.00		<0.6
1.4mg/kg	Aromatic C21-C35	1500		<1.4	<1.4				64.00		<1.4
10mg/kg	Aromatic C5-C35	-		<10	<10				130.00		<10
10mg/kg	TPH Ali/Aro Total	-		<10	<10				280.00		<10
10mg/kg	EPH (C10-C35)	-									
10mg/kg	TPH (C10-C40)	-									
	PAHs										
0.03mg/kg	Naphthalene	5.6		<0.03	<0.03				<0.03		<0.03
0.03mg/kg	Acenaphthylene	420		<0.03	<0.03				0.04		<0.03
0.03mg/kg	Acenaphthene	510		<0.03	<0.03				<0.03		<0.03
0.03mg/kg	Fluorene	400		<0.03	<0.03				<0.03		<0.03
0.03mg/kg	Phenanthrene	220		0.11	0.13				0.47		0.47
0.03mg/kg	Anthracene	5400		<0.03	<0.03				0.16		0.12
0.03mg/kg	Fluoranthene	560		0.3	0.17				0.68		0.97
0.03mg/kg	Pyrene	1200		0.27	0.14				0.55		0.89
0.03mg/kg	Benzo(a)anthracene	11		0.12	0.08				0.28		0.48
0.03mg/kg	Chrysene	22		0.09	0.06				0.15		0.32
0.03mg/kg	Benzo(b)fluoranthene	3.3		0.14	0.11				0.24		0.67
0.03mg/kg	Benzo(k)fluoranthene	93		0.03	<0.03				0.06		0.17
0.03mg/kg	Benzo(a)pyrene	2.7		0.12	0.09				0.19		0.62
0.03mg/kg	Indeno(1,2,3-c,d)pyrene	36		0.04	0.04				0.17		0.20
0.03mg/kg	Dibenzo(a,h)anthracene	0.28		<0.03	0.03				0.03		0.04
0.03mg/kg	Benzo(g,h,i)perylene	340		0.05	0.05				0.5		0.29
0.10mg/kg	PAH - USEPA 16, Total	9224		1.3	0.87				3.6		5.2
	Phenols										
0.3mg/kg	Phenol - Monohydric	316		<0.3	0.4				<0.3		<0.3

Key

xx	At or exceeding the SSAC (Site Specific Assessment Criteria)
xx	Within 90th percentile of SSAC contaminant value
LoD	Laboratory 'Limit of Detection'
*	Based on ATKINS AtRisk Value, 2017

Comparison of Samples vs Site Specific Assessment Criteria

Scenario: Residential with plant uptake (2.5% SOM)

LoD	Metals (Based on 6% SOM)	SSAC	Sample ID Depth	WS05 0.30	WS05 1.60	HP01 0.20-0.30	HP02 0.30-0.40
0.2mg/kg	Arsenic	37		5.6		9.4	
1.5mg/kg	Barium	-		47		81	
0.2mg/kg	Beryllium	1.7		0.30		0.60	
0.2mg/kg	Boron, Water Soluble	290		< 0.2		0.70	
0.1mg/kg	Cadmium	11		0.20		0.40	
0.15mg/kg	Chromium	910		9.8		18	
1mg/kg	Chromium, Hexavalent	6		< 1.0		< 1.0	
0.2mg/kg	Copper	2400		13		31	
0.3mg/kg	Lead	200		130		82	
0.05mg/kg	Mercury	40		0.11		0.23	
1mg/kg	Nickel	130		8.9		15	
0.5mg/kg	Selenium	250		< 0.5		< 0.5	
0.8mg/kg	Vanadium	410		18		32	
1mg/kg	Zinc	3700		30		82	
	Inorganics						
	pH	-		6.9	8.3	8.6	
0.1mg/kg	Cyanide, Total	-		< 0.1		0.20	
0.1mg/kg	Cyanide, Free*	34		< 0.1		< 0.1	
0.50%	Total Organic Carbon	-					
0.10%	Organic matter	-		0.7		2.2	
10mg/l	Sulphate Aqueous Extract as SO4	-		15	10	31	
10mg/kg	Sulphide	-		51		12	
0.01%	Sulphate as SO4, Total	-		0.05		0.06	
	Petroleum Hydrocarbons						
0.01mg/kg	Aliphatic C5-C6	78		0.13		<0.01	<0.01
0.01mg/kg	Aliphatic C6-C8	230		<0.01		<0.01	<0.01
0.01mg/kg	Aliphatic C8-C10	65		<0.01		<0.01	<0.01
1.5mg/kg	Aliphatic C10-C12	330		<1.5		<1.5	<1.5
1.2mg/kg	Aliphatic C12-C16	2400		<1.2		<1.2	<1.2
1.5mg/kg	Aliphatic C16-C21	92000		<1.5		<1.5	<1.5
3.4mg/kg	Aliphatic C21-C35	92000		<3.4		<3.4	<3.4
10mg/kg	Aliphatic C5-C35	-		<10		<10	<10
0.01mg/kg	Aromatic C5-C7	140		<0.01		<0.01	<0.01
0.01mg/kg	Aromatic C7-C8	290		<0.01		<0.01	<0.01
0.01mg/kg	Aromatic C8-C10	83		<0.01		<0.01	<0.01
0.9mg/kg	Aromatic C10-C12	180		<0.9		<0.9	<0.9
0.5mg/kg	Aromatic C12-C16	330		<0.5		<0.5	<0.5
0.6mg/kg	Aromatic C16-C21	540		<0.6		<0.6	<0.6
1.4mg/kg	Aromatic C21-C35	1500		<1.4		<1.4	<1.4
10mg/kg	Aromatic C5-C35	-		<10		<10	<10
10mg/kg	TPH Ali/Aro Total	-		<10		<10	<10
10mg/kg	EPH (C10-C35)	-					
10mg/kg	TPH (C10-C40)	-					
	PAHs						
0.03mg/kg	Naphthalene	5.6		<0.03		<0.03	
0.03mg/kg	Acenaphthylene	420		<0.03		<0.03	
0.03mg/kg	Acenaphthene	510		<0.03		<0.03	
0.03mg/kg	Fluorene	400		<0.03		<0.03	
0.03mg/kg	Phenanthrene	220		<0.03		0.17	
0.03mg/kg	Anthracene	5400		<0.03		<0.03	
0.03mg/kg	Fluoranthene	560		0.04		0.49	
0.03mg/kg	Pyrene	1200		0.04		0.44	
0.03mg/kg	Benzo(a)anthracene	11		0.03		0.21	
0.03mg/kg	Chrysene	22		<0.03		0.16	
0.03mg/kg	Benzo(b)fluoranthene	3.3		0.04		0.27	
0.03mg/kg	Benzo(k)fluoranthene	93		<0.03		0.07	
0.03mg/kg	Benzo(a)pyrene	2.7		<0.03		0.22	
0.03mg/kg	Indeno(1,2,3-c,d)pyrene	36		<0.03		0.08	
0.03mg/kg	Dibenzo(a,h)anthracene	0.28		<0.03		<0.03	
0.03mg/kg	Benzo(g,h,i)perylene	340		<0.03		0.09	
0.10mg/kg	PAH - USEPA 16, Total	9224		0.12		2.2	
	Phenols						
0.3mg/kg	Phenol - Monohydric	316		0.30		0.30	
0.01mg/kg	Polychlorinated Biphenyls	-					<0.01

Key

xx	At or exceeding the SSAC (Site Specific Assessment Criteria)
xx	Within 90th percentile of SSAC contaminant value
LoD	Laboratory 'Limit of Detection'
*	Based on ATKINS AtRisk Value, 2017

			Milton Place, Gravesend									
			Comparison of Samples vs Site Specific Assessment Criteria									
Criteria: Water Supply (Water Quality) Regulations, 2000												
			Sample ID	BH01	WS01A							
LoD	Metals	SSAC	Depth	1.00	1.50							
0.16ug/l	Arsenic, Dissolved	10		1.1	3.2							
0.26ug/l	Barium, Dissolved	-		7.5	6.7							
0.1ug/l	Beryllium, Dissolved	-		< 0.1	< 0.1							
12ug/l	Boron	1000		< 12	< 12							
0.03ug/l	Cadmium, Dissolved	5		< 0.03	< 0.03							
0.25ug/l	Chromium, Dissolved	50		5.3	2.2							
0.007ug/l	Chromium, Hexavalent	-		< 0.007	< 0.007							
0.4ug/l	Copper, Dissolved	2000		4.7	1.3							
0.09ug/l	Lead, Dissolved	10		0.81	0.64							
0.01ug/l	Mercury, Dissolved	1		0.01	0.02							
0.5ug/l	Nickel, Dissolved	20		0.80	< 0.5							
0.25ug/l	Selenium, Dissolved	10		0.26	< 0.25							
0.6ug/l	Vanadium, Dissolved	-		4.9	13							
1.3ug/l	Zinc, Dissolved	5000		3.3	< 1.3							
	Inorganics											
	pH	10										
40ug/l	Cyanide, Total	50		< 40	< 40							
20ug/l	Cyanide, Free	50		< 20	< 20							
40ug/l	Cyanide, Complex	-		< 40	< 40							
0.1mg/l	Sulphate as SO4	250000		4.4	5.1							
10ug/l	Sulphide	-		32	36							
1mg/l	Total Organic Carbon	-		3.8	4.0							
	Petroleum Hydrocarbons											
0.1ug/l	Aliphatic C5-C6	-		< 0.1	800							
0.1ug/l	Aliphatic C6-C8	-		< 0.1	12							
0.1ug/l	Aliphatic C8-C10	-		< 0.1	< 0.1							
1ug/l	Aliphatic C10-C12	-		< 1.0	< 1.0							
1ug/l	Aliphatic C12-C16	-		< 1.0	< 1.0							
1ug/l	Aliphatic C16-C21	-		< 1.0	< 1.0							
1ug/l	Aliphatic C21-C35	-		< 1.0	< 1.0							
1ug/l	Aliphatic C35-C40	-		< 1.0	< 1.0							
10ug/l	Aliphatic C5-C40			< 10	820.00							
0.1ug/l	Aromatic C5-C7	-		< 0.1	< 0.1							
0.1ug/l	Aromatic C7-C8	-		< 0.1	< 0.1							
0.1ug/l	Aromatic C8-C10	-		< 0.1	< 0.1							
1ug/l	Aromatic C10-C12	-		< 1.0	< 1.0							
1ug/l	Aromatic C12-C16	-		< 1.0	< 1.0							
1ug/l	Aromatic C16-C21	-		< 1.0	< 1.0							
1ug/l	Aromatic C21-C35	-		< 1.0	< 1.0							

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in “significant harm” as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. (Note: Water Resources Act contains no scope for considering significance of pollution). Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem, or organisation forming part of such ecosystem (note: the definitions of ecological systems within the draft circular on Contaminated Land, DETR, 2000).	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from Site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).
Medium	Chronic damage to human health (“significant harm” as defined in DETR, 2000). Pollution of sensitive water resources. (Note: Water Resources Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem, or organism forming part of such ecosystem, (note: the definitions of ecological systems within draft circular on Contaminated Land, DETR, 2000).	Concentration of a contaminant from Site exceed the generic, or Site-specific assessment criteria. Leaching of contaminants from a Site to a major or minor aquifer. Death of a species within a designated nature reserve.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services (“significant harm” as defined in the draft circular on Contaminated Land, DETR, 2000). Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater. Damage to building rendering it unsafe to occupy (for example foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc.), easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during Site works. The loss of plants in a landscaping scheme. Discolouration of concrete.

Table D1: Classification of Consequence

Classification	Definition
High Likelihood	There is a pollution linkage and an event that either appears very likely in the short-term and almost inevitable over the long-term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the short-term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long-term.

Table D2: Classification of Probability

		Consequence			
		Severe	Medium	Mild	Minor
Risk	High Likelihood	Very high risk	High risk	Moderate risk	Moderate/low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low Likelihood	Moderate risk	Moderate/low risk	Low Risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

Table D3: Combination of Consequence with Probability

APPENDIX E
GEOTECHNICAL LABORATORY
TEST CERTIFICATES

GEOLABS Limited
Bucknalls Lane
Garston
Watford
Hertfordshire
WD25 9XX

Tel: +44(0) 1923 892 190
Fax: +44(0) 1923 892 191
email: admin@geolabs.co.uk
web: www.geolabs.co.uk

Create Consulting Engineers
109-112 Temple Chambers
3-7 Temple Avenue
London
EC4Y 0HP

27 June 2023

Report No : GEO/38215/01

Page 1 of 1

For the attention of Mr A Warren

Our ref **GEO / 38215**
Your Ref **P23-2863**

Date samples received 26/05/2023
Date written instructions received 06/06/2023
Date testing commenced 07/06/2023
Date of sample disposal 25/07/2023

Project **MILTON PLACE, GRAVESEND**

Further to your instructions we have pleasure in enclosing the results of the tests you requested in the attached figures.

LABORATORY TEST REPORT

Item No	Test Quantity	Description
1	~	Liquid & Plastic Limits Summary
~	3	Water Content
~	3	Liquid & Plastic Limits
2	8	Saturation Water Content
3	9	Point Load Strength Index

Any opinions or interpretations expressed herein are outside the scope of UKAS accreditation. All results contained in this report are provisional unless signed by an approved signatory. The results contained in this report relate only to samples received in the laboratory and are tested 'as received' unless otherwise stated. This report should not be reproduced, except in full, without the written approval of the laboratory. The results reported are applicable only to the test items received by the laboratory.

All the necessary data required by the documented test procedures has been recorded and will be stored for a period of not less than 6 years. This data will be issued to yourselves at your request. All samples will be disposed of after the date shown above. Written confirmation will be required to retain the samples beyond this period and a storage charge may be applied.

We trust that the above meets your requirements and should you require any further information or assistance, please do not hesitate to contact us.

Yours faithfully
on behalf of **GEOLABS Limited**



S Burke
Senior Technician

Test Type:	Sample condition:
1 - 1 point 80g / 30° fall cone method.	1 - As Received
2 - 4 point 80g / 30° fall cone method.	2 - Air Dried
3 - Non plastic determination.	3 - Washed & Air Dried



SATURATION WATER CONTENT OF CHALK

Location	Depth m	Sample Ref	Sample Type	Description	Water Content BS EN ISO 17892-1 : 2014 %	Bulk Density BS EN ISO 17892-2 : 2014 : 5.2 Mg/m ³	Dry Density BS EN ISO 17892-2 : 2014 : 5.2 Mg/m ³	Saturation Water Content %	Porosity %
BH1	8.50		D	White CHALK.	31.4	1.91	1.45	32	46
BH1	17.50		D	White CHALK.	29.7	1.94	1.50	30	44
BH1	22.00		D	White CHALK.	27.1	1.99	1.57	27	42
BH2	7.00		D	White CHALK.	35.6	1.93	1.42	33	47
BH2	16.00		D	White CHALK.	35.0	1.92	1.42	33	47
BH2	22.00		D	White CHALK.	29.3	1.93	1.49	30	45
TP01	1.00-1.50		D	White CHALK.	30.6	1.92	1.47	31	46
TP04	1.80		D	White CHALK.	29.9	1.93	1.49	30	45

Notes

Tested by SB
Checked and Approved by



S Burke - Senior Technician
27/06/2023

Project Number:

GEO / 38215

Project Name:

MILTON PLACE, GRAVESEND
P23-2863



DETERMINATION OF POINT LOAD STRENGTH ON ROCK

Sample details				Point Load test											
Borehole Ref.	Sample Ref.	Depth (m)	Description	D. Tested	Test type & Direction		Sample width W (mm)	Platen separation (mm)		Water Content (%)	Equiv. Diameter D _e (mm)	Failure Load P (kN)	I _s P/De ² (MPa)	Correction Factor F	Point Load Index I _{s(50)} (MPa)
								Start D	End D'						
BH1		8.50	White CHALK	15/06/23	I	U	45.1	30.3	28.1		40.2	0.19	0.12	0.91	0.11
BH1		13.00	White CHALK	15/06/23	I	U	30.0	23.6	21.5		28.7	0.07	0.08	0.78	0.06
BH1		17.50	White CHALK	15/06/23	I	U	80.0	47.6	43.2		66.3	0.64	0.14	1.14	0.16
BH1		22.00	White CHALK	15/06/23	I	U	42.5	23.4	21.0		33.7	0.10	0.09	0.84	0.08
BH2		7.00	White CHALK	15/06/23	I	U	32.0	32.1	30.3		35.1	0.08	0.07	0.85	0.06
BH2		16.00	White CHALK	15/06/23	I	U	43.3	30.1	27.8		39.1	0.15	0.10	0.90	0.09
BH2		22.00	White CHALK	15/06/23	I	U	47.6	26.4	24.1		38.2	0.10	0.07	0.89	0.06
TP01		1.00-1.50	White CHALK	15/06/23	I	U	45.0	39.8	37.5		46.4	0.30	0.14	0.97	0.14
TP01		1.80	White CHALK	15/06/23	I	U	53.1	36.2	34.3		48.2	0.45	0.19	0.98	0.19

(*) Sample failed on weakness

 Test type and direction: **D** - Diametral **A** - Axial **B** - Block **I** - Irregular lump **P** - Perpendicular to planes of weakness **U** - Random or unknown orientation **L** - Parallel to planes of weakness

Checked and Approved by  C Clergeaud (Snr. Geologist) Date: 22/06/2023	Project Number: GEO / 38215 Project Name: MILTON PLACE, GRAVESEND P23-2863	 
--	---	--



Client	Create Consulting Engineers	TEST RESTRICTION
Project No.	38215	
Project Name	MILTON PLACE, GRAVESEND	

The following tests have been scheduled on the above project and **CANNOT** be performed for the reason stated. If alternative samples are available for the restricted tests, please supply details.

Laboratory ID	BH / TP No.	Sample Ref.	Depth (m)		Type	Test(s) Scheduled			Reason for Restriction	Description
488116	BH1		13.00		D				No suitable lumps	White structureless CHALK
						SMC				
Comments / remarks										Test restriction raised by 



Create Consulting Engineers Ltd

FAO Tom Bennett

15 Princes Street

NORWICH

NR3 1AF

Our Project No 104409
Our Report and sample No NNPL2023060142-
Your Sample Ref B1
Your Project or Order No 5070
Date Report Issued 03 July 2023
Date Tested 27 June 2023

Tom.Bennett@createconsultingengineers.co.uk

Page 1 of 1

Determination of the California Bearing Ratio to BS 1377 : Part 4 : 1990 (Withdrawn)

Scheme	Gravesend, Milton Place		
Location	TP02 @ 0.4m	Specimen: 1	
Date sampled	22 May 2023	Date received	31 May 2023
Sampled by	Client	Sample Mass	17.695kg
If a sample certificate was provided, it is available for inspection. The accuracy of any information provided by third parties cannot be guaranteed. These results only relate to the sample tested. Samples submitted by clients are tested 'as received'			
Material	Soil	Sample type	Bulk Disturbed
Description	Greyish white mottled white CHALK, recovered as slightly sandy, gravelly SILT. Gravel is angular to sub-rounded, fine to coarse chalk and rare flint.		
Supplier	Not applicable	Source	Ex site

Test Specimen Preparation details

Location	Not applicable	Method of Division	Quartering
Orientation	Not applicable	Preparation Method	Sieving, Natural Moisture Content
Retained 37.5mm	12.8 %	Retained 20mm	129.2* %
BS Method	3.4, 2.5kg Rammer	Grading zone	X
Number of layers	3	Bulk Density	1.81 Mg/m ³
Blows per layer	62 Blows	Dry Density	1.44 Mg/m ³
Condition	Soaked	Init. Moisture Content	23.0 %
Amount of Swell (mm)	-0.068	Soaking Period	4 days

Test Results

		CBR Value	Surface Modulus \$	
		%	Mpa	
	Top	5.1	50	\$ The calculation of Surface Modulus is not covered by UKAS accreditation
	Bottom	3.2	37	
Moisture Content Method		Oven dried @ 105-110°C		
Moisture Content Top	%	25.0	Moisture Cont. Bottom	% 25.0

Remarks

*Test not applicable for materials with more than 25% retained on a 20mm BS test sieve, BS 1377 part 4:1990 cl 7.2.12. The insitu value is likely to be higher than the test result.

This report shall not be reproduced, except in full, without the prior approval of Norfolk Partnership Laboratory



Create Consulting Engineers Ltd
FAO Tom Bennett
15 Princes Street
NORWICH
NR3 1AF

Our Project No 104409
Our Report and sample No NNPL2023060143-
Your Sample Ref B1
Your Project or Order No 5070
Date Report Issued 03 July 2023
Date Tested 23 June 2023

Tom.Bennett@createconsultingengineers.co.uk

Page 1 of 1

Determination of the California Bearing Ratio to BS 1377 : Part 4 : 1990 (Withdrawn)

Scheme	Gravesend, Milton Place		
Location	TP04 @ 0.5m	Specimen: 1	
Date sampled	23 May 2023	Date received	31 May 2023
Sampled by	Client	Sample Mass	19.296kg
If a sample certificate was provided, it is available for inspection. The accuracy of any information provided by third parties cannot be guaranteed. These results only relate to the sample tested. Samples submitted by clients are tested 'as received'			
Material	Soil	Sample type	Bulk Disturbed
Description	Firm dark brown, gravelly CLAY. Gravel is angular to sub-angular flint and occasional chalk.		
Supplier	Not applicable	Source	Ex site

Test Specimen Preparation details

Location	Not applicable	Method of Division	Quartering
Orientation	Not applicable	Preparation Method	Sieving, Natural Moisture Content
Retained 37.5mm	2.7 %	Retained 20mm	5.0 %
BS Method	3.4, 2.5kg Rammer	Grading zone	4
Number of layers	3	Bulk Density	2.04 Mg/m ³
Blows per layer	62 Blows	Dry Density	1.72 Mg/m ³
Condition	Soaked	Init. Moisture Content	18.0 %
Amount of Swell (mm)	0.007	Soaking Period	4 days

Test Results

		CBR Value	Surface Modulus \$	\$ The calculation of Surface Modulus is not covered by UKAS accreditation
		%	Mpa	
Top	2.4	31		
Bottom	3.4	39		
Moisture Content Method	Oven dried @ 105-110°C			
Moisture Content Top	%	19.0	Moisture Cont. Bottom	% 17.0

Remarks

This report shall not be reproduced, except in full, without the prior approval of Norfolk Partnership Laboratory

Create Consulting Engineers Ltd
 FAO Tom Bennett
 15 Princes Street
 NORWICH
 NR3 1AF

Our Project No 104409
Our Report and sample No NNPL2023060145-
Your Sample Ref B1
Your Project or Order No 5070
Date Report Issued 03 July 2023
Date Tested 27 June 2023

Tom.Bennett@createconsultingengineers.co.uk

Page 1 of 1

Determination of the California Bearing Ratio to BS 1377 : Part 4 : 1990 (Withdrawn)

Scheme	Gravesend, Milton Place		
Location	WS04 @ 0.4m	Specimen: 1	
Date sampled	24 May 2023	Date received	31 May 2023
Sampled by	Client	Sample Mass	10.085kg
If a sample certificate was provided, it is available for inspection. The accuracy of any information provided by third parties cannot be guaranteed. These results only relate to the sample tested. Samples submitted by clients are tested 'as received'			
Material	Soil	Sample type	Bulk Disturbed
Description	Dark greyish brown, clayey, very gravelly, fine and medium SAND. Gravel is angular to sub-angular, fine to coarse chalk and flint.		
Supplier	Not applicable	Source	Ex site

Test Specimen Preparation details

Location	Not applicable	Method of Division	Quartering
Orientation	Not applicable	Preparation Method	Sieving, Natural Moisture Content
Retained 37.5mm	8.0 %	Retained 20mm	16.1 %
BS Method	3.4, 2.5kg Rammer	Grading zone	5
Number of layers	3	Bulk Density	1.89 Mg/m ³
Blows per layer	62 Blows	Dry Density	1.55 Mg/m ³
Condition	Soaked	Init. Moisture Content	19.0 %
Amount of Swell (mm)	-0.004	Soaking Period	4 days

Test Results

		CBR Value	Surface Modulus \$	\$ The calculation of Surface Modulus is not covered by UKAS accreditation
		%	Mpa	
Top	7.1	62		
Bottom	7.6	64		
Mean Value	7	63		
Moisture Content Method	Oven dried @ 105-110°C			
Moisture Content Top	%	22.0	Moisture Cont. Bottom	% 22.0

Remarks

This report shall not be reproduced, except in full, without the prior approval of Norfolk Partnership Laboratory



Create Consulting Engineers Ltd

Tom Bennett

15 Princes Street
NORWICH
NR3 1AF

Our Project No. 104409

Our Report and sample No. NNPL2023060144-6

Our Specimen Ref.

Your Order No. 5070

Date Report Issued 03 Jul 2023

Tom.Bennett@createconsultingengineers.co.uk

Page 1 of 1

Determination of Saturation Water Content of Chalk to BS1377-2 : 2022

Scheme	Gravesend, Milton Place		
Location	TP06	Depth	0.5 m
Date sampled	23 May 2023	Date received	31 May 2023
Sampled by	Client	Date tested	
Sample type	Bulk Disturbed		
If a sample certificate was provided, it is available for inspection. The accuracy of any information provided by third parties cannot be guaranteed. These results only relate to the sample tested. Samples submitted by clients are tested 'as received'			
Material	Soil		
Description	Intact, white chalk GRAVEL.		
Supplier	Not applicable	Source	Not applicable

	Test Specimen
Location	
Orientation	Not applicable
	Preparation Details
Method of Division	
Preparation Method	Oven dried @ 105 -110°C
Water Content (%)	26.91
Dry Density (Mg/m³)	1.51
Saturation Water Content (%)	29

Remarks

This report shall not be reproduced, except in full, without the prior approval of Norfolk Partnership Laboratory

Test Code = 602

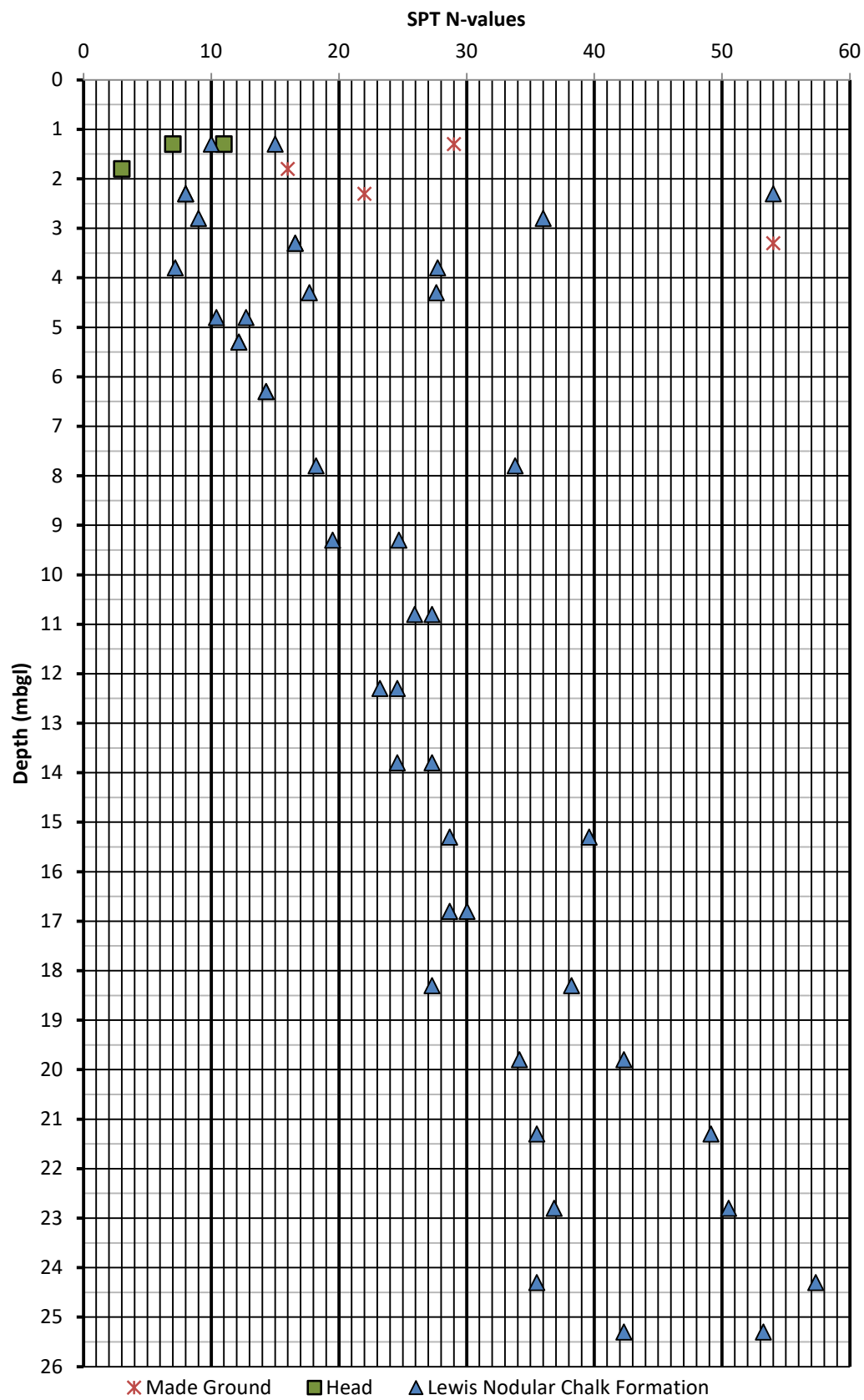
Jim Elliot (Lead Technical Support Tech.)



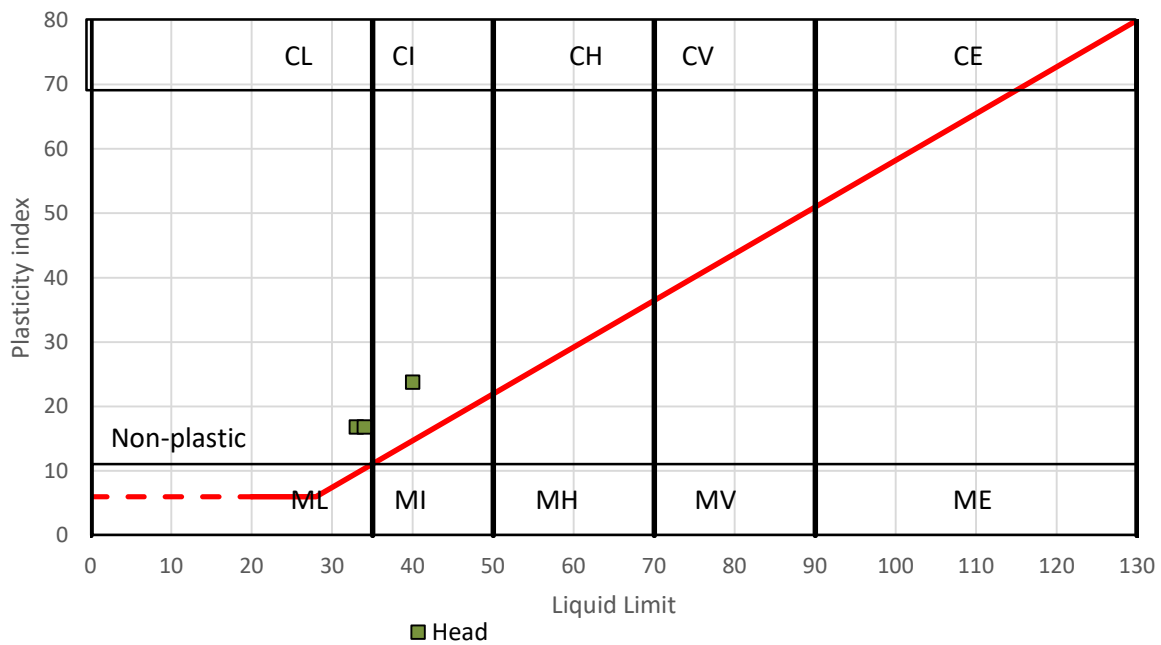
APPENDIX F

GEOTECHNICAL PLOTS

Milton Place SPT depth plot



Plasticity Chart



APPENDIX G

GROUND GAS MONITORING

Ground Gas and Groundwater Monitoring Record Sheet

JOB DETAILS

Site: Milton Place, Gravesend
Date: 09.06.2023

Visit No: 1 of 3
Operator: AW



Monitoring Point	Time	GAS CONCENTRATIONS								FLOW DATA		VOLATILES		WELL AND WATER DATA		COMMENTS
		Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		%LEL		Flow rate (l/hr)		PID Peak (ppm)	Product thickness (mm)	Water level (mbgl)	Well Depth (m)	
		Peak	Steady	Peak	Steady	Min.	Steady	Peak	Steady	Peak	Steady					
WS01A	10:41		0.0		1.6		18.0			0.1				DRY	2.75	
BH02	10:51		0.0		2.3		17.9			0.2				9.00	24.70	
WS04	11:04		0.0		0.5		19.1			0.2				DRY	2.37	
WS02	11:12		0.0		0.2		19.3			0.2				DRY	4.90	
Max		NA	0.0	NA	2.3	NA	19.3	NA	NA	0.2	NA	NA	NA	9.00	24.70	
Min		NA	0.0	NA	0.2	NA	17.9	NA	NA	0.1	NA	NA	NA	DRY	2.37	

ND - Not detected

NR - Not recorded

NA - Non applicable

METEOROLOGICAL AND SITE INFORMATION:

State of ground:

Wind:

Cloud cover:

Precipitation:

Time monitoring performed:

Barometric pressure (mbar):

Pressure trend (Daily):

Source:

Air Temperature (Deg. C):

☒ Dry	☐ Moist	☐ Wet	☐ Snow	☐ Frozen
☒ Calm	☐ Light	☐ Moderate	☐ Strong	
☒ None	☐ Slight	☐ Cloudy	☐ Overcast	
☒ None	☐ Slight	☐ Moderate	☐ Heavy	
	10:39 Start		11:15 End	
	1014 Start		1014 End	
	☐ Falling	☒ Steady	☐ Rising	
GA5000				
	21 Before		21 After	

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter:

GA5000

Gas Range:

CH₄ 0 - 100% CO₂ 0 - 100% O₂ 0 - 25%

Gas Flow range:

+100/-50 l/hour

Differential Pressure:

(+/-) 1000 Pa

Ambient air check:

CH₄ 0.0 CO₂ 0.1 O₂ 20.5

Ground Gas and Groundwater Monitoring Record Sheet

JOB DETAILS

Site: Milton Place, Gravesend
Date: 23.06.2023

Visit No: 2 of 3
Operator: AW



Monitoring Point	Time	GAS CONCENTRATIONS								FLOW DATA		VOLATILES		WELL AND WATER DATA		COMMENTS
		Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		%LEL		Flow rate (l/hr)		PID Peak (ppm)	Product thickness (mm)	Water level (mbgl)	Well Depth (m)	
		Peak	Steady	Peak	Steady	Min.	Steady	Peak	Steady	Peak	Steady					
WS01A	07:40		0.0		1.2		18.8			0.1				DRY	2.75	
WS04	07:44		0.0		1.6		18.2			0.2				DRY	2.40	
WS02	07:50		0.0		1.1		19.1			0.1				DRY	4.80	
BH02	08:00		0.0		2.1		18.2			0.1				9.00	24.70	
Max		NA	0.0	NA	2.1	NA	19.1	NA	NA	0.2	NA	NA	NA	9.00	24.70	
Min		NA	0.0	NA	1.1	NA	18.2	NA	NA	0.1	NA	NA	NA	DRY	2.40	

ND - Not detected

NR - Not recorded

NA - Non applicable

METEOROLOGICAL AND SITE INFORMATION:

State of ground:

Wind:

Cloud cover:

Precipitation:

Time monitoring performed:

Barometric pressure (mbar):

Pressure trend (Daily):

Source:

Air Temperature (Deg. C):

☒ Dry	☐ Moist	☐ Wet	☐ Snow	☐ Frozen
☒ Calm	☐ Light	☐ Moderate	☐ Strong	
☒ None	☐ Slight	☐ Cloudy	☐ Overcast	
☒ None	☐ Slight	☐ Moderate	☐ Heavy	
	07:35 Start		08:03 End	
	1015 Start		1015 End	
	☐ Falling	☒ Steady	☐ Rising	
GA5000				
	17 Before		17 After	

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter:

GA5000

Gas Range:

CH₄ 0 - 100% CO₂ 0 - 100% O₂ 0 - 25%

Gas Flow range:

+100/-50 l/hour

Differential Pressure:

(+/-) 1000 Pa

Ambient air check:

CH₄ 0.0 CO₂ 0.1 O₂ 20.4

Ground Gas and Groundwater Monitoring Record Sheet

JOB DETAILS

Site: Milton Place, Gravesend
Date: 29.06.2023

Visit No: 3 of 3
Operator: AW



Monitoring Point	Time	GAS CONCENTRATIONS								FLOW DATA		VOLATILES		WELL AND WATER DATA		COMMENTS
		Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		%LEL		Flow rate (l/hr)		PID Peak (ppm)	Product thickness (mm)	Water level (mbgl)	Well Depth (m)	
		Peak	Steady	Peak	Steady	Min.	Steady	Peak	Steady	Peak	Steady					
WS01A	16:38		0.0		1.5		17.7			0.1				DRY	2.75	
WS04	16:43		0.0		0.4		18.5			0.2				DRY	2.40	
WS02	16:50		0.0		0.9		19.0			0.1				DRY	4.80	
BH02	16:58		0.0		2.0		18.2			0.3				9.10	24.70	
Max		NA	0.0	NA	2.0	NA	19.0	NA	NA	0.3	NA	NA	NA	9.10	24.70	
Min		NA	0.0	NA	0.4	NA	17.7	NA	NA	0.1	NA	NA	NA	DRY	2.40	

ND - Not detected

NR - Not recorded

NA - Non applicable

METEOROLOGICAL AND SITE INFORMATION:

State of ground:

Wind:

Cloud cover:

Precipitation:

Time monitoring performed:

Barometric pressure (mbar):

Pressure trend (Daily):

Source:

Air Temperature (Deg. C):

☒ Dry	☐ Moist	☐ Wet	☐ Snow	☐ Frozen
☐ Calm	☐ Light	☒ Moderate	☐ Strong	
☐ None	☒ Slight	☐ Cloudy	☐ Overcast	
☒ None	☐ Slight	☐ Moderate	☐ Heavy	
	16:35 Start		17:05 End	
	1020 Start		1020 End	
	☐ Falling	☒ Steady	☐ Rising	
GA5000				
	19 Before		19 After	

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter:

GA5000

Gas Range:

CH₄ 0 - 100% CO₂ 0 - 100% O₂ 0 - 25%

Gas Flow range:

+100/-50 l/hour

Differential Pressure:

(+/-) 1000 Pa

Ambient air check:

CH₄ 0.0 CO₂ 0.1 O₂ 20.9

Traffic Light Classification	Methane		Carbon Dioxide	
	Typical Maximum Concentration (%v/v)	Gas Screening Value (l/hr)	Typical Maximum Concentration (%v/v)	Gas Screening Value (l/hr)
Green	1	0.16	5	0.78
Amber 1	5	0.63	10	1.56
Amber 2	20	1.56	30	3.10
Red				

Appendix 1: NHBC Traffic Light System Classification. Traffic Lights with Typical Maximum Concentrations and Gas Screening Values

Traffic Light Classification	Ground Gas Protection Measures Required
Green	No ground gas protection required.
Amber 1	Low level protection, including membrane and ventilated sub-floor void (minimum one complete change in 24 hours) to create a permeability contrast and limit ingress of ground gas into buildings.
Amber 2	High level protection, including membrane and ventilated sub-floor void (minimum one complete change in 24 hours) to create a permeability contrast and prevent ingress of ground gas into buildings.
Red	Development not normally acceptable without further ground gas risk assessment and/or remedial mitigation measures to reduce / remove the source of ground gas.

Appendix 2: NHBC Traffic Light System Classification. Ground Gas Protection Measures Required for the Traffic Lights

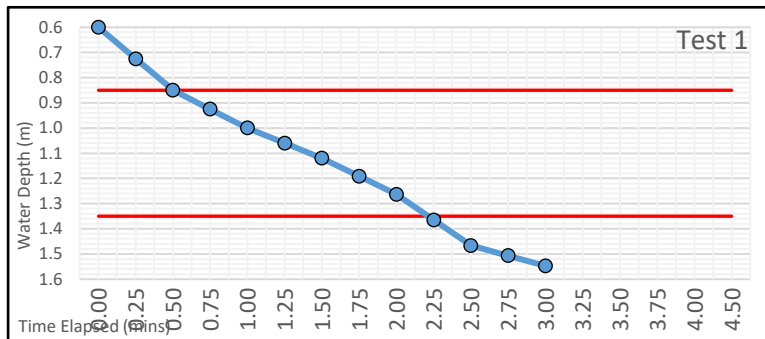
APPENDIX H

SOAKAGE TEST RESULTS

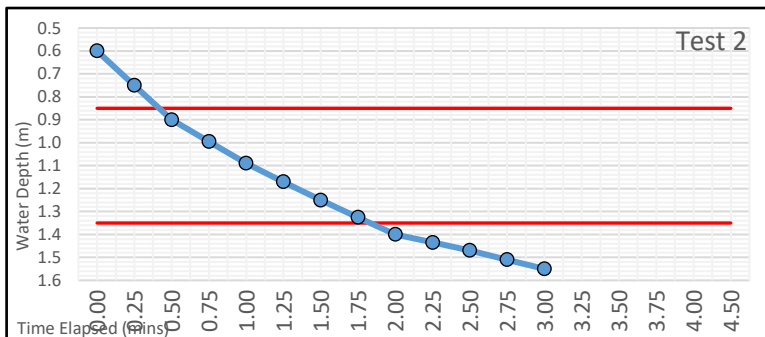
Site:	Milton Place, Gravesend		
Client:	Hill Partnerships Ltd		
Job No:	P23-2863	Date:	23/05/2023

Soil type at test level	Structureless CHALK		
Groundwater	Not encountered	Stone Filled?	Yes
Sidewall stability	Stable, vertical	Voids Ratio (%)	0.41

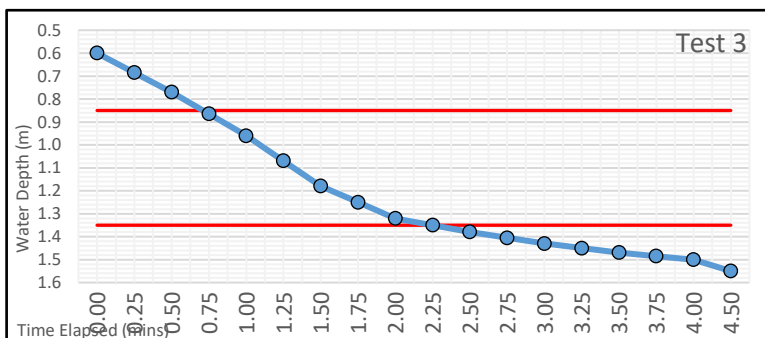
Trial Pit Dimensions (m)	
Length	1.60
Width	0.30
Depth	1.60
Test volume (m ³)	0.48
Effective Depth	1.00



$V_{p75-25} \text{ (m}^3\text{)}$	0.10
$A_{S50} \text{ (m}^2\text{)}$	2.38
$t_{p75-25} \text{ (mins)}$	2
Soil infiltration rate $f = \frac{V_{p75-25}}{a_{S50} \times t_{p75-25}}$	3.94E-04



V_{p75-25} (m ³)	0.10
A_{S50} (m ²)	2.38
t_{p75-25} (mins)	2
Soil infiltration rate $f = \frac{V_{p75-25}}{a_{S50} \times t_{p75-25}}$	4.31E-04



$V_{p75-25} \text{ (m}^3\text{)}$	0.10
$A_{S50} \text{ (m}^2\text{)}$	2.38
$t_{p75-25} \text{ (mins)}$	2
Soil infiltration rate $f = \frac{V_{p75-25}}{a_{S50} \times t_{p75-25}}$	4.59E-04

[illegible]

Remarks

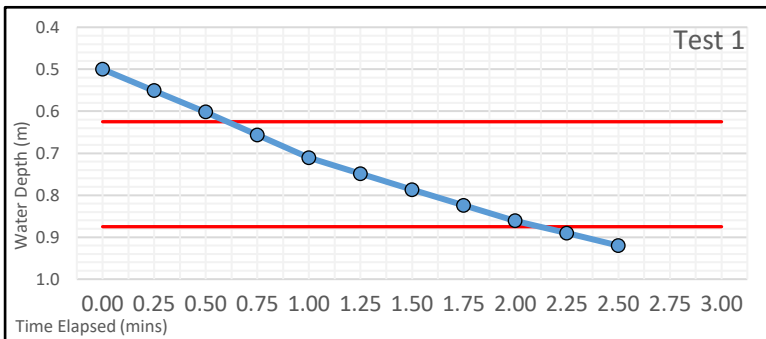
- 1 Infiltration testing carried out between 0.6m and 1.6m
2 Datalogger number 825023
3 Test 1 carried out on 23/05/2023
4 Test 2 carried out on 24/05/2023
5 Test 3 carried out on 24/05/2023

Analysis by: TB
Checked by: CB

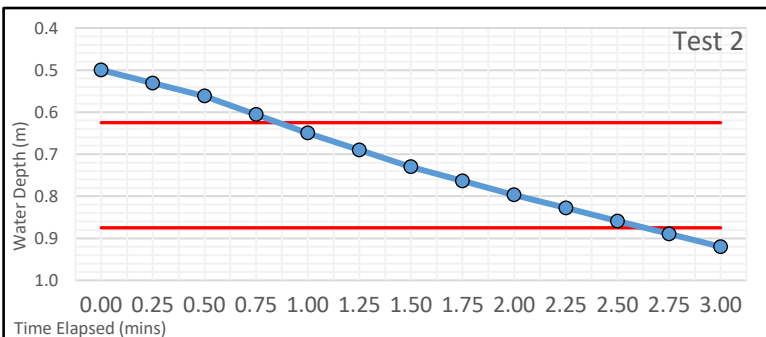
Site:	Milton Place, Gravesend		
Client:	Hill Partnerships Ltd		
Job No:	P23-2863	Date:	23/05/2023

Soil type at test level	Structureless CHALK		
Groundwater	Not encountered	Stone Filled?	Yes
Sidewall stability	Stable, vertical	Voids Ratio (%)	0.41

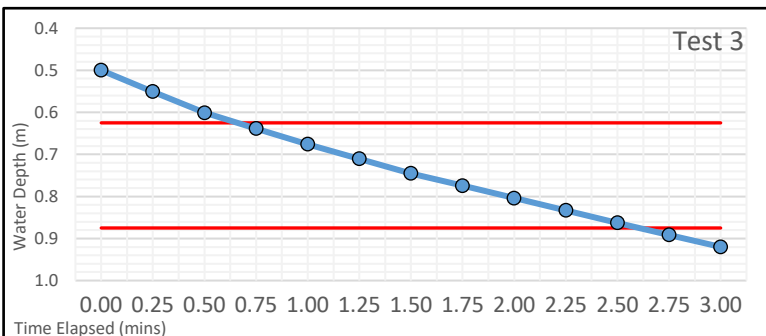
Trial Pit Dimensions (m)	
Length	1.40
Width	0.30
Depth	1.00
Test volume (m ³)	0.21
Effective Depth	0.50



$V_{p75-25} \text{ (m}^3\text{)}$	0.04
$A_{S50} \text{ (m}^2\text{)}$	1.27
$t_{p75-25} \text{ (mins)}$	2
Soil infiltration rate $f = \frac{V_{p75-25}}{a_{S50} \times t_{p75-25}}$	3.64E-04

[illegible]

$V_{p75-25} \text{ (m}^3\text{)}$	0.04
$A_{S50} \text{ (m}^2\text{)}$	1.27
$t_{p75-25} \text{ (mins)}$	1
Soil infiltration rate $f = \frac{V_{p75-25}}{a_{S50} \times t_{p75-25}}$	4.35E-04



$V_{p75-25} \text{ (m}^3\text{)}$	0.04
$A_{S50} \text{ (m}^2\text{)}$	1.27
$t_{p75-25} \text{ (mins)}$	2
Soil infiltration rate $f = \frac{V_{p75-25}}{a_{S50} \times t_{p75-25}}$	2.82E-04

[illegible]

- | | |
|--|------------|
| 1 Infiltration testing carried out between 0.5m and 1.0m | |
| 2 Datalogger number | 823595 |
| 3 Test 1 carried out on | 23/05/2023 |
| 4 Test 2 carried out on | 23/05/2023 |
| 5 Test 3 carried out on | 23/05/2023 |

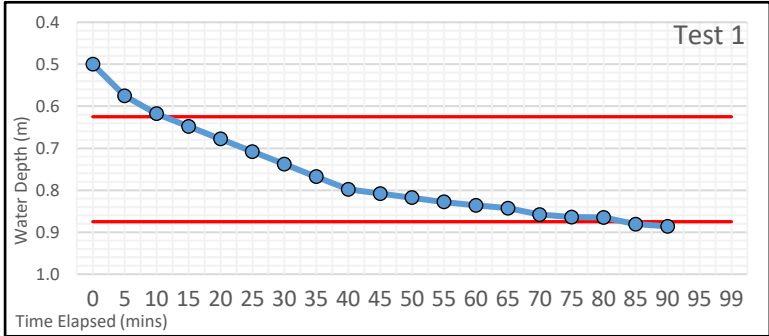
Analysis by: TB

Checked by: CB

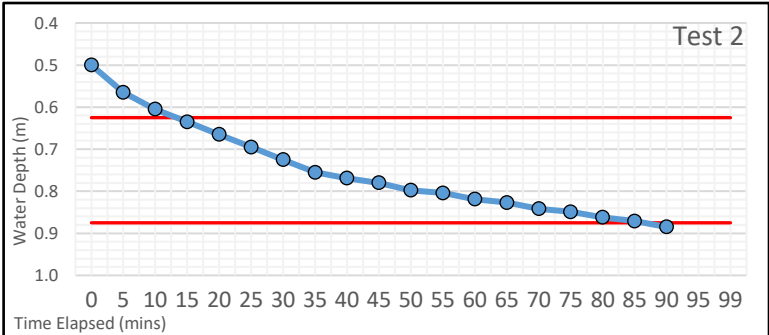
Site:	Milton Place, Gravesend		
Client:	Hill Partnerships Ltd		
Job No:	P23-2863	Date:	23/05/2023

Soil type at test level	Structureless CHALK		
Groundwater	Not encountered	Stone Filled?	Yes
Sidewall stability	Stable, vertical	Voids Ratio (%)	0.41

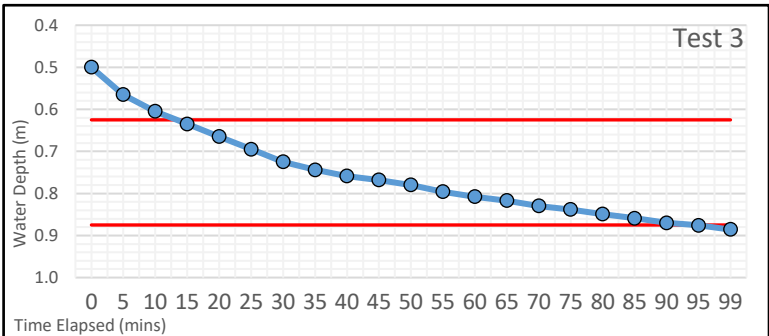
Trial Pit Dimensions (m)	
Length	1.30
Width	0.30
Depth	1.00
Test volume (m ³)	0.20
Effective Depth	0.50



$V_{p75-25} \text{ (m}^3\text{)}$	0.04
$A_{S50} \text{ (m}^2\text{)}$	1.19
$t_{p75-25} \text{ (mins)}$	69
Soil infiltration rate $f = \frac{V_{p75-25}}{a_{S50} \times t_{p75-25}}$	8.11E-06



$V_{p75-25} \text{ (m}^3\text{)}$	0.04
$A_{S50} \text{ (m}^2\text{)}$	1.19
$t_{p75-25} \text{ (mins)}$	68
Soil infiltration rate $f = \frac{V_{p75-25}}{a_{S50} \times t_{p75-25}}$	8.29E-06



$V_{p75-25} \text{ (m}^3\text{)}$	0.04
$A_{S50} \text{ (m}^2\text{)}$	1.19
$t_{p75-25} \text{ (mins)}$	71
Soil infiltration rate $f = \frac{V_{p75-25}}{a_{S50} \times t_{p75-25}}$	7.89E-06

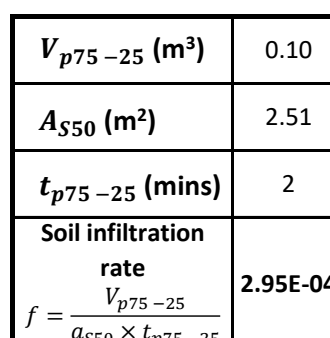
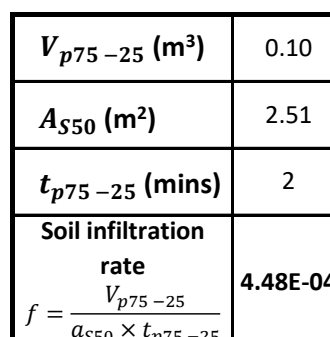
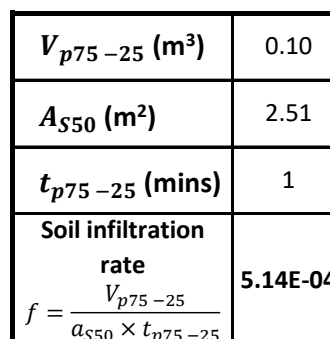
[illegible]

Remarks

- | | |
|--|------------|
| 1 Infiltration testing carried out between 0.5m and 1.0m | |
| 2 Datalogger number | 823595 |
| 3 Test 1 carried out on | 23/05/2023 |
| 4 Test 2 carried out on | 23/05/2023 |
| 5 Test 3 carried out on | 23/05/2023 |

Analysis by: TB
Checked by: CB

Trial Pit Dimensions (m)	
Length	1.70
Width	0.30
Depth	2.00
Test volume (m ³)	0.51
Effective Depth	1.00

[illegible]

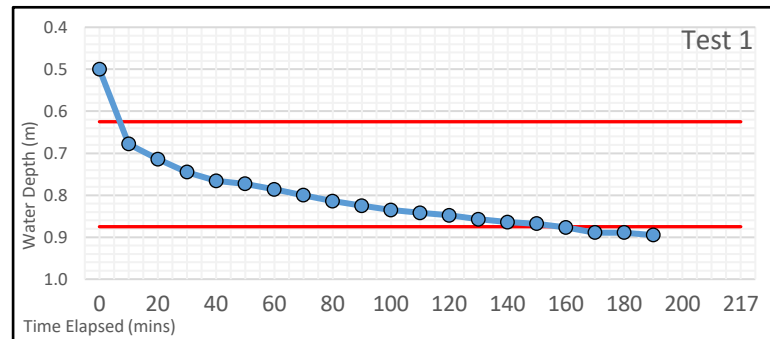
Remarks	
1	Infiltration testing carried out between 1.0m and 2.0m
2	Datalogger number 823591
3	Test 1 carried out on 23/05/2023
4	Test 2 carried out on 24/05/2023
5	Test 3 carried out on 24/05/2023

Analysis by: TB
Checked by: CB

Site:	Milton Place, Gravesend		
Client:	Hill Partnerships Ltd		
Job No:	P23-2863	Date:	23/05/2023

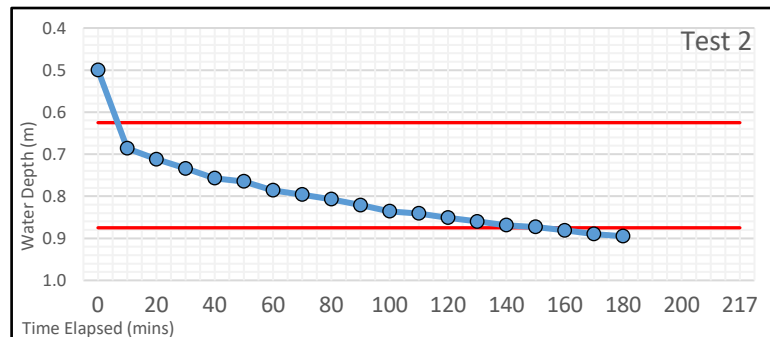
Soil type at test level	MADE GROUND		
Groundwater	Not encountered	Stone Filled?	Yes
Sidewall stability	Stable, vertical	Voids Ratio (%)	0.41

Trial Pit Dimensions (m)	
Length	1.70
Width	0.30
Depth	1.00
Test volume (m ³)	0.26
Effective Depth	0.50

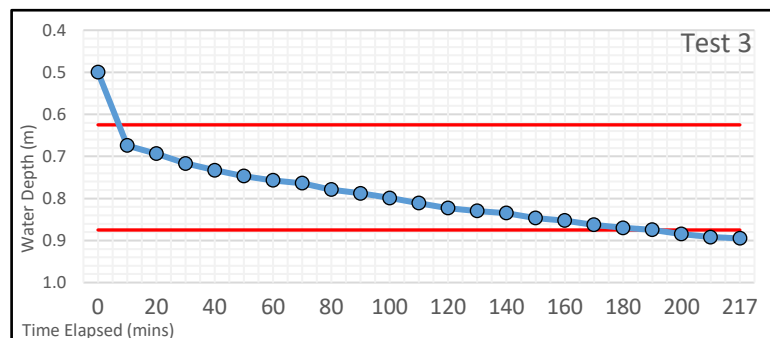


V_{p75-25} (m ³)	0.05
A_{S50} (m ²)	1.51
t_{p75-25} (mins)	152
Soil infiltration rate $f = \frac{V_{p75-25}}{A_{S50} \times t_{p75-25}}$	3.80E-06

Time (mins)	Test 1	Test 2	Test 3
0	0.50	0.50	0.50
10	0.68	0.69	0.67
20	0.71	0.71	0.69
30	0.75	0.73	0.72
40	0.77	0.76	0.73
50	0.77	0.77	0.75
60	0.79	0.79	0.76
70	0.80	0.80	0.76
80	0.81	0.81	0.78
90	0.83	0.82	0.79
100	0.84	0.84	0.80
110	0.84	0.84	0.81
120	0.85	0.85	0.82
130	0.86	0.86	0.83
140	0.86	0.87	0.84
150	0.87	0.87	0.85
160	0.88	0.88	0.85
170	0.89	0.89	0.86
180	0.89	0.90	0.87
190	0.90		0.88
200			0.89
210			0.89
217			0.90



V_{p75-25} (m ³)	0.05
A_{S50} (m ²)	1.51
t_{p75-25} (mins)	149
Soil infiltration rate $f = \frac{V_{p75-25}}{A_{S50} \times t_{p75-25}}$	3.89E-06

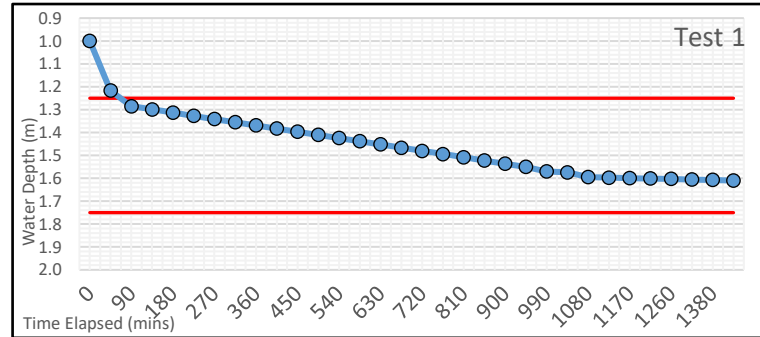


V_{p75-25} (m ³)	0.05
A_{S50} (m ²)	1.51
t_{p75-25} (mins)	184
Soil infiltration rate $f = \frac{V_{p75-25}}{A_{S50} \times t_{p75-25}}$	3.14E-06

Remarks	
1	Infiltration testing carried out between 0.5m and 1.0m
2	Datalogger number 823838
3	Test 1 carried out on 23/05/2023
4	Test 2 carried out on 23/05/2023
5	Test 3 carried out on 24/05/2023
Analysis by: TB	
Checked by: CB	

Site:	Milton Place, Gravesend		
Client:	Hill Partnerships Ltd		
Job No:	P23-2863	Date:	23/05/2023

Soil type at test level	Slightly Silty CLAY		
Groundwater	Not encountered	Stone Filled?	Yes
Sidewall stability	Stable, vertical	Voids Ratio (%)	0.41



$V_{p75-25} \text{ (m}^3\text{)}$	0.10
$A_{550} \text{ (m}^2\text{)}$	2.51
$t_{p75-25} \text{ (mins)}$	N/A
Soil infiltration rate $f = \frac{V_{p75-25}}{a_{550} \times t_{p75-25}}$	TEST FAIL

Trial Pit Dimensions (m)	
Length	1.70
Width	0.30
Depth	2.00
Test volume (m ³)	0.51
Effective Depth	1.00

Time (mins)	Test 1	Test 2	Test 3
0	1.00	-	-
45	1.22	-	-
90	1.29	-	-
135	1.30	-	-
180	1.31	-	-
225	1.33	-	-
270	1.34	-	-
315	1.35	-	-
360	1.37	-	-
405	1.38	-	-
450	1.40	-	-
495	1.41	-	-
540	1.42	-	-
585	1.44	-	-
630	1.45	-	-
675	1.47	-	-
720	1.48	-	-
765	1.49	-	-
810	1.51	-	-
855	1.52	-	-
900	1.54	-	-
945	1.55	-	-
990	1.57	-	-
1035	1.57	-	-
1080	1.60	-	-
1125	1.60	-	-
1170	1.60	-	-
1215	1.60	-	-
1260	1.60	-	-
1320	1.61	-	-
1380	1.61	-	-
1440	1.61	-	-

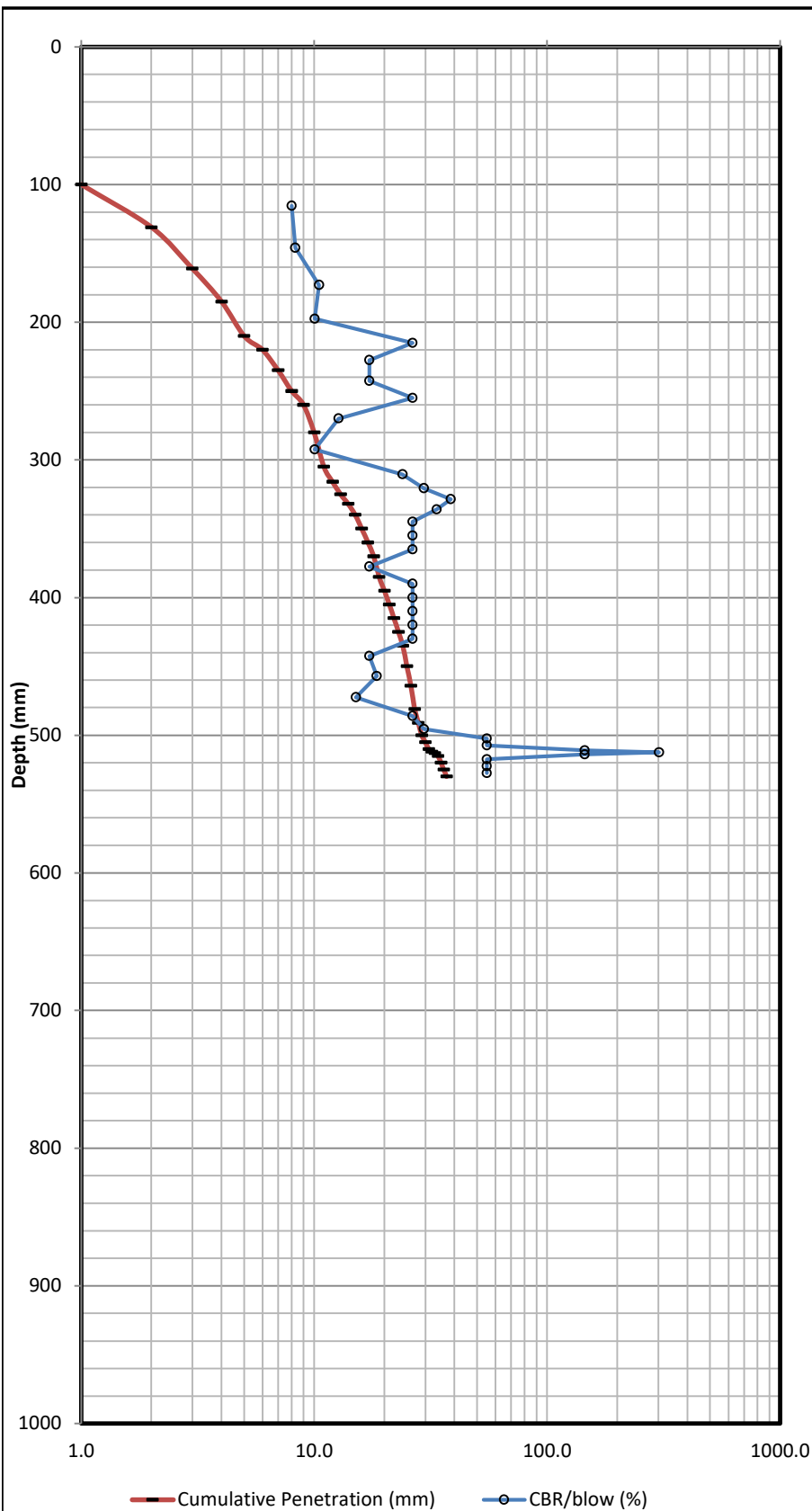
Remarks
1 Infiltration testing carried out between 1.0m and 2.0m 2 Datalogger number 823594 3 Test 1 carried out on 23/05/2023 4 Test failed due to insufficient drainage in 24 hour period
Analysis by: TB Checked by: CB

APPENDIX I

DYNAMIC CONE PENETROMETER RESULTS

Date	22/05/2023
Job Number	P23-2863
Site	Milton Place, Gravesend
Engineer	TB

Location	TP02
	DCP02



Interpreted CBR Value

100mm Made Ground removed

Start of Test

Initial Penetration

MADE GROUND

21.2

HEAD

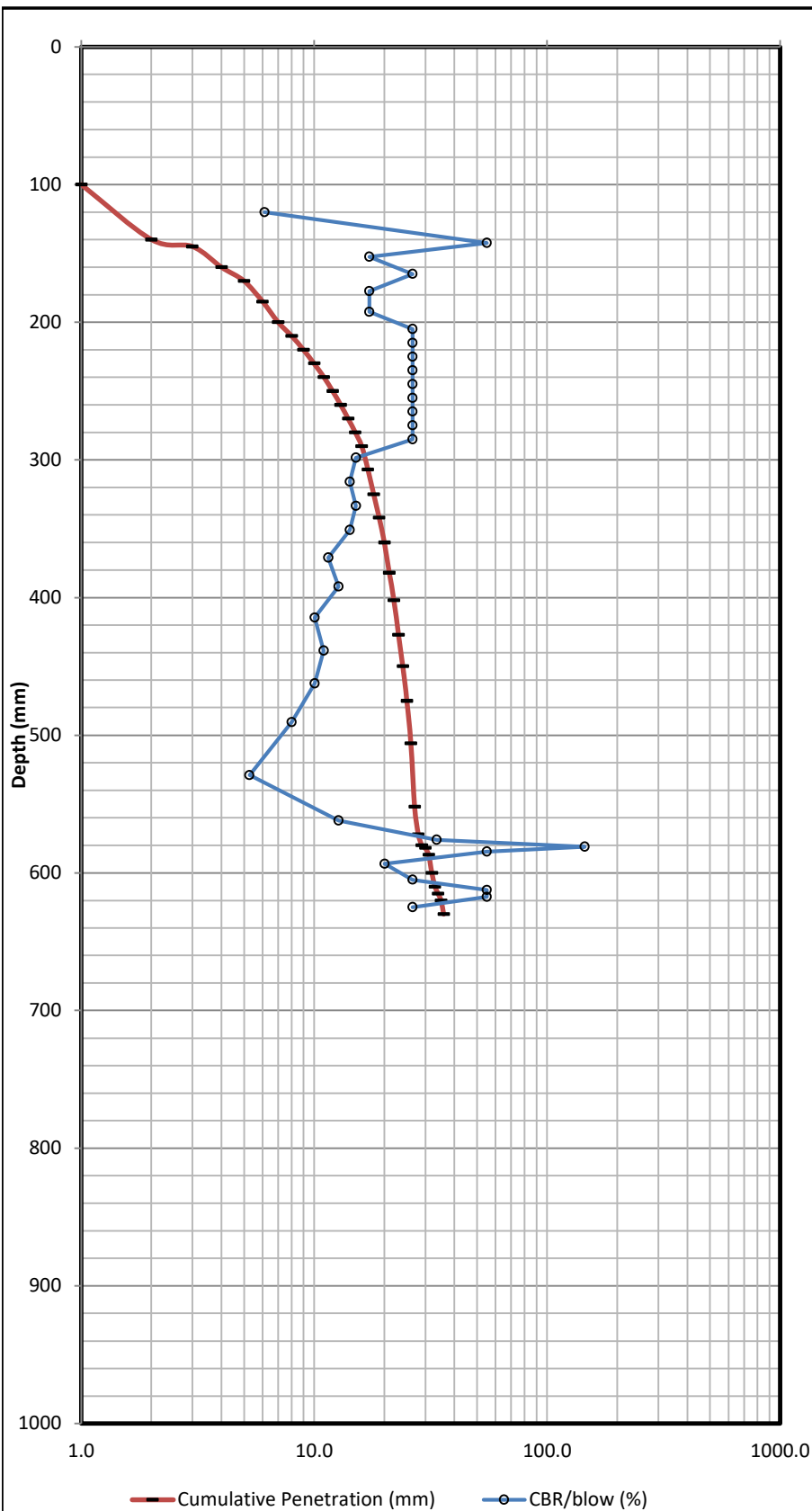
CHALK

End of test

1. 100mm Made Ground removed prior to starting test
2. Test refused at 530mm

Date	22/05/2023
Job Number	P23-2863
Site	Milton Place, Gravesend
Engineer	TB

Location	TP04
	DCP04



Interpreted CBR Value

100mm Made Ground removed

Start of Test

Initial Penetration

MADE GROUND

8.8

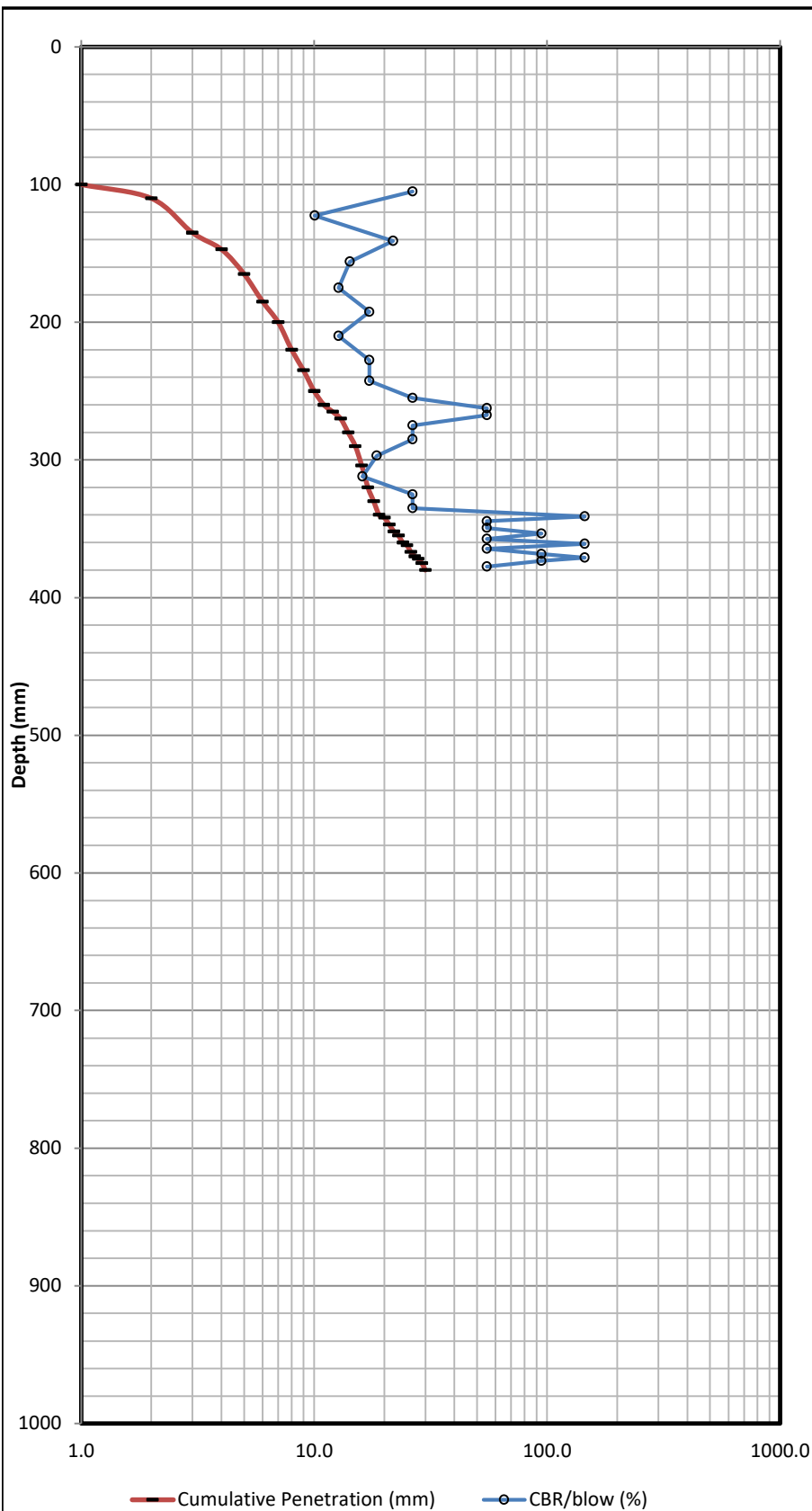
CHALK

End of test

1. 100mm Made Ground removed prior to starting test
2. Test refused at 630mm

Date	22/05/2023
Job Number	P23-2863
Site	Milton Place, Gravesend
Engineer	TB

Location	TP05
	DCP05

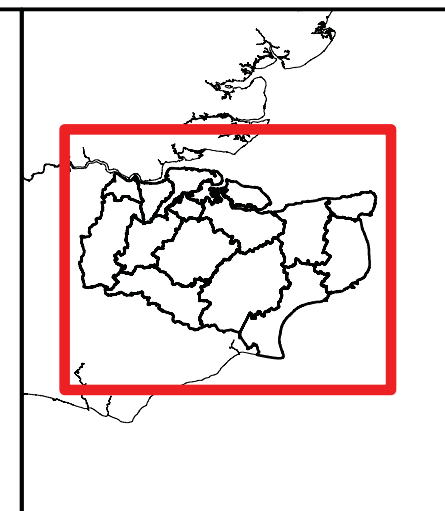
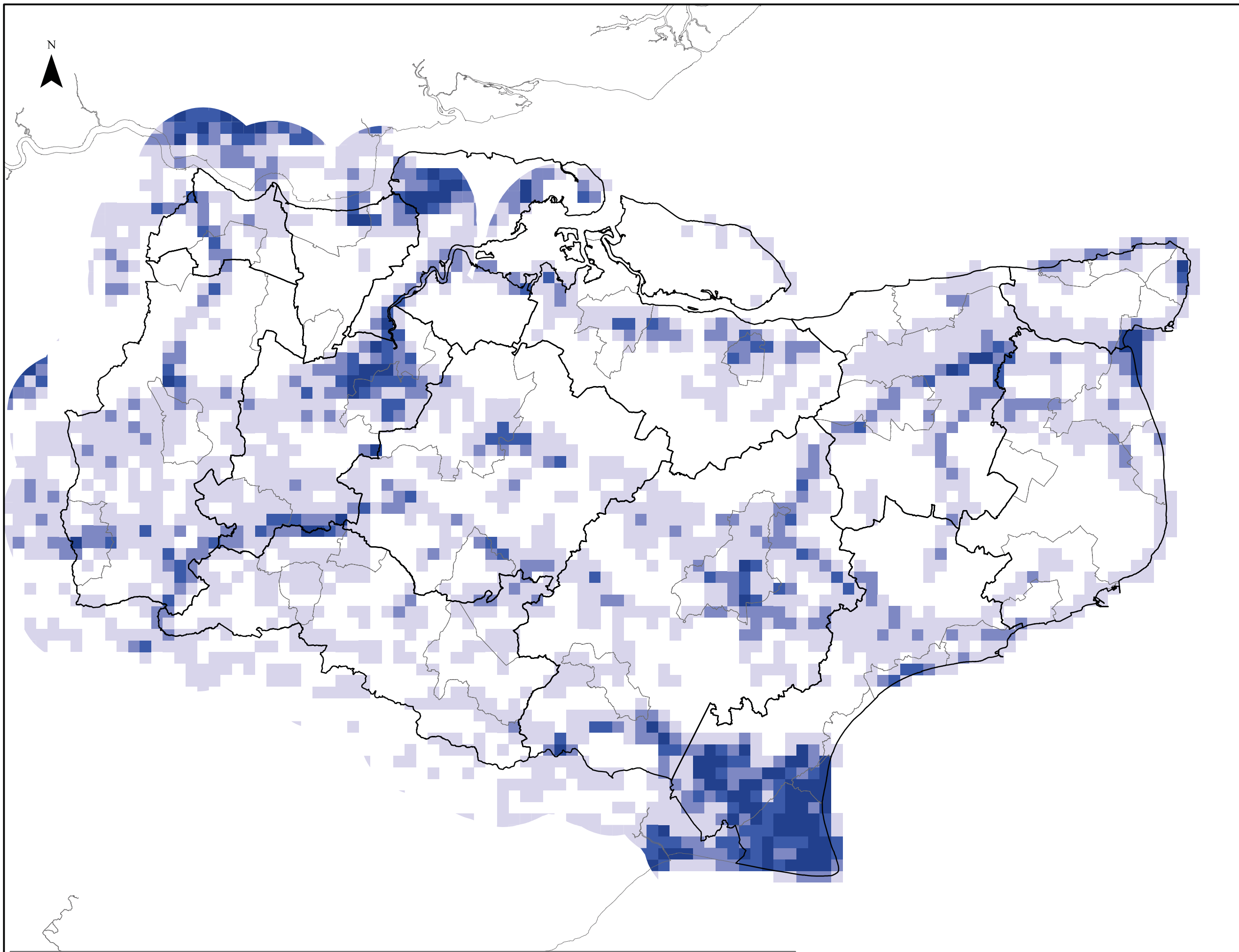


Interpreted CBR Value	
100mm Made Ground removed	
Start of Test	
Initial Penetration	
(18.6)	MADE GROUND
End of test	

1. 100mm Made Ground removed prior to starting test
2. Test refused at 380mm

APPENDIX D – Groundwater Risk Areas

Extract from Kent County Council's Preliminary Flood Risk Assessment



Legend

Groundwater Risk Areas

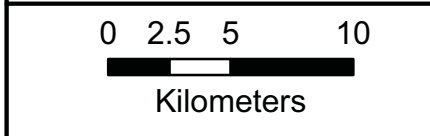
	Negligible
	Low
	Medium
	High

Drawing Title:

Groundwater Risk Areas

Drawing Number:

Figure 6



This map is based upon Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office (C) Crown Copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. 100019238. 2010

APPENDIX E – Southern Water Asset Plans

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
0003	C	14.08	0.00	
0212	C	0.00	0.00	
0906	C	17.25	0.00	
1009	C	0.00	0.00	
1010	C	0.00	0.00	
1011	C	0.00	0.00	
1012	C	12.20	9.21	
1013	C	0.00	0.00	
1014	C	12.10	0.00	
1113	C	0.00	0.00	
1905	C	15.82	5.89	
1906	C	16.48	6.01	
2101	C	11.41	0.00	
2902	C	12.06	0.00	
2906	C	12.53	5.66	
3203	C	0.00	0.00	
3901	C	13.37	5.62	
4805	C	15.47	5.60	
5802	C	14.69	5.57	
6807	C	9.42	0.00	
6809	C	11.60	5.53	
0002	F	15.06	0.00	
0008	F	0.00	0.00	
0009	F	0.00	0.00	
0010	F	14.53	11.72	
0011	F	0.00	0.00	
0104	F	14.99	10.61	
0105	F	0.00	0.00	
0108	F	0.00	0.00	
0109	F	16.04	13.50	
0110	F	0.00	0.00	
0204	F	0.00	0.00	
0206	F	0.00	0.00	
0216	F	0.00	0.00	
0904	F	16.16	0.00	
0905	F	0.00	0.00	
0909	F	16.77	0.00	
0910	F	16.67	13.68	
1001	F	0.00	0.00	
1002	F	13.67	10.65	
1003	F	13.15	10.15	
1004	F	0.00	0.00	
1005	F	0.00	0.00	
1006	F	0.00	0.00	
1007	F	0.00	0.00	
1008	F	0.00	0.00	
1101	F	0.00	0.00	
1102	F	14.75	12.08	
1103	F	0.00	0.00	
1104	F	0.00	0.00	
1105	F	13.80	11.08	
1106	F	0.00	0.00	
1107	F	14.21	0.00	
1108	F	0.00	0.00	
1109	F	0.00	0.00	
1110	F	0.00	0.00	
1111	F	0.00	0.00	
1112	F	0.00	0.00	
1114	F	0.00	0.00	
1115	F	0.00	0.00	
1116	F	0.00	0.00	
1117	F	13.44	10.64	
1118	F	12.91	0.00	
1119	F	12.58	9.15	
1120	F	13.19	0.00	
1121	F	0.00	0.00	
1201	F	0.00	0.00	
1202	F	0.00	0.00	
1203	F	0.00	0.00	
1204	F	0.00	0.00	
1205	F	0.00	0.00	
1206	F	0.00	0.00	
1207	F	14.87	12.35	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
1208	F	0.00	0.00	
1209	F	0.00	0.00	
1210	F	14.16	0.00	
1211	F	13.40	10.84	
1212	F	0.00	0.00	
1213	F	0.00	0.00	
1214	F	13.51	6.36	
1215	F	0.00	0.00	
1216	F	0.00	0.00	
1217	F	0.00	0.00	
1218	F	0.00	0.00	
1219	F	0.00	0.00	
1220	F	0.00	0.00	
1803	F	15.93	0.00	
1804	F	15.65	0.00	
1805	F	15.00	13.56	
1901	F	0.00	0.00	
1902	F	0.00	0.00	
1903	F	13.41	10.01	
1904	F	14.83	10.49	
2001	F	0.00	0.00	
2002	F	0.00	0.00	
2003	F	0.00	0.00	
2004	F	0.00	0.00	
2005	F	0.00	0.00	
2006	F	0.00	0.00	
2007	F	0.00	0.00	
2201	F	11.39	0.00	
2202	F	8.64	6.57	
2802	F	15.50	13.88	
2901	F	11.99	0.00	
2903	F	0.00	0.00	
2904	F	0.00	0.00	
2905	F	12.68	0.00	
2907	F	0.00	0.00	
2908	F	0.00	0.00	
2909	F	0.00	0.00	
2910	F	0.00	0.00	
2911	F	0.00	0.00	
2912	F	0.00	0.00	
2913	F	0.00	0.00	
2914	F	12.23	9.85	
3001	F	0.00	0.00	
3802	F	0.00	0.00	
3803	F	0.00	0.00	
3804	F	15.17	13.26	
3805	F	16.70	14.28	
3902	F	13.51	11.47	
4001	F	0.00	0.00	
4002	F	0.00	0.00	
4003	F	0.00	0.00	
4004	F	0.00	0.00	
4005	F	0.00	0.00	
4006	F	0.00	0.00	
4007	F	0.00	0.00	
4008	F	0.00	0.00	
4009	F	0.00	0.00	
4010	F	0.00	0.00	
4011	F	0.00	0.00	
4012	F	0.00	0.00	
4013	F	0.00	0.00	
4014	F	0.00	0.00	
4101	F	0.00	0.00	
4102	F	0.00	0.00	
4103	F	7.12	4.83	
4104	F	6.54	5.52	
4105	F	6.67	5.36	
4106	F	6.63	5.42	
4107	F	6.89	5.63	
4201	F	0.00	0.00	
4202	F	0.00	0.00	
4801	F	0.00	0.00	
4802	F	0.00	0.00	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
4803	F	0.00	0.00	
4804	F	0.00	0.00	
4806	F	15.65	13.74	
4901	F	0.00	0.00	
4902	F	0.00	0.00	
4903	F	0.00	0.00	
4904	F	0.00	0.00	
4905	F	0.00	0.00	
4906	F	0.00	0.00	
4907	F	0.00	0.00	
4908	F	0.00	0.00	
4909	F	0.00	0.00	
4910	F	0.00	0.00	
4911	F	0.00	0.00	
4912	F	0.00	0.00	
4913	F	0.00	0.00	
4914	F	0.00	0.00	
4915	F	0.00	0.00	
4916	F	0.00	0.00	
4917	F	0.00	0.00	
5001	F	7.76	5.31	
5002	F	0.00	0.00	
5003	F	10.14	0.00	
5004	F	9.88	7.64	
5005	F	7.81	5.50	
5006	F	6.89	0.00	
5007	F	8.51	6.32	
5008	F	7.84	5.68	
5009	F	0.00	0.00	
5010	F	0.00	0.00	
5101	F	6.51	5.73	
5102	F	6.67	5.57	
5801	F	13.89	11.81	
5803	F	14.15	12.33	
5804	F	13.10	10.98	
5805	F	12.64	10.65	
5806	F	11.99	0.00	
5807	F	11.62	10.59	
5901	F	13.00	0.00	
5902	F	12.74	11.98	
5903	F	11.92	11.03	
5904	F	11.87	10.80	
5905	F	12.68	11.88	
5906	F	13.03	0.00	
5907	F	12.18	9.96	
5908	F	10.28	0.00	
5909	F	11.74	10.17	
5910	F	10.00	8.86	
5911	F	11.82	10.97	
5912	F	10.77	9.23	
5913	F	9.12	0.00	
6001	F	7.69	5.06	
6002	F	7.78	0.00	
6003	F	7.92	5.36	
6004	F	7.89	5.36	
6005	F	0.00	0.00	
6006	F	5.10	2.56	
6007	F	5.51	0.00	
6008	F	0.00	0.00	
6101	F	0.00	0.00	
6102	F	0.00	0.00	
6103	F	0.00	0.00	
6104	F	4.57	3.06	
6105	F	0.00	0.00	
6106	F	4.80	2.64	
6107	F	4.80	2.56	
6108	F	4.87	2.40	
6109	F	4.64	2.29	
6110	F	4.81	2.13	
6111	F	4.80	2.06	
6202	F	4.48	3.02	
6203	F	0.00	0.00	
6801	F	11.11	10.14	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
6802	F	0.00	0.00	
6803	F	9.63	0.00	
6804	F	9.39	5.69	
6805	F	9.21	0.00	
6806	F	8.23	7.29	
6808	F	7.90	6.38	
6901	F	0.00	0.00	
6902	F	10.54	8.39	
6903	F	9.67	8.54	
6904	F	9.05	7.08	
6905	F	7.45	6.09	
6906	F	0.00	0.00	
6907	F	7.82	5.22	
6908	F	6.62	4.30	
6909	F	6.95	6.18	
6910	F	7.38	6.11	
6911	F	8.43	5.91	
6912	F	8.38	0.00	
6913	F	0.00	0.00	
6915	F	0.00	0.00	
7001	F	4.52	3.02	
7002	F	4.66	3.17	
7003	F	4.42	3.36	
7004	F	4.74	0.00	
7005	F	5.27	0.00	
7007	F	4.55	3.39	
7103	F	0.00	0.00	
7104	F	0.00	0.00	
7105	F	4.76	1.93	
7204	F	4.89	1.18	
7206	F	0.00	0.00	
7803	F	6.64	0.00	
7804	F	0.00	0.00	
7901	F	4.80	3.38	
7904	F	0.00	0.00	
7905	F	5.14	2.04	
7906	F	5.18	1.86	
7907	F	0.00	0.00	
7908	F	5.86	0.00	
0253	S	0.00	0.00	
0254	S	13.68	0.00	
0950	S	17.12	15.51	
1050	S	11.75	4.49	
1051	S	0.00	0.00	
1052	S	11.93	0.00	
1053	S	11.67	0.00	
1150	S	13.70	0.00	
1250	S	14.13	0.00	
1850	S	0.00	0.00	
1950	S	16.51	0.00	
2050	S	0.00	0.00	
2150	S	0.00	0.00	
2850	S	0.00	0.00	
295C	S	0.00	0.00	
296C	S	0.00	0.00	
3050	S	0.00	0.00	
3051	S	0.00	0.00	
3052	S	0.00	0.00	
3053	S	0.00	0.00	
3150	S	0.00	0.00	
3250	S	0.00	0.00	
3251	S	0.00	0.00	
325C	S	0.00	0.00	
326C	S	0.00	0.00	
327C	S	0.00	0.00	
395C	S	0.00	0.00	
4050	S	0.00	0.00	
4150	S	6.90	5.50	
4151	S	0.00	0.00	
4152	S	0.00	0.00	
4153	S	5.51	0.00	
4154	S	7.25	5.88	
4156	S	6.63	4.98	

APPENDIX F – Southern Water Pre-Planning Enquiry Response



Angus Coles
Hill Partnerships Ltd
29 Red Lion St
Chesham
Buckinghamshire
HP5 1EJ

Your ref
17990

Our ref
DSA000038742

Date
12 December 2024

Contact
Tel 0330 303 0119

Dear Mr Coles,

Level 1 Capacity Check Enquiry: Milton Place, Ordnance Road, Gravesend, Kent, DA12 2BT.

We have completed the capacity check for the above development site and the results are as follows:

Foul Water

The enquiry has been reassessed to determine the capacity available for 0.70 l/s at manhole reference TQ65743001.

There is currently adequate capacity in the local sewerage network to accommodate a foul flow of 0.70 l/s for the above development at manhole reference TQ65743001. Please note that no surface water flows (existing or proposed) can be accommodated within the existing foul sewerage system unless agreed by the Lead Local Flood Authority in consultation with Southern Water, after the hierarchy Part H3 of Building Regulations has been complied with.

Connecting to our network

It should be noted that this information is only a hydraulic assessment of the existing sewerage network and does not grant approval for a connection to the public sewerage system. A formal Sewer Connection (S106) application is required to be completed and approved by Southern Water Services. To make an application visit: developerservices.southernwater.co.uk

Please note the information provided above does not grant approval for any designs/drawings submitted for the capacity analysis. The results quoted above are only valid for 12 months from the date of issue of this letter.

Please get in touch via the Get Connected customer dashboard if you have any queries.

Yours sincerely,

Future Growth Planning Team
Developer Services

southernwater.co.uk/developing-building/planning-your-development

APPENDIX G – Kent County Council’s LLFA Correspondence

Dillan Halai

From: Alex Herman
Sent: 04 November 2024 17:39
To: Daniel.Hoare@kent.gov.uk
Cc: kate@invictaplanning.co.uk; shazad.ghani@gravesham.gov.uk; allan.cox@gravesham.gov.uk; ethan.bonthron@gravesham.gov.uk; faye.hobbs@gravesham.gov.uk; David.Barton@kent.gov.uk; Cathy.Bishop@kent.gov.uk; paul.white@gravesham.gov.uk; chloehouston@hill.co.uk; AlanaDowney@hill.co.uk; TaylorAndrews@hill.co.uk; Tom Aldridge
Subject: RE: Milton Place Car Park- Pre App 2 [Filed 20 Feb 2025 09:41]

Hi Daniel,

Thank you for your latest feedback.

RE infiltration testing – we are agreeable to a condition being included for further testing to be carried out on site to prove that a good infiltration rate is achievable at the proposed basin location.

RE pre planning surface water capacity check – we are not proposing to make this application at this stage, as we believe we can infiltrate on site, and connecting to the surface water sewer is only a backup option which we would only pursue in more detail should in the unlikely event infiltration prove not possible.

I trust our response is satisfactory and we can proceed with our Drainage Strategy for the planning application on this basis.

Kind regards,

Alex Herman
Director



Powell Tolner & Associates Ltd

T: 01494 772 721 | M: 07957 463 183 | W: www.ptaconsult.co.uk
PTA, 29 Red Lion Street, Chesham, Bucks., HP5 1EJ



IMPORTANT: [Email disclaimer](#)

PTA is a trading name of Powell Tolner & Associates Limited. Powell Tolner & Associates Limited is registered in England and Wales. Reg. No.: 8399579, Reg. Office: 22 Wycombe End, Beaconsfield, Buckinghamshire, HP9 1NB, UK.

From: Daniel.Hoare@kent.gov.uk <Daniel.Hoare@kent.gov.uk>

Sent: 04 November 2024 10:08

To: Alex Herman <alex.herman@ptaconsult.co.uk>

Cc: kate@invictaplanning.co.uk; shazad.ghani@gravesham.gov.uk; allan.cox@gravesham.gov.uk; ethan.bonthron@gravesham.gov.uk; faye.hobbs@gravesham.gov.uk; David.Barton@kent.gov.uk; Cathy.Bishop@kent.gov.uk; paul.white@gravesham.gov.uk; chloehouston@hill.co.uk; AlanaDowney@hill.co.uk; TaylorAndrews@hill.co.uk

Subject: RE: Milton Place Car Park- Pre App 2

Morning Alex,

Apologies for the delay in responding back to you.

From your email and the drawing, I have no immediate concerns arising from the design presented.

My follow up comments would be:

- The timing of when undertaking further infiltration testing on site. For most major applications proposing infiltration, we would typically request for preliminary testing to be provided as part of outline/full stages, with further targeted testing to be carried out as part of the detailed design stage. With preliminary testing having already been undertaken, we would seek to attach a detailed design condition that would require further ground investigations to be carried out before construction commences.
- With the option of discharging to the sewer being a potential alternative should rates not be feasible, we would advise that a capacity check is undertaken with Southern Water prior to the application being submitted. The purpose of this is to confirm if the receiving sewer has sufficient capacity to accommodate the additional flows from the development, thus identifying if the second option is feasible if the first option fails.

Kind Regards,

Daniel

Daniel Hoare MCIWEM | Senior Flood Risk Officer | Flood & Water Management | Kent County Council | Invicta House, County Hall, Maidstone ME14 1XX | External: 03000 413550

As Lead Local Flood Authority (LLFA) for the County, we are the statutory consultee in planning to [promote](http://www.kent.gov.uk/waste-planning-and-land/flooding-and-drainage/sustainable-drainage-systems) the provision of Sustainable Drainage Systems. You can find out more by visiting: <http://www.kent.gov.uk/waste-planning-and-land/flooding-and-drainage/sustainable-drainage-systems>

From: Alex Herman <alex.herman@ptaconsult.co.uk>

Sent: 04 November 2024 09:11

To: Daniel Hoare - GT - ECE <Daniel.Hoare@kent.gov.uk>

Cc: Kate Holland <kate@invictaplanning.co.uk>; Shazad Ghani <shazad.ghani@gravesham.gov.uk>; allan.cox@gravesham.gov.uk; ethan.bonthron@gravesham.gov.uk; faye.hobbs@gravesham.gov.uk; David Barton - GT TRA <David.Barton@kent.gov.uk>; Cathy Bishop - ECE <Cathy.Bishop@kent.gov.uk>; Paul White <paul.white@gravesham.gov.uk>; Chloe Houston <chloehouston@hill.co.uk>; Alana Downey <AlanaDowney@hill.co.uk>; Taylor Andrews <TaylorAndrews@hill.co.uk>

Subject: RE: Milton Place Car Park- Pre App 2

Some people who received this message don't often get email from alex.herman@ptaconsult.co.uk. [Learn why this is important](#)

Hi Daniel,

I hope you are well. Could you please provide your feedback to our below responses. It would be really appreciated if you could respond today as we have the next pre-app meeting at 9.30am tomorrow morning. Please find attached again for reference our updated Surface Water Drainage Strategy drawing. Many thanks in advance.

Kind regards,

Alex Herman
Director



Powell Tolner & Associates Ltd

T: 01494 772 721 | M: 07957 463 183 | W: www.ptaconsult.co.uk

PTA, 29 Red Lion Street, Chesham, Bucks., HP5 1EJ



IMPORTANT: [Email disclaimer](#)

PTA is a trading name of Powell Tolner & Associates Limited. Powell Tolner & Associates Limited is registered in England and Wales. Reg. No.: 8399579, Reg. Office: 22 Wycombe End, Beaconsfield, Buckinghamshire, HP9 1NB, UK.

From: Alex Herman

Sent: 24 October 2024 12:25

To: 'daniel.hoare@kent.gov.uk' <daniel.hoare@kent.gov.uk>

Cc: 'Kate Holland' <kate@invictaplanning.co.uk>; 'shazad.ghani@gravesham.gov.uk'

<shazad.ghani@gravesham.gov.uk>; 'allan.cox@gravesham.gov.uk' <allan.cox@gravesham.gov.uk>;

'ethan.bonthron@gravesham.gov.uk' <ethan.bonthron@gravesham.gov.uk>; 'faye.hobbs@gravesham.gov.uk'

<faye.hobbs@gravesham.gov.uk>; 'David.Barton@kent.gov.uk' <David.Barton@kent.gov.uk>;

'Cathy.Bishop@kent.gov.uk' <Cathy.Bishop@kent.gov.uk>; 'Paul White' <paul.white@gravesham.gov.uk>; 'Chloe

Houston' <ChloeHouston@hill.co.uk>; 'Alana Downey' <AlanaDowney@hill.co.uk>; 'Taylor Andrews'

<TaylorAndrews@hill.co.uk>

Subject: RE: Milton Place Car Park- Pre App 2

Hi Daniel,

Apologies, but just to clarify, the next pre-app meeting is not today as I suggested below, but is actually next Tuesday 1st October. I understand that you will not be attending that meeting, but please feel free to respond with any further thoughts before the next meeting and I will relay any further correspondence between us back to the team.

Kind regards,

Alex Herman

Director



Powell Tolner & Associates Ltd

T: 01494 772 721 | M: 07957 463 183 | W: www.ptaconsult.co.uk

PTA, 29 Red Lion Street, Chesham, Bucks., HP5 1EJ



IMPORTANT: [Email disclaimer](#)

PTA is a trading name of Powell Tolner & Associates Limited. Powell Tolner & Associates Limited is registered in England and Wales. Reg. No.: 8399579, Reg. Office: 22 Wycombe End, Beaconsfield, Buckinghamshire, HP9 1NB, UK.

From: Alex Herman

Sent: 23 October 2024 19:11

To: daniel.hoare@kent.gov.uk

Cc: Kate Holland <kate@invictaplanning.co.uk>; shazad.ghani@gravesham.gov.uk; allan.cox@gravesham.gov.uk;

ethan.bonthron@gravesham.gov.uk; faye.hobbs@gravesham.gov.uk; David.Barton@kent.gov.uk;

Cathy.Bishop@kent.gov.uk; Paul White <paul.white@gravesham.gov.uk>; Chloe Houston

<ChloeHouston@hill.co.uk>; Alana Downey <AlanaDowney@hill.co.uk>; Taylor Andrews

<TaylorAndrews@hill.co.uk>

Subject: RE: Milton Place Car Park- Pre App 2 [Filed 23 Oct 2024 19:11]

Hi Daniel,

Thank you for your below comments following the last pre-app meeting on 1st October. In advance of tomorrow's pre-app meeting, please find below our response to your comments (in GREEN) and please find attached our updated preliminary Surface Water Drainage Strategy drawing which now includes;

- The latest proposed site plan overlaid
- Allowance for attenuating run-off from the resurfaced car park into the infiltration basin, overall basin volume increased to circa 280m³ to accommodate run-off from the car park
- The Southern Water deep surface water sewer is shown crossing the car park and the site entrance
- We have shown provision for an overflow from the infiltration basin into the Southern Water sewer – should infiltration rates prove not to be as anticipated on site during construction/installation of the infiltration basin

Responses to your comments;

- Several of the drawings shown within the meeting, including the Preliminary Surface Water Drainage Strategy Sketch, do not feature the surface water sewer crossing the car park from manhole 1050 (Milton Road) to 2150 near the entrance of the Fort. Alex (PTA Consult) confirmed to us that this sewer line is known and has been considered. It is advisable that this is shown on any future strategy drawing to ensure that the development proposals do not encroach the sewer line. A question was raised about potential diversions, if necessary. The LLFA can confirm that the sewer is an asset owned and operated by Southern Water, subsequently requiring their consent instead of ours. **The sewer is now shown on the attached updated drawing – we will liaise where necessary with Southern Water to seek approval for building the new site access over the sewer, albeit the sewer is very deep with +6m cover over the pipe at the proposed site entrance and therefore considered to be unaffected by the proposed scheme.**
- The current proposals presented within the meeting would be that the current extent of the car park would be reduced from the development and that the remaining section would be resurfaced. It is our understanding that no formal drainage currently exists for the car park. With the relative fall from Milton Road towards the proposed infiltration basin, there is the potential of flows from this area contributing to the basin. This may subsequently need consideration for additional storage to be provided within the basin or for separate drainage measures to be included serving the car park. **We have now included for attenuating the resurfaced car park in the overall catchment area for the site and providing addition storage in the infiltration basin. We propose to introduce a new land drain along the eastern edge of the car park to capture run-off from the car park and positively drain it into the basin via below ground perforated pipework in the land drain and subsequently into the basin via a new headwall/outlet pipe, as shown indicatively on the attached updated drawing.**
- Alternatively, it was indicated that a potential bund may be used to convey flows away from the basin. The LLFA would have concerns with this approach as this may encourage the channelling of flows, whereas the existing situation is a sheet flow onto the greenspace, where it is expected to infiltrate. This process would be interrupted with the introduction of a bunded basin. Further consideration as to how to manage runoff from the car park is needed. **We will not be proposing a bund around the infiltration basin and instead are proposing a land drain to capture runoff from the car park as noted above.**
- A copy of the Phase 2 Geo-Environmental Report was made available to us prior to the meeting. Within this report, it included an assessment into the extent and material used to infill the former swimming pool is needed. It is unclear as to whether the proposed basin

would be partially located within the extent of the former swimming pool. With the former pool being infilled with demolition material from the former building, we would expect any material in contact with basin to be removed and replaced where needed with clean soils/inert material. Furthermore, additional material may have to be removed where there is a potential for interaction of infiltrating surface water and the material. This is to ensure against mobilising potential contaminants contained within the demolished material. **Agree. We propose to locate the basin as far as possible away from the known extent of the swimming pool infill.**

- The current rate the infiltration basin has been designed for is $2.82 \times 10^{-4} \text{ m/s}$. The Phase 2 Geo-Environmental report shows the closest trial pits where infiltration tests have been undertaken are TP03 and TP04. The rates obtained between both pits are viewed to be significantly different, with the lowest value within TP03 of 0.028 m/hr ($7.89 \times 10^{-6} \text{ m/s}$) and 1.06 m/hr ($2.95 \times 10^{-4} \text{ m/s}$) for TP04. The difference between the rates is likely attributable to the test depth of the trial pits. The soakage test within TP04 was between 1-2 meters deep, wholly within the chalk, whereas TP03 was only tested to a metre deep and with made ground recorded to 0.6m deep. With the basin proposed to extend to only a metre in depth, we raised concerns that the application of the higher rate in the design of the basin (TP04) may overestimate the achievable rate of infiltration at a shallower depth (more respective of TP03). We would therefore seek further clarification as to the reasoning for using the higher rate, as we would typically seek for the lowest rate to be utilised. **We consider that $2.82 \times 10^{-4} \text{ m/s}$ is the most appropriate rate for the location of the proposed basin, and we will ensure that crest and base level of the basin will be set low enough to be in contact with the good chalk material. We have had a look to see what the impact would be on the size, shape and volume of the basin should we need to use the lowest infiltration rate of $7.89 \times 10^{-6} \text{ m/s}$, and the size of basin would not fit within the space available on site. As per note we have added to the attached drawing, we suggest the following;**

“Exact volume of pond, and therefore shape, is subject to results of onsite infiltration testing within this location. Pond size shown is maximised for the space available. If infiltration rates for this area are poorer than anticipated, a high level surface water overflow into the adjacent public surface water sewer network will be required. The surface water would be reduced to greenfield Qbar rates, and discharged into the adjacent Southern Water sewer network; pending approval from the LLFA and Southern Water.”
- Statement 10.16 within the Phase 2 Geo-Environmental Report refers to separation distances between proposed structures and infiltrating features. With no recommended distance being specified, we would expect for the CIRIA C574 guidance (Engineering in Chalk) to be followed. If the chalk is of ‘low density’, the document advises for a separation distance of 10 metres to be applied. For future drainage strategy drawings, it was advised for this to be illustrated. **Agree, the basin has been positioned so that it is at least 10m away from any buildings.**
- The Phase 2 Geo-Environmental Report indicates that groundwater levels were taken within boreholes on the 22nd of May 2023. The report highlights that groundwater was struck at 7.0m bgl (BH02). With the River Thames being near to the proposed site, there could be interactions with the river, resulting in fluctuating levels groundwater. With the winter months approaching, we would advise that further monitoring is undertaken during this period through winter and spring, when groundwater should be rising/ reaching peak. In view of a formal planning submission being made in November, it would be something the LLFA would likely Condition, with results being provided at detailed design. **We understand your concern, however based on**

the SI report and local BGS borehole records we consider that there is a low risk of groundwater fluctuation to a shallow enough depth to potentially affect the proposed infiltration strategy.

- As per all major developments, the LLFA seek for adequate pollution control on site. This would be in accordance with Part E - Chapter 26 of the CIRIA SuDS Manual (2015). An assessment should be made using the supporting guidance within in this chapter to demonstrate suitable levels of treatment being provided by the drainage system. With uncertainty surrounding the contributions of runoff from the car parking area, pollutants from this area may also have to be considered if this area will be draining to the infiltration basin. **As per the note on the attached drawing, we consider that the proposed hardstanding catchment areas of the site are deemed to be low to medium pollution risk. The combined pollution mitigation indices for the infiltration basin is above 0.7, 0.6 & 0.7 for total suspended solids, metals, and hydrocarbons respectively, in line with the recommendations of the CIRIA SuDS Manual (C753 2015) for a medium pollution risk area.**

I trust the above and attached provide a helpful update and response to your comments, but please do provide us with any further thoughts or questions you may have on our latest proposals in advance of our formal planning submission.

Kind regards,

Alex Herman
Director



Powell Tolner & Associates Ltd

T: 01494 772 721 | M: 07957 463 183 | W: www.ptaconsult.co.uk

PTA, 29 Red Lion Street, Chesham, Bucks., HP5 1EJ



IMPORTANT: [Email disclaimer](#)

PTA is a trading name of Powell Tolner & Associates Limited. Powell Tolner & Associates Limited is registered in England and Wales. Reg. No.: 8399579, Reg. Office: 22 Wycombe End, Beaconsfield, Buckinghamshire, HP9 1NB, UK.

From: Daniel.Hoare@kent.gov.uk <Daniel.Hoare@kent.gov.uk>

Sent: 03 October 2024 11:25

To: kate@invictaplanning.co.uk; shazad.ghani@gravesham.gov.uk; allan.cox@gravesham.gov.uk; ethan.bonthron@gravesham.gov.uk; faye.hobbs@gravesham.gov.uk; David.Barton@kent.gov.uk; Cathy.Bishop@kent.gov.uk

Cc: paul.white@gravesham.gov.uk; Chloe Houston <ChloeHouston@hill.co.uk>; Alana Downey <AlanaDowney@hill.co.uk>; Taylor Andrews <TaylorAndrews@hill.co.uk>

Subject: RE: Milton Place Car Park- Pre App 2

You don't often get email from daniel.hoare@kent.gov.uk. [Learn why this is important](#)

[EXTERNAL EMAIL] This email originated from outside of Hill. Exercise caution when opening attachments or clicking links, especially from unknown senders.

Morning,

Thank you for inviting myself and Cathy to the meeting on Tuesday to discuss the potential drainage arrangements for the forthcoming planning submission. As raised within the meeting, we have prepared some follow up comments below for consideration moving forward. We are more than happy to have further discussions if needed.

- Several of the drawings shown within the meeting, including the Preliminary Surface Water Drainage Strategy Sketch, do not feature the surface water sewer crossing the car park from manhole 1050 (Milton Road) to 2150 near the entrance of the Fort. Alex (PTA Consult) confirmed to us that this sewer line is known and has been considered. It is advisable that this is shown on any future strategy drawing to ensure that the development proposals do not encroach the sewer line. A question was raised about potential diversions, if necessary. The LLFA can confirm that the sewer is an asset owned and operated by Southern Water, subsequently requiring their consent instead of ours.
- The current proposals presented within the meeting would be that the current extent of the car park would be reduced from the development and that the remaining section would be resurfaced. It is our understanding that no formal drainage currently exists for the car park. With the relative fall from Milton Road towards the proposed infiltration basin, there is the potential of flows from this area contributing to the basin. This may subsequently need consideration for additional storage to be provided within the basin or for separate drainage measures to be included serving the car park.
- Alternatively, it was indicated that a potential bund may be used to convey flows away from the basin. The LLFA would have concerns with this approach as this may encourage the channelling of flows, whereas the existing situation is a sheet flow onto the greenspace, where it is expected to infiltrate. This process would be interrupted with the introduction of a bunded basin. Further consideration as to how to manage runoff from the car park is needed.
- A copy of the Phase 2 Geo-Environmental Report was made available to us prior to the meeting. Within this report, it included an assessment into the extent and material used to infill the former swimming pool is needed. It is unclear as to whether the proposed basin would be partially located within the extent of the former swimming pool. With the former pool being infilled with demolition material from the former building, we would expect any material in contact with basin to be removed and replaced where needed with clean soils/inert material. Furthermore, additional material may have to be removed where there is a potential for interaction of infiltrating surface water and the material. This is to ensure against mobilising potential contaminants contained within the demolished material.
- The current rate the infiltration basin has been designed for is $2.82 \times 10^{-4} \text{m/s}$. The Phase 2 Geo-Environmental report shows the closest trial pits where infiltration tests have been undertaken are TP03 and TP04. The rates obtained between both pits are viewed to be significantly different, with the lowest value within TP03 of 0.028 m/hr ($7.89 \times 10^{-6} \text{m/s}$) and 1.06 m/hr ($2.95 \times 10^{-4} \text{m/s}$) for TP04. The difference between the rates is likely attributable to the test depth of the trial pits. The soakage test within TP04 was between 1-2 meters deep, wholly within the chalk, whereas TP03 was only tested to a metre deep and with made ground recorded to 0.6m deep. With the basin proposed to extend to only a metre in depth, we raised concerns that the application of the higher rate in the design of the basin (TP04) may overestimate the achievable rate of infiltration at a shallower depth (more respective of TP03). We would therefore seek further clarification as to the reasoning for using the higher rate, as we would typically seek for the lowest rate to be utilised.

- Statement 10.16 within the Phase 2 Geo-Environmental Report refers to separation distances between proposed structures and infiltrating features. With no recommended distance being specified, we would expect for the CIRIA C574 guidance (Engineering in Chalk) to be followed. If the chalk is of 'low density', the document advises for a separation distance of 10 metres to be applied. For future drainage strategy drawings, it was advised for this to be illustrated.
- The Phase 2 Geo-Environmental Report indicates that groundwater levels were taken within boreholes on the 22nd of May 2023. The report highlights that groundwater was struck at 7.0m bgl (BH02). With the River Thames being near to the proposed site, there could be interactions with the river, resulting in fluctuating levels groundwater. With the winter months approaching, we would advise that further monitoring is undertaken during this period through winter and spring, when groundwater should be rising/ reaching peak. In view of a formal planning submission being made in November, it would be something the LLFA would likely Condition, with results being provided at detailed design.
- As per all major developments, the LLFA seek for adequate pollution control on site. This would be in accordance with Part E - Chapter 26 of the CIRIA SuDS Manual (2015). An assessment should be made using the supporting guidance within in this chapter to demonstrate suitable levels of treatment being provided by the drainage system. With uncertainty surrounding the contributions of runoff from the car parking area, pollutants from this area may also have to be considered if this area will be draining to the infiltration basin.

If there was anyone missed off the mailing list, please forward a copy on to them.

Kind Regards,

Daniel

Daniel Hoare MCIWEM | Senior Flood Risk Officer | Flood & Water Management | Kent County Council | Invicta House, County Hall, Maidstone ME14 1XX | External: 03000 413550

As Lead Local Flood Authority (LLFA) for the County, we are the statutory consultee in planning to promote the provision of Sustainable Drainage Systems. You can find out more by visiting: <http://www.kent.gov.uk/waste-planning-and-land/flooding-and-drainage/sustainable-drainage-systems>

From: Kate Holland <kate@invictaplanning.co.uk>

Sent: Friday, September 27, 2024 3:40 PM

To: Shazad Ghani <shazad.ghani@gravesham.gov.uk>; allan.cox@gravesham.gov.uk; Ethan Bonthron <ethan.bonthron@gravesham.gov.uk>; Faye Hobbs <faye.hobbs@gravesham.gov.uk>; David Barton - GT TRA <David.Barton@kent.gov.uk>; Daniel Hoare - GT - ECE <Daniel.Hoare@kent.gov.uk>; Cathy Bishop - ECE <Cathy.Bishop@kent.gov.uk>

Cc: paul.white@gravesham.gov.uk; Chloe Houston <chloehouston@hill.co.uk>; Alana Downey <AlanaDowney@hill.co.uk>; Taylor Andrews <TaylorAndrews@hill.co.uk>

Subject: RE: Milton Place Car Park- Pre App 2

Good afternoon

Following on from my email yesterday, please see attached surface water drainage strategy sketch to also be discussed at our meeting next week.

Kind regards

Kate

Kate Holland
Invicta Planning

Planning Director | BSc MA MRTPI

www.invictaplanning.co.uk

E: kate@invictaplanning.co.uk

M: 07889 807874 T: 01732 885563

A: Chart House, 10 Western Road, Borough Green, Kent,
TN15 8AG



From: Kate Holland

Sent: 26 September 2024 18:00

To: Shazad Ghani <shazad.ghani@gravesham.gov.uk>; allan.cox@gravesham.gov.uk; Ethan Bonthron <ethan.bonthron@gravesham.gov.uk>; Faye Hobbs <faye.hobbs@gravesham.gov.uk>; David.Barton@kent.gov.uk; Daniel.Hoare@kent.gov.uk; Cathy.Bishop@kent.gov.uk

Cc: paul.white@gravesham.gov.uk; Chloe Houston <ChloeHouston@hill.co.uk>; Alana Downey <AlanaDowney@hill.co.uk>; Taylor Andrews <TaylorAndrews@hill.co.uk>

Subject: Milton Place Car Park- Pre App 2

Good afternoon All

Ahead of our meeting next week, please see the link below to the pre-application pack of information which includes:

- Cover Letter from Invicta Planning
- Pre-App document produced by JTP
- Transport Scoping Note produced by TPA

We are also intending to send some information in relation to the surface water drainage strategy for the site tomorrow morning; however, in the interim the location and size of the SuDS features are included on the landscape drawings within the JTP document.

<https://we.tl/t-00O1Fbi99C>

I will produce and circulate a meeting agenda ahead of the meeting.

Any questions, please do let me know.

Kind regards

Kate

Kate Holland
Invicta Planning

Planning Director | BSc MA MRTPI

www.invictaplanning.co.uk

E: kate@invictaplanning.co.uk

M: 07889 807874 T: 01732 885563

A: Chart House, 10 Western Road, Borough Green, Kent,
TN15 8AG



APPENDIX H – Post Development Drainage Calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	0.800
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.025	5.00	10.613	450	565212.404	174051.792	1.893
2	0.021	5.00	9.340	450	565249.620	174061.174	1.000
3	0.016	5.00	9.439	450	565248.833	174064.330	1.209
4	0.047	5.00	8.815	600	565289.090	174074.418	1.195
5	0.022	5.00	11.495	450	565195.067	174065.734	1.180
6	0.022	5.00	11.310	450	565203.227	174101.841	1.365
7	0.012	5.00	11.104	450	565209.689	174108.257	1.309
8	0.028	5.00	10.606	450	565221.590	174078.376	1.121
9	0.028	5.00	10.648	450	565216.335	174097.795	0.998
10			10.272	450	565226.960	174097.365	0.987
11	0.044	5.00	9.699	450	565237.839	174080.769	0.899
12	0.019	5.00	10.069	450	565233.303	174098.962	1.529
13	0.014	5.00	10.004	1200	565231.429	174106.569	1.604
14	0.140	5.00	8.509	1200	565278.306	174118.341	1.409
15			8.509	1200	565276.999	174123.533	1.509
16	0.226	5.00	9.064	450	565260.201	174130.299	0.950
Pond			8.720		565272.901	174127.074	1.723
17			8.720		565275.319	174130.938	1.220

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)
1.000	1	2	38.380	0.600	8.720	8.340	0.380	101.0	150	5.64	50.0
1.001	2	3	3.253	0.600	8.340	8.305	0.035	92.9	150	5.69	50.0
1.002	3	4	41.502	0.600	8.230	7.620	0.610	68.0	225	6.13	50.0
1.003	4	14	45.227	0.600	7.620	7.325	0.295	153.3	225	6.84	50.0
2.000	5	6	37.018	0.600	10.315	9.945	0.370	100.0	150	5.61	50.0
2.001	6	7	9.106	0.600	9.945	9.795	0.150	60.7	150	5.73	50.0
2.002	7	13	21.805	0.600	9.795	9.050	0.745	29.3	150	5.93	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)
1.000	1.000	17.7	4.5	1.743	0.850	0.025	0.0	51	0.834
1.001	1.043	18.4	8.2	0.850	0.984	0.046	0.0	70	1.012
1.002	1.587	63.1	11.1	0.984	0.970	0.062	0.0	64	1.203
1.003	1.053	41.9	19.7	0.970	0.959	0.109	0.0	109	1.038
2.000	1.004	17.7	4.0	1.030	1.215	0.022	0.0	48	0.812
2.001	1.293	22.8	7.9	1.215	1.159	0.044	0.0	61	1.175
2.002	1.868	33.0	10.1	1.159	0.804	0.056	0.0	57	1.640

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)
3.000	8	10	19.734	0.600	9.485	9.285	0.200	98.7	150	5.33	50.0
4.000	9	10	10.634	0.600	9.650	9.285	0.365	29.1	150	5.09	50.0
3.001	10	12	6.541	0.600	9.285	9.115	0.170	38.5	150	5.39	50.0
5.000	11	12	18.750	0.600	8.800	8.615	0.185	101.4	150	5.31	50.0
3.002	12	13	7.834	0.600	8.540	8.475	0.065	120.5	225	5.50	50.0
2.003	13	14	48.333	0.600	8.400	7.250	1.150	42.0	300	6.26	50.0
1.004	14	15	5.354	0.600	7.100	7.000	0.100	53.5	450	6.88	50.0
1.005	15	Pond	1.000	0.600	7.000	6.997	0.003	333.3	450	6.89	50.0
6.000	16	Pond	2.000	0.600	8.114	7.695	0.419	4.8	225	5.01	50.0
1.006	Pond	17	1.000	0.600	7.400	7.500	-0.100	-10.0	150	6.91	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)
3.000	1.011	17.9	5.1	0.971	0.837	0.028	0.0	55	0.873
4.000	1.872	33.1	5.0	0.848	0.837	0.028	0.0	40	1.358
3.001	1.627	28.8	10.2	0.837	0.804	0.056	0.0	62	1.492
5.000	0.998	17.6	7.9	0.749	1.304	0.044	0.0	71	0.972
3.002	1.190	47.3	21.6	1.304	1.304	0.119	0.0	107	1.164
2.003	2.432	171.9	34.2	1.304	0.959	0.189	0.0	91	1.912
1.004	2.783	442.6	79.2	0.959	1.059	0.438	0.0	128	2.126
1.005	1.108	176.2	79.2	1.059	1.273	0.438	0.0	211	1.079
6.000	6.029	239.7	40.9	0.725	0.800	0.226	0.0	63	4.542
1.006	1.000	17.7	120.0	1.170	1.070	0.664	0.0	150	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	38.380	101.0	150	1 PTA	10.613	8.720	1.743	9.340	8.340	0.850
1.001	3.253	92.9	150	1 PTA	9.340	8.340	0.850	9.439	8.305	0.984
1.002	41.502	68.0	225	1 PTA	9.439	8.230	0.984	8.815	7.620	0.970
1.003	45.227	153.3	225	1 PTA	8.815	7.620	0.970	8.509	7.325	0.959
2.000	37.018	100.0	150	1 PTA	11.495	10.315	1.030	11.310	9.945	1.215
2.001	9.106	60.7	150	1 PTA	11.310	9.945	1.215	11.104	9.795	1.159
2.002	21.805	29.3	150	1 PTA	11.104	9.795	1.159	10.004	9.050	0.804
3.000	19.734	98.7	150	1 PTA	10.606	9.485	0.971	10.272	9.285	0.837
4.000	10.634	29.1	150	1 PTA	10.648	9.650	0.848	10.272	9.285	0.837
3.001	6.541	38.5	150	1 PTA	10.272	9.285	0.837	10.069	9.115	0.804

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	450	Manhole	Adoptable	2	450	Manhole	Adoptable
1.001	2	450	Manhole	Adoptable	3	450	Manhole	Adoptable
1.002	3	450	Manhole	Adoptable	4	600	Manhole	Adoptable
1.003	4	600	Manhole	Adoptable	14	1200	Manhole	Adoptable
2.000	5	450	Manhole	Adoptable	6	450	Manhole	Adoptable
2.001	6	450	Manhole	Adoptable	7	450	Manhole	Adoptable
2.002	7	450	Manhole	Adoptable	13	1200	Manhole	Adoptable
3.000	8	450	Manhole	Adoptable	10	450	Manhole	Adoptable
4.000	9	450	Manhole	Adoptable	10	450	Manhole	Adoptable
3.001	10	450	Manhole	Adoptable	12	450	Manhole	Adoptable

Pipeline Schedule

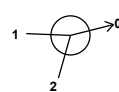
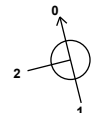
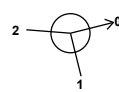
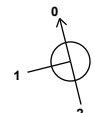
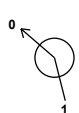
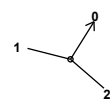
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
5.000	18.750	101.4	150	1 PTA	9.699	8.800	0.749	10.069	8.615	1.304
3.002	7.834	120.5	225	1 PTA	10.069	8.540	1.304	10.004	8.475	1.304
2.003	48.333	42.0	300	1 PTA	10.004	8.400	1.304	8.509	7.250	0.959
1.004	5.354	53.5	450	1 PTA	8.509	7.100	0.959	8.509	7.000	1.059
1.005	1.000	333.3	450	1 PTA	8.509	7.000	1.059	8.720	6.997	1.273
6.000	2.000	4.8	225	1 PTA	9.064	8.114	0.725	8.720	7.695	0.800
1.006	1.000	-10.0	150	1 PTA	8.720	7.400	1.170	8.720	7.500	1.070

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
5.000	11	450	Manhole	Adoptable	12	450	Manhole	Adoptable
3.002	12	450	Manhole	Adoptable	13	1200	Manhole	Adoptable
2.003	13	1200	Manhole	Adoptable	14	1200	Manhole	Adoptable
1.004	14	1200	Manhole	Adoptable	15	1200	Manhole	Adoptable
1.005	15	1200	Manhole	Adoptable	Pond		Junction	
6.000	16	450	Manhole	Adoptable	Pond		Junction	
1.006	Pond		Junction		17		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	565212.404	174051.792	10.613	1.893	450				
						0	1.000	8.720	150
2	565249.620	174061.174	9.340	1.000	450		1	1.000	8.340
						0	1.001	8.340	150
3	565248.833	174064.330	9.439	1.209	450		1	1.001	8.305
						0	1.002	8.230	225
4	565289.090	174074.418	8.815	1.195	600		1	1.002	7.620
						0	1.003	7.620	225
5	565195.067	174065.734	11.495	1.180	450		0	2.000	10.315
						0	2.000	9.945	150
6	565203.227	174101.841	11.310	1.365	450		1	2.001	9.945
						0	2.001	9.795	150
7	565209.689	174108.257	11.104	1.309	450		1	2.001	9.795
						0	2.002	9.795	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
8	565221.590	174078.376	10.606	1.121	450		0	3.000	9.485	150
9	565216.335	174097.795	10.648	0.998	450		0	4.000	9.650	150
10	565226.960	174097.365	10.272	0.987	450		1	4.000	9.285	150
							2	3.000	9.285	150
							0	3.001	9.285	150
11	565237.839	174080.769	9.699	0.899	450		0	5.000	8.800	150
12	565233.303	174098.962	10.069	1.529	450		1	5.000	8.615	150
							2	3.001	9.115	150
							0	3.002	8.540	225
13	565231.429	174106.569	10.004	1.604	1200		1	3.002	8.475	225
							2	2.002	9.050	150
							0	2.003	8.400	300
14	565278.306	174118.341	8.509	1.409	1200		1	2.003	7.250	300
							2	1.003	7.325	225
							0	1.004	7.100	450
15	565276.999	174123.533	8.509	1.509	1200		1	1.004	7.000	450
							0	1.005	7.000	450
16	565260.201	174130.299	9.064	0.950	450		0	6.000	8.114	225
Pond	565272.901	174127.074	8.720	1.723			1	6.000	7.695	225
							2	1.005	6.997	450
							0	1.006	7.400	150
17	565275.319	174130.938	8.720	1.220			1	1.006	7.500	150

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	1 year (l/s)	3.1
Rainfall Events	Singular	Drain Down Time (mins)	480	30 year (l/s)	8.8
Summer CV	1.000	Additional Storage (m³/ha)	20.0	100 year (l/s)	11.8
Winter CV	1.000	Starting Level (m)		Check Discharge Volume	✓
Analysis Speed	Detailed	Check Discharge Rate(s)	✓	100 year 360 minute (m³)	

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
30	35	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	2.40
Greenfield Method	IH124	Growth Factor 100 year	3.19
Positively Drained Area (ha)	1.432	Betterment (%)	0
SAAR (mm)	551	QBar	3.7
Soil Index	3	Q 1 year (l/s)	3.1
SPR	0.40	Q 30 year (l/s)	8.8
Region	7	Q 100 year (l/s)	11.8
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	1.432	Storm Duration (mins)	360
Soil Index	3	Betterment (%)	0
SPR	0.40	PR	
CWI		Runoff Volume (m³)	

Node Pond Online Weir Control

Flap Valve	x	Design Depth (m)	2.000	Discharge Coefficient	0.590
Replaces Downstream Link	✓	Design Flow (l/s)	0.1		
Invert Level (m)	8.000	Width (m)	2.000		

Node Pond Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	6.625
Side Inf Coefficient (m/hr)	1.01520	Porosity	1.00	Time to half empty (mins)	64

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	63.3	63.3	0.600	147.5	150.2	1.200	274.4	280.7
0.200	86.8	87.6	0.800	187.3	191.0	1.400	321.8	329.7
0.400	114.7	116.4	1.000	229.8	234.7	1.600	369.9	379.5

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.66%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	8.761	0.041	2.9	0.0170	0.0000	OK
15 minute summer	2	11	8.401	0.061	5.2	0.0348	0.0000	OK
15 minute summer	3	11	8.280	0.050	7.0	0.0214	0.0000	OK
15 minute summer	4	11	7.703	0.083	12.3	0.0889	0.0000	OK
15 minute summer	5	10	10.353	0.038	2.6	0.0204	0.0000	OK
15 minute summer	6	11	9.995	0.050	5.0	0.0241	0.0000	OK
15 minute summer	7	11	9.840	0.045	6.3	0.0154	0.0000	OK
15 minute summer	8	10	9.528	0.043	3.3	0.0289	0.0000	OK
15 minute summer	9	10	9.682	0.032	3.3	0.0229	0.0000	OK
15 minute summer	10	10	9.337	0.052	6.5	0.0083	0.0000	OK
15 minute summer	11	10	8.856	0.056	5.1	0.0641	0.0000	OK
15 minute summer	12	10	8.630	0.090	13.6	0.0367	0.0000	OK
15 minute summer	13	11	8.473	0.073	21.5	0.0948	0.0000	OK
240 minute summer	14	148	7.283	0.183	23.4	0.5688	0.0000	OK
360 minute summer	15	216	7.262	0.262	38.5	0.2958	0.0000	OK
15 minute summer	16	10	8.171	0.057	26.4	0.2789	0.0000	OK
240 minute summer	Pond	152	7.259	0.262	35.4	66.5852	0.0000	OK
15 minute summer	17	1	7.500	0.000	0.0	0.0000	0.0000	OK

Link Event (Velocity)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	2.8	0.549	0.160	0.2016	
15 minute summer	2	1.001	3	5.2	0.834	0.281	0.0202	
15 minute summer	3	1.002	4	7.0	0.731	0.111	0.4112	
15 minute summer	4	1.003	14	11.7	0.905	0.279	0.5870	
15 minute summer	5	2.000	6	2.5	0.587	0.143	0.1610	
15 minute summer	6	2.001	7	5.0	1.030	0.218	0.0440	
15 minute summer	7	2.002	13	6.3	1.424	0.191	0.0968	
15 minute summer	8	3.000	10	3.3	0.681	0.183	0.0950	
15 minute summer	9	4.000	10	3.3	0.815	0.099	0.0433	
15 minute summer	10	3.001	12	6.4	1.253	0.224	0.0337	
15 minute summer	11	5.000	12	5.0	0.848	0.284	0.1109	
15 minute summer	12	3.002	13	13.6	0.980	0.287	0.1087	
15 minute summer	13	2.003	14	21.5	1.665	0.125	0.6255	
15 minute summer	14	1.004	15	48.8	1.088	0.110	0.2406	
15 minute summer	15	1.005	Pond	48.7	0.986	0.276	0.0494	
15 minute summer	16	6.000	Pond	26.3	3.663	0.110	0.0144	
240 minute summer	Pond	Weir	17	0.0				0.0
240 minute summer	Pond	Infiltration		13.2				

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.66%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	8.812	0.092	12.6	0.0388	0.0000	OK
15 minute summer	2	10	8.541	0.201	23.0	0.1156	0.0000	SURCHARGED
15 minute summer	3	11	8.340	0.110	30.7	0.0465	0.0000	OK
30 minute summer	4	20	7.986	0.366	52.9	0.3934	0.0000	SURCHARGED
15 minute summer	5	10	10.400	0.085	11.2	0.0455	0.0000	OK
15 minute summer	6	11	10.081	0.136	22.1	0.0651	0.0000	OK
15 minute summer	7	11	9.907	0.112	27.5	0.0380	0.0000	OK
15 minute summer	8	11	9.591	0.106	14.5	0.0705	0.0000	OK
15 minute summer	9	10	9.719	0.069	14.2	0.0492	0.0000	OK
15 minute summer	10	11	9.475	0.190	28.4	0.0301	0.0000	SURCHARGED
15 minute summer	11	11	9.171	0.371	22.4	0.4220	0.0000	SURCHARGED
15 minute summer	12	11	8.834	0.294	58.5	0.1206	0.0000	SURCHARGED
15 minute summer	13	11	8.557	0.157	93.0	0.2052	0.0000	OK
180 minute summer	14	120	7.942	0.842	85.5	2.6224	0.0000	SURCHARGED
180 minute summer	15	120	7.941	0.941	81.5	1.0639	0.0000	SURCHARGED
15 minute summer	16	10	8.256	0.142	115.2	0.6977	0.0000	OK
180 minute summer	Pond	124	7.940	0.943	125.8	220.2101	0.0000	SURCHARGED
15 minute summer	17	1	7.500	0.000	0.0	0.0000	0.0000	OK

Link Event (Velocity)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	12.4	0.772	0.703	0.5563	
15 minute summer	2	1.001	3	22.6	1.282	1.224	0.0558	
15 minute summer	3	1.002	4	30.5	0.976	0.484	1.2230	
15 minute summer	4	1.003	14	50.2	1.276	1.198	1.7207	
15 minute summer	5	2.000	6	11.0	0.805	0.622	0.5000	
15 minute summer	6	2.001	7	21.8	1.397	0.952	0.1407	
15 minute summer	7	2.002	13	27.6	2.023	0.836	0.2974	
15 minute summer	8	3.000	10	14.3	0.916	0.798	0.3047	
15 minute summer	9	4.000	10	14.2	1.109	0.428	0.1353	
30 minute summer	10	3.001	12	26.6	1.665	0.925	0.1045	
15 minute summer	11	5.000	12	21.6	1.227	1.225	0.3301	
15 minute summer	12	3.002	13	58.6	1.476	1.240	0.3012	
15 minute winter	13	2.003	14	87.7	2.251	0.510	2.2618	
15 minute summer	14	1.004	15	211.1	1.576	0.477	0.8483	
15 minute summer	15	1.005	Pond	211.0	1.625	1.198	0.1584	
15 minute summer	16	6.000	Pond	114.8	5.060	0.479	0.0453	
180 minute summer	Pond	Weir	17	0.0				0.0
180 minute summer	Pond	Infiltration		34.6				

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.66%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	1	20	8.971	0.251	16.0	0.1056	0.0000	SURCHARGED
30 minute summer	2	20	8.737	0.397	28.3	0.2281	0.0000	SURCHARGED
30 minute summer	3	20	8.627	0.397	38.3	0.1686	0.0000	SURCHARGED
30 minute summer	4	20	8.439	0.819	68.0	0.8813	0.0000	SURCHARGED
15 minute summer	5	12	10.451	0.136	14.7	0.0723	0.0000	OK
30 minute summer	6	19	10.276	0.331	28.1	0.1587	0.0000	SURCHARGED
30 minute summer	7	19	10.026	0.231	33.5	0.0783	0.0000	SURCHARGED
15 minute summer	8	11	9.874	0.389	18.9	0.2588	0.0000	SURCHARGED
15 minute summer	9	11	9.756	0.106	18.5	0.0762	0.0000	OK
15 minute summer	10	11	9.633	0.348	35.6	0.0553	0.0000	SURCHARGED
15 minute summer	11	11	9.508	0.708	29.2	0.8046	0.0000	FLOOD RISK
15 minute summer	12	11	8.950	0.410	75.4	0.1683	0.0000	SURCHARGED
30 minute summer	13	19	8.588	0.188	114.2	0.2459	0.0000	OK
120 minute summer	14	74	8.075	0.975	148.2	3.0373	0.0000	SURCHARGED
120 minute summer	15	76	8.068	1.068	143.9	1.2075	0.0000	SURCHARGED
15 minute summer	16	10	8.289	0.175	150.4	0.8630	0.0000	OK
120 minute summer	Pond	76	8.065	1.068	220.8	259.7289	0.0000	SURCHARGED
15 minute summer	17	1	7.500	0.000	0.0	0.0000	0.0000	OK

Link Event (Velocity)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	15.3	0.870	0.865	0.6757	
15 minute summer	2	1.001	3	28.4	1.616	1.544	0.0573	
30 minute summer	3	1.002	4	37.2	1.059	0.589	1.6506	
15 minute summer	4	1.003	14	58.8	1.477	1.403	1.7987	
30 minute summer	5	2.000	6	13.9	0.847	0.785	0.6184	
15 minute summer	6	2.001	7	26.7	1.517	1.169	0.1603	
15 minute winter	7	2.002	13	33.1	2.084	1.003	0.3758	
15 minute summer	8	3.000	10	17.9	1.015	1.000	0.3474	
15 minute summer	9	4.000	10	18.0	1.140	0.544	0.1644	
15 minute summer	10	3.001	12	35.4	2.013	1.232	0.1151	
15 minute summer	11	5.000	12	27.8	1.579	1.576	0.3301	
15 minute summer	12	3.002	13	75.4	1.896	1.594	0.3079	
30 minute winter	13	2.003	14	96.4	2.235	0.561	2.6180	
15 minute summer	14	1.004	15	259.8	1.711	0.587	0.8483	
15 minute summer	15	1.005	Pond	259.1	1.801	1.471	0.1584	
15 minute summer	16	6.000	Pond	149.7	5.272	0.625	0.0564	
120 minute summer	Pond	Weir	17	61.5				51.9
120 minute summer	Pond	Infiltration		39.0				

APPENDIX I – Proposed Drainage Layout

APPENDIX J – Below Ground Drainage Maintenance Plan



Powell Tolner & Associates Ltd

BELOW GROUND DRAINAGE MAINTENANCE PLAN

Project: Milton Place, Gravesend

PTA Project Ref: 10109

Document Ref: 10109-PTA-XX-XX-RP-C -9078

Status: Issue for Planning

Revision: P01

Date: February 2025

Client: Gravesham Community Investment Partnership LLP



Issued by

PTA
29 Red Lion Street
Chesham
Buckinghamshire
United Kingdom
HP5 1EJ
Tel: + 44 1494 772721
central@ptaconsult.co.uk

	Name	Position	Signature	Date
Prepared by:	Angus Coles	Graduate Civil Engineer	ADC	28.11.2024
Reviewed by:	Dillan Halai	Civil Design Engineer	DH	19.02.2025
For and on behalf of Powell Tolner & Associates Limited				

Revision	Date	Description	Prepared	Reviewed
P01	21.02.25	Issued for Planning	DH	AH

©This report is the copyright of PTA.

Any unauthorised reproduction or usage by any person other than the addressee is strictly prohibited.

TABLE OF CONTENTS

1	INTRODUCTION	1
2	Manholes, Inspection Chambers, Pipe Work, Drainage Channels & Gullies.....	2
3	Infiltration Basins.....	3
4	Filter Strips.....	4
5	CONSTRUCTION STAGE	5

1 INTRODUCTION

Project Name: Milton Place, Gravesend - 10109

Project Location: Milton Place, Gravesend, Kent, DA12 2BT

Job Number: 10109

This document has been prepared to provide a maintenance methodology to the surface water drainage elements proposed for this development. If any discrepancies from manufactures guidance is encountered, the proprietary system guidance should be adopted.

The drainage networks are comprised of gullies, basins, together with connecting pipe network, manholes & inspection chambers and filter strips. Refer to drawing 10109-PTA-XX-XX-DR-C-9300 for the Proposed Drainage Layout.

Any man-entry into the system and silt removal should be by trained personnel with adequate personal protective equipment. Approved safety procedures must be followed in accordance with the Health and Safety Act.

This drainage systems maintenance will be the responsibility of the project developer or by an appointed maintenance company and as such an appropriated maintenance regime should be implemented (as below).

2 Manholes, Inspection Chambers, Pipe Work, Drainage Channels & Gullies

The surface water drainage system should be inspected and maintained periodically, primarily to check for silt sedimentation within the system or ingress of any detritus or debris which would decrease system performance. Table 1 sets out the recommended maintenance actions and frequency.

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Remove manhole and chamber covers to sewers and flow control on network– inspect to ensure water is flowing freely and that the water flow route is unobstructed. Remove debris and silt as required. Traps of the internal gullies within the carpark.	Half Yearly Undertake one of these inspections after leaf fall in autumn
Occasional Maintenance	None required	
Remedial Actions	Re-line or replace pipework if unable to clear blockages by jetting.	As required
Monitoring	Inspect chambers for build-up of silt and debris	Half yearly

Table 1 – Operation & maintenance requirements for pipe network, manholes & inspection chambers, drainage channels & gullies - Based on CIRIA SuDS Manual 2015

3 Infiltration Basins

These are profiled basins which are designed to discharge water to the ground via infiltration.

Table 2 sets out the recommended maintenance actions and frequency for infiltration basins.

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Remove litter, debris and trash	Monthly
	Cut grass – for landscaped areas and access routes	Monthly (during growing season) or as required
	Cut grass – meadow grass in and around basin	Half yearly: spring (before nesting season) and autumn
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
Occasional Maintenance	Replace malfunctioning parts or structures.	As required
	Prune and trim trees and remove cuttings	As required
	Remove sediment from pre-treatment system when 50% full	As required
Remedial Actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realign the rip-rap	As required
	Repair or rehabilitate inlets, outlets and overflows	As required
	Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates	As required
	Relevel uneven surfaces and reinstate design levels	As required
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and pre-treatment systems for silt accumulation; establish appropriate silt removal frequencies	Half yearly
	Inspect infiltration surfaces for compaction and ponding	Monthly

Table 2 – Operation & maintenance requirements for Infiltration Basins –

Based on CIRIA SuDS Manual 2015

4 Filter Strips

The following Table 3 sets out the recommended maintenance actions and frequency for filter strips.

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Litter and debris removal.	Monthly (or as required)
	Cut the grass - to retain grass height within specified design range	Monthly during growing season, or as required
	Manage other vegetation and remove nuisance plants	Monthly or as required.
	Inspect filter strip surface to identify evidence of erosion, poor vegetation growth, compaction, ponding, sedimentation and contamination (eg oils)	Monthly, or as required.
	Check flow spreader and filter strip surface for even gradients	Monthly, or as required.
	Inspect gravel flow spreader upstream of filter strip for clogging	Monthly
	Inspect silt accumulation rates and establish appropriate removal frequencies	Monthly
Occasional maintenance	Reseed areas of poor vegetation growth- alter plant types to better suit conditions, if required	As required or if bare soil is exposed over > 10% of the filter strip area.
Remedial actions	Repair erosion or other damage by returfing or reseed	As required.
	Relevel uneven surfaces and reinstate design levels	As required.
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits, and prevent compaction of the soil surface.	As required.
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required.
	Remove and dispose of oils or petrol residues using safe standard practices	As required.

**Table 3 – Operation & maintenance requirements for attenuation pond
(Based on CIRIA SuDS Manual 2015)**

5 CONSTRUCTION STAGE

All recently installed drainage is to be checked at least once weekly via walkover survey during the full period of construction. All excess silts and debris to be removed and disposed of appropriately. Temporary covers to be installed in order to avoid any site debris entering the newly installed chambers, linear channel drains & pipework. Excavated materials should be placed in such a manner that any instability will not result in them directly entering the drainage network.