



**ARCH
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DRAINAGE STRATEGY



QUEENS VIEW, NETLEY



**ARCH
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DRAINAGE STRATEGY

for

QUEENS VIEW
NETLEY

Client:

Eastleigh Borough Council
Eastleigh House
Upper Market Street
Eastleigh SO50 9YN

ISSUE		A	B	C
Issued By	C Hendry	C Hendry	C Hendry	
Date	12.07.2023	04.09.2023	30.11.2023	
Purpose	Information	Information	Information	
Approved By	CH	CH	CH	

Project No. AAL307



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1.0 Executive Summary

Arch Associates Limited have been commissioned by Eastleigh Borough Council to prepare the Foul and Surface Water Drainage Strategy to accompany the planning application at Queens View, Netley. The proposed development includes demolition of the existing structures to make way for a new build residential scheme of 18 apartments.

Foul water is intended to connect to the existing public sewer to the west of the site. Surface water is intended to infiltration into the permeable River Terrace Deposits on site via a combination of permeable paving and buried crate soakaways. All surface water drainage features are designed to cater for the 1 in 100-year storm event plus 45% allowance for climate change.

2.0 The Site

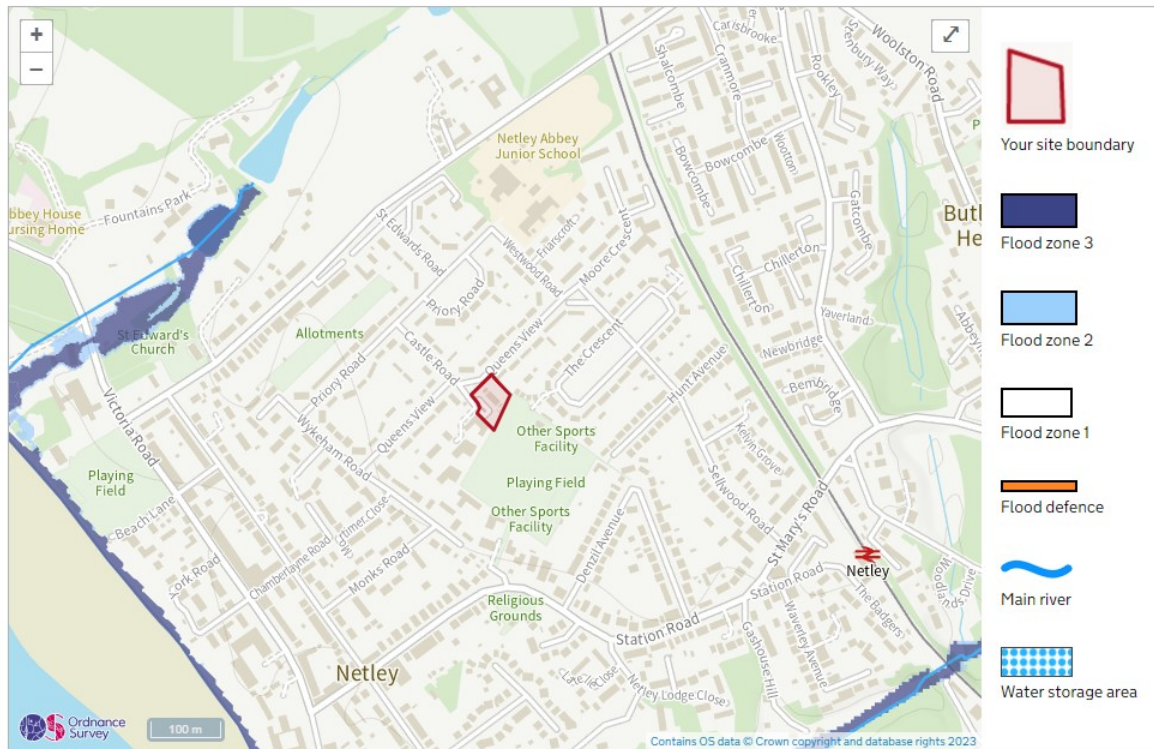
The existing site comprises two semi-detached, two storeyed, brick, mixed use buildings with commercial use on ground floor and flats on the first floor, including garages adjacent to their northern and eastern edge. The site surfacing includes a tarmacadam covered car park and turning circle to the west and south-west, along with concrete flooring present in front of the structures and to the rear of the northern site building. Domestic gardens relating to the flats, mainly grass covered, and a conservatory were noted to the rear of the eastern building. Grassed areas with tarmacadam and gravel paths crossing were noted in the north-west and in the eastern part of the site and a grass patch was spotted in the middle of the turning circle.

Semi mature and mature trees line the eastern and north-eastern fringe of the study area, forming the domestic gardens of the properties. A mature tree is noted in the northern side of the site, next to the lock up garages.

The subject area was sloping down gently to the south-west with a very gentle slope towards The Solent, located ~800m from the site.

The site surroundings include residential properties and recreational ground to the south and east, housing across Queens View Road to the north and west, and commercial developments with associated grounds to the south-west.



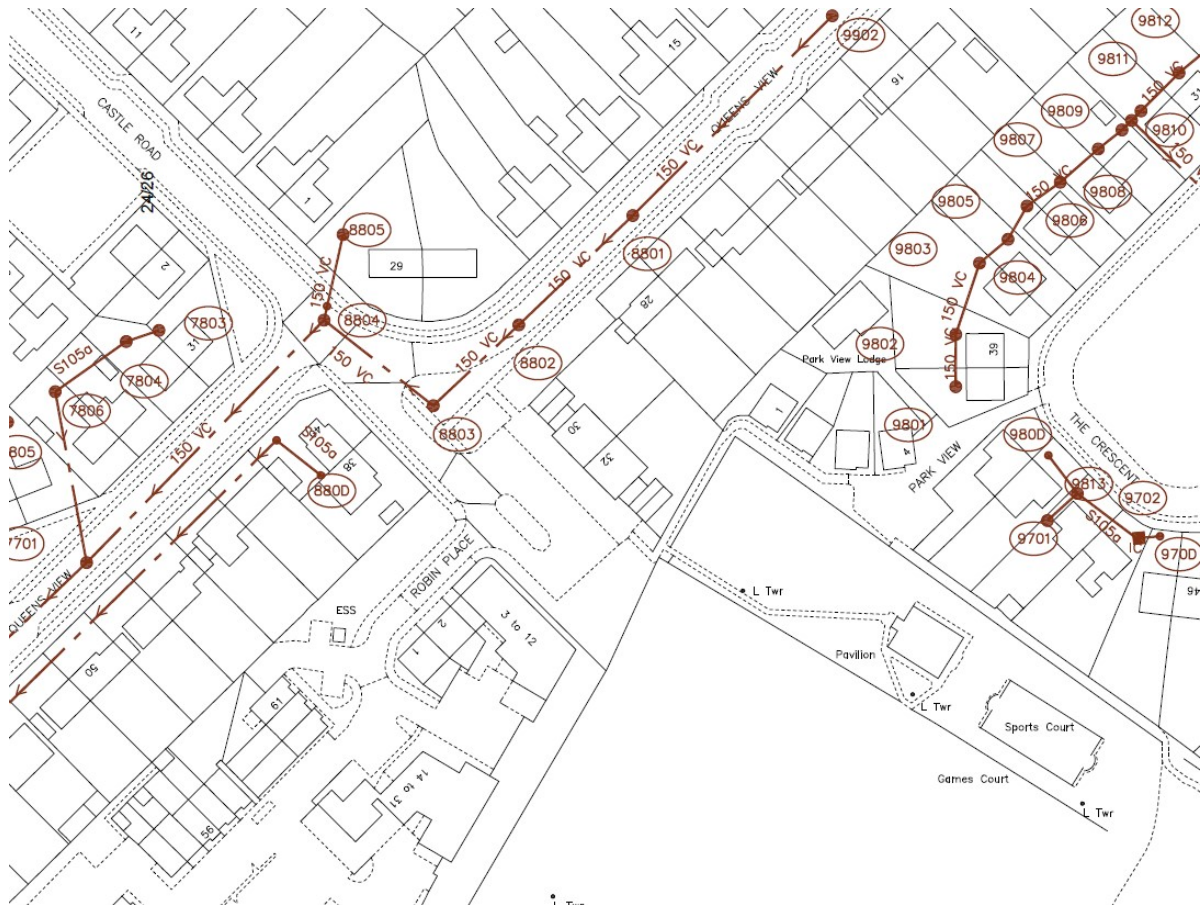


A review of the UK Government's Flood-Warning Information Services mapping online indicates that the site is located within Flood Zone 1, very low risk of flooding. No further flood risk assessment has therefore been completed apart from looking at on-site exceedance routes, which are discussed later in this report.

2.1 Existing Site Topography and Drainage

The site is generally flat with gentle gradient fall from north to south. The topographical survey shows the highest spot level within the site is circa 24.95mAOD in the north, and lowest point of 24.08mAOD in the south. Refer to the topographical survey in Appendix 2.

A review of the Southern Water asset plan confirms that there is an existing public foul sewer running within Queens View, into which we understand the existing structures drain their foul water.



Geology

BGS online mapping indicates the site to be underlain by the Selsey Sand Formation bedrock, with overlying River Terrace Deposits.

A site-specific site investigation was carried out by Soils Limited in May 2023, which confirmed the BGS mapping. The Selsay Sand formation was encountered in WS1 at a depth of 6m below ground level. The River Terrace Deposits were generally found to be of gravelly sandy clay over clayey sandy Gravel.

Groundwater was not encountered during any of the investigations, which was expected in this location given the geology, elevation, and proximity to the coast.

BRE365 infiltration was conducted, and the results ranged from 1.78×10^{-5} m/s to 6.8×10^{-5} m/s.

3.0 Proposed Foul and Surface Water Drainage

3.1 Foul Water

Given the site topography and location of the existing foul sewer, it is proposed to discharge the foul water run-off from the site into the existing 150mm diameter foul main sewer to the west of the site. The proposed foul water drainage strategy has been designed in accordance with the Sewage Sector Guidance and Part H of the Building Regulations. Refer to Appendix 5 – Drainage Strategy Drawings for details.

A section 106 application to connect will need to be made with Southern Water should the scheme be granted planning permission.

The hydraulic design for the discharge rate for the foul wastewater design has been calculated based on a flow rate of 4000l/day per dwelling. Therefore, the discharge rate for the proposed residential development of 18 dwellings equates to a peak foul discharge rate of approximately 0.74 litres/second.

3.2 Surface Water

Consideration has been given to all possible forms of discharge for surface water and in accordance with the hierarchy with the NPPF 2021, which are as follows:

1. Collect surface water runoff for re-use
2. Infiltrate to ground
3. Discharge to a surface water body
4. Discharge to a surface water sewer, highway drain, or another drainage system

5. Discharge to a combined sewer

Collection and re-use of surface water should be considered but is likely to be of small volume in comparison to the proposed development and is therefore not considered as materially contributing to the management of surface water run-off during extreme events.

Infiltration to ground is considered achievable on this scheme due to the presence of permeable granular soils, which will provide adequate capacity for permeable paving and buried soakaway features.

Discharge to a surface water body is not viable at this site due to a lack of surface water bodies in the vicinity. It is also not required due to the viability of infiltration.

Discharge to a surface water sewer, highway drain, or another drainage system is not viable as there are no surface water sewers in the vicinity. It is also not required due to the viability of infiltration.

Based on available information, infiltration to ground is proposed for this development. Run-off from the roof areas and small parking area to the south of the site will be directed into buried crate soakaways, while external hard landscaping will infiltrate to ground via the use of permeable paving and porous subbase.

In accordance with Table 25.2 of the SuDS Manual, a factor of safety of 3 has been utilised in calculation of the subbase depth due to the area being drained being over 1000m² and the risk of damage being a minor inconvenience.



The crate soakaways and permeable paving have been designed in MicroDrainage and an infiltration rate of 1.78×10^{-5} m/s (0.064m/hr) has been used.

SuDS Treatment Train Components

Based on the guidance in CIRIA C753, the following analysis has been undertaken with the relative mitigation indices for the proposed levels of treatment taken from CIRIA C753 Tables 26.3 (surface waters) and Table 26.4. The resultant assessment is summarised within the Table below.

Element	Pollution Hazard Indices			
	Pollution Hazard Level	Total Suspended Solids	Metals	Hydrocarbons
Residential Parking	Low	0.5	0.4	0.4
	Pollution Mitigation Indices			
Permeable Pavign		0.7	0.6	0.7
Total		0.7	0.6	0.7
Sufficiency		Sufficient	Sufficient	Sufficient

4.0 Maintenance of SUDS features:

General Maintenance

In addition to the maintenance of specific SuDS features, such as soakaways, the following table outlines general maintenance requirements of the surface water system.

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Remove sediment & debris from pre-treatment devices & floor of inspection chambers	Annually
	Cleaning of any gutters & any filters on downpipes	Annually
	Trimming and roots that may be causing blockages	Annually (or as required)
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually

Permeable Block Paving

Permeable surfaces including permeable block paving, porous asphalt, gravel or free draining soils that allow rain to percolate through the surface into underlying drainage layers. They must be protected from silt, sand, compost, mulch, etc. Permeable block paving and porous asphalt can be cleaned by suction brushing.

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Twice a year, once after autumn leaf fall, and the second in spring – pay particular attention to areas



		where water runs onto pervious surface from adjacent impermeable areas as this is most likely to collect sediment.
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, though vegetation maintenance or soil slip, has been raised to within 50mm of the level of paving.	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace any lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	
	Inspect for evidence of poor operation and/or weed growth – if required take	Three-monthly, 48 h after large storms in first six months



	remedial action	
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Soakaways

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection chamber	Annually
Occasional Maintenance	Remove sediment and debris from pre-treatment components and floor of inspection chamber	As required based on inspection
Remedial Actions	Reconstruct soakaway if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway).	As required
Monitoring	Inspect silt traps and note rate of sedimentation	Monthly in first year, then annually
	Check soakaways to ensure emptying is occurring	Annually

Foul Drainage Maintenance

The foul drainage system has been designed in accordance with the relevant codes of practice and should achieve self-cleansing velocity with the anticipated foul water flows. Maintenance of the system should therefore be minimal, but blockages may occur with improper use, such as inappropriate objects being flushed down toilets, in which case rodding or jetting may be required. This work should be carried out on an ad hoc basis by a specialist contractor.

SuDS Maintenance Responsibility

The maintenance of the SuDS features, and drainage generally, will be funded by the charity. The management company will formally appoint a drainage company (under a service agreement) to inspect and maintain the pumping station apparatus at the required frequency.

5.0 Exceedance Flow Routes

Exceedance flow routes may be caused by a flow rate higher than the design storm event, or potentially a blockage in the system. Consideration must therefore be given to the routes of overland exceedance flow routes.

Given the topography of the site, exceedance flows would naturally flow downhill towards the southern boundary, at which point it will discharge onto Castle Road. Refer to Appendix 5.

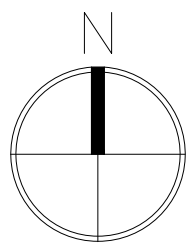




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Appendix 1

Proposed Masterplan



- Notes
1. This drawing is the copyright of MH Architects Ltd
 2. Do not scale this drawing except for Local Authority planning purposes
 3. All dimensions must be checked on site by the contractor prior to commencement of the works.

Client Approval					
X	A	-	Approved		
X	B	-	Approved with comments		
X	C	-	Do not use		
Rev.	Revision Note/Purpose of Issue	Drw By	Date	Chk By	Date

- site boundary
- proposed trees
- existing trees
- existing trees removed
- existing building footprint
- access points to homes
- block paving - shared surface
- paving - footpaths
- tarmac
- public landscape
- private landscape
- boundary landscape

Eastleigh Borough Council
Queens View
Netley Abbey
Residential proposals

Drawing title
Site plan

Drawn	Date	Checked	Date	Scale at A1
JDM	12/06/23	HJS	13/06/23	1:200
Job No.	Pro.	Org.	Zone	Level
19-067	EBC	MHA	XX	XX
Purpose of Issue	Type	Role	No.	Rev.
	DR	AR	0019	A03

PLANNING

Ground Floor | Bicentennial Building
Southern Gate | Chichester
West Sussex | PO19 8EZ

t: 01243 774748
e: admin@mharchitects.co.uk
www.mharchitects.co.uk

Limited Company
Registered in England No. 0994213

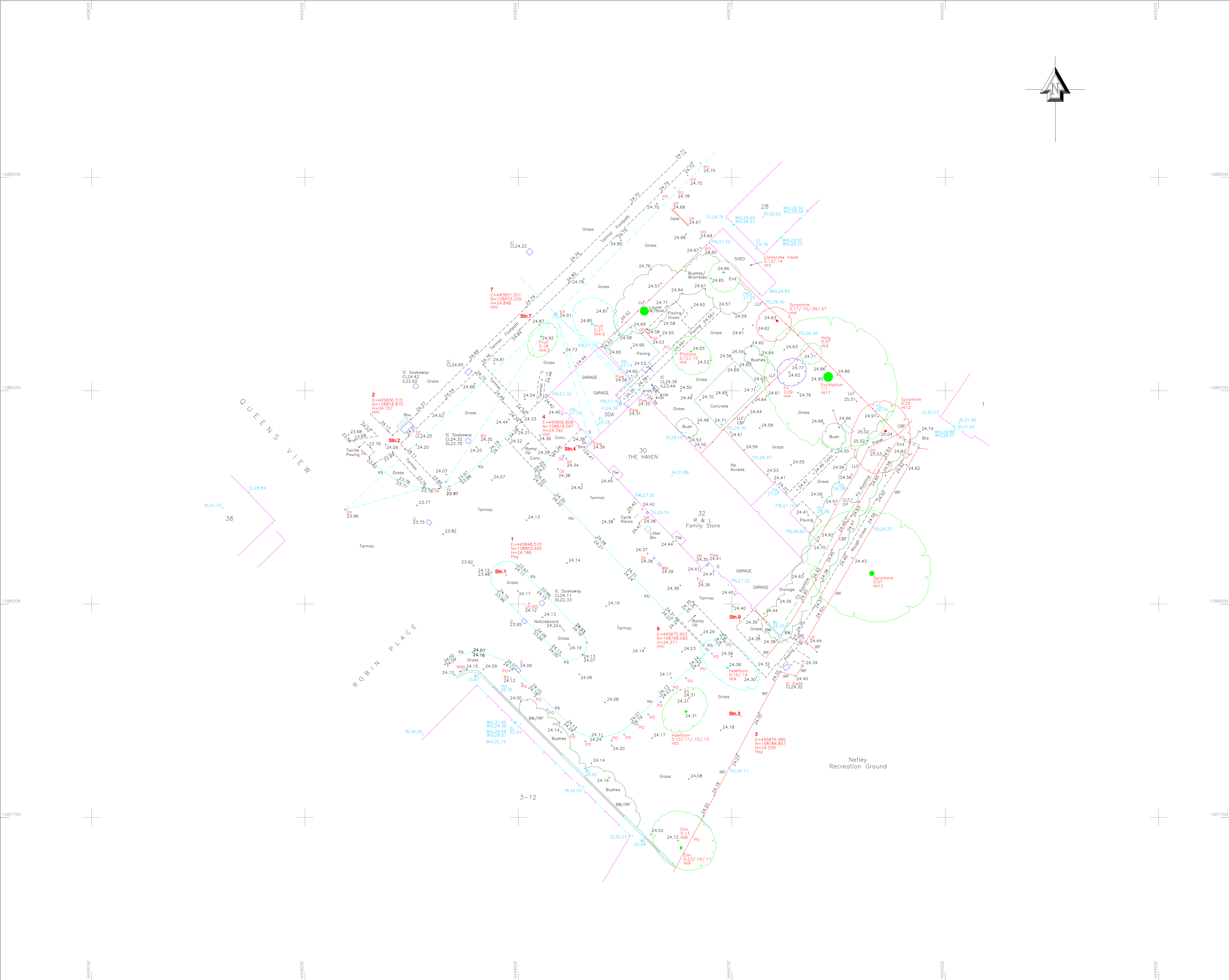




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Appendix 2

Topographical Survey



NOTES

DO NOT SCALE FROM DRAWING

ALL DIMENSIONS TO BE CHECKED ON SITE

NOTES:

ALL MEASUREMENTS ARE TAKEN TO EXISTING

SURFACE FINISHES UNLESS STATED OTHERWISE

ALL HEIGHTS ARE IN M

ALL ARROWS POINT UP

ALL LEVELS IN METRES AND RELATE TO

GPS CONTROL (00)

Legend

AV	Air Valve	L/Bin	Litter Bin
BEB	Bellish Beacon	LB	Lamp Post
BH	Borehole	LP	Lamp Post
BL	Bed Level	M/Bole	Multiple Bole
BO	Bolt	Mem	Memorial
BRS	Brick Setts	MR	Marker
BS	Bus Stop	MS	Milestone
CATV	Cable TV Cover	NB	Notice Board
CB	Control Box	OHC	Overhead Cable
CCTV	Surveillance Camera	OSBM	Bench Mark
CL	Channel	Pav	Paving
CL	Cover Level	PI	Pillar
Cob	Cobbles	PM	Parking Meter
Col	Column	PO	Post
Conc	Concrete	PWL	Parapet Wall Level
Cul	Culvert	RE	Rodding Eye
Cyc	Cycle Rack	RG	Rough Ground
DA	Drop Away	RL	Ridge Level
Dk	Drop Kerb	RL	Road Line
DR	Drain	RN	Road Nail
DP	Down Pipe	RNB	Road Name Board
EL	Eave Level	RP	Reflector Post
EIC	Electricity IC	RS	Road Sign
EP	Electricity Pole	RWP	Rain Water Pipe
ER	Earth Rod	Sap	Sapling
FB	Flower Bed	Shr	Shrub
Fd	Foundations	SL	Sump Level
FEL	Fence Level	Spok	Spok
FH	Fire Hydrant	ST	Step
FL	Floor Level	STW	Stay Wire
FP	Flag Pole	SV	Stop Valve
FLT	Floodlights	TacP	Tactile Paving
FRL	Flat Roof Level	TGB	Telephone Call Box
G	Gully	THL	Threshold Level
Gh	Grass House	TIC	Telecom IC
GP	Gate Post	TK	Tank
GV	Gas Valve	Tm	Ticket Machine
HL	Hedge Level	TL	Traffic Light
Ht	Height	Tm	Tarmac
IC	Inspection Cover	TP	Telegraph Pole
IL	Invert Level	Tr	Tree
IRV	Irrigation Valve	UTL	Unable To Lift
JB	Junction Box	VP	Vent Pipe
Kb	Kerb	WL	Wall Level
KO	Kerb Outlet	WM	Water Meter
ø	Diameter	WtrL	Water Level

Boundary Descriptions			
Fence Details			
Barrier	Int.F	Interwoven	
Barbed Wire	LLF	Larch Lap	
Close Board	P	Post	
Concrete Fence	PCF	Post & Chain	
Corrugated Iron	PCF	Post & Roll	
Chain Link	PWF	Post & Wire	
Chestnut Paling	PWF	Post & Wire Mesh	
Iron Railings	W	Wall	
Wall Details			
Brick and Flint Wall	Drainage Survey Bench Mark	↑	DSBM
Brick Wall	Temporary Bench Mark	↑	TBM
Concrete Wall	Borehole	⬇	
Flint Wall			
Retaining Wall			
Sloping Masonry			
Wall			

All underground service information should be checked prior to any works taking place. The type, size and route of all drainage has been ascertained by visual inspection only.
An arboriculturist must be contacted to verify tree species and descriptions if necessary.

DATE	REVISIONS

HAMPSHIRE LAND SURVEYS LTD
Land, Building and Engineering Surveys

Mobile 07563 677394
E-Mail hamps@aol.com
www.hlsld.co.uk

CLIENT
Estleigh Borough Council
Estleigh House
Upper Market Street
Estleigh
Hampshire SO50 9YN

PROJECT No. HLS 2297

TITLE
30-32 QUEENS VIEW
NETLEY
Site Survey Existing

SCALE 1:200
DATE JUNE 2022
DRAWN KLB
CHECKED DB

DRG No. 2297_22_06_01
REV. -



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Appendix 3

Southern Water Sewer Plan

108960



445630

446101

SEWER RECORDS PAGE 2 OF 2

[illegible]

LINE STYLES / COLOURS		MATERIALS		LEGEND - SEWERS	
Brown	— Foul	AK Asphaltene	Manhole (SV)	Washed (FAC)	Other (S)
	— Foul/Sewer Sewer	BAC Bonded Asbestos Cement (BSC, Risk Common)	Manhole (FAC)	Washed (FAC)	Other (S)
	— Foul/Vacuum Main	BRK Brick (Engineering)	Lamp hole (SV)	Rodding Eye (SV)	Change in sewer (S)
	— Foul/Rising Main	CC Concrete Culvert	Lamp hole (FAC)	Long eye (SV)	Change in sewer (S)
	— Combined	CC Cast Iron	Pumping Station (SV)	Gauging point (FAC)	Roll-off valve
Red	— Combined	CC Concrete (H-20)	Pumping Station (FAC)	Gauging point (SV)	Flap in sewer
	— Combined Sewer Sewer	CC Concrete (H-20)	Sticky entry manhole (SV)	Inspect chamber (FAC)	Gate
	— Combined Rising Main	CSA Concrete Sinterings (polished)	Sticky entry manhole (FAC)	Inspect chamber (FAC)	Gate
	— Lateral Duct	CS Concrete Sinterings (dotted)	Blind shaft (SV)	Storm Tank (SV)	Storm Tank (SV)
Orange	— Building Over Agreement Area	DU Ductile Iron	Blind shaft (FAC)	Storm Tank (FAC)	Storm Tank (FAC)
	— Trench Effluent	GRG Glass Reinforced Concrete	Open Manhole (SV)	Storm Tank (SV)	Storm Tank (SV)
	— Trench Effluent	GRG Glass Reinforced Concrete	Open Manhole (FAC)	Storm Tank (FAC)	Storm Tank (FAC)
	— Trench Effluent	GRG Glass Reinforced Concrete	Open Manhole (FAC)	Storm Tank (FAC)	Storm Tank (FAC)
Dark Blue	— Trench Effluent	MAC Macrolyte in Reinforced Asbestos	Open Manhole (SV)	Storm Tank (SV)	Storm Tank (SV)
	— Trench Effluent	MAC Macrolyte in Reinforced Asbestos	Open Manhole (FAC)	Storm Tank (FAC)	Storm Tank (FAC)
	— Trench Effluent	MAC Macrolyte in Reinforced Asbestos	Open Manhole (FAC)	Storm Tank (FAC)	Storm Tank (FAC)
	— Trench Effluent	MAC Macrolyte in Reinforced Asbestos	Open Manhole (FAC)	Storm Tank (FAC)	Storm Tank (FAC)
Purple	— Sewer Catchment	PL Polyethylene	Open Manhole (SV)	Storm Tank (SV)	Storm Tank (SV)
	— Section 104 Area	PL Polyethylene	Open Manhole (FAC)	Storm Tank (FAC)	Storm Tank (FAC)
	— Section 104 Area	PL Polyethylene	Open Manhole (FAC)	Storm Tank (FAC)	Storm Tank (FAC)
	— Section 104 Area	PL Polyethylene	Open Manhole (FAC)	Storm Tank (FAC)	Storm Tank (FAC)
Light Blue	— Surface Water	PVC Polyethylene Chloride	Open Manhole (SV)	Storm Tank (SV)	Storm Tank (SV)
	— Surface Water Rising Main	PVC Polyethylene Chloride	Open Manhole (FAC)	Storm Tank (FAC)	Storm Tank (FAC)
	— Surface Water Rising Main	PVC Polyethylene Chloride	Open Manhole (FAC)	Storm Tank (FAC)	Storm Tank (FAC)
	— Surface Water Rising Main	PVC Polyethylene Chloride	Open Manhole (FAC)	Storm Tank (FAC)	Storm Tank (FAC)
Yellow	— Private	SH Steel	Open Manhole (SV)	Storm Tank (SV)	Storm Tank (SV)
	— Access Shaft	SH Steel	Open Manhole (FAC)	Storm Tank (FAC)	Storm Tank (FAC)
	— Access Shaft	SH Steel	Open Manhole (FAC)	Storm Tank (FAC)	Storm Tank (FAC)
	— Access Shaft	SH Steel	Open Manhole (FAC)	Storm Tank (FAC)	Storm Tank (FAC)
Green	— Decommissioned	SH Steel	Open Manhole (SV)	Storm Tank (SV)	Storm Tank (SV)
	— Decommissioned	SH Steel	Open Manhole (FAC)	Storm Tank (FAC)	Storm Tank (FAC)
	— Decommissioned	SH Steel	Open Manhole (FAC)	Storm Tank (FAC)	Storm Tank (FAC)
	— Decommissioned	SH Steel	Open Manhole (FAC)	Storm Tank (FAC)	Storm Tank (FAC)

Drawn by: KumariM

Title: 30 Queens View

Date: 02/11/2021



SHAPES (S)			
A	Arch	R	Rectangular
B	Belt	S	Square
C	Circular	T	Trapezoidal
E	Egg	U	U Shape
H	Horseshoe	X	Other

NODE REFERENCING SYSTEM			
1st digit:	hundred metre easting identifier		
2nd digit:	hundred metre northing identifier		
3rd digit:	sewer type identifier		
	0-4 = Foul/Combined		
	5-6 = Surface Water		
4th digit:	next sequential node		



Appendix 4

Extracts of Site Investigation



Main Investigation Report

at

30-32 Queens View, Netley, Southampton, Hampshire SO31 5EA

for

Eastleigh Borough Council

Reference: 20870/MIR

June 2023

Control Document

Project

30-32 Queens View, Netley, Southampton, Hampshire SO31 5EA

Document Type

Main Investigation Report (MIR)

Document Reference

20870/MIR

Document Status

Final

Date

June 2023

Prepared by

Olia Kontogianni BSc, MSEng

(ok@soilslimited.co.uk)



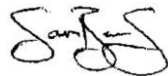
First check by

Eur Ing R B Higginson BSc, PGDip, CEng, MICE, FGS.



Second check by

S J Bevins BSc.(Hons) MSc. CEng CEnv MIMMM FGS MCorIE RoGEP



This is not a valid document for use in the design of the project unless it is titled Final in the document status box.

Current regulations and good practice were used in the preparation of this report. The recommendations given in this report must be reviewed by an appropriately qualified person at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.



Commission

This document comprises the Main Investigation Report (MIR) and incorporates the results, discussion, and conclusions to this intrusive works. General site data is recorded below:

Commission Record	
Client	Eastleigh Borough Council
Site Name	30-32 Queens View, Netley, Southampton, Hampshire SO31 5EA
Grid Reference	SU 458 088
Soils Limited Quotation Ref	Q27498rev102, dated 16 th March 2023
Clients Purchase Order	000337277, dated 6 th April 2023

Documents associated with this development that must be referred to are given below.

Record Of Associated Documents			
Reference	Type	Date	Creator
LP3177/DS/1	Phase I Desk Study and Site Reconnaissance	4 th January 2023	Leap Environmental Ltd

Limitations and Disclaimers

The report was prepared solely for the brief described in Section 1.1 of this report.

The contents, recommendations and advice given in the report are subject to the Terms and Conditions given in Soils Limited's Quotation

Soils Limited disclaims any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report has been prepared by Soils Limited, with all reasonable skill, care and diligence within the terms of the Contract with the Client, incorporation of our General Conditions of Contract of Business and taking into account the resources devoted to us by agreement with the Client.

The report is personal and confidential to the Client and Soils Limited accept no responsibility of whatever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report wholly at its own risk.

The Client may not assign the benefit of the report or any part to any third party without the written consent of Soils Limited.

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the Client in accordance with their brief. As such these do not necessarily address all aspects of ground behaviour at the site.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

If the term "competent person" is used in this report or any Soils Limited document, it means an engineering geologist or civil engineer with a minimum of three years post graduate experience in the understanding and application of the appropriate codes of practice.

Unless the site investigation works have been designed and specified in accordance with EC7, this report is a Geotechnical Investigation Report and is not necessarily a Ground Investigation Report as defined by EC7 (Eurocode 7 Part 1, §3.4, Part 2, §6.1) or a Geotechnical Design Report (Eurocode 7 Part 1, §2.8) as defined by Eurocode 7 and as such may not characterise the ground conditions and additional works may be required to comply with the requirements of EC7.

Within the report reference to ground level relates to the site level at the time of the investigation, unless otherwise stated.

Exploratory hole is a generic term used to describe a method of direct investigation. The term exploratory pit, borehole or window sample borehole implies the specific technique used to produce an exploratory hole.

The depth to roots and/or of desiccation may vary from that found during the investigation. The Client is responsible for establishing the depth to roots and/or of desiccation on a plot by plot basis prior to the construction of foundations. Supplied site surveys may not include substantial shrubs or bushes and is also unlikely to have data on any trees, bushes or shrubs removed prior to or following the site survey.

Where trees are mentioned in the text this means existing trees, substantial bushes or shrubs, recently removed trees (approximately 20 years to full recovery on cohesive soils) and those planned as part of the site landscaping).

The geotechnical laboratory testing was performed by GEO Site & Testing Services Ltd (GSTL) in accordance with the methods given in BS 1377:1990 Parts 1 to 8 and their UKAS accredited test methods.

For the preparation of this report, the relevant BS code of practice were adopted for the geotechnical laboratory testing technical specifications, in the absence of the relevant Eurocode specifications (ref: ISO TS 17892).

The chemical analyses were undertaken by Derwentside Environmental Testing Services (DETS) in accordance with their UKAS and MCERTS accredited test methods or their documented in-house testing procedures. This investigation did not comprise an environmental audit of the site or its environs.

Ownership of land brings with it onerous legal liabilities in respect of harm to the environment. "Contaminated Land" is defined in Section 57 of the Environment Act 1995 (as updated 2021) as:

"Land which is in such a condition by reason of substances in, on or under the land that significant harm is being caused or that there is a significant possibility of such harm being caused or that pollution of controlled waters is being, or is likely to be caused".

It must be noted that a detailed survey of the possible presence or absence of invasive species, such as Japanese Knotweed, is outside of the scope of investigation.

Deleterious materials may be present in any Made Ground that pose a potential risk to site workers, end users and adjacent vulnerable receptors. These could include a range of contaminants, including asbestos, especially if the material includes large fractions of demolition derived materials.

The investigation, analysis or recommendations in respect of contamination are made solely in respect of the prevention of harm to vulnerable receptors, using where possible

best practice at the date of preparation of the report. The investigation and report do not address, define or make recommendations in respect of environmental liabilities. A separate environmental audit and liaison with statutory authorities is required to address these issues.

All environmental works are undertaken in the context of, and in compliance with, BS10175+A2 2017 and LCRM (EA 2021) and all other pertinent planning, standards, documentation and guidance appropriate to the site at the time of production which may include, but are not necessarily limited to, documents provided by BS/CEN/ISO, NHBC, AGS, CIEH, CIRIA, SoBRA and CLAIRE.

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Section I Introduction

I.1 Objective of Investigation

The Client commissioned Soils Limited to undertake an intrusive ground investigation and to prepare a Main Investigation Report to supply the Client and their designers with information regarding ground conditions, to assist in preparing a foundation scheme for development that was appropriate to the settings present on the site.

The investigation was to be undertaken to provide comment on appropriate foundation options for the proposed development. The investigation was to be made by means of in-situ testing and geotechnical laboratory testing undertaken on soil samples taken from the exploratory holes.

No Preliminary Investigation Report was undertaken by Soils Limited for the site that would allow a Conceptual Site Model (CSM) to be produced and potential contamination risks to be identified and assessed. To assist in delineating the scope of works described above, reliance was also placed on the Phase I Desk Study and Site Reconnaissance, ref.: LP3177/DS/1, dated January 2023, which was supplied to Soils Limited by the client.

Following liaison and agreement with the Client and as recommended in the above report:

- Two (2No.) standpipe monitoring wells were installed within the boreholes, to allow groundwater/ground-gas monitoring on three (3No.) occasions.
- Soil samples were to be taken for chemical laboratory testing to enable recommendations for the safe redevelopment of the site and the protection of site workers, end-users and the public from any contamination identified.

I.2 Site Description

The site of the proposed development comprised two semi-detached, two storeyed, brick, mixed use buildings with commercial use on ground floor and flats on the first floor, including garages adjacent to their northern and eastern edge.

The site surfacing included a tarmacadam covered car park and turning circle to the west and south-west, along with concrete flooring present in front of the structures and to the rear of the northern site building. Domestic gardens relating to the flats, mainly grass covered, and a conservatory were noted to the rear of the eastern building. Grassed areas with tarmacadam and gravel paths crossing were noted in the north-west and in the eastern part of the site and a grass patch was spotted in the middle of the turning circle.

Semi mature and mature trees were lining the eastern and north-eastern fringe of the study area, forming the domestic gardens of the properties. A mature tree was noted in the northern side of the site, next to the lock up garages and few scattered mature trees

were in the south-eastern side of the site within the grass covered area together with some shrubbery along the south-western boundary.

The subject area was sloping down gently to the south-west with a slope of $\sim 2^\circ$, towards 'The Solent' located $\sim 800\text{m}$ from the site.

The site surroundings included residential properties and recreational ground to the south and east, housing across 'Queens View Road' to the north and west and commercial developments with associated grounds to the south-west.

The location plan is given in Figure 1. An aerial photograph of the site and its close environs has been included in Figure 2.

1.3 Proposed Development

The proposals for the site comprised demolition of the existing structures to erect a three-storey building consisting of 20 No. residential flats. The proposed development was to include hard landscaping in the form of car park spaces and a parking court, footpaths and a bin storage area. Soft landscaping was to be included in the form of private gardens mainly to the rear of the flats along with low maintenance soft landscaped areas predominantly on the perimeter of the site and within the car park area to the front.

In compiling this report reliance was placed on drawing No.: 0019 Rev. P05, dated 8th August 2022 by MH Architects. The recommendations provided within this report are made exclusively in relation to the scheme outlined above and must not be applied to any other scheme without further consultation with Soils Limited. Soils Limited must be notified about any change or deviation from the scheme outlined.

Development plans provided by the Client are presented in Appendix F.

1.4 Anticipated Geology

The 1:50,000 BGS Geology map showed the site to be underlain by the Selsey Sand Formation bedrock, with overlying River Terrace Deposits.

1.4.1 River Terrace Deposits

The rivers Test and Itchen have deposited extensive spreads of River Terrace Deposits in the Southampton area, representative of ancient floodplains. In total, eleven terraces have been recorded. The River Terrace Deposits consist predominantly of gravels made up of subangular to rounded flints with a significant sand component locally with lenses of silt, clay or peat.

The five highest terraces have appreciable clay content. Poorly sorted, clayey and sandy silts and silty clays overlie the 1st, 3rd, 5th and 6th terraces and locally at above terrace gravel.

I.4.2 Selsey Sand Formation

Silty sand, silty clay and sandy clayey silt, glauconitic, bioturbated, locally calcareous.

Rests on the Marsh Farm Formation at a sharp contact on a burrowed surface overlain by glauconitic sandy silt with a few pebbles. Overlain by Barton Clay Formation.

Boundary based a distinction of sand content from fine- to very fine-grained sandstone of the Tellina Bed (topmost Selsey Formation) to the olive grey glauconitic sandy clays of the Barton Clay Formation.

Section 2 Site Works

2.1 Proposed Project Works

The proposed intrusive investigation was designed to provide information on the ground conditions and to aid the design of foundations for the proposed residential development. The intended investigation, as outlined within the Soils Limited quotation (Q27498rev102, dated 16th March 2023), was to comprise the following items:

- Service clearance of proposed test hole locations
- 4No. window sample boreholes and dynamic probes (DPSH) up to a depth of 4.00m bgl
- Installation of wells in two (2No.) of the boreholes, to allow groundwater/ground-gas monitoring on three (3No.) occasions, following liaison and agreement with the Client
- 2No. machine excavated trial pits to allow infiltration testing in accordance with BRE365
- Geotechnical laboratory testing
- Chemical laboratory analysis

2.1.1 Actual Project Works

The actual project works were undertaken on 9th, 10th and 15th May 2023, with subsequent sample logging, laboratory testing, monitoring, and reporting. The actual works comprised:

- Service clearance of proposed test hole locations
- 4No. window sample boreholes to a maximum depth of 3.00m bgl (WS1 to WS4)
- 4No. dynamic probes (DPSH) to a maximum depth of 6.00m bgl (DP1 to DP4), adjacent and prior to the drilling of the relevant window sample boreholes
- Installation of wells in two (2No.) of the boreholes (WS1 and WS4), to allow groundwater/ground-gas monitoring on three (3No.) occasions
- 3No. machine excavated trial pits (TPSK1, TPSK2 and TPSK2b) to 1.20m, 2.50m and 1.50m bgl respectively, to allow infiltration testing in accordance with BRE365
- Geotechnical laboratory testing
- Chemical laboratory analysis

Two window sample boreholes (WS1 and WS4) were backfilled with gravel and bentonite following the installation of monitoring wells; the remaining boreholes were backfilled with gravel; all trial pits (TPSK1, TPSK2 and TPSK2b) were backfilled with arisings and left slightly proud to accommodate future settlement.

The installation details are as follows:

- Ground level to 1.00m in WS1 and to 0.40m bgl in WS4 – plain 50mm pipework/bentonite backfill
- From 1.00m and 0.40m bgl to a depth of 2.70m and 1.40m bgl in WS1 and WS4 respectively, perforated 50mm pipework/gravel backfill with bentonite seal at depth.

The window samples WS2, WS3 and WS4 and dynamic probes DP2, DP3 and DP4, stopped at shallower depths than initially planned, due to the very competent material (dense soils) encountered, through which the equipment could not safely advance. The drilled depth in WS1 was limited to 3.00m bgl, due to the sides of the borehole continuously collapsing below that depth.

Trial pit TPSK1 stopped at a shallower depth than initially planned in order to reduce the risk of the excavator striking the overhead electrical cables running above the exploratory hole location. The depth of TPSK2 was also limited, due to the sides of the trial pit continuously collapsing. TPSK2b was subsequently undertaken at the same location of TPSK2, although at a shallower depth, to examine the infiltration potential of the ground within that depth.

All exploratory hole locations have been presented in Figure 3.

Following completion of site works, soil cores were logged and sub sampled so that samples could be sent to the laboratory for both contamination and geotechnical testing.

2.2 Ground Conditions

On 9th May 2023, service clearance of proposed test hole locations was undertaken using a cable avoidance tool (RD8000) to trace low and high voltage electricity cables, BT, security cabling and metal pipes. To detect non-metallic services such as fibre optic, clay drainage, plastic gas, and water services, Ground Penetration Radar (Leica DS2000) was used.

Two trial pits were machine excavated to depths of 1.20m and 2.50m below ground level (bgl) and infiltration testing was undertaken in each of them, in accordance with BRE365, the results of which are presented in Section 3.2.

On 10th May 2023, four (4No.) window sample boreholes were drilled, using a Premier Compact Series 110 rig, to depths ranging between 1.00m and 3.00m bgl.

Four super heavy dynamic probes were driven prior and adjacent to their corresponding window sample borehole to depths ranging between 1.50m and 6.00m bgl.

A standpipe was installed within each of the window sample borehole locations WS1 and WS4, to allow for continued monitoring of both groundwater and ground gas on three (3No.) occasions, following liaison and agreement with the client and as recommended in the Phase I Desk Study and Site Reconnaissance, undertaken for the site by Leap Environmental Ltd (Report ref.: LP3177/DS/1, dated January 2023).

On 12th May 2023, an additional trial pit (TPSK2b) was machine excavated to a depth of 1.20m bgl and infiltration testing was undertaken within it, in accordance with BRE365, the results of which are presented in Section 3.2.

The maximum depths of exploratory holes have been included in Table 2.1.

Table 2.1 Final Depth of Exploratory Holes

Exploratory Hole	Depth (m bgl)	Exploratory Hole	Depth (m bgl)
WS1 ^w	3.00 ¹	DP1	6.00
WS2	1.00 ²	DP2	1.50 ²
WS3	1.50 ²	DP3	1.70 ²
WS4 ^w	1.50 ²	DP4	1.80 ²
TPSK1	1.20 ²		
TPSK2	2.50 ²		
TPSK2b	1.20		

Notes: ¹ Depth limited due to sides of the hole collapsing, ² Depth limited due to dense soils encountered, w - well installation The depths given in this table are taken from the ground level on-site at the time of investigation.

The soil conditions encountered were recorded and soil sampling commensurate with the purposes of the investigation was carried out. The depths given on the exploratory hole logs and quoted in this report were measured from ground level.

The soils encountered from immediately below ground surface have been described in the following manner. Where the soil incorporated an organic content such as either decomposing leaf litter or roots or has been identified as part of the in-situ weathering profile, it has been described as Topsoil both on the logs and within this report. Where man has clearly either placed the soil, or the composition altered, with say greater than an estimated 5% of a non-natural constituent, it has been referred to as Made Ground both on the log and within this report.

For more complete information about the soils encountered within the general area of the site reference must be made to the detailed records given within Appendix B, but for the purposes of discussion, the succession of conditions encountered in the exploratory holes in descending order can be summarised as:

Made Ground (MG)
River Terrace Deposits (RTD)
Selsey Sand Formation (SLSY)

The ground conditions encountered in the exploratory holes are summarised in Table 2.2.

Table 2.2 Ground Conditions

Strata	Depth Encountered (m bgl)		Typical Thickness (m)	Typical Description
	Top	Bottom		
MG	G.L.	0.40 – 0.45	0.40	Firm, dark brown, sandy, gravelly CLAY to sandy, gravelly SILT, with flint, tarmacadam, brick, concrete and clinker. Rare plastic found. Frequent rootlets noted.
RTD	0.40 – 0.45	2.70	2.30	Soft to firm, greyish brown, slightly sandy, very gravelly CLAY. Occasional rootlets noted. Becoming clayey, sandy, fine to coarse flint GRAVEL with depth. Becoming slightly sandy, very gravelly CLAY with depth.
SLSY	2.70	>3.00 ^{1 2}	Not proven ²	Yellowish brown, mottled orange, slightly clayey SILT.

Note(s): ¹ Final depth of exploratory hole. ² Base of strata not encountered. The depths given in this table are taken from the ground level on-site at the time of investigation. G.L. – Ground Level

It must be noted that the Selsey Sand Formation bedrock was only encountered within WS1, therefore the full depth of the River Terrace Deposits could not be established within the remaining three window sample borehole locations, which were terminated within the superficial stratum.

2.3 Ground Conditions Encountered in Exploratory Holes

The ground conditions encountered in exploratory holes have been described below in descending order. The engineering logs are presented in Appendix B.1.

2.3.1 Made Ground

Soils described as Made Ground were encountered in all four window samples and all three trial pits from ground level to depths ranging between 0.40m and 0.45m bgl.

The Made Ground typically comprised firm, dark brown, slightly sandy, gravelly CLAY to slightly sandy, slightly gravelly SILT, becoming gravelly with depth. Gravel was angular to rounded, fine to coarse flint, tarmacadam, brick, concrete and clinker. Rare plastic was found. Frequent rootlets were noted. Odour of manure was identified in WS1. Odour of chlorinated solvents was noted in WS2, and very faint soapy/floral odour was noted in WS3.

The established depth of Made Ground found at each exploratory hole location has been included in Table 2.3.

Table 2.3 Established Depth of Made Ground

Exploratory Hole	Depth (m bgl)	Exploratory Hole	Depth (m bgl)
WS1	0.40	TPSK1	0.40
WS2	0.40	TPSK2	0.40
WS3	0.40	TPSK2b	0.40
WS4	0.45		

2.3.2 River Terrace Deposits

The superficial River Terrace Deposits were encountered directly below the Made Ground in all window sample boreholes (WS1 to WS4) and inferred within their corresponding dynamic probes (DP1 to DP4) and within all exploratory pits (TPSK1, TPSK2, TPSK2b), to depths ranging from 1.00m bgl (WS2) and 2.70m bgl. However, all exploratory holes except from the location of WS/DP1 were terminated within the soils of the River Terrace Deposits, so the full depth of the stratum could not be established in these locations.

The soils typically comprised soft to firm, greyish brown, slightly sandy, very gravelly CLAY. Gravel was angular to sub angular, fine to coarse flint. Occasional rootlets were noted. Becoming yellowish to orangish brown, clayey, sandy, fine to coarse flint GRAVEL with depth. Becoming yellowish brown and orangish brown mottled, slightly sandy, very gravelly CLAY with depth. Distinct floral soapy/solvent odour was noted from 2.00m bgl in WS1.

The established depth of River Terrace Deposits found at each exploratory hole location has been included in Table 2.4.

Table 2.4 Established Depth of River Terrace Deposits

Exploratory Hole	Depth (m bgl)	Probe Hole	Depth (m bgl)
WS1	2.70	DP1	2.70 ²
WS2	1.00 ¹	DP2	1.50 ^{1 2}
WS3	1.50 ¹	DP3	1.70 ^{1 2}
WS4	1.50 ¹	DP4	1.80 ^{1 2}
TPSK1	1.20 ¹		
TPSK2	2.50 ¹		
TPSK2b	1.20 ¹		

Note: ¹ Final depth of exploratory hole. ² Inferred from dynamic probes.

2.3.3 Selsey Sand Formation

The Selsey Sand Formation bedrock was only encountered in the location of WS1 and inferred within its corresponding dynamic probe (DP1), directly below the River Terrace Deposits to the final investigatory depth of 6.00m bgl.

The stratum comprised yellowish brown, mottled orange, slightly clayey SILT. Rare clay laminations were encountered at base.

The established depth of the Selsey Sand Formation found at each exploratory hole location has been included in Table 2.5.

Table 2.5 Established Depth of Selsey Sand Formation

Exploratory Hole	Depth (m bgl)	Probe Hole	Depth (m bgl)
WS1	3.00 ¹	DPI	6.00 ^{1, 2}
WS2	N/E	DP2	N/E
WS3	N/E	DP3	N/E
WS4	N/E	DP4	N/E
TPSK1	N/E		
TPSK2	N/E		
TPSK2b	N/E		

Note: ¹ Final depth of exploratory hole. ² Inferred from dynamic probes. N/E = Not encountered

2.4 Roots

Roots were encountered in all window sample boreholes and trial pits to depths ranging between 0.40m and 0.90m bgl. The established depth of root penetration found at the exploratory hole locations has been included in Table 2.6.

Table 2.6 Established Depth of Root Penetration

Exploratory Hole	Depth (m bgl)
WS1	0.65
WS2	0.65
WS3	0.80
WS4	0.90
TPSK1	0.40
TPSK2	0.50
TPSK2b	0.50

Roots may be found to greater depth at other locations on the site particularly close to trees and/or trees that have been removed both within the site and its close environs.

Semi mature and mature trees were lining the eastern and north-eastern fringe of the study area, forming the domestic gardens of the properties. A mature tree was noted in the northern side of the site, next to the lock up garages and few scattered mature trees were in the south-eastern side of the site within the gras covered area together with some shrubbery along the south-western boundary. A search on Google Earth of an aerial photograph of the site and its environs dated 1999 (earliest available aerial photograph), showed the south-eastern site boundary as being covered by mature trees.

It must be emphasised that the probability of determining the maximum depth of roots from a narrow diameter borehole is low. A direct observation such as from within an exploratory pit is necessary to gain a better indication of the maximum root depth.

2.5 Groundwater

Groundwater was not encountered in any of the exploratory hole locations at the time of the investigation. This could potentially be attributed to the depth of all exploratory holes being limited.

Wells were installed in two (2No.) window sample boreholes (WS1 and WS4) to allow for combined groundwater/soil-gas monitoring on three (3No.) occasions, following instructions from the Client.

Groundwater records taken during the intrusive investigation and during the groundwater/soil-gas monitoring to date, are shown in Table 2.7.

Table 2.7 Groundwater Records and Monitoring Data

Exploratory Hole	Well Depth (m bgl)	Depth to Water (m bgl)			
		10.05.23 ¹	16.05.23 ²	26.05.23 ²	14.06.23 ²
WS1	2.70	N/E	N/E	N/E	N/E
WS4	1.40	N/E	N/E	N/E	N/E

Note: ¹ Reading taken during drilling. ² Reading taken during monitoring N/E = Not encountered

Changes in groundwater level occur for reasons including seasonal effects, rainfall events and variations in drainage.

The investigation and groundwater monitoring were conducted in May 2023, when groundwater levels should be falling from their annual maximum (highest) elevation, which typically occurs around March to the annual minimum (lowest) which typically occurs around September.

Section 3 Geotechnical In-Situ and Laboratory Testing

3.1 Dynamic Probe Tests

The results were converted to equivalent SPT “N₆₀” values based on dynamic energy using commercial computer software (Geostru). The results were then interpreted based on the classifications outlined in Appendix C.1, Table C.1.1 and C.1.2.

Table 3.1 SPT Hammer Efficiency

Rig Reference	Energy Ratio Er (%)
Premier 4	89.93

Table 3.2 Inferred SPT Interpretation

Strata	Depth Range (m bgl)	Inferred N ₆₀ Range	Cohesive Soils	
			Cohesive Strength	Inferred Cohesion
River Terrace Deposits	0.40 – 2.70	4 - 59	Very low to Very high	Cu=20 – 295kPa
Selsey Sand Formation	2.70 – >6.00 ¹	12 - 30	Medium to Very High	Cu=60 – 150kPa
Strata	Depth Range (m bgl)	Inferred N ₆₀ Range	Granular Soils	
			Relative Density	
River Terrace Deposits	0.40 – 1.50	8 - >50	Loose to Very dense	

Note(s): SPT “N₆₀” values presented have been corrected in accordance with BS EN 22476 Part 3 ¹ Base of strata not encountered.

A full interpretation of the DPSH tests, are outlined in Appendix C.2, Table C.2.1.

3.2 Infiltration Tests

Infiltration tests were performed in trial pits TPSK1, TPSK2 and TPSK2b in order to audit the infiltration potential of the ground for development that was appropriate to the settings present on the site.

The tests were undertaken within the granular soils of River Terrace Deposits within all the locations. The test within trial pit TPSK2 was abandoned due to minimal infiltration recorded over the course of the day.

The tests comprised piping water via a water tanker in TPSK1 and TPSK2 and via a water bowser in TPSK2b. The fall in water level over time was then recorded to give an indication of soakage potential.

BRE DG365:2023 states that for an accurate infiltration rate to be obtained a soakage pit needs to be filled three times in quick succession. Each test is completed once 75% of the water present has drained away, in order to determine whether or not the underlying ground conditions may be suitable for surface water drainage.

Table 3.3 presents the infiltration test results performed within all three exploratory pits.

Table 3.3 Infiltration Test Results

Exploratory Hole	Test Cycle	Test Stratum	Test Depth (m bgl)	Infiltration Rate (m/sec)	Notes
TPSK1	1	RTD	1.16	6.70×10^{-5}	Gravel - natural soils
	2	RTD	1.08	6.80×10^{-5}	
	3	RTD	1.06	5.94×10^{-5}	
TPSK2	1	RTD	2.42	-	No infiltration rate was calculated due to the lack of infiltration recorded.
TPSK2b	1	RTD	1.20	2.80×10^{-5}	Gravel - natural soils
	2	RTD	1.20	3.05×10^{-5}	
	3	RTD	1.20	1.78×10^{-5}	Gravel – natural soils. Data extrapolated after 130min to calculate an infiltration rate.
Notes: RTD = River Terrace Deposits					

Infiltration rates of between 1.78×10^{-5} m/sec and 6.80×10^{-5} m/sec were calculated within the soils of the River Terrace Deposits.

For a soakaway to be viable it is required to empty by 50% in a 24-hour period in saturated ground conditions.

3.3 Atterberg Limit Tests

Atterberg Limit tests were performed on two samples, one obtained from the cohesive beds of River Terrace Deposits and one from the cohesive soils of Selsey Sand Formation bedrock. The results were classified in accordance with BRE Digest 240 and NHBC Standards Chapter 4.2.

Table 3.4 Atterberg Limit Results Classification

Strata	Depth (m bgl)	Volume Change Potential	
		NHBC	BRE 240
River Terrace Deposits (cohesive)	2.40	Low	Low
Selsey Sand Formation (cohesive)	2.80	None	Low

A full interpretation of the Atterberg Limit tests, is outlined in Table C.2.2, Appendix C.2 and the laboratory report in Appendix C.3.

3.4 Particle Size Distribution Tests

Particle Size Distribution (PSD) tests were performed on four samples from the granular beds of River Terrace Deposits and on one sample from the Selsey Sand Formation bedrock.

Table 3.5 Particle Size Distribution Classification

Strata	Depth (m bgl)	Volume Change Potential	
		NHBC	BRE 240
River Terrace Deposits (granular)	1.10, 1.0-1.50, 1.0-2.0, 2.80	No	No
Selsey Sand Formation (cohesive)	2.80	Yes	Yes

Note that a cohesive soil is only classified as having a volume change potential if it is also plastic and an Atterberg Limit test can be conducted on the strata.

A full interpretation of the PSD tests, is outlined in Table C.2.3, Appendix C.2 and the laboratory report in Appendix C.3.

3.5 Sulphate and pH Tests

Water soluble sulphate (2:1) and pH testing in accordance with Building Research Establishment Special Digest 1, 2005, 'Concrete in Aggressive Ground'.

Table 3.6 Sulphate and pH Test Results

Strata	Depth (m bgl)	Sulphate Concentration (mg/l)	pH
River Terrace Deposits (cohesive)	0.60	23	7.2
River Terrace Deposits (granular)	0.90	<10	7.4

The significance of the sulphate and pH Test results is discussed in Section 5.2 and the laboratory report in Appendix C.3.

Section 4 Engineering Appraisal

4.1 Established Ground Conditions

An engineering appraisal of the soil types encountered during the site investigation and likely to be encountered during the redevelopment of this site is presented. Soil descriptions are based on analysis of disturbed samples taken from the exploratory holes.

4.1.1 Made Ground

Foundations must not be placed on non-engineered fill unless such use can be justified on the basis of a thorough ground investigation and detailed design. Foundations must be taken through any Topsoil and/or Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

Soils described as Made Ground were encountered in all four window samples and all three exploratory pits from ground level to depths ranging between 0.40m and 0.45m bgl. The Made Ground typically comprised firm, dark brown, slightly sandy, gravelly CLAY to slightly sandy, slightly gravelly SILT, becoming gravelly with depth. Gravel was angular to rounded, fine to coarse flint, tarmacadam, brick, concrete and clinker. Rare plastic was found. Frequent rootlets were noted. Odour of manure was identified in WS1. Odour of chlorinated solvents was noted in WS2, and very faint soapy/floral odour was noted in WS3.

4.1.2 River Terrace Deposits

The superficial River Terrace Deposits were encountered directly below the Made Ground in all window sample boreholes (WS1 to WS4) and inferred within their corresponding dynamic probes (DP1 to DP4) and within all exploratory pits (TPSK1, TPSK2, TPSK2b), to depths ranging from 1.00m bgl (WS2) and 2.70m bgl. However, all exploratory holes except from the location of WS/DP1 were terminated within the soils of the River Terrace Deposits, so the full depth of the stratum could not be established in these locations.

The soils of the River Terrace Deposits are normally consolidated, predominantly granular soils, although in the subject site were locally cohesive as well. As such are expected to display low to moderate bearing capacities with moderate to high settlement characteristics. The granular beds of the River Terrace Deposits were considered suitable for the proposed development.

4.1.3 Selsey Sand Formation

The Selsey Sand Formation bedrock was only encountered in the location of WS1 and inferred within its corresponding dynamic probe (DP1), directly below the River Terrace Deposits to the final investigatory depth of 6.00m bgl.

Soils of the Selsey Sand Formation are overconsolidated cohesive soils in the present investigation and are expected to display moderate bearing capacities with moderate settlement characteristics. The soils of the Selsey Sand Formation were considered a suitable bearing stratum for the proposed development; however, their upper horizon

was encountered beyond the depth of traditional shallow foundations.

4.1.4 Guidance on Shrinkable Soils

The ground conditions were established as River Terrace Deposits with a thickness of 2.70m, overlying the bedrock of Selsey Sand Formation encountered only in the location of WS/DP1.

The volume change potential for each stratum was established and presented in Table 4.1.

Table 4.1 Established Volume Change Potential by Strata

Strata	Volume Change Potential		Established Lower Boundary (m bgl)
	BRE	NHBC	
RTD (cohesive)	Low ¹	Low ¹	0.80
RTD (granular)	No ²	No ²	2.70
SLSY (cohesive)	Low ¹	No ¹	Not determined

Notes: ¹ Atterberg Limit Testing ² PSD Testing

The Building Research Establishment (BRE) Digests 240, 241 and 242 provide guidance on 'best practice' for the design and construction of foundations on shrinkable soils.

The results from Atterberg Limits Tests classified the cohesive beds of River Terrace Deposits as **low volume change potential** in accordance with NHBC Standards Chapter 4.2.

The PSD tests indicated that all four samples tested from the granular beds of River Terrace Deposits had no volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

Atterberg Testing indicated that the Selsey Sand Formation bedrock had **no volume change potential** in accordance with NHBC Standards Chapter 4.2.

Low volume change potential should therefore be adopted where foundations pass through the superficial cohesive soils of the River Terrace Deposits.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot-by-plot basis to establish an appropriate founding depth prior to the construction of foundations. This must take account of trees, substantial bushes and hedgerows that are to remain, those that have already been removed or are to be removed or those that are to be planted as part of the site landscaping. When trees are felled, it can take up to twenty years for desiccation caused by roots to recover. Site surveys may not include substantial shrubs or bushes and is also unlikely to have data on any trees, bushes or shrubs removed prior to or following the site survey and the foundation designer must investigate all sources, including local knowledge, aerial photographs and the like.

The BRE Digest 241 states: *“An increasingly common, potentially damaging situation is where trees or hedges have been cut down prior to building. The subsequent long-term swelling of the zone of clay desiccated by the roots, as moisture slowly returns to the ground, can be substantial. The rate at which the ground recovers is very difficult to predict and if there is any doubt that recovery is complete then bored pile foundations with suspended beams and floors should be used”*.

The stated intention of the NHBC is to ensure that shrinkage and swelling of plastic soils does not adversely affect the structural integrity of foundations to such a degree that remedial works would be required to restore the serviceability of the building. It must be borne in mind that adherence to the NHBC tables and design recommendations may not, in all cases, totally prevent foundation movement and cracking of brickwork might occur.

The BRE Digest 240 suggests: “Two courses of action are open:

Estimate the potential for swelling or shrinkage and try to avoid large changes in the water content, for example by not planting trees near the foundations.

Accept that swelling or shrinkage will occur and take account of it. The foundations can be designed to resist resulting ground movements or the superstructure can be designed to accommodate movement without damage.”

The design of foundations suitable to withstand movements is presented in BRE Digest 241 “Low-rise buildings on shrinkable clay soils: Part 2”.

4.1.5 Groundwater

Groundwater was not encountered in any of the exploratory hole locations at the time of the investigation and post site works monitoring. This could potentially be attributed to the depth of all exploratory holes being limited.

Groundwater monitoring was ongoing at the time of reporting and will be updated upon completion.

Section 5 Foundation Scheme

5.1 Foundation Recommendations

Foundations **must not** be constructed within any Made Ground and cohesive beds of River Terrace Deposits due to the likely variability and potential for large load induced settlements both total and differential.

Roots were encountered in all window sample boreholes and exploratory pits to depths ranging between 0.40m and 0.90m bgl. If roots are encountered during the construction phase foundations **must not be placed within any live root penetrated** or desiccated **cohesive soils or those with a volume change potential**. Should the foundation excavations reveal such materials, the excavations **must** be extended to greater depth in order to bypass these unsuitable soils. Excavations must be checked by a suitable person prior to concrete being poured.

Considering the type of development, a shallow foundation solution, in the granular River Terrace Deposits was considered the most suitable.

The proposed development is likely to be both light and brittle. It is therefore considered that foundation design is undertaken using NHBC Standards Chapter 4.2.

5.1.1 Shallow Foundations into the River Terrace Deposits (granular beds)

Based on a 5.00 by 0.75m strip foundation, using commercial software Table 5.1 shows the calculated bearing values and anticipated settlement characteristics. The maximum encountered depth of Made Ground and unsuitable soils was 0.80m bgl, bearing capacities were calculated below this depth.

Given the limitations of only a single test location with adequate depth, an allowable bearing capacity of no more than 180kPa should be adopted for foundations formed within the granular soils of River Terrace Deposits underlying the site. Foundations formed onto soils in greater depths, is possible to be placed within the cohesive beds of River Terrace Deposits found underlying the granular beds in the location of WS1, which would result in significantly lower bearing capacity values.

Table 5.1 Allowable Bearing Capacities in the River Terrace Deposits

Depth (m bgl)	Size (m)	Bearing Capacity (kPa)	Anticipated Settlement (mm)
1.00	5.00 x 0.75	180	25

All foundation formations must be examined, recorded, and signed off by a competent person.

The use of reinforced trench fill foundations reduces the potential for differential settlement affecting the foundations.

For the allowable bearing value given above, settlements should not exceed the

presented values, provided that excavation bases are carefully bottomed out and blinded or concreted as soon after excavation as possible and kept dry.

Foundations must not be constructed over former structures and other hard spots. The foundations design must be suitable for the conditions present at the site.

The anticipated settlement includes both elastic settlement and long-term drained settlement (in the case of cohesive soils).

Anticipated settlements may be taken as proportional to the bearing capacity adopted (for the same configuration of foundation), therefore if the bearing value is halved the anticipated settlement will halve.

It has been assumed that the foundations to any existing structures have been grubbed out. Where foundations have been grubbed out the new foundation must be taken through any backfill material into suitable natural ground as outlined in this report.

5.1.2 Ground Floor Slab

NHBC Standards 2023 states ground floors should be constructed as suspended floors where:

- *“the foundation depth dictated by the NHBC Standards 2023, Chapter 4.2.10 would exceed 1.5m bgl;”*
- *“ground floor construction is undertaken when the surface soils are seasonally desiccated;”*
- *“the depth of fill exceeds 600mm;”*
- *“there is shrinkable soil that could be subject to movement, expansive material or other unstable soils;”*
- *“the ground has been subject to vibratory improvement;” or*
- *“ground or fill is not suitable to support ground-bearing slabs.”*

It is considered that a ground bearing floor slab construction could be suitable for the development providing that any near surface cohesive soils are removed and replaced with suitably rolled and compacted granular fill.

5.2 Subsurface Concrete

The sulphate and pH tests carried out in accordance with BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground', established the site concrete classifications for each stratum as presented in Table 5.2. The classification given was determined using the mobile groundwater case, in the view of groundwater being encountered within the underlying granular beds.

Table 5.2 Concrete Classification

Stratum	Design Sulphate Class	ACEC Class
RTD (granular)	DS-I	AC-I
RTD (cohesive)		

Concrete to be placed in contact with soil or groundwater must be designed in accordance with the recommendations of Building Research Establishment Special Digest 1 2005, '*Concrete in Aggressive Ground*' taking into account any possible exposure of potentially pyrite bearing natural ground and the pH of the soils.

5.3 Excavations

Shallow excavations in the Made Ground and River Terrace Deposits are likely to be marginally stable in the short term at best.

Excavations beneath the groundwater table are likely to be unstable and dewatering of foundation trenches may be necessary.

Section 6 Site Drainage

6.1 Soakaways

Given the observed infiltration over the test period, it is considered that the site would be suitable for the adoption of a surface water soakaway system located within the granular beds of River Terrace Deposits. In accordance with BRE DG365:2023 a rate of 1.78×10^{-5} m/sec should be used in the design of the soakaway system (i.e. the slowest rate recorded during all infiltration tests). Note that the above infiltration rate was calculated after extrapolation of the available data.

It is recommended that the results of the in-situ permeability testing are passed to a drainage engineer for commentary and design.

Section 7 Determination of Chemical Analysis

7.1 Site Characterisation and Revised Conceptual Site Model

No Preliminary Investigation Report was undertaken by Soils Limited for the site that would allow a Conceptual Site Model (CSM) to be produced and potential contamination risks to be identified and assessed.

Reliance was therefore, placed in the Phase I Desk Study and Site Reconnaissance, ref.: LP3177/DS/1, dated January 2023 by Leap Environmental Ltd, which was supplied to Soils Limited by the client and according to which potential on-site and off-site sources of soil and groundwater contamination comprised the following:

- Made Ground on-site (i.e. fill material associated with current site structures) potentially including asbestos, metals, polycyclic aromatic hydrocarbons (PAHs), and being a plausible source of ground-gas
- Historic allotment gardens on-site (potentially being a source of pesticides, heavy metals and polycyclic aromatic hydrocarbons (PAHs))
- Allotment gardens and historic farmland – off site sources (potentially being a source of pesticides, heavy metals and polycyclic aromatic hydrocarbons (PAHs))
- Electrical substation – off site sources (potentially being a source of polychlorinated biphenyl, heavy metals and petroleum hydrocarbons)

As discussed in the above report:

- The site is underlain by Secondary A aquifers of High Vulnerability relating to the superficial River Terrace Deposits and Selsey Sand Formation bedrock underlying the site.
- Shallow groundwater is anticipated on-site. Perched water may be present in any Made Ground deposits underlying the site.
- There are no surface water features within the site or adjoining the site boundary. There are also no surface water features within 500m of the site. The closest is Southampton Water which is located ~570m southwest of the site. The site is situated within the Itchen coastal catchment.
- There are no active abstraction licences within 1000m of the subject site.
- The site does not lie within a currently designated groundwater Source Protection Zone (SPZ).

This Main Investigation Report established:

- The presence of Made Ground in each of the exploratory holes to depths ranging between 0.40m and 0.45m bgl. The Made Ground typically comprised firm, dark brown, slightly sandy, gravelly CLAY to slightly sandy, slightly gravelly SILT, becoming gravelly with depth. Gravel was angular to rounded, fine to coarse flint, tarmacadam, brick, concrete and clinker. Rare plastic was found. Frequent

rootlets were noted. Odour of manure was identified in WS1. Odour of chlorinated solvents was noted in WS2, and very faint solvent odour was noted in WS3.

- No significant visual or olfactory indicators of hydrocarbon contamination was present within the Made Ground.
- The presence of River Terrace Deposits in each of the exploratory holes directly beneath the Made Ground to a maximum depth of 2.70m bgl in the location of WS/DP1. The soils generally comprised soft to firm, greyish brown, slightly sandy, very gravelly CLAY. Gravel was angular to sub angular, fine to coarse flint. Occasional rootlets were noted. Becoming yellowish to orangish brown, clayey, sandy, fine to coarse flint GRAVEL with depth. Becoming yellowish brown and orangish brown mottled, slightly sandy, very gravelly CLAY with depth. Distinct floral soapy/solvent odour was noted from 2.00m bgl in WS1. Note that all exploratory holes except from the location of WS/DP1 were terminated within the soils of the River Terrace Deposits, so the full depth of the stratum could not be established in these locations.
- Shallow groundwater was not encountered in any of the exploratory hole locations within the Made Ground and/or River Terrace Deposits during the investigation and the 1st groundwater monitoring visit. However, this can be attributed to the limited depth of all exploratory holes undertaken on site.

Therefore, the Preliminary Qualitative Risk Assessment of the Phase I Desk Study and Site Reconnaissance, ref.: LP3177/DS/1, by Leap Environmental Ltd, did not require significant revision and is presented in Appendix D.1.

7.2 Soil Sampling

Exploratory hole locations were established to provide an overview of ground conditions across the site in relation to the proposed construction, together with enabling the collection of samples to enable chemical characterisation of the underlying strata.

Representative samples for potential environmental testing were obtained from the exploratory holes at depths of between 0.10m and 0.50m to allow appropriate representation of the materials encountered, with additional samples to be obtained, if necessary, where there was visual or olfactory evidence of contamination.

Unless otherwise stated, analytical testing was based initially on a screening suite of commonly identified inorganic and organic contaminants, taking into account the prevailing site conditions and the findings of the initial conceptual site model.

7.3 Determination of Chemical Analysis

The driver for determination of the analysis suite was the information obtained from the Phase I Desk Study and Site Reconnaissance, ref.: LP3177/DS/1, by Leap Environmental Ltd and the Main Investigation Report intrusive investigation.

The chemical analyses were carried out on 4No. samples of Made Ground and 1No. sample of the granular River Terrace Deposits. The nature of the analyses is detailed in Table 7.1.

Table 7.1 Chemical Analyses Suites - Soil

No. of Tests	Determinants	Soil Tested	
		MG	RTD
5	Metal suites: Arsenic, Boron (Water Soluble), Cadmium, Chromium (total & hexavalent), Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc	✓	✓
5	Organic Matter	✓	✓
5	pH	✓	✓
5	Sulphate contents – water soluble	✓	✓
5	Asbestos screening	✓	✓
5	Phenols – total monohydric	✓	✓
1	Organochlorine Pesticides	✓	
1	Organophosphorus Pesticides	✓	
5	Polycyclic aromatic hydrocarbons (PAH) – (EPA 16)	✓	✓
5	Extractable Petroleum Hydrocarbons – (EPH) Texas Banded	✓	✓

The soil testing was carried out in compliance with the MCERTS performance standard, and the results are shown in Appendix D.2, test reports 23-06330 and 23-06541.

Section 8 Qualitative Risk Assessment

8.1 Assessment Criteria

The assessment criteria used to determine risks to human health are derived and explained within Appendix D.3.

8.2 Representative Contamination Criteria - Soil

In compiling this report reliance was placed on drawing No.: 0019 Rev. P05, dated 8th August 2022 by MH Architects. The recommendations provided within this report are made exclusively in relation to the scheme outlined above and must not be applied to any other scheme without further consultation with Soils Limited. Soils Limited must be notified about any change or deviation from the scheme outlined.

Based on the proposed development, the results of the chemical analysis have been compared against generic assessment criteria (GAC) for a '**Residential with home grown produce**' end use, as presented in SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination December 2014 (C4SL), derived for the protection of human health. Where this document has not published screening values for determinants, GACs derived for the same end use have been adopted from the following published guidance; DEFRA Soil Guideline Values (SGV) and LQM/CIEH/Suitable 4 Use Level (S4UL).

To assess the potential toxicity of organic determinants (Petroleum Hydrocarbons and Polyaromatic Hydrocarbons) to the human health, soils samples were analysed for Soil Organic Matter (SOM). The selected samples analysed recorded, SOM values of between **0.5%** and **4.2%**. For each soil sample tested, the resultant SOM allowed for the correct comparison to be made with the appropriate guideline value for each organic determinants analysed.

8.3 Risk Assessment – Made Ground

Table 8.1 outlines the samples that have exceeded their relevant assessment criteria. The full laboratory report is presented in Appendix D.2.

Table 8.1 Summary of GAC Exceedances – Made Ground

Location	Depth (m bgl)	Contaminant	Concentration	Guidance Level (S4UL)	SOM (%)
WS2	0.10	Dibenz(a,h)anthracene	0.40	0.30	4.2

Note(s): Units mg/kg, SOM – Organic Matter

The risk assessment has established a potential pollutant linkage in relation to human health from a single elevated Polyaromatic Hydrocarbons (PAHs) concentration within the Made Ground, in WS2 at 0.10m bgl.

8.4 Risk Assessment – River Terrace Deposits

Table 8.2 outlines the samples that have exceeded their relevant assessment criteria. The full laboratory report is presented in Appendix D.2.

Table 8.2 Summary of GAC Exceedances – River Terrace Deposits

Location	Depth (m bgl)	Contaminant	Concentration	Guidance Level
None				

The risk assessment has established no potential chemical pollutant linkage in relation to human health receptors within the sample tested from the River Terrace Deposits.

8.5 Asbestos

The test certificate for each sample submitted for contamination analysis during this investigation includes the results of an Asbestos Screen.

In each case 'Not detected' was reported.

This finding does not obviate the risk of asbestos being present on the site and the Client must seek advice from qualified and competent asbestos specialist during and prior to undertaking works to ensure compliance with appropriate legislation and guidance.

8.6 Risk to Groundwater

From information provided by the Phase I Desk Study and Site Reconnaissance, ref.: LP3177/DS/1, dated January 2023 by Leap Environmental Ltd, the Groundsure Maps stated, that the superficial River Terrace Deposits and the Selsey Sand Formation bedrock had a Secondary A Aquifer designation, indicating that the units maintain the potential to sustain large volumes of water. The overall groundwater vulnerability was soils of Medium Vulnerability, soils with moderate ability to attenuate diffuse source pollutants or in which it is possible that some non-adsorbed diffuse source pollutants and liquid discharges could penetrate the soils layer.

The soils of River Terrace Deposits underlying the Made Ground reaching to a proven depth of 2.70m bgl, were assessed by the intrusive investigation as predominantly granular, permeable soils, and therefore could be considered a sensitive receptor; however, shallow groundwater was not encountered within the superficial soils during the intrusive investigation. The predominantly cohesive soils of the Selsey Sand Formation underlying the River Terrace Deposits are impermeable subject to soil composition (presence of clayey lenses), therefore, are not considered a sensitive receptor.

A quantitative Groundwater Risk Assessment was not commissioned as part of the site investigation report. However, it is considered that the elevated PAHs recorded in WS2 at a depth of 0.10m bgl, presumably resulted from a tarmacadam inclusion present in the Made Ground, which is going to be removed as part of the development works and/or remediation of the site and therefore, represent a **very low to negligible risk** to

groundwater quality.

If considered appropriate by the Local Planning Authority, leachate tests could be undertaken, in the absence of groundwater, as part of any additional ground investigation.

8.7 Risk from Ground Gas Ingression

The Phase I Desk Study and Site Reconnaissance, ref.: LP3177/DS/1, dated January 2023 by Leap Environmental Ltd, suggested that there was a moderate risk of ground gas generation associated with the Made Ground underlying the site.

The intrusive investigation recorded Made Ground at a thickness of up to 0.45m bgl; no putrescible material was observed within the Made Ground. PAHs were recorded in concentrations in excess of the relevant S4UL for a 'Residential with Home Grown Produce' land-use scenario in one location within the site boundaries but are not significant contributors to the creation of ground gases or vapours.

Therefore, as the ground investigation recorded Made Ground at a thickness less than 0.50m and no putrescible material was encountered, the overall risk from ground gas to the proposed development is considered to be very low. Taking into consideration the likely potential source of ground gases, limited to the presence of Made Ground, three monitoring visits have been undertaken over a period of a month, in accordance with current guidance, the results of which are presented in Table 8.3 and provided in Appendix E.

Table 8.3 Ground Gas Results

Date (Baro Trend)	TH	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	H ₂ S (ppm)	CO (ppm)	LEL (%)	aP (mb)	Flow (l/h)	Dp	H ₂ O (m bgl)	Hole (m)	VOC (ppm)
16/05/23 (Steady)	ATM	<1.0	0.0	20.6	<1.0	<1.0	<0.1	1023	0.0	<1.0	-	-	<1.0
	WS1	<1.0	0.5	20.1	<1.0	<1.0	<0.1	1023	0.0	<1.0	Dry	2.64	10.0
	WS4	<1.0	1.8	18.6	<1.0	<1.0	<0.1	1023	0.0	<1.0	Dry	1.37	2.0
26/05/23 (Rising)	ATM	<1.0	0.0	20.8	<1.0	<1.0	<0.1	1030	0.3	1.0	-	-	<1.0
	WS1	<1.0	0.6	19.9	<1.0	<1.0	<0.1	1030	0.3	1.0	Dry	2.40	<1.0
	WS4	<1.0	2.2	19.0	<1.0	2.0	<0.1	1030	0.1	1.0	Dry	1.35	<1.0
14/06/23 (Rising)	ATM	<1.0	0.0	20.9	<1.0	<1.0	<0.1	1015	0.0	<1.0	-	-	<1.0
	WS1	<1.0	0.5	20.5	<1.0	1.0	<0.1	1016	0.0	<1.0	Dry	2.62	<1.0
	WS4	<1.0	2.0	19.2	<1.0	1.0	<0.1	1015	0.0	<1.0	Dry	1.35	<1.0
Maximum		<0.1	2.2	20.5	<1.0	2.0	<0.1	1030	0.3	1.0	-	-	10.0
Minimum		<0.1	0.5	18.6	<1.0	<1.0	<0.1	1015	<0.1	<1.0	Dry	-	<1.0
Note: Zero reading = below the equipment detection limit.													

Based on the documentation presented in the "BS 8485:2015+A1:2019", Code of practice for the design of protective measures for Methane and Carbon Dioxide ground gases for new buildings" the hazardous gas flow rate (Q_{hg}) was calculated using Equation 1:

$$Q_{hg} = \left(\frac{C_{hg}}{100} \right) \times q \quad \text{Equation 1}$$

Where:

C_{hg} is the measured hazardous gas concentration in percentage volume-by-volume

q is the flow rate in litres per hour of combined gases found by direct measurement – where the flow rate is zero or below the detection level of the instrument, this must default to the detection limit, in this case 0.1 ltr/hr.

The highest concentration of carbon dioxide (CO₂) was recorded at 2.2% by volume, in WS4 on 26th May 2023. Consequently, the values used in Equation 1 were 2.2 and 0.3l/hr for the hazardous ground gas concentration and flow rate respectively, and therefore Equation 1 gives the below results:

$$Q_{hg} = \left(\frac{2.2}{100} \right) \times 0.3 = 0.0066 \text{ l/hr}$$

The results derive a Gas Screening Value of 0.0066, which is significantly below the CS1/CS2 threshold of 0.07.

VOC (Volatile Organic Compounds) screening undertaken during the monitoring has recorded a maximum of 10.0ppm in WS1 on 16th May 2023; this is potentially linked to the elevated Polyaromatic Hydrocarbons (PAHs) concentration found within the Made Ground in WS2 at 0.10m bgl. However, the maximum VOCs being significantly above the average for the dataset (average of 2.6ppm vs maximum of 10.0ppm), is not considered significant in context and was recorded on only one date at a single location, so this peak value may be an outlier or artefact. In addition, the remainder of the results do not indicate VOCs in excess of a worst case of 2.0ppm and an average of 1.2ppm. As such, it is considered that this potentially is an anomaly and is not considered representative of the gas conditions prevalent onsite.

CIRIA C665 and BS8485:2015+A1:2019 both state that where concentrations of carbon dioxide are consistently recorded over 5% v/v and/or methane in excess of 1%, consideration should be given to increasing the Characteristic Situation to 2 on a precautionary basis.

Where such situations prevail, consideration should also be given to the gas and conceptual site models as to which is the more appropriate situation to consider in light of the potential and actuality for active generation both on and off-site. Reviewing the dataset, site model and quality of data, no methane was recorded above instrument detection limit (0.1%), and carbon dioxide concentration was not recorded above 2.2% on all monitoring occasions. As such no precautionary rise to CS2 is indicated from the dataset.

The technical results of the initial characterisation of the ground gas regime, classifies the site as Characteristic Situation 1 (CS1), where no ground gas protection is necessary within new properties. Therefore, the results of the precautionary monitoring showed that the moderate risk initially identified in the Phase I Desk Study and Site Reconnaissance, ref.: LP3177/DS/1, dated January 2023 by Leap Environmental Ltd was not appropriate

for the site.

The precautionary monitoring identified no anomalous or unexpected results or indications of active gas generation and/or significant flow. As such, no protection measures are either indicated or considered necessary.

8.7.1 Radon

The site **was not situated** within an area where protection or risk assessment against the ingress of radon was required. Radon protection measures **will not be required** within the proposed new development.

8.8 Generic Quantitative Risk Assessment

Quantitative risk assessments are undertaken for the soil and ground gas. The full laboratory chemical report is presented in Appendix D.2.

8.8.1 Soils

One of the samples tested showed concentrations in excess of the relevant S4UL for a residential land-use scenario. In WS2 at 0.10m bgl, Dibenz(a,h)anthracene was recorded at a concentration of 0.40mg/kg against the residential end-use S4UL of 0.30mg/kg.

The Tier 1 risk assessment therefore established that there was a potential risk to construction workers and other vulnerable receptors on exposure which will have to be considered in relation to the site works by the H&S advisors and is beyond the scope of this report.

8.8.2 Groundwater

The Groundwater Risk Assessment established that there is a **very low** residual risk to the groundwater receptor as discussed in Section 8.6.

8.8.3 Ground Gas

The Preliminary Investigation Report identified a moderate risk of ground gas associated with Made Ground underlying the site.

Monitoring of the wells installed within WS1 and WS4 has been undertaken on three occasions, including targeting periods of steady and rising pressure. In accordance with BS8485:2015, a **very low risk** was identified, which does not require gas protection measures.

8.9 Recommendations

Soil chemical analysis recorded one sample (WS2:0.10m bgl) with substance levels over their representative guideline values. WS2 was located beneath proposed residential gardens.

Therefore, there was a risk to the Human Health, Building Structures and Services and Groundwater receptor, which would require a remediation strategy.

The remedial objective for the site is to ensure site clean-up removes any unacceptable risk to the identified receptors of Human Health, Building Structures and Services and Groundwater receptor. The risk is likely to be further mitigated by the placement of a building and hard cover significantly reducing the potential infiltration to the ground and hence the passage and volume of available groundwater. In the areas of proposed soft landscaping (private gardens), any potential contamination linkages will be broken by emplacement of appropriate depth of clean soils imported to provide a suitable growing medium.

In essence the remedial objective must sever any source-pathway-receptor pollutant linkages that have been established. Once this has been achieved, by whatever means, there can theoretically be no risk.

8.10 Duty of Care

Groundworkers must maintain a good standard of personal hygiene including the wearing of overalls, boots, gloves and eye protectors and the use of dust masks during periods of dry weather.

8.11 Excavated Material

Excavated material as waste must be defined or classified prior to any disposal, transport, recycling or re-use at or by an appropriately licensed or exempt carrier and/or off-site disposal facility. The requirements inherent in both Duty of Care and Health and Safety must also be complied with. In order to determine what is to happen, what is suitable, appropriate and most effective in the disposal of wastes, especially those subject to CDM waste management plan requirements, several factors must be considered, and competent advice must always be sought.

8.12 Re-use of Excavated Material On-site

The re-use of on-site soils may be undertaken either under the Environmental Permitting Regulations 2007 (EPR), in which case soils other than uncontaminated soils are classed as waste, or under the CL:AIRE Voluntary Code of Practice (CoP) which was published in September 2008 and is accepted as an alternative regime to the EPR.

8.13 Imported Material

Any soil, which is to be imported onto the site, must undergo chemical analysis to permit classification prior to its importation and placement in order to ascertain its status with specific regard to contamination, i.e. to prove that it is suitable for the purpose for which it is intended.

8.14 Discovery Strategy

There may be areas of contamination not identified during the course of the investigation. Such occurrences may also be discovered during the demolition and construction

phases for the redevelopment of the site.

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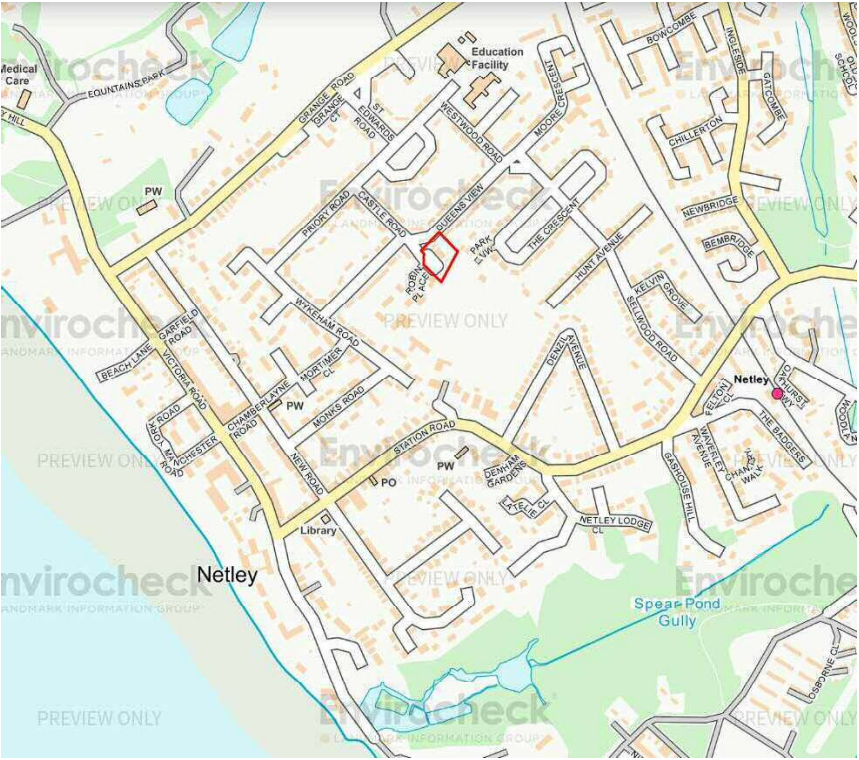


Figure I – Site Location Map

Job Number 20870	Project 30-32 Queens View, Netley, Southampton, Hampshire SO31 5EA
Client Eastleigh Borough Council	Date June 2023

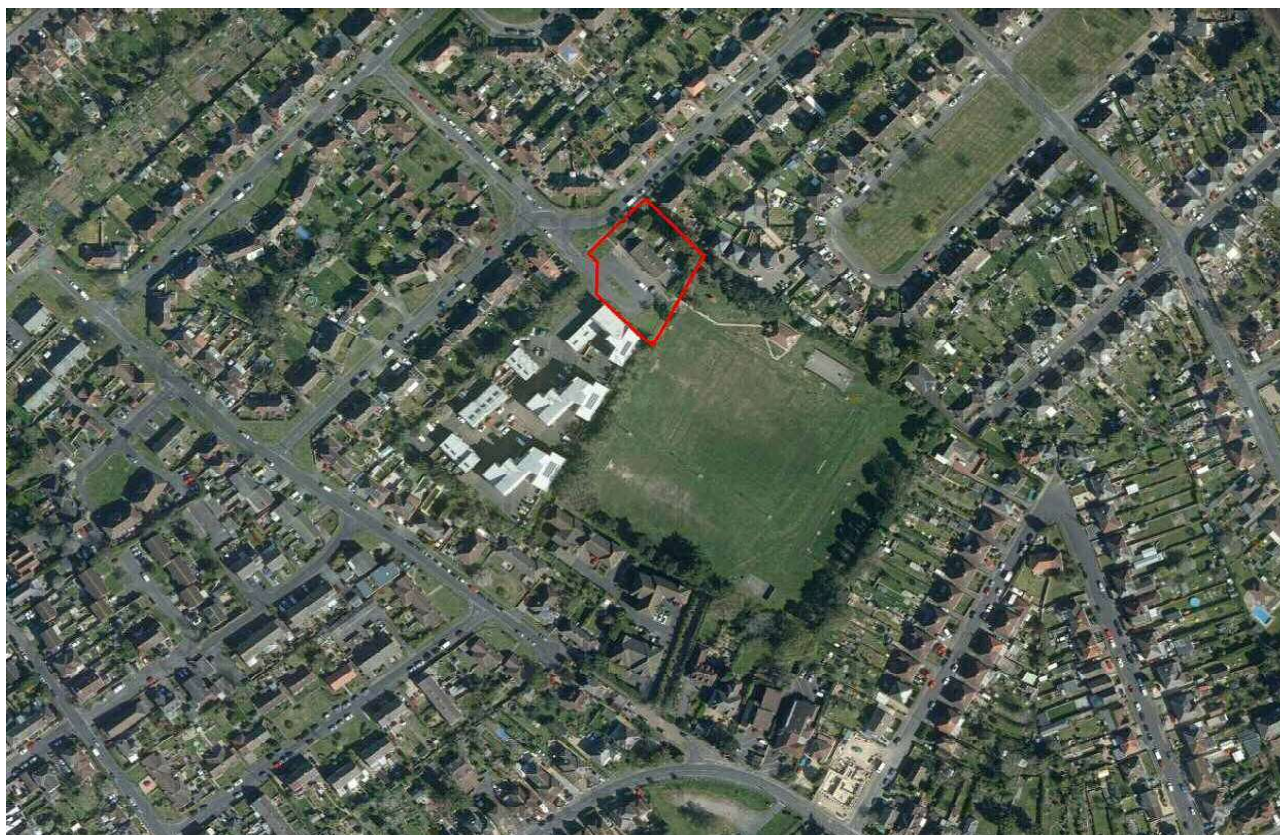


Figure 2 – Aerial Photograph



Project

30-32 Queens View, Netley,
Southampton, Hampshire
SO31 5EA

Client

Eastleigh Borough Council

Date

June 2023

Job Number

20870



Figure 3 – Exploratory Hole Plan

Project

30-32 Queens View, Netley,
Southampton, Hampshire
SO31 5EA

Client

Eastleigh Borough Council

Date

June 2023

Job Number

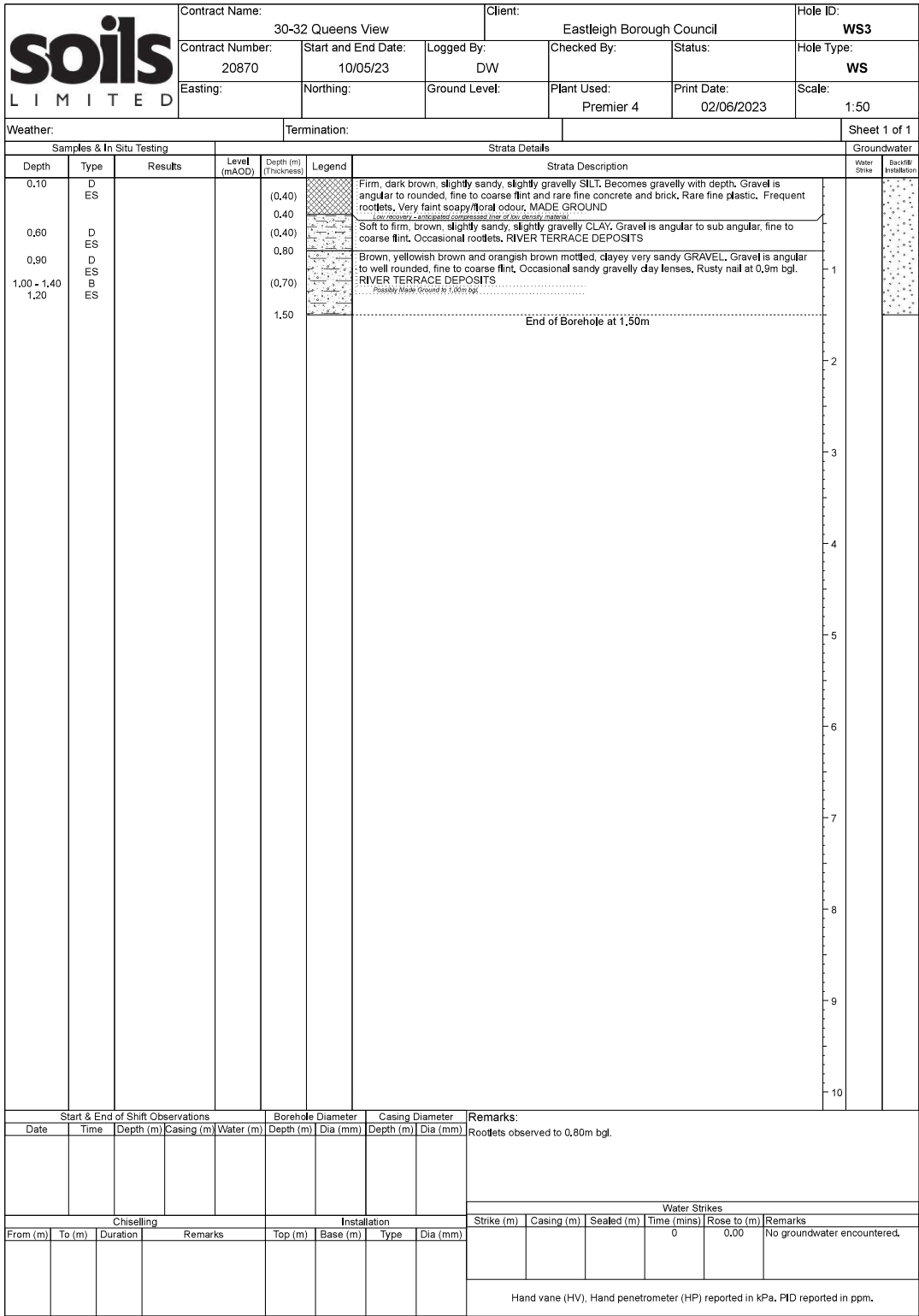
20870

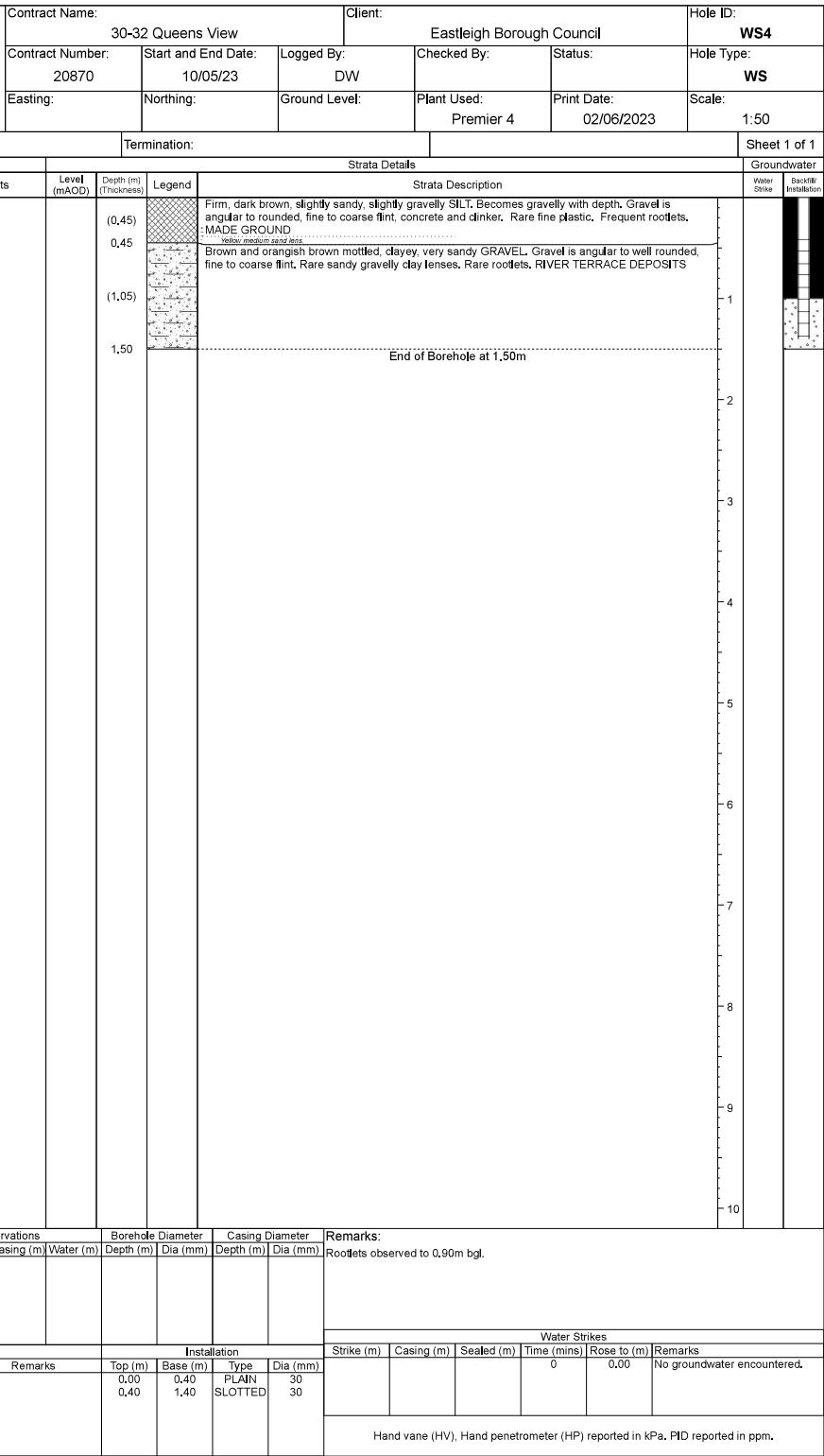


Appendix B Field Work

Appendix B.1 Engineers Logs

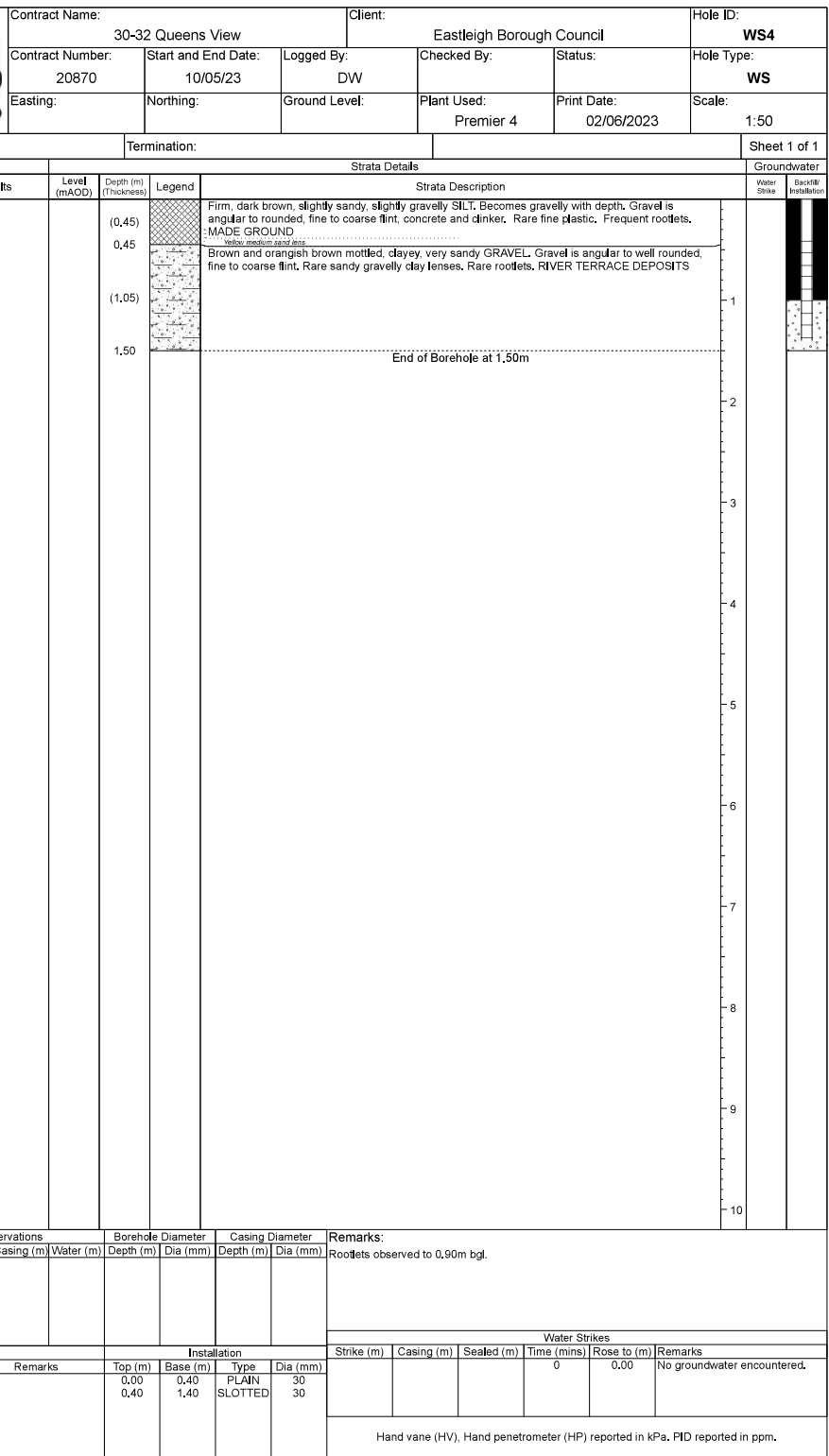
	Contract Name: 30-32 Queens View			Client: Eastleigh Borough Council			Hole ID: WS2							
	Contract Number: 20870		Start and End Date: 10/05/23		Logged By: DW		Checked By:		Status:		Hole Type: WS			
	Easting:		Northing:		Ground Level:		Plant Used: Premier 4		Print Date: 02/06/2023		Scale: 1:50			
Weather:				Termination:						Sheet 1 of 1				
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill Installation	
0.10	D ES			(0,40)		Firm, dark brown, slightly sandy, slightly gravelly CLAY. Becomes gravelly with depth. Gravel is angular to rounded, fine to coarse flint, brick, and unbound black stained potential tarmac gravel. Frequent rootlets, Odour of chlorinated solvents, MADE GROUND <i>Band with gravel with black staining and strong chlorinated solvents odour</i> Greyish brown, sandy, clayey GRAVEL. Gravel is angular to sub-angular, fine to coarse flint. Frequent rootlets, Fines reducing with depth. Very faint soapy odour, RIVER TERRACE DEPOSITS Orangish brown, yellowish brown and dark brown mottled, silty becoming clayey sandy, slightly GRAVEL. Gravel is angular to well rounded, fine to coarse flint, RIVER TERRACE DEPOSITS <i>Dark brown soapy band</i>								
0.50	D ES			0.40										
	D ES			0.65										
0.80	D ES			(0,35) 1.00										
						End of Borehole at 1,00m						1		
												2		
												3		
												4		
												5		
												6		
												7		
												8		
												9		
												10		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks: Rootlets observed to 0,65m bgl.					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)						
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
												0	0,00	No groundwater encountered.
									Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.					





	Contract Name: 30-32 Queens View			Client: Eastleigh Borough Council			Hole ID: WS2						
	Contract Number: 20870		Start and End Date: 10/05/23		Logged By: DW		Checked By:		Status:		Hole Type: WS		
	Easting:		Northing:		Ground Level:		Plant Used: Premier 4		Print Date: 02/06/2023		Scale: 1:50		
Weather:				Termination:						Sheet 1 of 1			
Samples & In Situ Testing				Strata Details								Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill Installation
0.10	D ES			(0,40)		Firm, dark brown, slightly sandy, slightly gravelly CLAY. Becomes gravelly with depth. Gravel is angular to rounded, fine to coarse flint, brick, and unbound black stained potential tarmac gravel. Frequent rootlets, Odour of chlorinated solvents, MADE GROUND Band with gravel with black staining and strong chlorinated solvents odour Greyish brown, sandy, clayey GRAVEL. Gravel is angular to sub-angular, fine to coarse flint. Frequent rootlets, Fines reducing with depth. Very faint soapy odour, RIVER TERRACE DEPOSITS Orangish brown, yellowish brown and dark brown mottled, silty becoming clayey sandy, slightly GRAVEL. Gravel is angular to well rounded, fine to coarse flint, RIVER TERRACE DEPOSITS Dark brown soapy ooze End of Borehole at 1,00m						1	
0.50	D ES		0.40										
	ES		0.65										
0.80	D ES		(0,35)										
	ES		1.00										
												2	
												3	
												4	
												5	
												6	
												7	
												8	
												9	
												10	
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:				
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Rootlets observed to 0,65m bgl.				
									Water Strikes				
Chiselling					Installation		Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)			0	0,00	No groundwater encountered.
									Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.				

	Contract Name: 30-32 Queens View			Client: Eastleigh Borough Council			Hole ID: WS3								
	Contract Number: 20870		Start and End Date: 10/05/23		Logged By: DW		Checked By:		Status:		Hole Type: WS				
	Easting:		Northing:		Ground Level:		Plant Used: Premier 4		Print Date: 02/06/2023		Scale: 1:50				
Weather:				Termination:						Sheet 1 of 1					
Samples & In Situ Testing				Strata Details										Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill Installation		
0.10	D ES			(0,40)		Firm, dark brown, slightly sandy, slightly gravelly SILT. Becomes gravelly with depth. Gravel is angular to rounded, fine to coarse flint and rare fine concrete and brick. Rare fine plastic. Frequent rootlets. Very faint soapy/floral odour, MADE GROUND (see recovery - anticipated compressed line of low density material) Soft to firm, brown, slightly sandy, slightly gravelly CLAY. Gravel is angular to sub angular, fine to coarse flint. Occasional rootlets, RIVER TERRACE DEPOSITS Brown, yellowish brown and orangish brown mottled, clayey very sandy GRAVEL. Gravel is angular to well rounded, fine to coarse flint, Occasional sandy gravelly clay lenses, Rusty nail at 0,9m bgl. RIVER TERRACE DEPOSITS Possibly Needs Ground to 1,00m bgl.						1			
0,60	D ES		(0,40)												
0,90	D ES		(0,80)												
1,00 - 1,40	B ES		(0,70)		End of Borehole at 1,50m						2				
1,20	ES		1,50												
												3			
												4			
												5			
												6			
												7			
												8			
												9			
												10			
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:						
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Rootlets observed to 0,80m bgl.						
Chiselling					Installation		Water Strikes								
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	
												0	0,00	No groundwater encountered.	
									Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.						



Soakaway Calculations

Soakaway Test No.	TPSK1 Test 1
Contract:	30-32 Queens View
Contract No.	20870

Field Test

Trial Pit Log (include details of groundwater):

See trial Pit record

Depth of Pit	1.16 m
Width of Pit	0.65 m
Length of Pit	1.70 m
Depth of Pit Soaked	0.56 m

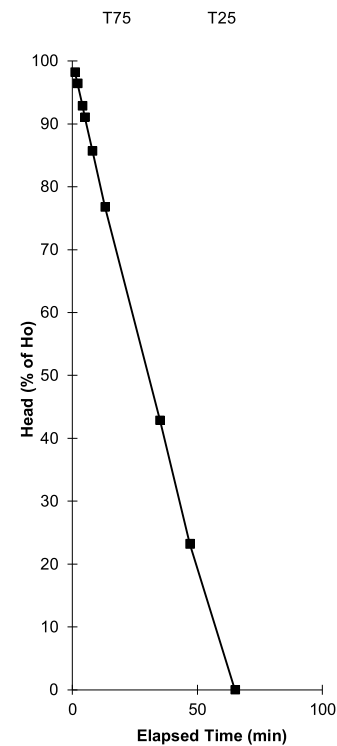
ap50	2.421 m2
Vp75-25	0.3094 m3
t75-25	31.8 min
water used	0.6188 m3
f	6.708E-05 m/sec.

Field Data

Depth to	Elapsed	Head of	Head of
Water	Time	Water	Water
(m)	(min)	(% of Ho)	(m)
0.60	0	100	0.56
0.61	1	98	0.55
0.62	2	96	0.54
0.64	4	93	0.52
0.65	5	91	0.51
0.68	8	86	0.48
0.73	13	77	0.43
0.92	35	43	0.24
1.03	47	23	0.13
1.16	65	0	0.00

T75	14.158	75
T25	45.909	25
T75-25	31.751	Derived from Best Fit

Comments



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Soakaway Calculations

Soakaway Test No.	TPSK1 Test 2
Contract:	30-32 Queens View
Contract No.	20870

Field Test

Trial Pit Log (include details of groundwater):

See trial Pit record

Depth of Pit	1.08 m
Width of Pit	0.65 m
Length of Pit	1.70 m
Depth of Pit Soaked	0.58 m

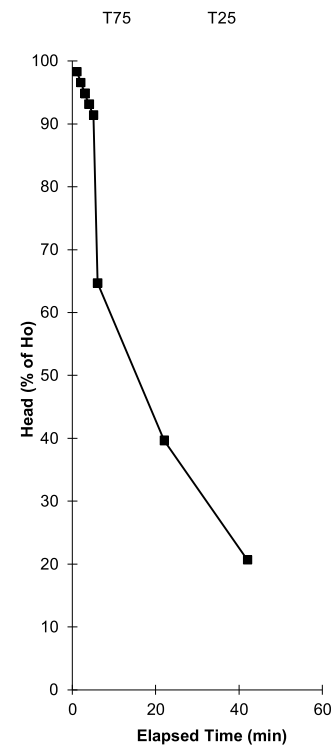
ap50	2.468 m2
Vp75-25	0.32045 m3
€75-25	31.8 min
water used	0.6409 m3
f	6.796E-05 m/sec.

Field Data

Depth to	Elapsed	Head of	Head of
Water	Time	Water	Water
(m)	(min)	(% of Ho)	(m)
0.50	0	100	0.58
0.51	1	98	0.57
0.52	2	97	0.56
0.53	3	95	0.55
0.54	4	93	0.54
0.55	5	91	0.53
0.71	6	65	0.38
0.85	22	40	0.23
0.96	42	21	0.12

T75	5.613	75
T25	37.455	25
T75-25	31.842	Derived from Best Fit

Comments



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Soakaway Calculations

Soakaway Test No.	TPSK1 Test 3
Contract:	30-32 Queens View
Contract No.	20870

Field Test

Trial Pit Log (include details of groundwater):

See trial Pit record

Depth of Pit	1.06 m
Width of Pit	0.65 m
Length of Pit	1.70 m
Depth of Pit Soaked	0.65 m

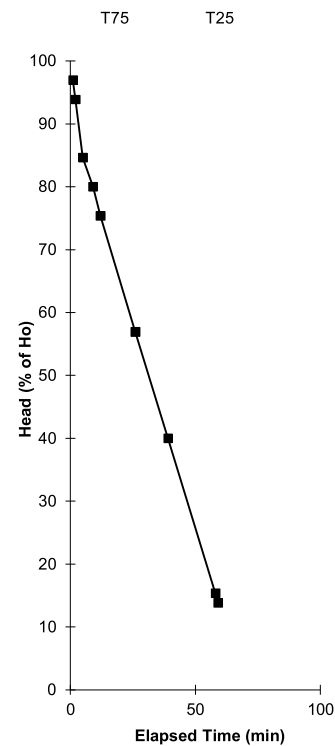
ap50	2.6325 m2
Vp75-25	0.359125 m3
ε75-25	38.3 min
water used	0.7183 m3
f	5.939E-05 m/sec.

Field Data

Depth to	Elapsed	Head of	Head of
Water	Time	Water	Water
(m)	(min)	(% of Ho)	(m)
0.41	0	100	0.65
0.43	1	97	0.63
0.45	2	94	0.61
0.51	5	85	0.55
0.54	9	80	0.52
0.57	12	75	0.49
0.69	26	57	0.37
0.80	39	40	0.26
0.96	58	15	0.10
0.97	59	14	0.09

T75	12.292	75
T25	50.578	25
T75-25	38.286	Derived from Best Fit

Comments



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Soakaway Calculations

Soakaway Test No.	TPSK2 Test 1
Contract:	30-32 Queens View
Contract No.	20870

Field Test

Trial Pit Log (include details of groundwater):

See trial Pit record

Depth of Pit	2.42 m
Width of Pit	0.65 m
Length of Pit	2.10 m
Depth of Pit Soaked	0.74 m

ap50	3.4	m2
Vp75-25	0.50505	m3
t75-25	0.0	min
water used	1.0101	m3
f	N/A	m/sec.

Field Data

Depth to	Elapsed	Head of	Head of
Water	Time	Water	Water
(m)	(min)	(% of Ho)	(m)
1.68	0	100	0.74
1.69	1	99	0.74
1.70	13	97	0.72
1.71	18	96	0.71
1.74	40	92	0.68
1.76	61	89	0.66
1.77	91	88	0.65
1.79	118	85	0.63
1.82	176	82	0.61
1.82	200	81	0.60
1.83	220	80	0.59
1.85	260	77	0.57

T75	0.000	75
T25	0.000	25
T75-25	0.000	Derived from Best Fit

Comments

Infiltration stopped - unable to calculate infiltration rate

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Figure 1 is a line graph showing the percentage of cells in the G2/M phase of the cell cycle over time for two cell lines, T75 and T25. The x-axis represents 'Elapsed Time (min)' from 0 to 300. The y-axis represents '% of cells in G2/M phase' from 0 to 100. Both cell lines show a decrease in the percentage of cells in G2/M phase over time, with T75 cells showing a faster decline than T25 cells.

Elapsed Time (min)	T75 (% of cells in G2/M phase)	T25 (% of cells in G2/M phase)
0	100	100
10	95	100
20	90	100
30	85	100
40	80	100
50	75	100
60	70	100
70	65	100
80	60	100
90	55	100
100	50	100
110	45	100
120	40	100
130	35	100
140	30	100
150	25	100
160	20	100
170	15	100
180	10	100
190	5	100
200	0	100
210	-5	100
220	-10	100
230	-15	100
240	-20	100
250	-25	100
260	-30	100
270	-35	100
280	-40	100
290	-45	100
300	-50	100

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Soakaway Calculations

Soakaway Test No.	TPSK2b Test 1
Contract:	30-32 Queens View
Contract No.	20870

Field Test

Trial Pit Log (include details of groundwater):

See trial Pit record

Depth of Pit	1.20 m
Width of Pit	0.70 m
Length of Pit	2.00 m
Depth of Pit Soaked	0.56 m

ap50	2.912 m2
Vp75-25	0.392 m3
t75-25	80.3 min
water used	0.7840 m3
f	2.793E-05 m/sec.

Field Data

Depth to	Elapsed	Head of	Head of
Water	Time	Water	Water
(m)	(min)	(% of Ho)	(m)
0.64	0	100	0.56
0.65	1	98	0.55
0.675	2	94	0.53
0.695	4	90	0.51
0.72	6	86	0.48
0.73	7	84	0.47
0.74	9	82	0.46
0.76	12	79	0.44
0.79	16	73	0.41
0.81	19	70	0.39
0.83	23	66	0.37
0.88	35	57	0.32
0.885	39	56	0.32
0.91	44	52	0.29
0.94	51	46	0.26
0.96	58	43	0.24
1.01	72	34	0.19
1.03	79	30	0.17
1.06	95	25	0.14
1.08	99	21	0.12

[illegible]

T75	14.667	75
T25	95.000	25
T75-25	80.333	Derived from Best Fit

Comments

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Surrey, KT20 5SR**

Elapsed Time (min)	T75 (F/F0)	T25 (F/F0)
0	1.00	1.00
5	0.95	0.98
10	0.90	0.95
15	0.85	0.92
20	0.80	0.88
25	0.75	0.85
30	0.70	0.82
35	0.65	0.78
40	0.60	0.75
45	0.55	0.72
50	0.50	0.68
55	0.45	0.65
60	0.40	0.62
65	0.35	0.58
70	0.30	0.55
75	0.28	0.52
80	0.25	0.48
85	0.22	0.45
90	0.20	0.42
95	0.18	0.40
100	0.25	0.45

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Soakaway Calculations

Soakaway Test No.	TPSK2b Test 2
Contract:	30-32 Queens View
Contract No.	20870

Field Test

Trial Pit Log (include details of groundwater):

See trial Pit record

Depth of Pit	1.20 m
Width of Pit	0.70 m
Length of Pit	2.00 m
Depth of Pit Soaked	0.48 m

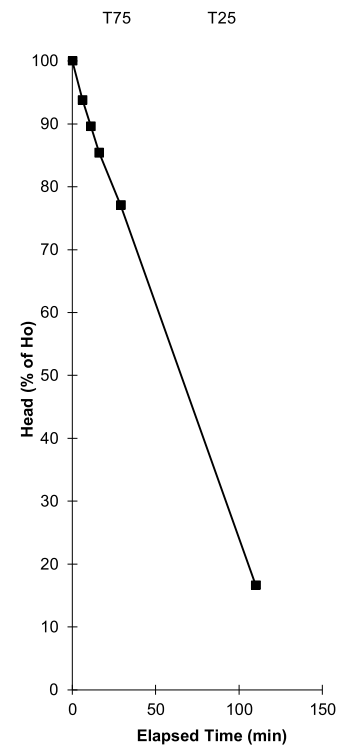
ap50	2.696 m2
Vp75-25	0.336 m3
t75-25	68.2 min
water used	0.6720 m3
f	3.045E-05 m/sec.

Field Data

Depth to	Elapsed	Head of	Head of
Water	Time	Water	Water
(m)	(min)	(% of Ho)	(m)
0.72	0	100	0.48
0.75	6	94	0.45
0.77	11	90	0.43
0.79	16	85	0.41
0.83	29	77	0.37
1.12	110	17	0.08

T75	31.793	75
T25	100.000	25
T75-25	68.207	Derived from Best Fit

Comments



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Soakaway Calculations

Soakaway Test No.	TPSK2b Test 3
Contract:	30-32 Queens View
Contract No.	20870

Field Test	Trial Pit Log (include details of groundwater): See trial Pit record
Depth of Pit	1.20 m
Width of Pit	0.70 m
Length of Pit	2.00 m
Depth of Pit Soaked	0.59 m
ap50	2.993 m2
Vp75-25	0.413 m3
t75-25	121.8 min
water used	0.8260 m3
f	1.889E-05 m/sec.

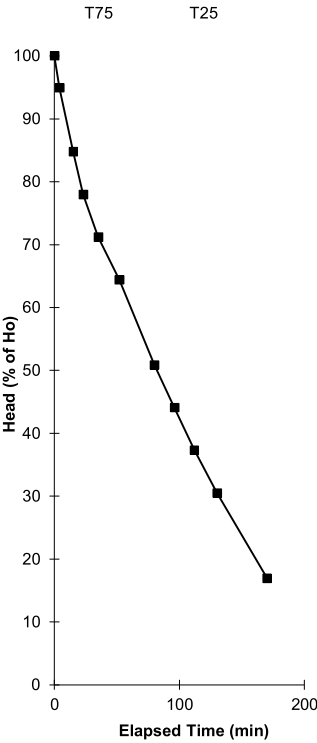
Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.61	0	100	0.59
0.64	4	95	0.56
0.7	15	85	0.50
0.74	23	78	0.46
0.78	35	71	0.42
0.82	52	64	0.38
0.9	80	51	0.30
0.94	96	44	0.26
0.98	112	37	0.22
1.02	130	31	0.18
1.1	170	17	0.10

T75	28.250	75
T25	150.000	25
T75-25	121.750	Derived from Best Fit

Comments
Data extrapolated to calculate an infiltration rate.

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Facsimile: 01737 812 557





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ASSOCIATES

Appendix 5

Drainage Strategy Drawings



KEY TO HEALTH AND SAFETY SYMBOLS	
THESE NOTES ARE BASED ON THE USE OF EXPERIENCED AND COMPETENT CONTRACTORS CARRYING OUT THE WORK USING AN APPROVED SAFE METHOD OF WORKING	
	INDICATES A RESIDUAL RISK REQUIRING A COMPULSORY ACTION
	INDICATES A RESIDUAL RISK REQUIRING A PROHIBITIVE ACTION
	INDICATES A RESIDUAL RISK AS A WARNING
	INDICATES A RESIDUAL RISK FOR INFORMATION

**COLOURED
DRAWING**
REQUEST A COLOURED COPY IF
THIS STAMP IS NOT RED

THIS DRAWING IS TO BE
READ IN CONJUNCTION WITH
DRAWING AAL307-5051 FOR
DRAINAGE DETAILS

DRAINAGE LEGEND	
	EXISTING SURFACE / STORM WATER SEWER / MANHOLE
	EXISTING FOUL WATER SEWER / MANHOLE
	SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER (SEE SCHEDULE FOR DETAILS).
	100mm Dia. PVCu. SN4 STORM WATER DRAIN (U.N.O.)
	ATTENUATION TANK / SOAKAWAY OUT OF PROPRIETARY CRATE SYSTEM (SEE SCHEDULE FOR DETAILS).
	ACO DRAIN / SUMP.
	FOUL WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER (SEE SCHEDULE FOR DETAILS).
	100mm Dia. PVCu. SN4 FOUL WATER DRAIN (U.N.O.)

- NOTES
- © This drawing is the copyright of ARCH Associates Limited. It may not be copied, altered or reproduced without their written authority. This drawing must not be scaled. IF IN DOUBT ASK.
- GENERAL NOTES
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND DETAILS.
 - ALL FIGURED DIMENSIONS TO BE TAKEN IN PREFERENCE TO SCALED DIMENSIONS.
 - ANY DISCREPANCIES BETWEEN THIS DRAWING AND OTHER INFORMATION IS TO BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO THE COMMENCEMENT OF THE WORKS ON SITE.
 - THE MAIN CONTRACTOR SHALL BE RESPONSIBLE FOR THE SETTING OUT AND ACCURACY OF ALL DIMENSIONS.
 - THE CONTRACTOR IS TO ENSURE THE STABILITY AND STRUCTURAL INTEGRITY OF THE EXISTING PROPERTY AT ALL TIMES DURING WORKS AND IS TO BE RESPONSIBLE FOR ALL PROPPING AND SHORING AS REQUIRED.
 - MAIN CONTRACTOR TO PROVIDE AND FIX SUITABLE BRACING AND PROPPING FOR ALL ELEMENTS IN THE TEMPORARY CONDITION DURING CONSTRUCTION STAGE, SUCH AS TO ENSURE STRUCTURE STABILITY AT ALL TIMES.
 - IT IS THE CONTRACTORS SOLE RESPONSIBILITY FOR ASCERTAINING SAFE DISPOSAL OF ANY OFF-SITE EXCAVATED SPOIL. NO CLAIM RESULTING FROM ABNORMAL TIP REQUIREMENTS WILL BE ENTERTAINED.
- DRAINAGE
- ALL MATERIALS AND WORKMANSHIP TO SEWERAGE SECTOR DESIGN AND CONSTRUCTION GUIDANCE DOCUMENT APPENDIX C APPROVED VERSION 2.2.
 - ALL MATERIALS AND WORKMANSHIP TO COMPLY WITH BS EN 752-1: 2008
 - WHEN USING VITRIFIED CLAY PIPEWORK WITH FLEXIBLE JOINTS, SUPERSTRENGTH SHALL BE USED. ALL ADAPTABLE WORKS SHALL USE V.C PIPEWORK. FOR NON-ADOPTED SYSTEM PVCU-SN4 CLASS PIPEWORK AND FITTINGS MAY BE SUBSTITUTED.
 - CONCRETE ENCASEMENT, MINIMUM 150 BED AND HAUNCH, TO BE USED ON PIPEWORK UNDER ROADS WITH LESS THAN 1200 COVER TO CROWN.
 - UNLESS OTHERWISE STATED, ALL PIPEWORK TO BE BEDDED AND SURROUNDED IN 10mm SINGLE SIZE AGGREGATE UP TO 450mm DIAMETER. FOR LARGER PIPEWORK, 20mm SHALL BE USED.
 - REFER TO MANHOLE SCHEDULE FOR SIZES, COVERS ETC.
 - ALL MATERIALS TO COMPLY WITH THE RELEVANT BS-EN, LATEST EDITION, FOR PIPEWORK AND FITTINGS.
 - UPON COMPLETION, ALL WORKS TO BE THOROUGHLY CLEANED BY FLUSHING.

P2	30.11.2023	UPDATED TO NEW SITE LAYOUT	JH
P1	12.07.2023	PRELIMINARY ISSUE FOR COMMENT	JH
Rev.	Date	Description	By

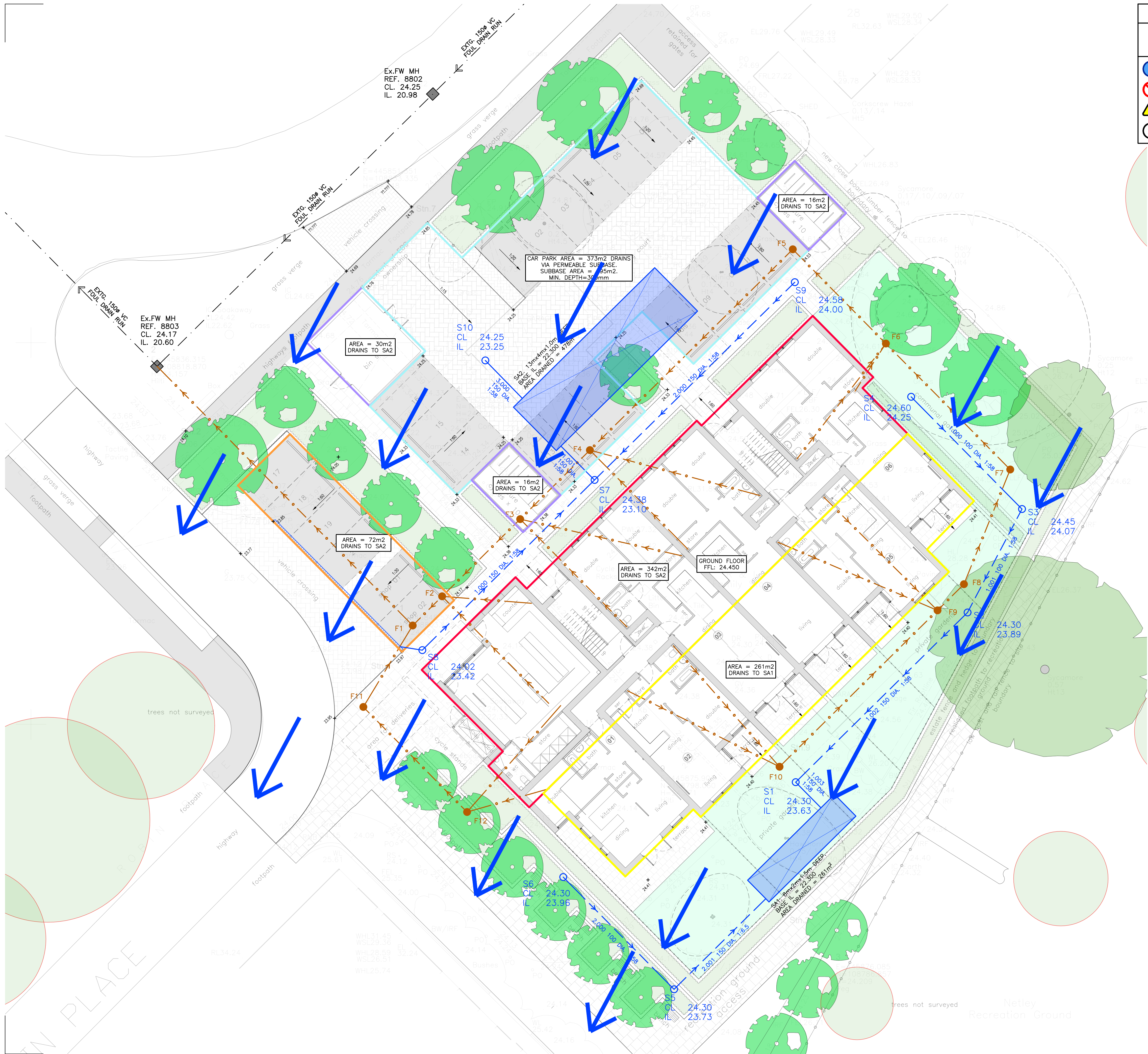
01489 890004
admin@archassociates.co.uk
www.archassociates.co.uk

Client
EASTLEIGH BOROUGH COUNCIL

Architect
MH ARCHITECTS

Project title
RE—DEVELOPMENT OF
30—32 QUEENS VIEW, NETLEY.

Drawing title	
DRAINAGE STRATEGY	
Scale 1:125	Paper size A1
Date FEB.2023	Drawn by JH
Checked by CH	Status S0
Name	
Project code / No. Originator Zone Level Type Role Number Revision	
AAL307 - AAL-00-XX-DR-S-5001-P02	



KEY TO HEALTH AND SAFETY SYMBOLS

THESE NOTES ARE BASED ON THE USE OF EXPERIENCED AND COMPETENT CONTRACTORS CARRYING OUT THE WORK USING AN APPROVED SAFE METHOD OF WORKING

INDICATES A RESIDUAL RISK REQUIRING A COMPULSORY ACTION

INDICATES A RESIDUAL RISK REQUIRING A PROHIBITIVE ACTION

INDICATES A RESIDUAL RISK AS A WARNING

INDICATES A RESIDUAL RISK FOR INFORMATION

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THIS DRAWING IS TO BE
READ IN CONJUNCTION WITH
DRAWING AAL307-5051 FOR
DRAINAGE DETAILS

DRAINAGE LEGEND

EXISTING SURFACE / STORM WATER SEWER / MANHOLE

EXISTING FOUL WATER SEWER / MANHOLE

SURFACE WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER (SEE SCHEDULE FOR DETAILS).

100mm Dia. PVCu. SN4 STORM WATER DRAIN (U.N.O.)

ATTENUATION TANK / SOAKAWAY OUT OF PROPRIETARY CRATE SYSTEM (SEE SCHEDULE FOR DETAILS).

ACO DRAIN / SUMP.

FOUL WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER (SEE SCHEDULE FOR DETAILS).

100mm Dia. PVCu. SN4 FOUL WATER DRAIN (U.N.O.)

- NOTES**
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- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND DETAILS.
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 - THE CONTRACTOR IS TO ENSURE THE STABILITY AND STRUCTURAL INTEGRITY OF THE EXISTING PROPERTY AT ALL TIMES DURING WORKS AND IS TO BE RESPONSIBLE FOR ALL PROPPING AND SHORING AS REQUIRED.
 - MAIN CONTRACTOR TO PROVIDE AND FIX SUITABLE BRACING AND PROPPING FOR ALL ELEMENTS IN THE TEMPORARY CONDITION DURING CONSTRUCTION STAGE, SUCH AS TO ENSURE STRUCTURE STABILITY AT ALL TIMES.
 - IT IS THE CONTRACTORS SOLE RESPONSIBILITY FOR ASCERTAINING SAFE DISPOSAL OF ANY OFF-SITE EXCAVATED SPOIL. NO CLAIM RESULTING FROM ABNORMAL TIP REQUIREMENTS WILL BE ENTERTAINED.
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Rev.	Date	Description	By

ARCH ASSOCIATES

01489 890004
admin@archassociates.co.uk
www.archassociates.co.uk

Client
EASTLEIGH BOROUGH COUNCIL

Architect
MH ARCHITECTS

Project title
RE—DEVELOPMENT OF
30—32 QUEENS VIEW, NETLEY.

Drawing title

EXCEEDANCE ROUTING

Scale	Paper size	Date	Drawn by	Checked by	Status
1:125	A1	FEB.2023	JH	CH	SO

Name

Project code / No. | Originator | Zone | Level | Type | Role | Number | Revision

AAL307 - AAL-00-XX-DR-S-5002-P02



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Appendix 6

Surface Water Drainage Calculations

Arch Associates Limited				Page 1																																																					
Town House St Geroge's Square Bishops Waltham Southampton S032 1AF				QUEENS VIEW NETLEY																																																					
Date 10/07/2023 18:24				Designed by ARCH ASSOCIATES																																																					
File Drainage.MDX				Checked by CH																																																					
XP Solutions				Network 2020.1.3																																																					
<u>STORM SEWER DESIGN by the Modified Rational Method</u> <u>Design Criteria for Storm</u> Pipe Sizes STANDARD Manhole Sizes STANDARD FSR Rainfall Model - England and Wales <table><tr><td>Return Period (years)</td><td>100</td><td>Foul Sewage (l/s/ha)</td><td>0.000</td><td>Maximum Backdrop Height (m)</td><td>1.500</td></tr><tr><td>M5-60 (mm)</td><td>19.200</td><td>Volumetric Runoff Coeff.</td><td>1.000</td><td>Min Design Depth for Optimisation (m)</td><td>0.600</td></tr><tr><td>Ratio R</td><td>0.350</td><td>PIMP (%)</td><td>100</td><td>Min Vel for Auto Design only (m/s)</td><td>1.00</td></tr><tr><td>Maximum Rainfall (mm/hr)</td><td>50</td><td>Add Flow / Climate Change (%)</td><td>0</td><td>Min Slope for Optimisation (1:X)</td><td>100</td></tr><tr><td>Maximum Time of Concentration (mins)</td><td>30</td><td>Minimum Backdrop Height (m)</td><td>0.200</td><td></td><td></td></tr></table> Designed with Level Soffits												Return Period (years)	100	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500	M5-60 (mm)	19.200	Volumetric Runoff Coeff.	1.000	Min Design Depth for Optimisation (m)	0.600	Ratio R	0.350	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00	Maximum Rainfall (mm/hr)	50	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	100	Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200																		
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Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200																																																						
<u>Network Design Table for Storm</u> <table><tr><th>PN</th><th>Length (m)</th><th>Fall (m)</th><th>Slope (1:X)</th><th>I.Area (ha)</th><th>T.E. (mins)</th><th>Base Flow (l/s)</th><th>k (mm)</th><th>HYD SECT</th><th>DIA (mm)</th><th>Section Type</th><th>Auto Design</th></tr><tr><td>1.000</td><td>10.300</td><td>0.176</td><td>58.5</td><td>0.007</td><td>4.00</td><td>0.0</td><td>0.600</td><td>o</td><td>100</td><td>Pipe/Conduit</td><td></td></tr></table> <u>Network Results Table</u> <table><tr><th>PN</th><th>Rain (mm/hr)</th><th>T.C. (mins)</th><th>US/IL (m)</th><th>Σ I.Area (ha)</th><th>Σ Base Flow (l/s)</th><th>Foul (l/s)</th><th>Add Flow (l/s)</th><th>Vel (m/s)</th><th>Cap (l/s)</th><th>Flow (l/s)</th></tr><tr><td>1.000</td><td>50.00</td><td>4.17</td><td>24.254</td><td>0.007</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.01</td><td>7.9</td><td>1.3</td></tr></table>												PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design	1.000	10.300	0.176	58.5	0.007	4.00	0.0	0.600	o	100	Pipe/Conduit		PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	1.000	50.00	4.17	24.254	0.007	0.0	0.0	0.0	1.01	7.9	1.3
PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design																																														
1.000	10.300	0.176	58.5	0.007	4.00	0.0	0.600	o	100	Pipe/Conduit																																															
PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)																																															
1.000	50.00	4.17	24.254	0.007	0.0	0.0	0.0	1.01	7.9	1.3																																															
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Arch Associates Limited		Page 2
Town House St Geroge's Square Bishops Waltham Southampton S032 1AF	QUEENS VIEW NETLEY	
Date 10/07/2023 18:24 File Drainage.MDX	Designed by ARCH ASSOCIATES Checked by CH	
XP Solutions	Network 2020.1.3	

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.001	7.650	0.131	58.4	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.002	15.820	0.270	58.6	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	2.400	0.041	58.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	10.310	0.176	58.6	0.007	4.00	0.0	0.600	o	100	Pipe/Conduit	
2.001	8.440	0.148	57.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	2.000	0.035	57.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.001	50.00	4.30	24.078	0.007	0.0	0.0	0.0	1.01	7.9	1.3
1.002	50.00	4.50	23.897	0.020	0.0	0.0	0.0	1.32	23.3	3.6
1.003	50.00	4.53	23.627	0.020	0.0	0.0	0.0	1.32	23.3	3.6
2.000	50.00	4.17	23.960	0.007	0.0	0.0	0.0	1.01	7.9	1.3
2.001	50.00	4.28	23.734	0.007	0.0	0.0	0.0	1.33	23.6	1.3
1.004	50.00	4.55	22.300	0.027	0.0	0.0	0.0	1.33	23.6	4.9

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Town House St Geroge's Square Bishops Waltham Southampton S032 1AF	QUEENS VIEW NETLEY	
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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S4	24.600	0.346	Open Manhole	450	1.000	24.254	100				
S3	24.600	0.522	Open Manhole	450	1.001	24.078	100	1.000	24.078	100	
S2	24.300	0.403	Open Manhole	450	1.002	23.897	150	1.001	23.947	100	
S1	24.300	0.673	Open Manhole	450	1.003	23.627	150	1.002	23.627	150	
S6	24.100	0.140	Open Manhole	450	2.000	23.960	100				
S5	24.300	0.566	Open Manhole	450	2.001	23.734	150	2.000	23.784	100	
SOAKAWAY	24.300	2.000	Open Manhole	1200	1.004	22.300	150	1.003	23.586	150	1286
								2.001	23.586	150	1286
SOAKAWAY	24.350	2.085	Open Manhole	0		OUTFALL		1.004	22.265	150	

No coordinates have been specified, layout information cannot be produced.

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	100	S4	24.600	24.254	0.246	Open Manhole	450
1.001	o	100	S3	24.600	24.078	0.422	Open Manhole	450
1.002	o	150	S2	24.300	23.897	0.253	Open Manhole	450
1.003	o	150	S1	24.300	23.627	0.523	Open Manhole	450
2.000	o	100	S6	24.100	23.960	0.040	Open Manhole	450
2.001	o	150	S5	24.300	23.734	0.416	Open Manhole	450
1.004	o	150	SOAKAWAY	24.300	22.300	1.850	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	10.300	58.5	S3	24.600	24.078	0.422	Open Manhole	450
1.001	7.650	58.4	S2	24.300	23.947	0.253	Open Manhole	450
1.002	15.820	58.6	S1	24.300	23.627	0.523	Open Manhole	450
1.003	2.400	58.5	SOAKAWAY	24.300	23.586	0.564	Open Manhole	1200
2.000	10.310	58.6	S5	24.300	23.784	0.416	Open Manhole	450
2.001	8.440	57.0	SOAKAWAY	24.300	23.586	0.564	Open Manhole	1200
1.004	2.000	57.1	SOAKAWAY	24.350	22.265	1.935	Open Manhole	0

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Town House St Geroge's Square Bishops Waltham Southampton S032 1AF	QUEENS VIEW NETLEY	
Date 10/07/2023 18:24 File Drainage.MDX	Designed by ARCH ASSOCIATES Checked by CH	
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Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
1.000	S4	100	0.246	0.422	Unclassified	450	0	0.246	Unclassified
1.001	S3	100	0.253	0.422	Unclassified	450	0	0.422	Unclassified
1.002	S2	150	0.253	0.523	Unclassified	450	0	0.253	Unclassified
1.003	S1	150	0.523	0.564	Unclassified	450	0	0.523	Unclassified
2.000	S6	100	0.040	0.416	Unclassified	450	0	0.040	Unclassified
2.001	S5	150	0.416	0.564	Unclassified	450	0	0.416	Unclassified
1.004	SOAKAWAY	150	1.850	1.935	Unclassified	1200	0	1.850	Unclassified

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
1.004	SOAKAWAY	24.350	22.265	22.300	0	0

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Town House St Geroge's Square Bishops Waltham Southampton S032 1AF	QUEENS VIEW NETLEY	
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XP Solutions Network 2020.1.3		

Simulation Criteria for Storm

Volumetric Runoff Coeff 1.000	Manhole Headloss Coeff (Global) 0.500	Inlet Coeffiecient 0.800
Areal Reduction Factor 1.000	Foul Sewage per hectare (l/s) 0.000	Flow per Person per Day (l/per/day) 0.000
Hot Start (mins) 0	Additional Flow - % of Total Flow 0.000	Run Time (mins) 60
Hot Start Level (mm) 0	MADD Factor * 10m ³ /ha Storage 2.000	Output Interval (mins) 1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 19.200	Cv (Summer) 1.000
Return Period (years)	100	Ratio R 0.350	Cv (Winter) 0.840
Region England and Wales		Profile Type Summer Storm	Duration (mins) 30

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Online Controls for Storm

Pump Manhole: SOAKAWAY, DS/PN: 1.004, Volume (m³): 2.4

Invert Level (m) 22.300

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	0.0000	1.200	0.0000	2.200	0.0000	3.200	0.0000	4.200	0.0000	5.200	0.0000
0.400	0.0000	1.400	0.0000	2.400	0.0000	3.400	0.0000	4.400	0.0000	5.400	0.0000
0.600	0.0000	1.600	0.0000	2.600	0.0000	3.600	0.0000	4.600	0.0000	5.600	0.0000
0.800	0.0000	1.800	0.0000	2.800	0.0000	3.800	0.0000	4.800	0.0000	5.800	0.0000
1.000	0.0000	2.000	0.0000	3.000	0.0000	4.000	0.0000	5.000	0.0000	6.000	0.0000

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Town House St Geroge's Square Bishops Waltham Southampton S032 1AF	QUEENS VIEW NETLEY																			
Date 10/07/2023 18:24 File Drainage.MDX	Designed by ARCH ASSOCIATES Checked by CH																			
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<u>Storage Structures for Storm</u>																				
<u>Cellular Storage Manhole: SOAKAWAY, DS/PN: 1.004</u>																				
Invert Level (m) 22.300 Infiltration Coefficient Side (m/hr) 0.06408 Porosity 0.95 Infiltration Coefficient Base (m/hr) 0.06408 Safety Factor 3.0																				
<table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td></tr><tr><td>0.000</td><td>16.0</td><td>16.0</td><td>1.500</td><td>16.0</td><td>46.0</td><td>1.501</td><td>0.0</td><td>46.0</td></tr></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	16.0	16.0	1.500	16.0	46.0	1.501	0.0	46.0
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)												
0.000	16.0	16.0	1.500	16.0	46.0	1.501	0.0	46.0												
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Summary of Critical Results by Maximum Level (Rank 1) for Storm

Areal Reduction Factor	1.000	Manhole Headloss Coeff (Global)	0.500	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Foul Sewage per hectare (l/s)	0.000	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Additional Flow - % of Total Flow	0.000	Flow per Person per Day (l/per/day)	0.000

Synthetic Rainfall Details

```
Margin for Flood Risk Warning (mm) 300.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF
```

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Half Drain	Pipe
									Level (m)	Depth (m)	Volume (m³)			Time (mins)	Flow (l/s)
1.000	S4	15 Summer	100	+45%					24.322	-0.032	0.000	0.79			5.9
1.001	S3	15 Summer	100	+45%					24.147	-0.031	0.000	0.81			5.9

Arch Associates Limited		Page 10												
Town House St Geroge's Square Bishops Waltham Southampton S032 1AF	QUEENS VIEW NETLEY													
Date 10/07/2023 18:24 File Drainage.MDX	Designed by ARCH ASSOCIATES Checked by CH													
XP Solutions	Network 2020.1.3													
<u>Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>														
<table><thead><tr><th>PN</th><th>US/MH Name</th><th>Status</th><th>Level Exceeded</th></tr></thead><tbody><tr><td>1.000</td><td>S4</td><td>FLOOD RISK</td><td></td></tr><tr><td>1.001</td><td>S3</td><td>OK</td><td></td></tr></tbody></table>			PN	US/MH Name	Status	Level Exceeded	1.000	S4	FLOOD RISK		1.001	S3	OK	
PN	US/MH Name	Status	Level Exceeded											
1.000	S4	FLOOD RISK												
1.001	S3	OK												
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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
1.002	S2	15 Summer	100	+45%					23.997	-0.050	0.000	0.78		
1.003	S1	15 Summer	100	+45%	100/15 Summer				23.800	0.023	0.000	1.32		
2.000	S6	15 Summer	100	+45%					24.028	-0.032	0.000	0.80		
2.001	S5	15 Summer	100	+45%					23.789	-0.095	0.000	0.29		
1.004	SOAKAWAY	720 Winter	100	+45%	1/60 Summer				23.649	1.199	0.000	0.00		900

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
1.002	S2	16.8	OK	
1.003	S1	16.7	SURCHARGED	
2.000	S6	5.9	FLOOD RISK	
2.001	S5	5.9	OK	
1.004	SOAKAWAY	0.0	SURCHARGED	

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Town House St Geroge's Square Bishops Waltham Southampton SO32 1AF	QUEENS VIEW NETLEY SOAKAWAY 2 NETWORK	
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XP Solutions	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	19.300	Volumetric Runoff Coeff.	1.000	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.350	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	50	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	100
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	15.860	0.271	58.5	0.024	4.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	4.20	23.420	0.024	0.0	0.0	0.0	1.32	23.3	4.3

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Town House St Geroge's Square Bishops Waltham Southampton SO32 1AF	QUEENS VIEW NETLEY SOAKAWAY 2 NETWORK	
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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	18.430	0.315	58.5	0.017	4.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	5.500	0.101	54.5	0.007	4.00	0.0	0.600	o	100	Pipe/Conduit	
1.001	5.000	0.099	50.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	2.000	0.020	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.000	50.00	4.23	24.000	0.017	0.0	0.0	0.0	1.32	23.3	3.1
3.000	50.00	4.09	23.250	0.007	0.0	0.0	0.0	1.05	8.2	1.3
1.001	50.00	4.29	23.099	0.048	0.0	0.0	0.0	1.42	25.1	8.7
1.002	50.00	4.33	23.000	0.048	0.0	0.0	0.0	1.00	17.8	8.7

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S8	24.000	0.580	Open Manhole	450	1.000	23.420	150				
S9	24.580	0.580	Open Manhole	450	2.000	24.000	150				
S10	24.250	1.000	Open Manhole	450	3.000	23.250	100				
S9	24.250	1.151	Open Manhole	450	1.001	23.099	150	1.000	23.149	150	50
								2.000	23.685	150	586
								3.000	23.149	100	
SOAKAWAY 2	24.250	1.250	Open Manhole	450	1.002	23.000	150	1.001	23.000	150	
	24.250	1.270	Open Manhole	0		OUTFALL		1.002	22.980	150	

No coordinates have been specified, layout information cannot be produced.

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PIPELINE SCHEDULES for Storm										
Upstream Manhole										
PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., (mm)	L*W	
1.000	o	150	S8	24.000	23.420	0.430	Open Manhole		450	
2.000	o	150	S9	24.580	24.000	0.430	Open Manhole		450	
3.000	o	100	S10	24.250	23.250	0.900	Open Manhole		450	
1.001	o	150	S9	24.250	23.099	1.001	Open Manhole		450	
1.002	o	150	SOAKAWAY 2	24.250	23.000	1.100	Open Manhole		450	
Downstream Manhole										
PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., (mm)	L*W	
1.000	15.860	58.5	S9	24.250	23.149	0.951	Open Manhole		450	
2.000	18.430	58.5	S9	24.250	23.685	0.415	Open Manhole		450	
3.000	5.500	54.5	S9	24.250	23.149	1.001	Open Manhole		450	
1.001	5.000	50.5	SOAKAWAY 2	24.250	23.000	1.100	Open Manhole		450	
1.002	2.000	100.0		24.250	22.980	1.120	Open Manhole		0	
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Town House St Geroge's Square		QUEENS VIEW																																																									
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XP Solutions		Network 2020.1.3																																																									
Free Flowing Outfall Details for Storm <table><thead><tr><th>Outfall Pipe Number</th><th>Outfall C. Level Name (m)</th><th>I. Level (m)</th><th>Min I. Level (m)</th><th>D,L (mm)</th><th>W (mm)</th></tr></thead><tbody><tr><td>1.002</td><td>24.250</td><td>22.980</td><td>0.000</td><td>0</td><td>0</td></tr></tbody></table> Simulation Criteria for Storm <table><tbody><tr><td>Volumetric Runoff Coeff</td><td>1.000</td><td>Manhole Headloss Coeff (Global)</td><td>0.500</td><td>Inlet Coeffiecient</td><td>0.800</td></tr><tr><td>Areal Reduction Factor</td><td>1.000</td><td>Foul Sewage per hectare (l/s)</td><td>0.000</td><td>Flow per Person per Day (l/per/day)</td><td>0.000</td></tr><tr><td>Hot Start (mins)</td><td>0</td><td>Additional Flow - % of Total Flow</td><td>0.000</td><td>Run Time (mins)</td><td>60</td></tr><tr><td>Hot Start Level (mm)</td><td>0</td><td>MADD Factor * 10m³/ha Storage</td><td>2.000</td><td>Output Interval (mins)</td><td>1</td></tr></tbody></table> Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0 Synthetic Rainfall Details <table><tbody><tr><td>Rainfall Model</td><td>FSR</td><td>M5-60 (mm)</td><td>19.300</td><td>Cv (Summer)</td><td>1.000</td></tr><tr><td>Return Period (years)</td><td>100</td><td>Ratio R</td><td>0.350</td><td>Cv (Winter)</td><td>0.840</td></tr><tr><td colspan="2">Region England and Wales</td><td>Profile Type</td><td>Summer Storm</td><td>Duration (mins)</td><td>30</td></tr></tbody></table>						Outfall Pipe Number	Outfall C. Level Name (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)	1.002	24.250	22.980	0.000	0	0	Volumetric Runoff Coeff	1.000	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	0.800	Areal Reduction Factor	1.000	Foul Sewage per hectare (l/s)	0.000	Flow per Person per Day (l/per/day)	0.000	Hot Start (mins)	0	Additional Flow - % of Total Flow	0.000	Run Time (mins)	60	Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1	Rainfall Model	FSR	M5-60 (mm)	19.300	Cv (Summer)	1.000	Return Period (years)	100	Ratio R	0.350	Cv (Winter)	0.840	Region England and Wales		Profile Type	Summer Storm	Duration (mins)	30
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Date 30/11/2023 10:57	Designed by ARCH ASSOCIATES																			
File Drainage SA2.MDX	Checked by CH																			
XP Solutions	Network 2020.1.3																			
Storage Structures for Storm Cellular Storage Manhole: S9, DS/PN: 1.001 Invert Level (m) 22.300 Infiltration Coefficient Side (m/hr) 0.06400 Porosity 0.95 Infiltration Coefficient Base (m/hr) 0.06400 Safety Factor 3.0 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>52.0</td><td>45.0</td><td>1.000</td><td>52.0</td><td>81.0</td><td>1.001</td><td>0.0</td><td>81.0</td></tr></tbody></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	52.0	45.0	1.000	52.0	81.0	1.001	0.0	81.0
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)												
0.000	52.0	45.0	1.000	52.0	81.0	1.001	0.0	81.0												
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<u>Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>																			
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	US/MH		Level																
PN	Name	Status	Exceeded																
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2.000	S9	OK																	
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Town House St Geroge's Square Bishops Waltham Southampton S032 1AF	QUEENS VIEW NETLEY SOAKAWAY 2 NETWORK	
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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
3.000	S10	15 Summer	100	+45%					23.319	-0.031	0.000	0.81		
1.001	S9	600 Winter	100	+45%					23.081	-0.168	0.000	0.00		850
1.002	SOAKAWAY 2	15 Summer	1	+0%					23.000	-0.150	0.000	0.00		

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
3.000	S10	5.9	OK	
1.001	S9	0.0	OK	
1.002	SOAKAWAY 2	0.0	OK	

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Town House St Geroge's Square		QUEENS VIEW			
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File PERM PAV.SRCX		Checked by CH			
XP Solutions		Source Control 2020.1.3			
Summary of Results for 100 year Return Period (+45%)					
Half Drain Time : 131 minutes.					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	23.309	0.159	1.2	9.5	0 K
30 min Summer	23.357	0.207	1.2	12.8	0 K
60 min Summer	23.397	0.247	1.2	15.6	0 K
120 min Summer	23.419	0.269	1.2	17.0	0 K
180 min Summer	23.419	0.269	1.2	17.0	0 K
240 min Summer	23.413	0.263	1.2	16.6	0 K
360 min Summer	23.398	0.248	1.2	15.6	0 K
480 min Summer	23.382	0.232	1.2	14.5	0 K
600 min Summer	23.366	0.216	1.2	13.4	0 K
720 min Summer	23.350	0.200	1.2	12.3	0 K
960 min Summer	23.319	0.169	1.2	10.2	0 K
1440 min Summer	23.268	0.118	1.2	6.7	0 K
2160 min Summer	23.218	0.068	1.2	3.3	0 K
2880 min Summer	23.198	0.048	1.1	2.0	0 K
4320 min Summer	23.188	0.038	0.8	1.2	0 K
5760 min Summer	23.184	0.034	0.7	1.0	0 K
7200 min Summer	23.181	0.031	0.6	0.8	0 K
8640 min Summer	23.179	0.029	0.5	0.7	0 K
10080 min Summer	23.177	0.027	0.4	0.6	0 K
15 min Winter	23.309	0.159	1.2	9.5	0 K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
15 min Summer	131.324	0.0	21		
30 min Summer	88.267	0.0	35		
60 min Summer	56.615	0.0	62		
120 min Summer	35.051	0.0	118		
180 min Summer	26.079	0.0	148		
240 min Summer	20.989	0.0	180		
360 min Summer	15.437	0.0	248		
480 min Summer	12.404	0.0	316		
600 min Summer	10.458	0.0	384		
720 min Summer	9.093	0.0	450		
960 min Summer	7.284	0.0	578		
1440 min Summer	5.319	0.0	822		
2160 min Summer	3.876	0.0	1152		
2880 min Summer	3.092	0.0	1472		
4320 min Summer	2.245	0.0	2204		
5760 min Summer	1.786	0.0	2880		
7200 min Summer	1.495	0.0	3672		
8640 min Summer	1.295	0.0	4400		
10080 min Summer	1.146	0.0	5024		
15 min Winter	131.324	0.0	21		
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XP Solutions		Source Control 2020.1.3			
Summary of Results for 100 year Return Period (+45%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	23.357	0.207	1.2	12.8	0 K
60 min Winter	23.398	0.248	1.2	15.6	0 K
120 min Winter	23.421	0.271	1.2	17.1	0 K
180 min Winter	23.418	0.268	1.2	16.9	0 K
240 min Winter	23.409	0.259	1.2	16.4	0 K
360 min Winter	23.387	0.237	1.2	14.8	0 K
480 min Winter	23.362	0.212	1.2	13.1	0 K
600 min Winter	23.337	0.187	1.2	11.4	0 K
720 min Winter	23.313	0.163	1.2	9.8	0 K
960 min Winter	23.270	0.120	1.2	6.8	0 K
1440 min Winter	23.209	0.059	1.2	2.7	0 K
2160 min Winter	23.190	0.040	0.9	1.4	0 K
2880 min Winter	23.186	0.036	0.8	1.1	0 K
4320 min Winter	23.180	0.030	0.5	0.8	0 K
5760 min Winter	23.177	0.027	0.4	0.6	0 K
7200 min Winter	23.175	0.025	0.4	0.5	0 K
8640 min Winter	23.173	0.023	0.3	0.5	0 K
10080 min Winter	23.172	0.022	0.3	0.4	0 K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	88.267	0.0	35		
60 min Winter	56.615	0.0	62		
120 min Winter	35.051	0.0	118		
180 min Winter	26.079	0.0	152		
240 min Winter	20.989	0.0	188		
360 min Winter	15.437	0.0	264		
480 min Winter	12.404	0.0	338		
600 min Winter	10.458	0.0	408		
720 min Winter	9.093	0.0	474		
960 min Winter	7.284	0.0	598		
1440 min Winter	5.319	0.0	800		
2160 min Winter	3.876	0.0	1124		
2880 min Winter	3.092	0.0	1460		
4320 min Winter	2.245	0.0	2208		
5760 min Winter	1.786	0.0	2952		
7200 min Winter	1.495	0.0	3544		
8640 min Winter	1.295	0.0	4288		
10080 min Winter	1.146	0.0	5032		
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Date 30/11/2023 11:30 File PERM PAV.SRCX	Designed by ARCH ASSOCIATES Checked by CH																									
XP Solutions	Source Control 2020.1.3																									
Model Details Storage is Online Cover Level (m) 24.250 Porous Car Park Structure <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.06400</td><td>Width (m)</td><td>10.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>19.5</td></tr><tr><td>Max Percolation (l/s)</td><td>54.2</td><td>Slope (1:X)</td><td>500.0</td></tr><tr><td>Safety Factor</td><td>3.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.35</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>23.150</td><td>Cap Volume Depth (m)</td><td>0.300</td></tr></table>			Infiltration Coefficient Base (m/hr)	0.06400	Width (m)	10.0	Membrane Percolation (mm/hr)	1000	Length (m)	19.5	Max Percolation (l/s)	54.2	Slope (1:X)	500.0	Safety Factor	3.0	Depression Storage (mm)	5	Porosity	0.35	Evaporation (mm/day)	3	Invert Level (m)	23.150	Cap Volume Depth (m)	0.300
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