OMNIA

ENVIRONMENTAL CONSULTING

Remedial Method Statement (RMS)

A10965

Land off Lovedean Lane
Lovedean Lane
Waterlooville
PO8 9RN

Prepared for

Mr Albert Brazil
Lovedean Lane
Waterlooville
PO8 9RN

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Quality Assurance

Remarks	Draft
Date	September 2019
Prepared by	J. Hodges
Signature	[redacted]
Checked by	G. Larcombe
Signature	[redacted]
Authorised by	T. Mitchell
Signature	[redacted]
Project number	A10965/2.0 Draft

www.omnia-consulting.co.uk

Omnia Environmental Consulting
3-6 The Quarterdeck
Port Solent
Portsmouth
PO6 4TP

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1.0 INTRODUCTION

1.1 Background

A Remediation Method Statement (RMS) has been prepared by Omnia Environmental Consulting (OEC) following a series of environmental site investigations at the site of Lovedean Lane, Waterlooville, PO8 9RN.

The results of the previous site investigation are contained within the following report references:

- Omnia Environmental Consulting Phase I-II Report, Dated July 2018. OEC report reference A10965/1.0;
- Omnia Environmental Consulting Letter Report, Dated November 2018. OEC report reference A10965/181112/L1; and,
- Omnia Environmental Consulting Letter Report, Dated October 2019. OEC report reference A10965/1901025/L1.

This RMS is based upon the findings of the OEC Phase I-II Geo Environmental Site Assessment and the following letter reports. Therefore, recommended that this RMS is read in association with the above reports.

An initial ground investigation was undertaken by OEC in July 2018 which comprised the advancement of two (2no.) hand dug pits, five (5no.) window sample locations and the installation of 3 ground gas and groundwater monitoring standpipes. Elevated concentrations of Cadmium and PAHs was identified within the near surface Made Ground within WS101. The OEC Phase I-II Report concluded that the concentrations present within the near surface soils within WS101 did not have the potential to pose a significant risk to human health as the pathway was deemed inactive due to the presence of hardstanding overlying WS101. However, the site layout has been since updated (Reference: DD264) and the risk to human health is required to be readdressed. It was therefore concluded that the concentrations present within the near surface soils within WS101 had the potential to pose a significant risk to human health in areas of proposed private gardens.

This is in line with comments from the Contaminated Land Officer at Havant Borough Council Environmental Health at Havant Borough Council made comment on the two phases of investigation. It was concluded that due to the limited amount of soil samples, there was insufficient evidence to characterise the identified contamination in WS101 as an isolated hotspot and that further testing was recommended in the area of the former chalk pit (WS103) to assess the risk of contamination leaching to the underlying Principal Aquifer.

A further ground investigation was undertaken by OEC in August 2018 following elevated levels of Cadmium and PAHs within WS101, which comprised an additional 5no. hand dug locations to determine what extent, if any of contamination delineation around WS101.

The Phase I Desk Top Study identified the former chalk pit dated c.1868-1973, located in the eastern portion of the site located under the proposed Plots 2 and 3 in the provided drawing reference DD264. OEC report A10965/1.0 identified a 3.50m thickness of Made Ground overlying cohesive soils within location WS103, consistent with the approximate location of the former Chalk Pit.

Following comments from both Portsmouth Water and Havant Borough Council (Reference APP/18/01107 - Dated 24/07/2019) raising concerns regarding the risk to controlled water via the leaching potential of Made Ground within the former chalk pit. OEC conducted one (1no.) day of intrusive trial pitting on 17th September 2019 to determine to extent and depth of the Made Ground of the former chalk pit and to collect samples for soil chemical testing to comprise leachate testing, identified as the appropriate method to assess the risk to controlled waters, between OEC and Havant Borough Council via email correspondence between G. Larcombe and J. Driver on the 05/09/2019.

This RMS covers both the elevated concentrations found in both July, and August of 2018, and current phase of investigation carried out in September 2019.

A site location plan is presented in Appendix III.

1.2 Report Objectives

The purpose of the Remediation Strategy is to identify and evaluate feasible remedial technologies and to validate the successful implementation of a site remediation programme to ensure the safe, cost effective and regulatory compliant re-development of the site.

The RMS set out within this document has been prepared to provide an overview of remedial requirements based on the initial findings of both the Phase I-II Geo-Environmental report and the current phases of investigation produced by OEC.

This RMS is based on the proposed development layout presented in Figure 2.0. Should the proposed layout change, this document should be revised, and the extent of risk mitigation measures reviewed.

1.3 Scope of Works

The main aims of the remedial works are as follows:

- To provide a remediated site that is suitable for its proposed end use i.e. residential development
- To provide a landform/ground surface which can accommodate the design
- To ensure that construction/groundworkers are not put at an unacceptable short-term risk during the remediation and/or redevelopment of the site
- To satisfy the requirements of the regulatory authorities (i.e. the Local Planning Authority).

1.4 Proposed Development Plan

The proposed development is understood to comprise three (3no.) dwellings of low-rise residential housing, with associated private gardens, parking, access roads and small communal areas.

1.5 Summary of Parties Involved

Table 1.1: Involved Parties

Name of Party	Function / Interest
Mr Albert Brazil	Principal Contractor
Omnia Environmental Consulting (OEC)	Geo-Environmental Consultant

Name of Party	Function / Interest
Havant Borough Council	Human Health Regulator / Local Planning Authority

1.6 Limitations

The limitations of this report are presented in Appendix I.

2.0 SITE SETTINGS

2.1 Site Details

Site Address	Land off Lovedean lane, Lovedean Lane, Waterlooville, PO8 9RN
National Grid Reference	468793, 112278

All acronyms used within this report are defined in the Glossary presented in Appendix II.

A site location map is presented in Appendix III.

2.2 Current Site Use

Reference should be made to the site walkover in the Phase II report, as detailed within OEC report ref: A10965/1.0, dated July 2018, for a comprehensive discussion on site setting, although a summary of the site use at the time of the investigation is detailed below:

The site at Lovedean Lane, Waterlooville is situated approximately 2.7km north of Waterlooville town centre and was accessed from Lovedean Lane in the east. The site comprised a roughly rectangular parcel of land, narrowing towards the north. A single building was located in the centre of the site which was in a poor state of repair. The north of the site comprised an area capped with a sub-base material and the south of the site was an area of unkempt soft landscaping.

The site was bound by wooden fencing around the perimeter of the site with residential houses immediately beyond. The topography on site generally sloped towards the south, with the western area of the site elevating by approximately 1.5-2.0m comprising of woodland, contain mature deciduous trees.

2.3 Geology and Ground Conditions

The previous OEC reports ref: A10985/1.0 and A10965/191025/L1, indicates that the site is underlain by the following sequence, generally conforming with The British Geological Survey (BGS) map for the site Fareham, Sheet 316, Solid and Drift Edition at a scale of 1:50,000):

<u>Made Ground</u>

Made Ground was encountered within all intrusive locations, with the exception of WS104, to a maximum depth of 3.50m bgl within WS103, but generally encountered to a maximum depth of 0.10-0.40m bgl across the site. Made Ground generally comprised a superficial layer of sub-base material, encountered within WS101, WS102, and WS105, overlying cohesive deposits with anthropogenic material within WS101 and WS103.

Made Ground can be broadly sub-divided into two (2no.) distinct units:

- Made Ground comprised a pinkish grey, angular and sub-angular, fine to coarse, sandy GRAVEL of mixed lithology to a maximum depth of 0.25m bgl, attributed to a presumed Type 1 sub-base material encountered within locations WS101, WS102 and WS105.

- Within WS101 a dark brown, slightly silty, gravelly medium SAND was present with the gravel component comprising angular to sub-rounded, fine to coarse flint, brick, chalk, and rare plastic. This was encountered between the depths of 0.15-0.40m bgl.

Potentially infilled Old Chalk Pit – south of the site

Observations from historical mapping indicate that location WS103 is located within a former chalk pit, dating from c.1868 to c.1974. Within WS103, TP201, TP202 and TP204 Made Ground comprised a soft to firm, gravelly CLAY to a maximum depth of 3.50m bgl (WS103). The gravel component was angular to subrounded, fine to coarse flint with varying anthropogenic material comprising flint, concrete, plastic, chalk and cobble sized brick. The thickness of Made Ground within the identified locations is likely attributed to infilled material of the chalk pit identified within historical mapping.

Superficial Head Deposits – Head Deposits

Superficial head deposits were encountered within all intrusive locations. Made Ground was found to be immediately underlain by a soft to firm, brownish orange slightly sandy CLAY with a maximum proven thickness of 1.90m within WS101.

Bedrock Deposits – Tarrant Chalk Formation

Superficial deposits were underlain by bedrock attributed to the Tarrant Chalk Formation, with a maximum observed thickness of 3.8m as recorded in WS102. The base of the unit was not encountered during the ground investigation.

The chalk bedrock was recovered as structureless CHALK composed of yellowish white slightly gravelly slightly sandy SILT. Gravel is weak, low density, white with frequent black specks and rounded in a brownish cream matrix (Grade Dm). This unit was encountered within all locations with the exception of WS103, TP205 and TP206.

Within WS103 a firm orangish brown mottled grey and red CLAY was encountered between 3.50m bgl and 5.0m bgl. Sub-rounded chalk gravels were noted present from a depth of 4.0m bgl.

An intrusive hole location plan advanced during all phases of intrusive investigation is presented as Figure 3.0 and 3.1.

2.4 Hydrogeology and Hydrology

The previous report indicated that the site is underlain by bedrock deposits of the Tarrant Chalk Member which is identified as a Principal Aquifer. The site is located within a groundwater Source Protection Zone (SPZ) Zone 1 (Inner Catchment) and that no potable water and/or groundwater abstraction licenses have been identified within a 250m radius of the site.

2.4.1 Groundwater

No groundwater was encountered within any intrusive borehole or trial pits.

From review of the BGS Hydrogeological Map of Hampshire and Isles of Wight (1:100,000) the elevation of the potentiometric surface of the groundwater within the Chalk is approximately +30mAOD in the area of the site. Utilising a site elevation of approximately +62m AOD based on Ordnance Survey mapping, it is anticipated that groundwater within the Chalk will be encountered at a depth of approximately 32m bgl beneath the site.

2.5 Summary of Contaminant Distribution

2.5.1 Tier I Risk Assessment Results

A total of eighteen (18no.) soil samples were collected and screened at the laboratory from all phases of investigation. Table 2.1 shows how many samples were collected at each phase of investigation and testing criteria.

Table 2.1: Soil Samples Collected and Tested

Visit Date	Number of samples sent for analysis	Testing carried out
June 2018	8	Tier 1 human health risk assessment
August 2018	5	Tier 1 human health risk assessment
September 2019	5	Leachable PAH & Metals

Selected soils samples, from the June 2018 and August 2018, were submitted for a Tier 1 Risk Assessment for the area which were directly compared based on the proposed residential end use with home grown produce. The Tier 1 risk assessment determined that concentrations of the following determinants exceeded the screening criteria at three (3no.) locations within the near surface and considered to have the potential to pose a significant risk to human health:

- Cadmium (WS101);
- Lead (HP202); and.
- PAH (WS101, HP202)

Selected soils samples, from the September 2019, were submitted for leachate testing for CLEA Metals and PAH which were directly compared to UK Drinking Water Standards based on the identified risk to controlled waters in the underlying Aquifer. The risk assessment determined that concentrations of the following determinants exceeded the screening criteria at two (2no.) locations within the near surface and considered to have the potential to pose a significant risk to human health:

- PAH (TP201, TP204).

2.5.2 Exposure Pathways

Cadmium

The main exposure pathway for Cadmium is via consumption of home grown produce and attached soil.

Lead and Poly-Aromatic Hydrocarbons (PAH)

The main exposure pathway for lead and PAH concentrations of Benzo(b)Fluoranthene, Benzo(a)Pyrene and Dibenzo(a,h)Anthracene are via soil ingestion and indoor dust.

2.5.3 Risk to Groundwater

Groundwater was not encountered during investigation works, however in order to assess the risk to controlled waters soil samples from the former Chalk Pit in the south of the site was collected and tested for leachable PAH and metals. These specific determinants were tested based on the results from the previous phase of works. The Tarrant Chalk Member is a Principal Aquifer and is noted to feed the Bedhampton & Havant Springs. Results of which were compared to UK DWS or WFD EQS 2010 for screen determinants. This is detailed within OEC report A10965/191025/L1.

Elevated concentrations of PAH were identified within TP201 and TP204 through the total thickness of Made Ground, which are considered to have the potential to present a significant risk to controlled waters.

2.6 Identified Development Constraints

The following potential development constraints have been identified in relation to risk to human health:

- Elevated concentrations of Cadmium in the near surface soils within WS101;
- Elevated concentrations of Lead in the near surface soils within HP202; and,
- Elevated concentrations of PAH in the near surface soils within WS101 and HP202;
- Elevated concentrations of PAH in the Made Ground in the former Chalk Pit within TP201 and TP204.

Should any reuse of materials be proposed a detailed Materials Management Plan (MMP) will need to be completed in accordance with CL:AIRE CoP in accordance with current best practice.

Based upon the information obtained, Table 2.2 demonstrates that each of the potential pollutant linkages, based upon the contaminant-pathway-receptor model will need to be satisfactorily addressed by the anticipated remedial works across the site.

Table 2.2: Pollutant Linkage Assessment

Receptor	Potential Risk	Current Residual Risk	Mitigation
Human Health	*Ingestion*	YES	**Construction Phase** During the development phase, construction workers are likely to be in direct contact with impacted soils across the site. It is therefore recommended that a risk assessment is completed for activities being undertaken within the affected areas by the Principal Contractor. **Post-Development** Elevated concentrations of Cadmium, Lead, and PAH have been identified across the site, and are considered to have the potential to present a significant risk to human health in the areas of proposed soft landscaping and private gardens. It is therefore recommended that a clean cover system is installed within proposed areas of soft landscaping and private gardens across the site in order to render the pollution linkage inactive.
	Dermal contact	NO	Not Considered a risk
	Inhalation	NO	Not Considered a risk
	Asphyxiation	NO	Not considered a risk.
	Fire and explosion	NO	Not considered a risk.
Buildings	*Fire and explosion*	NO	Not considered a risk.
	Chemical attack on building materials and services	Potentially	It is recommended that the relevant water supply company is contacted prior to the selection of potable water supply pipe material.
Natural Environment	*Contamination of water resources*	YES	Elevated levels of PAH leachate within the Made Ground in the former chalk pit have been identified. The contents of the chalk pit are therefore considered to have the potential to pose a significant risk to the underlying Aquifer. It is therefore recommended that the impacted material is removed and replaced with a clean, chemically suitable engineered material in order to render the pollution linkage inactive.

3.0 REMEDIATION STRATEGY

3.1 General

The main aims of the remediation strategy are as follows:

- To provide a final ground surface suitable for the proposed use of the site i.e. residential dwellings
- To comply with the requirements of the Local Planning Authority and their Environmental Health Department to ensure future users of the site are not put at risk from any chemical contamination arising from its former use(s) or nature of materials present
- To ensure construction workers are not put at an unacceptable short-term risk when redeveloping the site

3.2 Remedial Measures

Based on the findings of the site investigation and the development constraints listed above, the following remediation strategy has been devised for the site. The proposed scope of works is summarised below and detailed in the subsequent sub-sections. Full details of the methodology are set out in Section 6.2 of the Method Statement. In summary this comprises:

- Excavation of near surface soils within areas of private gardens to 600mm bfgl or natural ground if encountered at a lesser depth;
- Excavation of impacted made ground from within the former chalk pit;
- Off-site disposal of excavated materials in line with current guidelines or relocation onsite within the constraints of an MMP if the criteria of the CL:AIRE CoP can be demonstrated to apply;
- Installation of a clean cover system, incorporating a high-visibility geotextile membrane within the private garden areas of plots 1-3; and,
- Backfilling of a chemically and geotechnically suitable material into the former chalk pit.

A validation report should be produced on completion of the works. This report will serve to confirm the works were undertaken in accordance with the relevant legislation, the remediation statement, method statements and as necessary Planning Conditions, as set out in detail in Section 6.0.

4.0 REMEDIAL WORKS

4.1 General

It is recommended that near surface soils within areas of private gardens and proposed communal soft landscaping are excavated to 600mm bfgl respectively, or natural ground if a lesser depth, and the made ground within the former chalk pit (estimated to approximately 12m (l) x 10m (w) x 3.5m-2.0m (d)) and removed off site prior to the implementation of a clean cover system or, relocated onsite within the constraints of an MMP if the criteria of the CL:AIRE CoP can be demonstrated. The locations of areas requiring excavation and a clean cover system are presented as Figure 4.0 in Appendix III.

4.2 Installation of a Clean Cover System in Areas of Private Gardens

A clean cover system should be installed to remove the currently active pollution linkage within the private garden area and within the proposed communal soft landscaping across the site as illustrated in Figure 4.0 and set out in the following sections.

However, should the proposed layout change, then the RMS should be reviewed and updated accordingly.

4.2.1 Excavation in Private Gardens

Elevated concentrations of Cadmium, Lead and PAH have been identified across the site. Soil should be excavated within all garden plots to a depth of 600mm bfgl, or natural ground if encountered at a lesser depth.

Following the excavation of impacted soils, material should be removed via a registered waste carrier or relocated onsite within the constraints of an MMP if the criteria of the CL:AIRE CoP can be demonstrated to apply.

4.2.2 Backfill of Excavations

A high visibility geotextile should be placed at the base of the clean cover system at a depth of 600mm bgl in private gardens to act as a marker layer and prevent the intermixing of clean imported soils with underlying soils. Alternatively, if natural soils are encountered at a lesser depth the membrane can be omitted, with the clean cover placed directly onto natural ground.

Material used to backfill the excavations should be chemically suitable and should also be tested against the screening criteria set out in Table 5.2. Only material complying with these target values should be used to ensure that the material does not present a significant risk to the identified receptors.

Clean soil should be placed in private gardens to provide 600mm of clean cover, or a lesser depth if natural soils are encountered within this horizon.

4.3 Excavation in former chalk pit

In the area previously occupied by the former chalk pit, impacted Made Ground should be excavated in order to remove elevated concentrations that pose a risk to controlled waters. For an area of approximately 12m (length) x 10m (width) x 3.5m-2.0m (depth). The area of impacted material is presented within Figure 6.0.

Following the excavation of impacted soils, material should be removed via a registered waste carrier or relocated onsite within the constraints of an MMP if the criteria of the CL:AIRE CoP can be demonstrated to apply.

Backfill of excavations around the former chalk pit should also be geotechnical suitable.

Areas requiring the installation of a clean cover system are illustrated on Figure 4.0 within Appendix III.

4.4 Underground Utilities Pipework

It is recommended that contact is made with the mains water supplier to ensure that the mains water supply pipework selected is in accordance with the requirements of the local water authority.

5.0 VALIDATION

5.1 Validation of Clean Cover System (Private Gardens)

In order to confirm that a clean cover system has been correctly installed and the exposure pathway broken, validation of remedial works is required.

Hand excavated validation pits should be advanced to a depth of 600mm bgl in the private gardens to validate the correct installation of the clean cover system and to confirm the placement of a high-visibility geotextile marker layer, as presented within Figure 5.0. Where membrane has been omitted due to the presence of natural soils within 600mm of the ground surface, soil samples should be collected across the whole depth to confirm chemical suitability.

The thickness of the cover system should be documented through on-site measurements and photographic evidence.

Soil samples should be collected from the emplaced clean imported soils and submitted for laboratory testing to confirm chemical suitability.

Upon receipt of compliant laboratory test results, a validation report should be produced to demonstrate that the correct thickness of chemically suitable clean soil has been used to form the clean cover system and confirm the placement of a high-visibility geotextile membrane at the base of the cover system.

5.2 Validation of Made Ground Removal Within the Former Chalk Pit

Adhering to best practise, OEC advise that a watching brief is conducted by a qualified environmental consultant during the removal of the contaminated made ground, and during the reinstatement of the suitable material. It is also advised that samples are collected from the base and sides of the excavated pit in order to verify all elevated contaminants have been removed.

5.3 Sampling Frequency of Imported Soils

The sampling frequency for materials to be managed under the Remediation Strategy is presented within Table 5.1 below. Samples should be analysed and compared to the guidance levels listed in Table 5.2.

Table 5.1: Chemical Validation Schedule

Purpose	Area	Testing Frequency	Chemical Analysis
Validation Testing in rear gardens	Private Garden	1 sample per $50m^3$	• Full CLEA Metals • Inorganic Compounds; • Speciated PAH; • Banded (C_5-C_{35}) TPH; • Asbestos Identification.

5.4 Validation Criteria

The clean cover system should meet the chemical suitability criteria set out in Table 5.2. It is considered that the values set out below will be suitably protective of the identified receptors.

The engineered fill being placed within the former chalk pit is required to be both, chemically and geotechnically suitable.

Table 5.2 – Chemical Suitability Criteria – Proposed Areas of Soft Landscaping & Private Gardens

Determinant	Units	Screening Value
Metals		
Arsenic	mg/kg	37
Beryllium	mg/kg	1.7
Cadmium	mg/kg	11
Chromium (III)	mg/kg	910
Chromium (VI)	mg/kg	6
Copper	mg/kg	2,400
Lead	mg/kg	200
Mercury	mg/kg	40
Nickel	mg/kg	180
Selenium	mg/kg	250
Zinc	mg/kg	3,700
General Inorganics		
Asbestos	mg/kg	0.001%
Cyanide	mg/kg	50
PAHs		
Naphthalene	mg/kg	2.3
Acenaphthylene	mg/kg	170
Acenaphthene	mg/kg	210
Fluorene	mg/kg	170
Phenanthrene	mg/kg	95
Anthracene	mg/kg	2,400
Fluoranthene	mg/kg	280
Pyrene	mg/kg	620
Benzo(a)Anthracene	mg/kg	7.2
Chrysene	mg/kg	15
Benzo(b)Fluoranthene	mg/kg	2.6
Benzo(k)Fluoranthene	mg/kg	77
Benzo(a)Pyrene	mg/kg	2.2
Indeno(123-cd) Pyrene	mg/kg	27
Dibenzo(a,h)Anthracene	mg/kg	0.24
Benzo(ghi)Perylene	mg/kg	320
Banded TPH		
TPH EC 5-6**	mg/kg	42
TPH EC >6-8**	mg/kg	100
TPH EC >8-10**	mg/kg	27
TPH EC> 10-12**	mg/kg	74
TPH EC> 12-16**	mg/kg	140
TPH EC> 16-21**	mg/kg	260
TPH EC> 21-35**	mg/kg	1,100
TPH EC> 35-44**	mg/kg	1,100

* Total cyanide Tier 1 GAC is taken from the Dutch Intervention Value (2010) for complex cyanide.

** The Tier 1 GAC for the banded hydrocarbon fraction is derived from the CIEH/S4UL assessment for petroleum hydrocarbons Criteria Working Group (CWG) for both aliphatic and aromatic compounds. OEC has utilised the lowest of the aliphatic and aromatic chain lengths in order to adopt a conservative approach, which is considered satisfactory for the protection of human health.

The origin of these GAC values is presented within Appendix IV.

6.0 RECORD KEEPING & VERIFICATION

6.1 Record Keeping

During the course of the remediation and site enabling works, the Principal Contractor (PC) should undertake the following record keeping protocols:

- Detailed daily site diary including material movements and photographs of the excavation works.

Record keeping on site, in particular movements and analysis of specific material types should be retained by the PC. This record should remain on site during the course of the works.

6.2 Verification

The records listed should then be incorporated into a Validation Report on completion of the remediation works.

The Validation Report will include the following:

- Copy of Consignment Notes relating to the movement of wastes to licensed waste management facilities where available;
- Detailed drawings showing all sampling locations from where impacted soils have been removed;
- Photographic evidence of Verification works, including any non-compliance and rectification measures.

6.3 Supervision and verification of works

All works as set out within this RMS should be documented via a watching brief during excavation works, and on completion validated by a suitably qualified and experienced Environmental Consultant. The level of attendance should be agreed with the Client and should involve validation and sampling of the clean cover system.

6.4 Previously Unidentified Contaminants

Should any additional significantly impacted material be encountered during the development works should be halted and contact made with the Environmental Consultant to determine the course of action. This is likely to include additional investigation and as necessary variation to the agreed RMS. Contact should be made with the regulator to confirm the proposed scope of works and any variation to the RMS.

APPENDIX I

LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between OE Ltd and the Client as indicated in Section 1.2.

2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information, it has been assumed it is correct. No attempt has been made to verify the information.

3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination, which are enforced, by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.

4. During the site walkover reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.

5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.

6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.

7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials this is for indicative purposes only and do not constitute or replace full and proper surveys.

8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.

9. OE cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by OE is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by OE in this connection without their explicit written agreement there to by OE.

10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

APPENDIX II

GLOSSARY

AST	ABOVE GROUND STORAGE TANK
BGS	BRITISH GEOLOGICAL SURVEY
BSI	BRITISH STANDARDS INSTITUTE
BTEX	BENZENE, TOLUENE, ETHYLBENZENE, XYLENES
CIEH	CHARTERED INSTITUTE OF ENVIRONMENTAL HEALTH
CIRIA	CONSTRUCTION INDUSTRY RESEARCH ASSOCIATION
CLEA	CONTAMINATED LAND EXPOSURE ASSESSMENT
CSM	CONCEPTUAL SITE MODEL
DNAPL	DENSE NON-AQUEOUS PHASE LIQUID (CHLORINATED SOLVENTS, PCB)
DWS	DRINKING WATER STANDARD
EA	ENVIRONMENT AGENCY
EQS	ENVIRONMENTAL QUALITY STANDARD
GAC	GENERAL ASSESSMENT CRITERIA
GL	GROUND LEVEL
GSV	GAS SCREENING VALUE
HCV	HEALTH CRITERIA VALUE
ICSM	INITIAL CONCEPTUAL SITE MODEL
LNAPL	LIGHT NON-AQUEOUS PHASE LIQUID (PETROL, DIESEL, KEROSENE)
ND	NOT DETECTED
LMRL	LOWER METHOD REPORTING LIMIT
NR	NOT RECORDED
PAH	POLY AROMATIC HYDROCARBON
PCB	POLY-CHLORINATED BIPHENYL
PID	PHOTO IONISATION DETECTOR
QA	QUALITY ASSURANCE
SGV	SOIL GUIDELINE VALUE
SPH	SEPARATE PHASE HYDROCARBON
SP.TPH (CWG)	TOTAL PETROLEUM HYDROCARBON (CRITERIA WORKING GROUP)
SPT	STANDARD PENETRATION TEST
SVOC	SEMI VOLATILE ORGANIC COMPOUND
UST	UNDERGROUND STORAGE TANK
VCCS	VIBRO CONCRETE COLUMNS
VOC	VOLATILE ORGANIC COMPOUND
WTE	WATER TABLE ELEVATION

UNITS

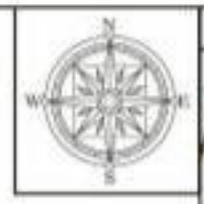
M	METRES
KM	KILOMETRES
%	PERCENT
%V/V	PERCENT VOLUME IN AIR
MB	MILLI BARS (ATMOSPHERIC PRESSURE)
L/HR	LITRES PER HOUR
µG/L	MICROGRAMS PER LITRE (PARTS PER BILLION)
PPB	PARTS PER BILLION
MG/KG	MILLIGRAMS PER KILOGRAM (PARTS PER MILLION)
PPM	PARTS PER MILLION
MG/M^3	MILLIGRAM PER METRE CUBED

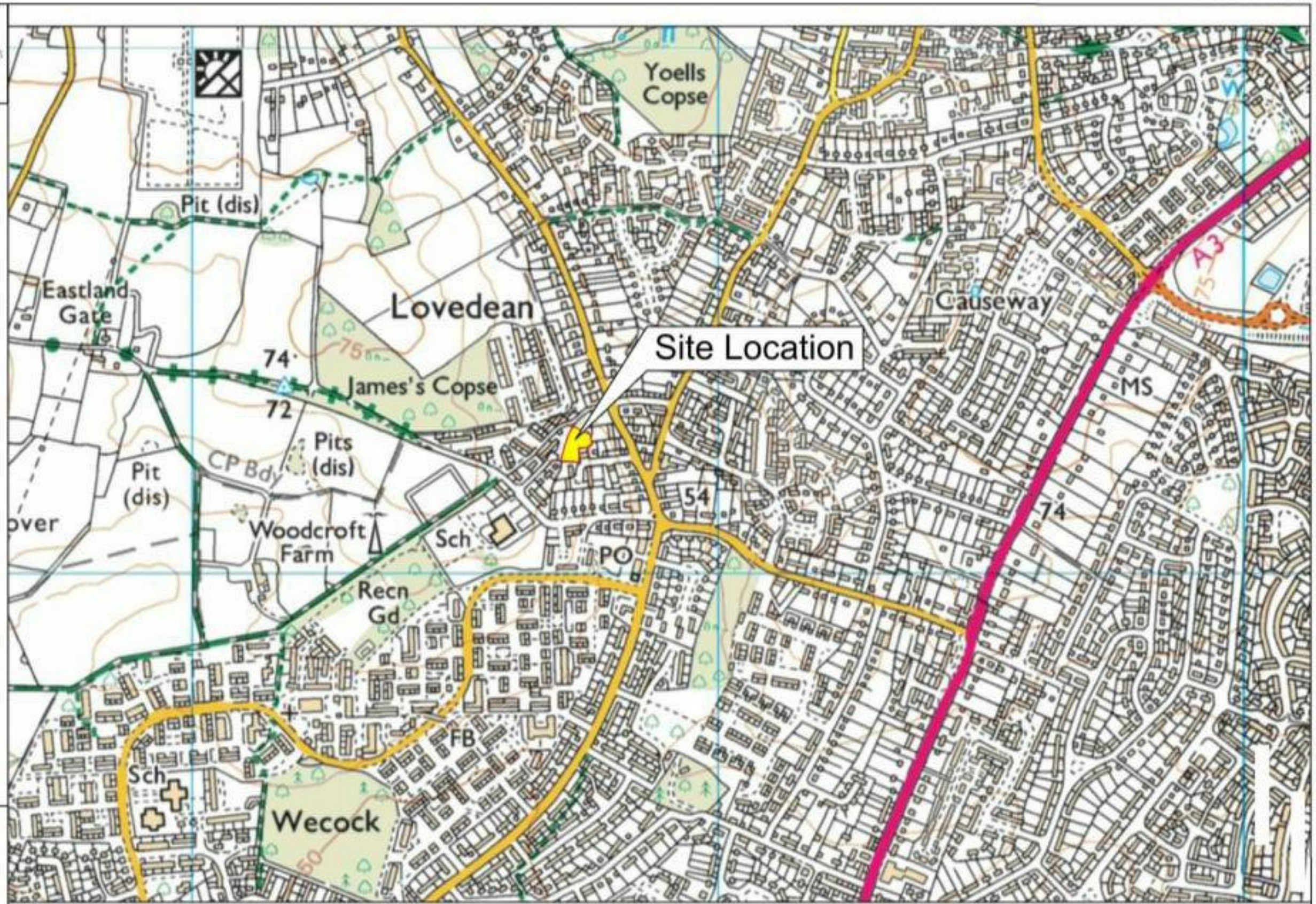
M BGL	METRES BELOW GROUND LEVEL
M BCL	METRE BELOW COVER LEVEL
MAOD	METRES ABOVE ORDNANCE DATUM (SEA LEVEL)
KN/M^2	KILO NEWTONS PER METRE SQUARED
µM	MICRO METRE

APPENDIX III

DRAWINGS

Key





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3-6 The Quarterdeck
Port Solent
Portsmouth
T: 01489 808888
E: info@omnia-consulting.co.uk
W: www.omnia-consulting.co.uk

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ENVIRONMENTAL CONSULTING

Job Title:	Client:	Project No: A10965	Date: 30/09/19	Drawing Title:
Lovedean Lane, Waterlooville	Mr Brazil	Drawn By: R.Durrant	Authorised By: G.Larcombe	Figure 1.0 - Site Location
		Scale: 1 square = 1km2	Notes:	

Key

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Fareham,
PO15 5TH
T: 01489 808088
E: info@omnia-consulting.co.uk
W: www.omnia-consulting.co.uk

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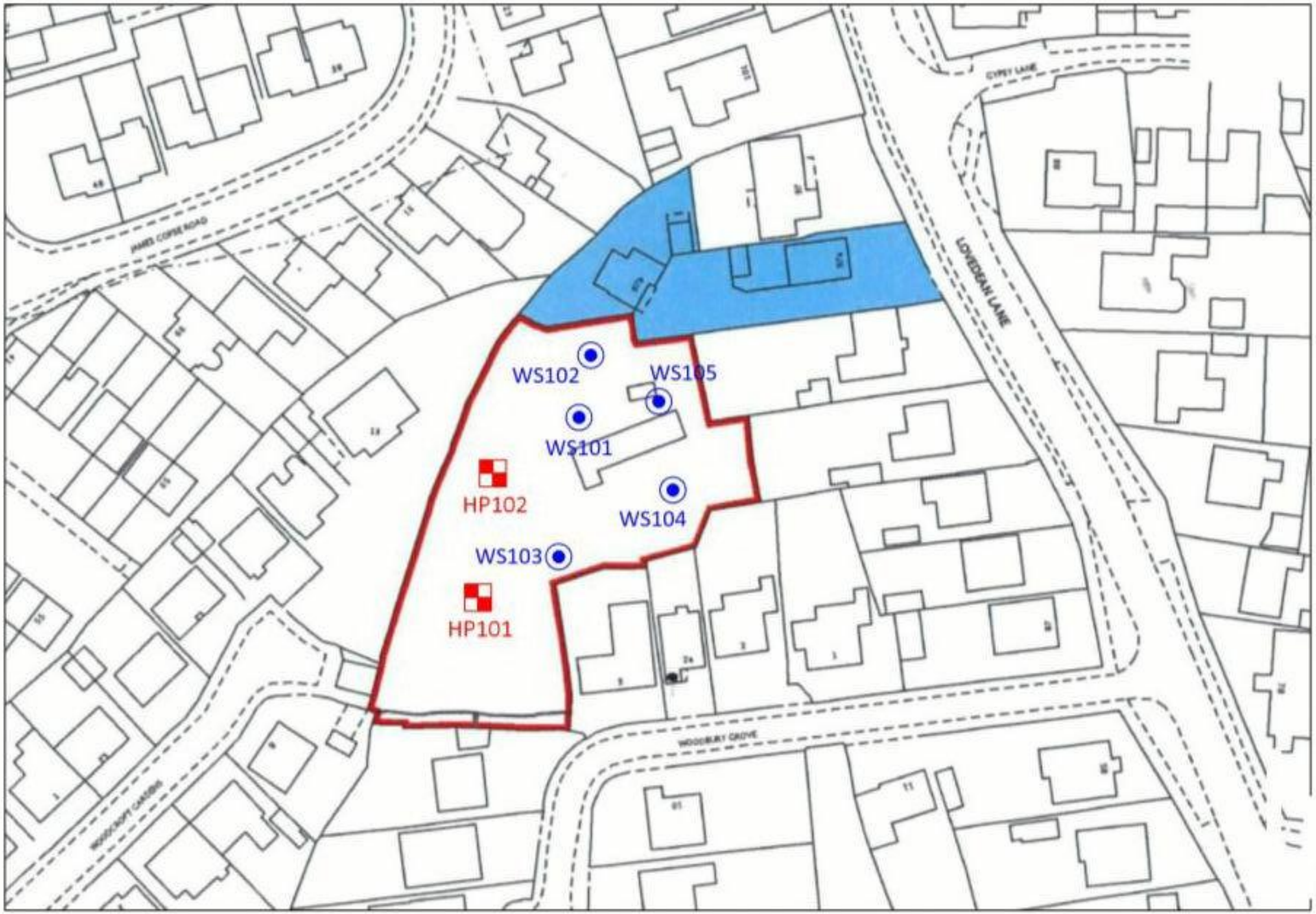
Job Title:	Client:	Project No:	Date:	Drawing Title:
Lovedean Lane, Waterlooville	Mr Brazil	A10965	30/09/2019	Figure 2.0 - Proposed Site Development Layout
		Drawn By: R.Durrant	Authorised By: G.Larcombe	
		Scale: NTS	Notes:	

Key

WS101 Approximate Window Sample Probehole Location

HP101 Approximate Hand Dug Pit Location



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E: info@omnia-consulting.co.uk
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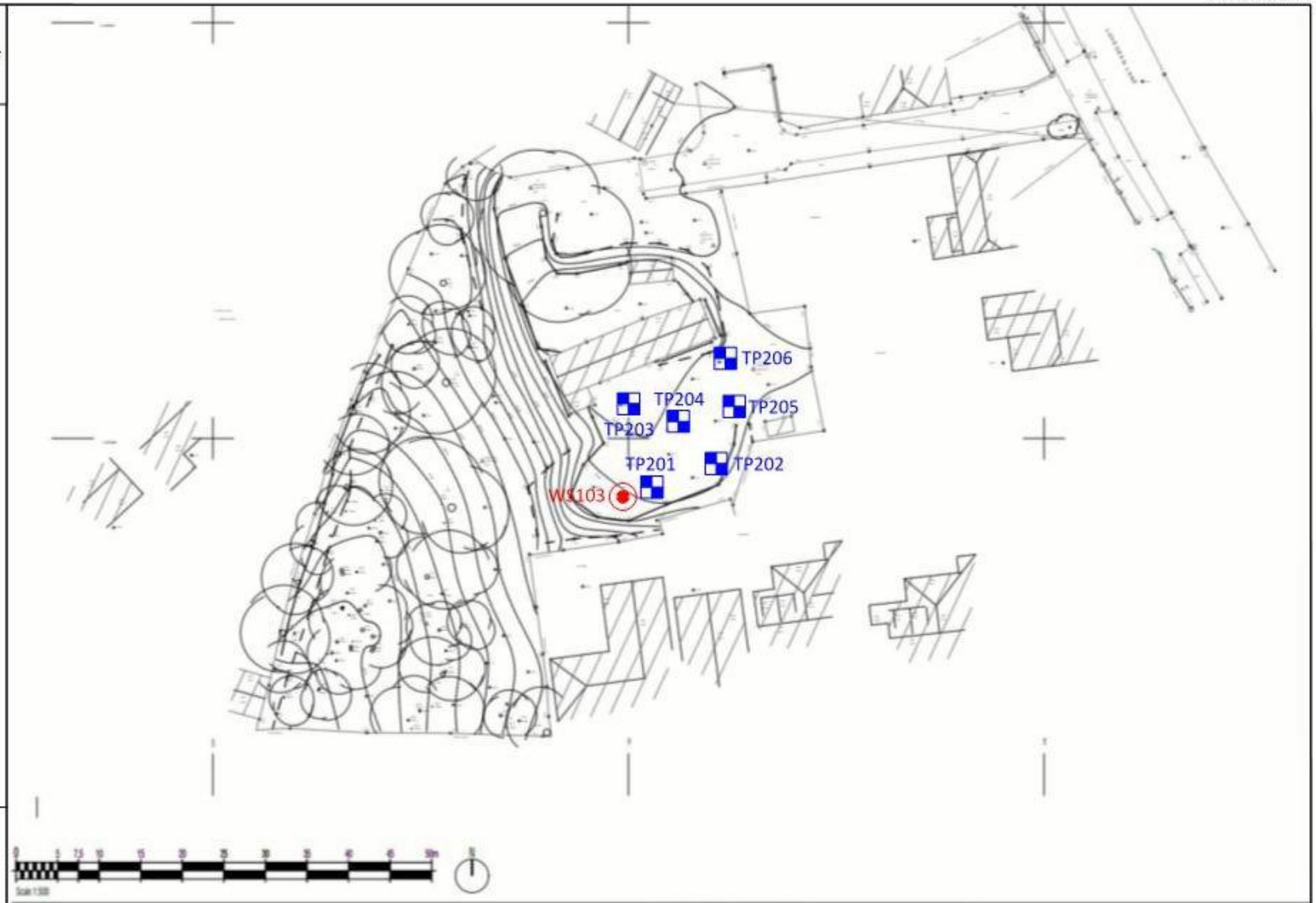
Job Title:	Client:	Project No:	Date:	Drawing Title:
Lovedean Lane, Waterlooville	PMC	A10965	19/07/18	3.0 - Intrusive Hole Location Plan
		Drawn By: G.Larcombe	Authorised By: T.Mitchell	
		Scale: NTS	Notes:	

Key

TP201 Approximate Trial Pit Locations

WS103 Approximate Windowless Sample Location previously identifying great thickness of Made Ground from inital investigation (A10965/1.0)



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PO15 5TH
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E: info@omnia-consulting.co.uk
W: www.omnia-consulting.co.uk

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Job Title:	Client:	Project No: A10965	Date: 30/09/2019	Drawing Title:
Lovedean Lane, Waterlooville	Mr Brazil	Drawn By: R.Durrant	Authorised By: G.Larcombe	Figure 3.1 - Intrusive Location Plan
		Scale: NTS	Notes:	

Key

600mm clean cover in areas of private garden or to natural ground

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Port Solent
Portsmouth
PO6 4TP
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E: info@omnia-consulting.co.uk
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Job Title:	Client:	Project No:	Date:	Drawing Title:
Lovedean Lane, Waterlooville	Mr Brazil	A10965	24/10/19	Figure 4.0 - Soil Remediation Area
		Drawn By: J.Hodges	Authorised By: G.Larcombe	
		Scale: NTS	Notes:	

Key

Area requiring high visibility geotextile marker layer if made ground in excess of 600mm

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PO6 4TP
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E: info@omnia-consulting.co.uk
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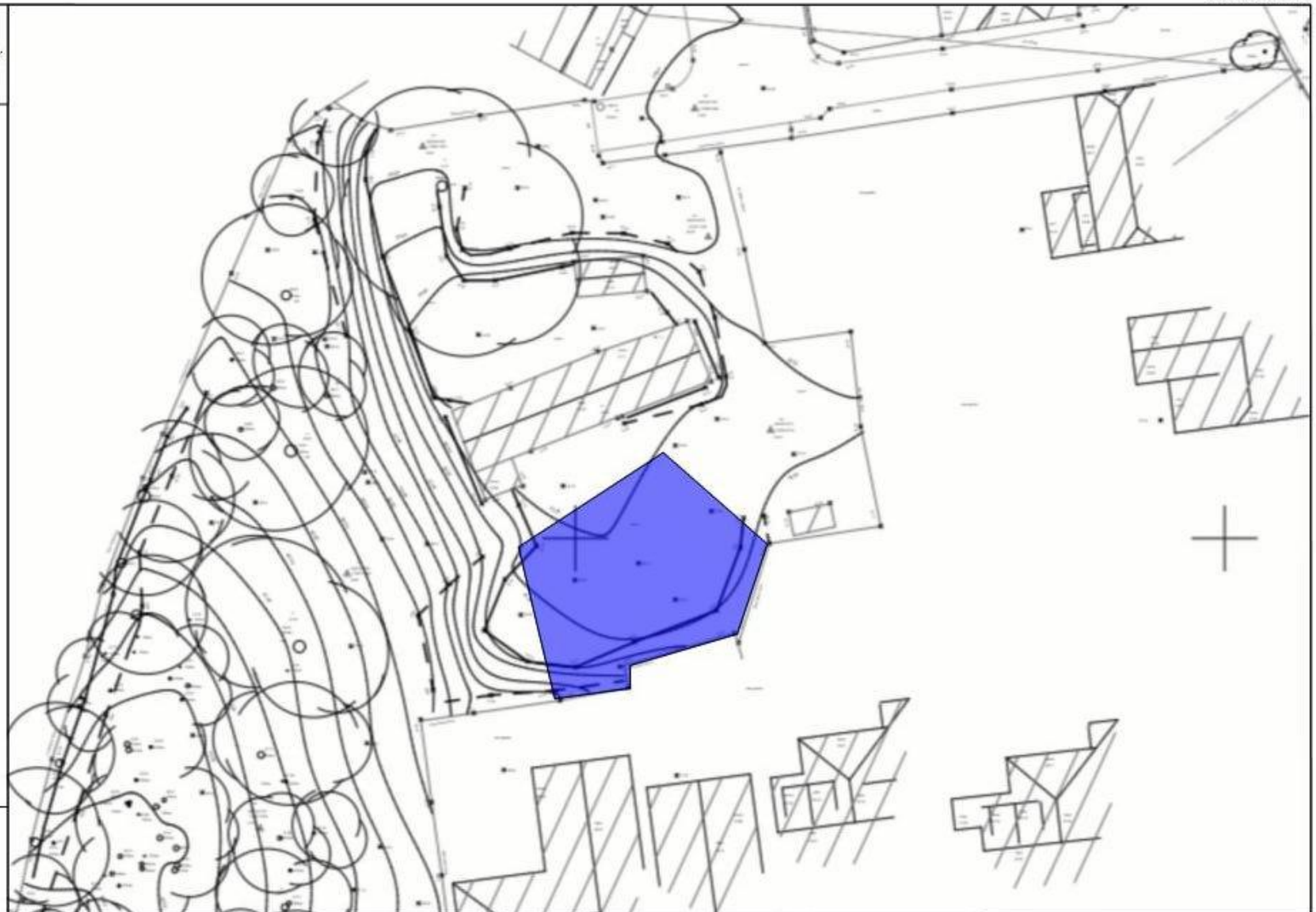
Job Title:	Client:	Project No:	Date:	Drawing Title:
Lovedean Lane, Waterlooville	Mr Brazil	A10965	24/10/19	Figure 5.0 - Areas requiring high visibily geotextile marker layer
		Drawn By: J.Hodges	Authorised By: G.Larcombe	
		Scale: NTS	Notes:	

Key

Area of soil removal within former chalk pit



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Job Title:	Client:	Project No:	Date:	Drawing Title:
Lovedean Lane, Waterlooville	Mr Brazil	A10965	24/10/19	Figure 6.0 - Area of soil removal within former chalk pit
		Drawn By: J.Hodges	Authorised By: G.Larcombe	
		Scale: NTS	Notes:	

APPENDIX IV

ORIGIN OF GAC VALUES

Determinant	Unit	GAC	Exposure Pathway	Origin of Risk Assessment Value
Metals				
Arsenic	mg/kg	37	1	LQM CIEH Suitable for Use Levels (S4UL) 2015- Inorganic Arsenic
Beryllium	mg/kg	1.7	1	LQM CIEH Suitable for Use Levels (S4UL) 2015
Boron	mg/kg	290	1	
Cadmium	mg/kg	11	2	
Chromium (III)	mg/kg	910	1	
Chromium (VI)	mg/kg	6	2	
Copper	mg/kg	2,400	2	
Lead	mg/kg	200	1	Category 4 Screening Level (C4SL) utilising exposure parameters from CLEA SR3 report.
Mercury	mg/kg	40	1	LQM CIEH Suitable for Use Levels (S4UL) 2015- Inorganic Mercury
Nickel	mg/kg	180	1,2	LQM CIEH Suitable for Use Levels (S4UL) 2015
Selenium	mg/kg	250	1,2	
Vanadium	mg/kg	410	2	
Zinc	mg/kg	3,700	2	
General Inorganics				
Total Cyanide*	mg/kg	50	1	Dutch Intervention Values 2010
Asbestos	%	0.001%	6	OEC Derived Value based on ICRCL
General Organics				
Phenol	mg/kg	280	2	LQM CIEH Suitable for Use Levels (S4UL) 2015 1%SOM
PAHs				
Naphthalene	mg/kg	2.3	2	LQM CIEH Suitable for Use Levels (S4UL) 2015 based on a sandy loam as defined in SR3 (EA 2009) 1% SOM
Acenaphthylene	mg/kg	170	2	
Acenaphthene	mg/kg	210	2	
Fluorene	mg/kg	170	2	
Phenanthrene	mg/kg	95	2	
Anthracene	mg/kg	2,400	2	
Fluoranthene	mg/kg	280	1,2	
Pyrene	mg/kg	620	1,2	
Benzo(a)Anthracene[c]	mg/kg	7.2	1	
Chrysene	mg/kg	15	1	
Benzo(b)Fluoranthene	mg/kg	2.6	1	
Benzo(k)Fluoranthene	mg/kg	77	1	
Benzo(a)Pyrene	mg/kg	2.2	1	
Indeno(123-cd)Pyrene	mg/kg	27	1	
Dibenzo(a,h)Anthracene	mg/kg	0.24	1	

Determinant	Unit	GAC	Exposure Pathway	Origin of Risk Assessment Value
Benzo(ghi)Perylene	mg/kg	320	1	
BTEX & MTBE				
Benzene	mg/kg	0.087	4	LQM CIEH Suitable for Use Levels (S4UL) 2015 1%SOM
Toluene	mg/kg	130	2,4	
Ethylbenzene	mg/kg	47	2,4	
Xylenes	mg/kg	56	2,4	LQM CIEH Suitable for Use Levels (S4UL) 2015 1% SOM o-Xylene
MTBE	mg/kg		4	Soil Generic Assessment Criteria for Human Health Risk Assessment (2010)
TPH-CWG				
Aliphatic				
Aliphatic EC 5-6	mg/kg	42	4	LQM CIEH Suitable for Use Levels (S4UL) 2015 based on a sandy loam as defined in SR3 (EA 2009) 1% SOM
Aliphatic EC >6-8	mg/kg	100	4	
Aliphatic EC >8-10	mg/kg	27	4	
Aliphatic EC >10-12	mg/kg	130[vapi]	4	
Aliphatic EC > 12-16	mg/kg	1,100[soli]	4	
Aliphatic EC > 16-35	mg/kg	65,000[soli]	1	
Aliphatic EC >35-44	mg/kg	65,000[soli]	1	
Aromatic				
Aromatic EC 5-7	mg/kg	70	4	LQM CIEH Suitable for Use Levels (S4UL) 2015 based on a sandy loam as defined in SR3 (EA 2009) 1% SOM
Aromatic EC>7-8	mg/kg	130	4	
Aromatic EC> 8-10	mg/kg	34	4	
Aromatic EC> 10-12	mg/kg	74	2	
Aromatic EC> 12-16	mg/kg	140	2	
Aromatic EC> 16-21	mg/kg	260	2	
Aromatic EC> 21-35	mg/kg	1,100	1	
Aromatic EC> 35-44	mg/kg	1,100	1	
Banded TPH				
TPH EC 5-6**	mg/kg	42	4	LQM CIEH Suitable for Use Levels (S4UL) 2015 based on a sandy loam as defined in SR3 (EA 2009) 1% SOM, utilising the most conservative of the Ali/Aro chain lengths.
TPH EC >6-8**	mg/kg	100	4	
TPH EC >8-10**	mg/kg	27	4	
TPH EC> 10-12**	mg/kg	74	2	
TPH EC> 12-16**	mg/kg	140	2	
TPH EC> 16-21**	mg/kg	260	1	
TPH EC> 21-35**	mg/kg	1,100	1	

Determinant	Unit	GAC	Exposure Pathway	Origin of Risk Assessment Value
TPH EC> 35-44**	mg/kg	1,100	1	

Notes

Abbreviations: GAC = General Assessment Criteria, n = number of samples, MC = Maximum Concentration; Loc of Ex = Location of Exceedance.

Main Exposure Pathways: 1 = Ingestion of Soil & Indoor Dust, 2 = Consumption of Homegrown Produce & Attached Soil; 3 = Dermal Contact (Indoor & Outdoor); 4 = Inhalation of Vapour (Indoor & Outdoor); 5 = Inhalation of Dust (Indoor & Outdoor), 6 = Inhalation of Fibres

* Total cyanide Tier 1 GAC is taken from the Dutch Intervention Value (2010) for complex cyanide.

** The Tier 1 GAC for the banded hydrocarbon fraction is derived from the CIEH/S4UL assessment for petroleum hydrocarbons Criteria Working Group (CWG) for both aliphatic and aromatic compounds. OEC has utilised the lowest of the aliphatic and aromatic chain lengths in order to adopt a conservative approach, which is considered satisfactory for the protection of human health.

(sol) – GAC presented exceeds the solubility saturation limit.
(vap) – GAC presented exceeds the vapour saturation limit.