

REMEDIATION SUMMARY
FOR
LAND AT KING'S CLOSE, YAPTON
FOR
PLOTLIFE SPV3 LTD

G6308

2 November 2017



Ground Management Ltd
Civil and Geotechnical Engineering Services

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1.0 INTRODUCTION

- 1.1** The site at King's Close in Yapton is an area of derelict land, covered in rough vegetation, to the rear of the Co-operative store on Main Road. The proposed development for the site is residential housing.
- 1.2** During March 2017 a desk study and preliminary investigation took place at the site in order to provide a basic understanding of the ground, groundwater and potential contamination conditions on the site. Details are provided within Ground Management Ltd's report titled Land Quality Assessment, King's Close, Yapton, March 2017. This preliminary investigation indicated a number of contamination concerns including substantial quantities of made ground and tipped material, the presence of metals, asbestos and polyaromatic hydrocarbons in the made ground, and oil and PAH contamination in one area within groundwater in the superficial deposits.
- 1.3** Following discussions with the Environment Agency, and comments from the Environmental Health Officer of Arun District Council, a second phase investigation took place during August 2017. The rationale for the second phase investigation, results of testing and monitoring are presented in Ground Management Ltd's report titled Land Quality Assessment Phase 2 Report of Land at Kings Close Yapton dated 5 October 2017. The report also presents an assessment of the results and provides information on the proposed remediation works considered necessary to allow development of the site.
- 1.4** The Phase 2 Report has been submitted to the Regulators and who have accepted its contents and provided comments that confirm and clarify requirements for remediation and assessment. (Reference email from EA dated 24Oct2017 and Arun DC dated 19Oct2017)
- 1.5** This document provides a summary of the proposed remediation works to inform the remediation strategy. It should be read in conjunction with the reports referenced above, by designers, contractors and supervisors, for familiarisation with the site history, investigation results and assessment.
- 1.6** Parts of the site have previously been infested by Japanese Knotweed and the Client has engaged specialists to advise on its assessment and management and therefore related issues are not covered here.
- 1.7** The work was carried out on behalf of Plotlife SPV3 Ltd and nothing in this report confers or purports to confer on any third party, any benefit or any right to enforce any term of this report pursuant to the Contract (Rights of Third Parties) Act 1999.

2.0 REMEDIATION SUMMARY

2.1 Soil Remediation

2.1.1 The results of the contamination testing on the made ground across the site indicate that there is widespread contamination by lead and PAHs, with subsidiary copper, arsenic and petroleum hydrocarbons. The concentrations of the contaminants are such that it would cause a significant risk to proposed residents. In addition, there is in near surface layers, and in the mounded materials, fragment of asbestos containing material (ACM).

2.1.2 It is suggested that in order to break the pollution linkage between the contamination present and the residents, a soil cover system is used wherever soft landscaping is to be undertaken within the development eg public open space and throughout private gardens (including paved areas in gardens in case paving is removed in the future). The soil cover system should be at least 600mm thick, comprising an upper topsoil layer of 200mm and a lower sub-soil layer of 400mm. The cover system should be underlain by a textile marker layer.

2.1.3 The imported placed topsoil and subsoil should be uncontaminated and conform to the criteria set out in Appendix 1. The amount of pre-supply and in-situ testing of materials will need to be agreed with Arun District Council who have advised :

Validation sampling of the imported material should be at a rate of one sample for every 100 m3 (approximately 150 tons) of material imported from a "greenfield" source or one sample for every 50 m3 for material from an unknown or potentially contaminated source. A minimum of three samples must be tested. An alternative sampling frequency will be considered if supported by appropriate justification or a risk assessment.

2.1.4 Any soils removed from the site as part of the remedial works, and destined for waste disposal will need to be tested for Waste Acceptance Criteria, to ensure that they are disposed of at a suitable landfill site. If soils that do, and do not contain asbestos, can be distinguished, then alternative destinations for the two types of soil may be identified. The soils would need to be transported to the landfill sites by a registered waste carrier.

2.1.5 Because the near surface soils contain fragments of ACM, the removal of at least the near surface layer of made ground would need to be undertaken in accordance with the Control of Asbestos 2012 Regulations. Although these regulations primarily relate to the removal of asbestos from buildings, they should also be used for the removal of soil which contains ACM. Guidance on this issue is contained in two CIRIA Guides: CIRIA C733 (2014) "Asbestos in soil and made ground: a guide to understanding and managing risks" and CIRIA C765 (2017) "Asbestos in soil and made ground: good practice site guide". It is recommended that the removal procedure is undertaken by a company who specialises in such work.

2.2 Groundwater Issues

- 2.2.1 The results of the groundwater testing indicate that the groundwater contamination in TP8 is of limited extent, but that there may be other very small areas of contaminated groundwater (such as at WS4).
- 2.2.2 The Environment Agency have agreed that the groundwater is unlikely to cause such problems, but would like to see a reduction in hydrocarbons in the vicinity of TP8 and WS4 as practically as possible.
- 2.2.3 It is conjectured that the contaminated water in TP8 and WS4 results from spillage or leakage within the former Works area or nearby. However the exact location of the spill/leak area itself has not yet been identified (the soils above the groundwater were relatively clean in both locations), but it is likely to consist of soils contaminated with similar contaminants to those in the groundwater or possibly an old leaking underground tank/pipework.
- 2.2.4 It is recommended that during site strip and excavation works for garden areas, roadways, drainage etc the opportunity should be taken to look for visual or olfactory indications of contaminated soils, underground tanks or pipework that may be contributing to such contamination, particularly in the area of TP8 and WS4, but also generally across the north of the site in the area of the old 'works' site. If soils that are obviously contaminated with oil/petroleum hydrocarbons, or tanks/pipework are found, they should be carefully removed and disposed of offsite, and any excavations replaced with clean soils. In the case of tanks/pipework, once removed the base and sides of the excavation should be inspected and any contaminated soils around the tanks/pipework also removed and disposed. Verification testing should be undertaken prior to backfilling the excavated areas with clean soils.
- 2.2.5 The criteria for this aspect of verification testing is set out in Appendix 2. The criteria have been chosen on a pragmatic basis so that obvious oil contaminated materials are removed, but that ash contaminated material, which has been found to be widespread across the site but does not contribute significantly to groundwater pollution, is allowed to remain present on site (although below a capping layer in areas of soft landscaping). The criteria are either the same or, for some species of PAH and TPH, higher than those used for imported topsoil/subsoil.
- 2.2.6 Risk assessment and method statements should be prepared with consideration given to the possibility of encountering contaminated soils and groundwater and ensure the contractor is prepared for containing, assessing and disposing of contaminated material appropriately.
- 2.2.7 If the design of the surface water drainage involves percolation of surface water into the ground at the site, the detailed design of the scheme should be discussed and agreed with the Environment Agency. It is important to avoid increasing the potential for mobilisation of contaminants into the groundwater.

- 2.2.8 In areas where infiltration drainage is to be installed, the base and sides of any excavation for drainage purposes should be inspected by an experienced contaminated land specialist, and any obvious contaminated made ground removed prior to placing of the drainage layers/storage. The areas around TP8 and WS4 should be avoided for soakaway drainage.

2.3 Ground Gas Issues

- 2.3.1 Based on the three rounds of readings from the gas monitoring programme, it is not necessary to provide any specific ground gas or vapour protection generally across the site. However, a basic gas protection system (equivalent to Characteristic Situation 2/Amber 1 in CIRIA 665) should be provided in the four units along the eastern side of the site, where there may be small amounts of contaminated soils or groundwater that could give rise to organic vapours. (Arun District Council state that a hydrocarbon membrane should be used even if groundwater remediation takes place). If oil/petroleum hydrocarbon contaminated soils/water are found elsewhere on site, the use of gas/vapour protective membranes may also be required in such areas.

2.4 General Issues

- 2.4.1 If during excavation or construction additional ground or groundwater contamination comes to light, it will be necessary to investigate it, and to determine what remedial actions are required, in conjunction with Arun District Council.
- 2.4.2 Any piling undertaken at the site is likely to involve piling penetration through the upper layers of made ground into the chalk aquifer below. It will be important to ensure that any contaminated soils or groundwater in the upper layers is not allowed to migrate down the pile bore to contaminate the chalk aquifer. In this respect, the Environment Agency usually prefer the use of CFA piles.
- 2.4.3 During this second phase investigation, no further work was undertaken on the risk assessment with respect to underground water supply pipes. Therefore the recommendation in our initial report still stands, that the site is not suitable for unprotected PE pipework because of the presence of elevated concentrations of PAHs in the made ground.
- 2.4.4 All remedial works, and the results of any monitoring, waste testing or verification testing, should be documented and contained within a Verification Report which will need to be submitted to Arun District Council on completion of the remedial works. Information on the contents of a Verification Report are contained in the Environment Agency publication "Verification of Remediation of Land Contamination" (2010).
- 2.4.5 All works should be conducted in a safe manner. Appropriate risk assessments and method statements should be prepared prior to start of works, site staff appropriately briefed, and appropriate protective clothing worn.

APPENDIX 1**CRITERIA FOR IMPORTED SOILS**

Potential contaminant	Criteria (mg/kg)
Arsenic	37
Cadmium	26
Chromium (III)	910
Copper	2400
Lead	210
Mercury (inorganic)	40
Nickel	130
Selenium	250
Zinc	3700
Acenaphthylene	420
Acenaphthene	510
Anthracene	5400
Benzo(a)anthracene	11
Benzo(a)pyrene	2.7
Benzo(b)fluoranthene	3.3
Benzo(ghi)perylene	340
Benzo(k)fluoranthene	93
Chrysene	22
Dibenzo(ah)anthracene	0.28
Fluorene	400
Fluoranthene	560
Ideno(1,2,3-cd)pyrene	36
Naphthalene	5.6
Phenanthrene	220
Pyrene	1200
TPH Aliphatic C5-C6	78
TPH Aliphatic C6-C8	230
TPH Aliphatic C8-C10	65
TPH Aliphatic C10-C12	330
TPH Aliphatic C12-C16	2400
TPH Aliphatic C16-C35	10000
TPH Aliphatic C35-C44	10000
TPH Aromatic C5-C7	140
TPH Aromatic C7-C8	290
TPH Aromatic C8-C10	83
TPH Aromatic C10-C12	180
TPH Aromatic C12-C16	330
TPH Aromatic C16-C21	540
TPH Aromatic C21-C35	1500
TPH Aromatic C35-C44	1500
pH	5 - 8

Values generally based on S4UL criteria for 2.5% SOM and a sandy loam soil.

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APPENDIX 2**CRITERIA FOR REMOVING OIL CONTAMINATED SOILS**

Potential contaminant	Criteria (mg/kg)
<i>Polyaromatic Hydrocarbons</i>	
Acenaphthylene	420
Acenaphthene	510
Anthracene	5400
Benzo(a)anthracene	120
Benzo(a)pyrene	90
Benzo(b)fluoranthene	80
Benzo(ghi)perylene	340
Benzo(k)fluoranthene	93
Chrysene	120
Dibenzo(ah)anthracene	20
Fluorene	400
Fluoranthene	560
Ideno(1,2,3-cd)pyrene	50
Naphthalene	15
Phenanthrene	300
Pyrene	1200
<i>Total Petroleum Hydrocarbons</i>	
TPH Aliphatic C5-C6	78
TPH Aliphatic C6-C8	230
TPH Aliphatic C8-C10	65
TPH Aliphatic C10-C12	330
TPH Aliphatic C12-C16	2400
TPH Aliphatic C16-C35	10000
TPH Aliphatic C35-C44	10000
TPH Aromatic C5-C7	140
TPH Aromatic C7-C8	290
TPH Aromatic C8-C10	83
TPH Aromatic C10-C12	180
TPH Aromatic C12-C16	400
TPH Aromatic C16-C21	2500
TPH Aromatic C21-C35	5000
TPH Aromatic C35-C44	1500