



90 Rose Green Road Bognor Regis

Contaminated Land Remediation Strategy



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Contaminated Land Remediation Strategy

1. Introduction

1.1. Instructions

Instructions were received from Stuart Wilson of Wilson Designer Homes, to undertake prepare a Contaminated Land Remediation Strategy detailing the works necessary to address ground contamination issues to enable the redevelopment of the site with residential housing at 90 Rose Green Road, Bognor Regis.

This Remediation Strategy is based on the findings of the following reports, which should be read in conjunction with this report:

- Phase 1 Land Desk Study report & Site Inspection Assessment Report Prepared by Iain Skinner and Dr Tina Skinner-Smith; and,
- Opus Geo-Environmental Ground Investigation Report dated April 2017 (ref: E-E1644.00/NM/DRC/CDS).

The site was previously a residential plot with stables and a commercial saw mill and is proposed to be redeveloped with 5 residential houses with private gardens and public open space.

The previous investigations at the site have identified asbestos contaminated soils in the central and eastern portion of the site in the area of the former commercial buildings and stable outbuildings. Asbestos in the form of chrysotile (white asbestos) and was found in six exploratory holes which comprised fragments of cement roofing/cladding and floor tiles. In one location a piece of Asbestos Insulation Board was found in the form of amosite/chrysotile. In addition, elevated Lead concentrations were identified within all samples of made ground analysed across the site. This document details the proposed strategy for the remediation of these unsuitable materials from a protection of human health perspective.

This Remediation Strategy is prepared for the specific use of the following parties, who are referred to in this document as:

- Employer – Wilson Designer Homes Limited;
- Principal Contractor – T J Transport Limited;
- TJ Appointed Sub-Contractor- Hampshire Environmental Services; and,
- Supervising Engineer – Opus.

The responsibilities of the Supervising Engineer are restricted to monitoring the works of the Sub-Contractor in terms of compliance with this Remediation Strategy, carrying out validation testing, liaison with Regulators and reporting. The Supervising Engineer has no responsibility for the direct instruction of the Sub-Contractor, or measurement and administration of the contract. The Supervising Engineer will report to the Employer who will issue all instructions to the Sub-Contractor.

This Remediation Strategy has been prepared solely for the purposes of remediation of soil at the site for the protection of human health perspective. Remediation criteria have been specified for the chemical quality of imported soils brought to the site, including for use in gardens and soft landscaped areas.

It should be noted that this document does not specify the engineering suitability of either the existing or any imported materials / soil. It has been assumed that all geotechnical engineering issues regarding these remedial works shall be the responsibility of the Contractor.

This Remediation Strategy should be submitted to Arun District Council for approval prior to any irrevocable actions and prior to adopting this Remediation Strategy.

Opus remind the Employer and Principal Contractor of their duties under the Construction (Design and Management) Regulations 2015, which include ensuring that those appointed to undertake the works on site are competent with regards to Health and Safety, amongst others.

This report has been produced on behalf of the Client, Wilson Designer Homes Limited, and no responsibility is accepted to any Third Party for all or any part. This report should not be relied upon or

transferred to any other parties without the express written authorisation of Opus. If any unauthorised Third Party comes into possession of this report, they rely on it at their own risk and the authors owe them no duty of care or skill.

This report has been prepared by Opus with all reasonable skill and care within the terms of the Contract with the Client, and taking account of the information made available by the Client, as well as the manpower and resources devoted to it by agreement with the Client. Opus disclaims any responsibility to the Client and others in respect of any matters outside the scope of the above Contract.

The findings and opinions conveyed via this report are based on information obtained from a variety of sources, as detailed, which Opus believes are reliable. Nevertheless, Opus cannot and does not guarantee the authenticity or reliability of the information it has relied upon from these sources.

Whilst this report may express an opinion on the possible configuration of strata or contaminants between or beyond exploratory hole positions or on the possible presence of features based on either, visual, verbal or published evidence, this is for guidance only, and no liability can be accepted for its accuracy. The comments on groundwater conditions are based on observations made at the time of the investigation. It should be noted, however, that groundwater levels may vary from those reported due to seasonal or other effects.

The plans enclosed in this report should not be used for scaling purposes. The latest revision of all drawings prevail.

2. Background Information on the Site

2.1. Location & Access

The site is located in the north east of Bognor Regis, West Sussex centred on National Grid Reference (NGR) 490278, 099315. The site is approximately 0.23Ha in size located within a residential setting with open farmland to the north.

Access to the site is via a narrow track off Rose Green Road at the south of the site.

2.2. Site Description

At the time of the investigation approximately 30% of the site is occupied by redundant buildings in various states of decay. These includes a detached former single storey residential bungalow located at the north west corner of the site and a number of out buildings scattered across the remaining central and east sections of the site. The latter buildings include a former stables, stores, shed and garage. A collapsed wooden structure (former saw mill) is also noted near the south entrance to the site. The remaining site area is overgrown with long vegetation and frequent shrubs.

With exception the former residential building the remaining outbuildings are considered in a state of disrepair. Many of the corrugated roofs, some which contain Asbestos, have collapsed and the wooden side panel, frames doors, rotted and removed/missing. Inside the buildings appear to have been used as storage including wood, old lighting, rusted machinery and other metal associated with the sites former use as a sawmill. Scattered metal, wood and fragments of former asbestos containing profiled sheeting, pipework etc. are found within the surrounding grassed areas.

Two semi mature to mature Oak Trees are noted near the south site border (approximately 10m to 15m high). A further two trees are located inside the site towards the west site boundary (approximately 10m high) with a further similar number tree sampling found on the site.

2.3. Summary of Geology, Hydrogeology and Hydrology

The site is indicated to be directly underlain by solid geology of the London Clay Formation with superficial River Terrace Deposits above in this area.

Reference to the Environment Agency web based groundwater maps indicates that the superficial deposits underlying the site both constitute Secondary A aquifer and the solid geology as an unproductive strata.

Secondary A aquifers consist of permeable layers capable of supporting water supplies at a local rather than strategic scale and in some cases form an important source of base flow to rivers.

The overlying soils have been classified as being of High Leaching Potential (U). This description is given for soils located in urban areas where there are fewer observations than elsewhere. A worst case vulnerability classification is assumed until proven otherwise.

Unproductive strata typically have low permeability and offer negligible water supply or river base flow potential

The site is not located within an Environment Agency designated Groundwater Source Protection Zone.

There are no significant surface water features within 250m of the site.

2.4. Proposed Development

It is understood that the site is proposed to be redeveloped by Wilson Designer Homes Limited for residential housing with private gardens, public open space, and associated infrastructure. The development area is proposed to accommodate 5 properties consisting of two storey detached and semi-detached houses of assumed conventional construction. The proposed development layout is shown on the drawing entitled Proposed Site Layout, Drawing No: 1542-100 Revision D dated January 2017 enclosed in Appendix A.

3. Results of the Investigation

3.1. General

The results of the investigation discussed below are based on the findings of the previous investigations carried out by Opus. An exploratory hole location plan is enclosed as Drawing No. E-E1644.00/101 P1.

3.2. Ground Conditions

3.2.1. *Made Ground*

Made Ground was encountered at all exploratory hole locations from the surface to depths ranging between 0.10m and 0.50m begl. It is noted that the average thickness of Made Ground across the site is approximately 0.30m. The Made Ground was characterised as a dark coloured (brown or black) gravelly sand or sandy topsoil with gravel content comprising fragments of brick and concrete, mortar, glass, ceramic tile fragments and suspected fragments of asbestos cement sheeting /tile.

It is noted that the Made Ground was relatively organic (loamy) in nature at a number of locations and included pockets of organic rich topsoil.

Other than the presence of potential asbestos containing materials, there was no olfactory evidence of contamination noted within the Made Ground during the investigation. It should be noted however that the Made Ground contains sharp objects and visually unappealing material which may deem it unsuitable for retention in some areas of the development. In addition it is noted that the Made Ground is potentially of high organic content.

3.2.2. *Natural Strata*

Underlying the Made Ground, River Terrace Deposits comprising either clay or gravelly sand, were encountered to the full depth of investigation at all exploratory hole locations. Where encountered as a clay these strata were typically found to be a firm to stiff consistency with hand shear vane tests in the range 60 to 102 kPa which indicates a medium to high strength strata in accordance with BS EN ISO 14688-2:2004,5.3,Table 5. Where encountered as a sand or gravelly sand the strata remained stable during excavation indicating a likely medium dense state, although further in situ testing would be required to confirm this.

Desiccated clay strata was encountered at TP1 from 0.5m begl to 1.2m begl with this being the full depth of investigation at this location.

No visual / olfactory evidence of contamination was noted within the River Terrace Deposits.

3.3. Groundwater

Groundwater was encountered in TP2 at 2.5mbgl (rising to 2.3m) and in TP4 at 2.4m begl (rising to 2.2m). Where groundwater is encountered then this is generally coincident with the presence of granular soils of sand or gravelly sand.

3.4. Asbestos Analysis of Soil Samples

During the advancement of the trial pits TP1–TP8 and surface samples SS1 to SS3, a total of fifteen soil samples of Made Ground were submitted to Concept Life Sciences (a UKAS accredited laboratory) for asbestos identification/ or quantification. Asbestos was identified in the following samples as shown in Table 3.4 (overleaf).

Table 3.4 Asbestos Laboratory Positive Results

Sample Location & laboratory sample number	Sample Matrix	Asbestos Containing Material	Asbestos Type
TP1 at 0.15 (614975 012)	ACM	Asbestos Cement	Chrysotile
SS3 BULK A (614975 008)	ACM	Asbestos Cement	Chrysotile
SS3 BULK B (614975 009)	ACM	Asbestos Cement	Chrysotile
SS3 BULK C (614975 010)	ACM	Floor Tile	Chrysotile
TP4 BULK A (614975 021)	ACM	Asbestos Cement	Chrysotile
TP4 BULK B (614975 022)	ACM	Asbestos Cement	Chrysotile
TP4 BULK C (614975 023)	ACM	Floor Tile	Chrysotile
TP7 BULK A (614975 035)	ACM	Asbestos Cement	Chrysotile
TP7 BULK B (614975 036)	ACM	Board / Panel	Amosite Chrysotile
TP7 BULK C (614975 037)	ACM	Asbestos Cement	Chrysotile
TP8 BULK A (614975 041)	ACM	Asbestos Cement	Chrysotile

Note: ACM refers to a bulk item of asbestos containing material.

In summary, laboratory analysis has identified asbestos to be present in the Made Ground at six locations and visually observed at further two locations in the former commercial area of the site development. The asbestos was mainly proven to be Chrysotile (white asbestos) present mainly as asbestos cement and floor tile. A piece of Asbestos insulation board was encountered in TP7/bulk B, this sample was retrieved from a depth of 0m to 0.4m below this was proven to contain chrysotile and amosite.

The results of the asbestos in soil analysis have been assessed in accordance with CIRIA Report C733 entitled 'Asbestos in Soil and Made Ground': a guide to understanding and managing risks' 2014. This report recommends that where asbestos in soil is identified and where qualitative risk assessment shows that there may be a risk of concern (i.e. it may be present at near surface in proposed soft landscaped areas etc.) then detailed quantitative risk assessment (DQRA) is required to evaluate whether they may be an unacceptable risk to health. In the absence of DQRA, then remediation of the asbestos contaminated soil is required where this is likely to be present at / near surface proposed gardens and soft landscaped areas.

3.5. Chemical Analysis of Soil Samples

Chemical analysis of the Made Ground detected elevated Lead concentrations exceed the screening value of 200mg/kg in all 7 samples with a maximum concentration of 2400mg/kg and a statistical 95th Percentile value of 1637mg/kg, indicate that these made ground materials are not suitable for use at near surface in proposed garden areas and public open space.

Portable water supply companies have published trigger concentrations to aid pipeline risk assessments associated with the selection of appropriate construction materials for potable water supply pipes. As the made ground is proposed to be removed from site there will be no further requirements on the pipe specification.

4. Remediation Strategy

4.1. Remediation Philosophy

The proposed remediation of contamination at the residential development site at 90 Rose Green Road, Bognor Regis has been based on the 'Suitable for Use' approach as advocated by Part IIA of the Environmental Protection Act 1990. The basis of the suitable for use approach is that land should be suitable for its current use and made suitable for any new use as official permission is given for that use. In addition, the requirements for remediation of contaminated land should be limited to the work necessary to prevent unacceptable risks to human health and the environment (including controlled waters) in relation to the current use, or officially permitted future use, of the land.

Under Part IIA of the Environmental Protection Act 1990 contaminated land is defined as land where **significant harm** is being caused or there is a **significant possibility of such harm** being caused, or where **significant pollution of controlled waters** is being caused, or there is a **significant possibility of such pollution** being caused. For land to be considered contaminated, a significant **contaminant linkage** must exist i.e. there must be a contamination **source**, a relevant **receptor** and a plausible **migration pathway**, by which the contaminant can cause significant harm to the receptor.

The National Planning Policy Framework 2012 states in Paragraph 120 that, with respect to the development of individual sites, 'where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner'. Paragraph 121 notes that 'planning policies and decisions should also ensure that ... the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation'. Paragraph 121 also states that 'after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990'.

This Remediation Strategy has been developed in general accordance with DEFRA and Environment Agency Contaminated Land Report CLR11 entitled Model Procedures for the Management of Land Contamination dated September 2004 and the Environment Agency's 'Guiding Principles for Land Contamination' (GPLC).

4.2. Conceptual Site Model

Based on the findings of the Phase 1 & 2 Geo-environmental Assessment, the revised conceptual site model for the proposed development based on a residential with consumption of home grown produce end use is as follows:

Table 4.2 Revised Conceptual Model

Source	Pathway	Receptor	Possible Contaminant Linkage	Significant Contaminant Linkage
Made Ground (<i>Lead impacted</i>)	Ingestion Dermal contact	Future occupants	Yes	Yes
	Inhalation (outdoor air)			
Made Ground (<i>Lead impacted</i>)	Inhalation (indoor air)	Future occupants	Yes	
Made Ground (<i>Lead impacted</i>)	Root uptake & human consumption	Plants, vegetables and fruit	Yes	Yes
Made Ground (<i>Lead impacted</i>)	Leaching	Secondary A Aquifer	Unlikely	

Table 4.2 Cont...

Source	Pathway	Receptor	Possible Contaminant Linkage	Significant Contaminant Linkage
Made Ground (asbestos impacted)	Inhalation (indoor and outdoor air)	Future occupants	Yes	Yes
		Construction workers		
		Maintenance workers		
		Site neighbours		

4.2.1. Definition of Significant Contaminant Linkage

The term **significant contaminant linkage** as used above is defined as one that has been identified through risk assessment as representing unacceptable risks to human health or the environment. Where a significant contaminant linkage has been identified above, remediation is considered necessary in order to break the pathway between the contamination source, migration pathway and the receptor.

4.2.2. Definition of Possible Contaminant Linkage

The term **possible contaminant linkage** as used above is defined as one that has the potential to represent unacceptable risks to human health or the environment but has not been identified through risk assessment. Where a possible contaminant linkage has been identified above, further investigation and risk assessment may be required to establish whether a significant contaminant linkage exists.

4.3. Remediation Objectives

The proposed Remediation Strategy for the site comprises one or a combination of the following remediation options to break to contaminant linkages identified in the above conceptual site model:

- I. Removal of contaminated materials, including the asbestos impacted Made Ground materials and the Lead contaminated Made Ground materials from all areas of the site and disposal off-site to a suitably permitted landfill, soil treatment centre or exempt facility;
- II. Excavation of contaminated materials including the asbestos impacted Made Ground and the Lead contaminated Made Ground materials from proposed garden areas and soft landscaping and placement beneath buildings, roads or permanent hardstanding (subject to engineering suitability and proposed levels), to encapsulate the contamination from human receptors; or,
- III. Encapsulation of contaminated materials, including the asbestos impacted Made Ground and the Lead contaminated Made Ground materials, beneath an engineered capping layer (minimum 1.0m in thickness), within all affected private gardens and soft landscaped areas, should proposed levels allow.

It is understood that the difference between current and final ground levels at the site, together with gravity drainage issues, will not permit the raising of the ground to accommodate a 1.00m thick capping layer in gardens and soft landscaped areas. Given the thickness of the unsuitable Made Ground and that it is located across the site (average thickness approximately 0.35m), it is considered most practical to excavate and remove all of this unsuitable Made Ground shown on Drawing No. E-E1644.00/200 P1 Remediation Plan, regardless of whether this is beneath proposed gardens, soft landscaping, houses, roads or driveways etc. This recommendation will also minimise the potential health and safety hazard presented to construction workers and the general public from the release of asbestos fibres if the materials were to remain on site.

In view of the above, this Remediation Strategy has only considered the removal of all contaminated Made Ground soils at the site in the remainder of this document. The remediation objectives detailed below are therefore required in order to break the significant contaminant linkages identified in the above conceptual site model.

The remediation objective of the proposed removal of all contaminated Made Ground at the site (items (i) and (ii)) is to break the following significant and potential contaminant linkages:

Contaminant Source		Pathway		Receptor
Made Ground –Lead impacted	➡	Ingestion Dermal contact Inhalation of dust (indoor/outdoor air)	➡	Future occupants
	➡	Root uptake & human consumption	➡	Plants, vegetables and fruit
Made Ground – Asbestos	➡	Inhalation (indoor/outdoor)	➡	Future occupants
				Construction Workers
				Maintenance Workers

5. Remediation of Made Ground

The Made Ground has been observed to be impacted by Asbestos and Lead, which requires remediation where present in proposed private gardens and public open space. However, it is proposed to remove all of the Asbestos and Lead impacted Made Ground soils from site. The lateral extent of the soil requiring remediation is shown on the enclosed Drawing No. E-E1644.00/200 P1 Remediation Plan.

Based on the findings of the investigation works carried out to date, the asbestos and Lead impacted soils cover an area of approximately 2,600m² (i.e. 53m by 49m) and the Made Ground soils typically range in depth between 0.25m and 0.5m below ground level. At an average depth of around 0.35m (incorporating an over-dig of approximately 0.10m – 0.20m), it is estimated at this stage that approximately 1,450m³ of Made Ground is to be removed. It should be noted that these quantities are approximate and in practice could vary upwards or downwards depending on the ground conditions actually encountered.

Given that asbestos cement / asbestos floor tiles have been found in the Made Ground in the centre and east locations of the site, it is anticipated that a potentially large proportion of the Made Ground soils may contain asbestos. Asbestos insulation board has been encountered in one location only (TP4).

The surface tipped ACM's will be first collected and bagged by appropriately trained operatives wearing personal and respiratory protective equipment. A machine excavator will then spread out material from the stockpiles and operatives will dampen, pick out the ACM's, bag and place in a secured skip.

Once the stockpiles are cleared of visually identifiable asbestos, the excavator will undertake a reduced dig of the made ground, first the excavator will tooth through the made ground, which will be supervised by asbestos trained banksman. During the excavation of the made ground through the top layer, the asbestos containing materials shall be hand separated and bagged by appropriately trained operative (banksman) wearing personal and respiratory protective equipment. From the laboratory analysis undertaken during the site investigation no loose / free asbestos fibres were found in the soils analysed.

At the end of this remediation exercise, all of the Made Ground soils from the vicinity of the site will have been removed and disposed of off-site.

Any excavation works involving asbestos impacted soils should be carried out in accordance with the Control of Asbestos Regulations 2012. Under these regulations an asbestos risk assessment must be undertaken. The risk assessment must make a prediction of the expected exposure to asbestos caused by the working method and compare this with the Control Limit in the regulations. Based on the predicted exposure, the risk assessment should detail the requirement for personal protective equipment (PPE), respiratory protective equipment (RPE), decontamination procedures and on-site facilities and air monitoring.

The risk assessment will also determine whether or not the remediation earthworks constitute 'licensable work' (LW) or 'notifiable non-licensed work' (NNLW). There is a requirement to notify the Health and Safety Executive (HSE) in advance of both LW and NNLW, but LW can only be undertaken by licensed asbestos removal contractors. NNLW can be undertaken by non-licensed contractors subject to specific requirements of the Control of Asbestos Regulations 2012. It is anticipated that the work with asbestos will be with asbestos cement and asbestos floor tiles materials with limited asbestos insulation board. It is therefore considered likely that the work shall comprise Non-licensed Work (NLW) under the Control of Asbestos Regulations 2012. NLW does not need to be undertaken by a licensed contractor, however, it is proposed that should further asbestos containing materials such as asbestos insulation or other friable products be encountered during the remediation works, then a licensed contractor would be employed to carry out the removal of such materials (engaged as a Subcontractor by the Principal Contractor).

The staff (including the Contractor's staff) engaged in the handling and removal of asbestos impacted soil should have undergone formal training for non-licensable work with asbestos, including the use of the appropriate PPE and RPE (together with face fit testing for RPE). For any licensable work, the appropriate training requirements will apply.

Prior to commencement of the excavation and removal of the asbestos impacted soil, the working area is to be securely fenced-off to prevent unauthorised access and the appropriate warning notices displayed. Whilst work is underway, access into the working area should be denied to anyone other than the Contractors employees and authorised personnel.

The Contractor is to provide air monitoring for asbestos fibres by a UKAS accredited laboratory for the first two days of the excavation works and removal of the contaminated soils, then once per week

thereafter, assuming that the results are below 0.01f/ml. However, should the requirement for more monitoring be identified, the frequency and duration of the monitoring would be subject to amendment. Commencement of the excavation and / or removal of asbestos contaminated soil shall not be permitted unless air monitoring is taking place at locations directed by the Supervisor given the nearby residential housing. The UKAS accredited analyst shall carry out the fibre counting on-site in a mobile laboratory.

The Contractor is to provide suitable welfare for work with asbestos and in accordance with HSE guidance, which must be present on-site and fully operational prior to the commencement of the works.

Inside the working area all personnel shall wear suitable personal protective equipment (PPE) and respiratory protective equipment (RPE). All disposable PPE and RPE is to be double bagged inside and placed into the lockable asbestos skip for disposal. A boot wash is to be provided outside away from the entrance of welfare unit and used before removing disposable PPE, boots and RPE prior to entering the welfare facility. The sub-contractors risk assessment will determine if a decontamination unit is required for the site.

Work must be planned in conjunction with the Supervisor to minimise the creation and spread of dust by avoiding multiple handling and minimising drop heights (during loading of waste materials into bodies of haulage vehicles).

The Contractor shall also provide means by which to spray and dampen down dust during the excavation works. The majority of the asbestos encountered was Chrysotile asbestos, with a single piece of Amosite observed. The spray shall comprise water along with a surfactant to suppress amphibole fibres (Amosite and Crocidolite) which are hydrophobic and are not suppressed by water alone. The impacted soil is to be excavated with care to minimise disturbance and release of asbestos fibres.

In the event that asbestos insulation board is encountered in quantities that will take it above short duration works (< 2 hours per week), asbestos insulation, asbestos coating and is confirmed as being present, then this could potentially be considered to be Licensable Work (LW) requiring a 14 day notification period to the HSE. In these circumstances the Contractor is to liaise with the HSE to establish whether the activity is licensed or not.

The skips or Lorries are to be fully and effectively sheeted (with tarpaulin rather than nets) and the wheels of the Lorries cleaned prior to leaving the contaminated area. In the event loading is undertaken on the access track any soil arisings which fall onto the track when loading the vehicle are to be cleared up by hand tools prior to the Lorry commencing on its journey.

In the event of any temporary stockpiling of the Asbestos and Lead contaminated soils pending removal, it will be necessary to take appropriate measures to prevent generation of airborne asbestos fibres and the migration of asbestos contaminated surface water run-off. It is considered that potential mitigation measures could include the provision of a suitably thick polythene membrane laid onto the ground surface and/or a sacrificial clean soil separating layer to protect the underlying uncontaminated clean soils from cross contamination with the stockpiled soils. Other potential mitigation measures could include covering the stockpile with thick polythene sheeting to restrict infiltration of precipitation and subsequent run-off and the generation of airborne asbestos fibres from wind-blown dust.

The excavation and removal of the asbestos and lead impacted Made Ground materials is to be inspected on-site by the Supervising Engineer. Verification sampling of the underlying soils will be required in order to determine if the removal works have been successful. No excavation or filling work is to be carried out without the prior agreement of the Supervising Engineer.

6. General Requirements for Soil Remediation

6.1. Unforeseen Ground Conditions

During the redevelopment of the site, should ground conditions differ significantly from those encountered during the course of the investigations to date, then works should be suspended immediately and the Supervising Engineer notified. An assessment of the suspect materials shall then be made and no further works carried out until a Specification detailing a scheme for dealing with the suspected contamination has been submitted to and agreed with all parties.

If contamination is encountered during the earthworks migrating from an off-site source, then measures will be undertaken to remediate and prevent recontamination occurring in the future. In such event Arun District Council will be notified accordingly, via the Supervising Engineer, and proposals will be developed and submitted for dealing with this off-site contamination for Arun District Council approval prior to implementation.

6.2. Segregation of Material Types

During the redevelopment of the site, including the excavation and removal of the asbestos and lead impacted soils, the Sub-Contractor will employ all reasonable measures to ensure segregation of the contaminated and 'clean' soils. Similarly, the Sub-Contractor shall employ all reasonable measures to prevent cross contamination during the handling of the 'clean' and contaminated soils particularly during the loading and movement of Lorries.

6.3. Disposal of Soils

Loading of vehicles shall be performed in an organised manner so as to prevent the spread of contaminants. All vehicles are to be sheeted and 'clean', prior to leaving site. The Contractor shall take all reasonable and applicable measures to prevent the escape of material during transportation.

Any soils removed from the site should be disposed of at an appropriately permitted waste disposal facility in line with relevant legislation and duty of care requirements. As producer of the waste, the landowner or employer has a Duty of Care to ensure that their waste is disposed of appropriately.

Prior to removing the contaminated soils from site, the classification of the waste as Inert, Non-hazardous or Hazardous shall be agreed with the receiving waste management facility. In the case of Inert and Hazardous waste, this should identify whether further Waste Acceptance Criteria (WAC) testing is required. The waste classification should make due reference to Environment Agency guidelines including Technical Guidance WM3 2015. All Inert and Non-hazardous contaminated soil to be disposed of to landfill requires pre-treatment in accordance with the EU Landfill Directive.

Should Hazardous waste be generated at the site, then the site should be registered with the Environment Agency as a Hazardous Waste Producer. Under the Hazardous Waste Regulations 2005, it is an offence to produce hazardous waste at premises, or remove that waste from premises, unless those premises are either registered with the Environment Agency or are exempt. Registration as a Hazardous Waste Producer can be carried out by correspondence, telephone or on the Environment Agency website. Furthermore, all controlled waste should only be transported by a registered waste carrier.

There is now a legal requirement to treat contaminated soil (including non-hazardous waste) prior to disposal to landfill. Originating from the Landfill Directive, this legislation seeks to increase recycling and reduce pollution from landfills. Typically on Brownfield sites there are two main options for treatment of contaminated soil, namely separation or bulk treatment. To qualify as 'treatment' a 'three point test' must be satisfied, this is summarised below:

- It must be a physical, thermal, chemical or biological process including sorting;
- It must change the characteristics of the waste;
- It must do so in order to:
 - reduce its volume, or
 - reduce its hazardous nature, or
 - facilitate its handling, or

- enhance its recovery.

The Environment Agency recommends that a written declaration is provided to waste management contractors confirming how the waste contaminated soils have been treated. Further guidance is provided by the Environment Agency in 'Your Waste-Your Responsibility Factsheet on Contaminated Soils'. It is anticipated that any pre-treatment of waste undertaken will comprise physical treatment involving the selective excavation and segregation of different categories of waste soil and non-waste soil.

Prior to any removal of contaminated materials, the Contractor shall supply the Supervising Engineer with details of the proposed receiving waste disposal site(s). The Contractor shall ensure that sufficient information (including laboratory results of soil testing) is provided to the receiving waste disposal site(s) prior to site works for waste classification purposes. On completion of disposal of the contaminated materials, the Contractor shall provide the Supervising Engineer with copies of the waste consignment notes. Should any soils be disposed of at a landfill site, then landfill tax will apply.

6.4. Re-use of Site Derived Waste Soils

As it is proposed to re-use site derived excavated soils (including natural materials from foundation and other deep excavations) at the site or import naturally occurring unpolluted soils directly from another site, such activities may potentially fall under the Environmental Permitting (England and Wales) Regulations 2010. In March 2011, Contaminated Land: Applications in Real Environments (CL:AIRE) published Version 2 of the Definition of Waste: Development Industry Code of Practice. The Code of Practice is supported by an Environment Agency Position Statement, which indicates:

"If materials are dealt with in accordance with the Code of Practice we consider that those materials are unlikely to be waste at the point when they are to be used for the purpose of land development."

Under the Code of Practice, such soils should not be a waste if they are retained on the site provided the re-use is "certain", the soils "are suitable for use without any treatment" and "only the quantity necessary for the specified works" as noted at the planning stage of the project is re-used. Rather than apply for a formal environmental permit or waste exemption, such works can now be undertaken under self-regulation so long as the protocols in the Code of Practice are followed. The Code of Practice requires the preparation of a Materials Management Plan, which needs to be signed off by a Qualified Person and the subsequent preparation of a Verification Plan and Verification Report. Opus is able to assist in the preparation of the above documents and provide an appropriate Qualified Person to sign off the Materials Management Plan.

6.5. Importation of Waste Materials from an Off-Site Source

Should it be proposed to import waste materials (as defined by the EU Waste Framework Directive) to site from an off-site source for use in construction, then either a waste exemption will need to be registered with the Environment Agency or a Standard Rules Permit obtained, depending on the quantities of waste to be imported. Such wastes may include clean topsoil and subsoil generated from other constructions sites, although by adopting the Code of Practice for the importation of these materials, this should omit the requirement for a waste exemption or Standard Rules Permit.

Should it be proposed to import recycled aggregate to site, then so long as this has been processed in accordance with the WRAP protocols this is unlikely to be considered to be a waste and no waste exemption or Standard Rules Permit is required, this is however dependant on the quantity of material to be imported. If the recycled aggregate has not been processed in accordance with the WRAP protocols then this may be considered a waste and an exemption or Standard Rules Permit will be required.

6.6. Supervision

The Contractor is to provide a competent representative on site for the duration of the Works to liaise with the Supervising Engineer and Employer. The representative shall be responsible for appropriate supervision of the remedial activities to ensure the works are carried out in accordance with the Remediation Strategy. The Contractor must also provide adequate engineering staff to ensure accurate quality control. The Contractor's staff and Sub-Contractors must be competent in their duties and have had experience of similar works, i.e. contaminated land remediation and asbestos handling and removal. The Contractor is to notify the Supervising Engineer of the identity of his representative.

6.7. Limitations of Soil Remediation Works

The scope of the proposed soil remediation works shall be considered provisional until approval of this document by Arun District Council and the NHBC (if required).

7. Health and Safety / Environmental Protection

7.1. Health and Safety

The Contractor shall be responsible for ensuring that the remedial works are carried out in full compliance with the appropriate health and safety legislation, guidance documents and approved Codes of Practice published by the Health and Safety Executive (HSE). Relevant legislation includes, but is by no means limited to the following (with amendments):

- Health and Safety at Work Act 1974;
- Management of Health and Safety at Work Regulations 1999;
- Construction (Design and Management) Regulations 2015;
- Control of Substances Hazardous to Health Regulations 2002;
- Control of Asbestos Regulations 2012;
- HSE report HS(G)66 entitled 'Protection of workers and the general public during the redevelopment of contaminated land' 1994;
- HSE Approved Code of Practice L143 titled 'Managing and working with asbestos' 2013; and,
- CIRIA Report C733 titled 'Asbestos in soil and made ground: a guide to managing the risks' 2014.

The Contractor should be aware of the potentially contaminated nature of the Made Ground materials at the site and a high standard of health and safety awareness should be adopted in order to protect the health of workers and the general public. Particular attention is drawn to presence of asbestos encountered in the made ground during the recent investigation works.

A Health and Safety Plan for the Works (including the asbestos risk assessment) shall be developed by the Contractor. No works will be permitted until an adequate plan has been submitted to, and approved by, the Supervising Engineer a minimum of one week beforehand.

7.2. Environmental Protection Measures

The remedial work shall be carried out with the minimum amount of disturbance and inconvenience to the neighbouring occupants and the general public. The site should be securely fenced from the general public to prevent unauthorised access or trespassing. Any excavations should be fenced off with suitable signage.

The Contractor shall take all measures necessary to minimise potential adverse impacts on the local environment. This may include measures to suppress the emission of dust during the remedial works to minimise nuisance to neighbouring occupants and the general public. Reference should be made to the requirements discussed in Section 7 above in relation to remediation of the asbestos impacted soils.

Care shall be taken to ensure that no significant amounts of sediment are allowed to enter surface water drains (or possible surface watercourses).

All plant used within the works is to be fully decontaminated prior to leaving site (or moving to other uncontaminated areas of the site) including all road Lorries disposing of contaminated soils. Wheel wash facilities shall be used when required along with other relevant equipment to ensure there is no spread of contamination beyond the works boundary, such as on the roads around the site. In the event loading is undertaken on the access track any soil arisings which fall onto the track are to be cleared up by hand tools prior to the Lorry commencing on its journey.

Any temporary storage of fuels will be in double skinned tanks or bunded tanks (capable of containing at least 110% of the tank volume) in accordance with good working practices to minimise any potential spillages.

Any complaints relating directly to the soil remediation works shall be recorded in a complaints register and dealt with immediately by the Contractor. The Contractor shall without delay inform the Supervising Engineer of any and all such occurrences and of the subsequent actions taken to ensure appropriate measures are put in place to rectify the nuisance and prevent further occurrences or similar complaints.

8. Verification Plan

8.1. Remediation of Made Ground

It is proposed to excavate and remove the full depth of the Made Ground which are impacted by Asbestos and Lead contamination from the area of the site. Following completion of this, the underlying natural subsoils will require inspection and testing by the Supervising Engineer to verify the success of the remedial works. Soil samples at the reduced level dig shall be collected by the Supervising Engineer and submitted to the laboratory and tested for the Lead and Asbestos. The soil samples shall be analysed at a UKAS and MCERTS accredited laboratory (anticipated to be Concept Life Sciences, CLS).

For this area, it is anticipated that around 10 to 15 No. validation samples shall be collected and analysed for Asbestos and Lead which also equates to approximately 15m centres. These samples shall be from the base of the excavation from the natural clay.

The laboratory results shall be compared to the remediation criteria contained in Table 1 (appended). If all the determinands are below the specified remediation criteria, then the soils will be considered to be acceptable. If any of the determinands exceed the specified remediation criteria then further remediation will be required. If deemed appropriate by the Supervising Engineer, the assessment of the laboratory results may involve determining the 95% upper confidence limits and comparison of these to the specified remediation criteria.

8.2. Importation of Soils to Site

It is anticipated that there will be enough site derived subsoil materials will be demonstrated as being suitable and that imported clean topsoil will be required to be brought on site for re-use in proposed gardens and soft landscaping.

Any imported chemically suitable ('clean') topsoil to be placed in private gardens and landscaped areas shall comprise 'as-dug' natural materials. The topsoil shall be obtained wherever possible from a single source (preferably), which has been inspected, tested and approved in advance by the Supervising Engineer.

For each proposed source of topsoil to be used on the site, a minimum of three representative samples will be collected by the Supervising Engineer during the inspection of the source and tested to demonstrate that the source is suitable for residential use with plant uptake. The purpose of the inspection is to ensure that the proposed source comprises chemically suitable material with limited potential for contamination to be incorporated.

The soil samples from the proposed sources of imported topsoil shall be submitted to the laboratory by the Supervising Engineer and tested for the full range of contaminants listed in Table 1 of this document. The results of the laboratory testing shall be compared to the remediation criteria also listed in Table 1. If one of the determinants (or alternatively 95% upper confidence limits) exceeds the specified acceptance criteria, then the Supervising Engineer will reject the proposed source of the soil.

Approval of the proposed off-site source of clean soil by the Supervising Engineer is required in writing prior to importation to site.

8.3. Verification Report

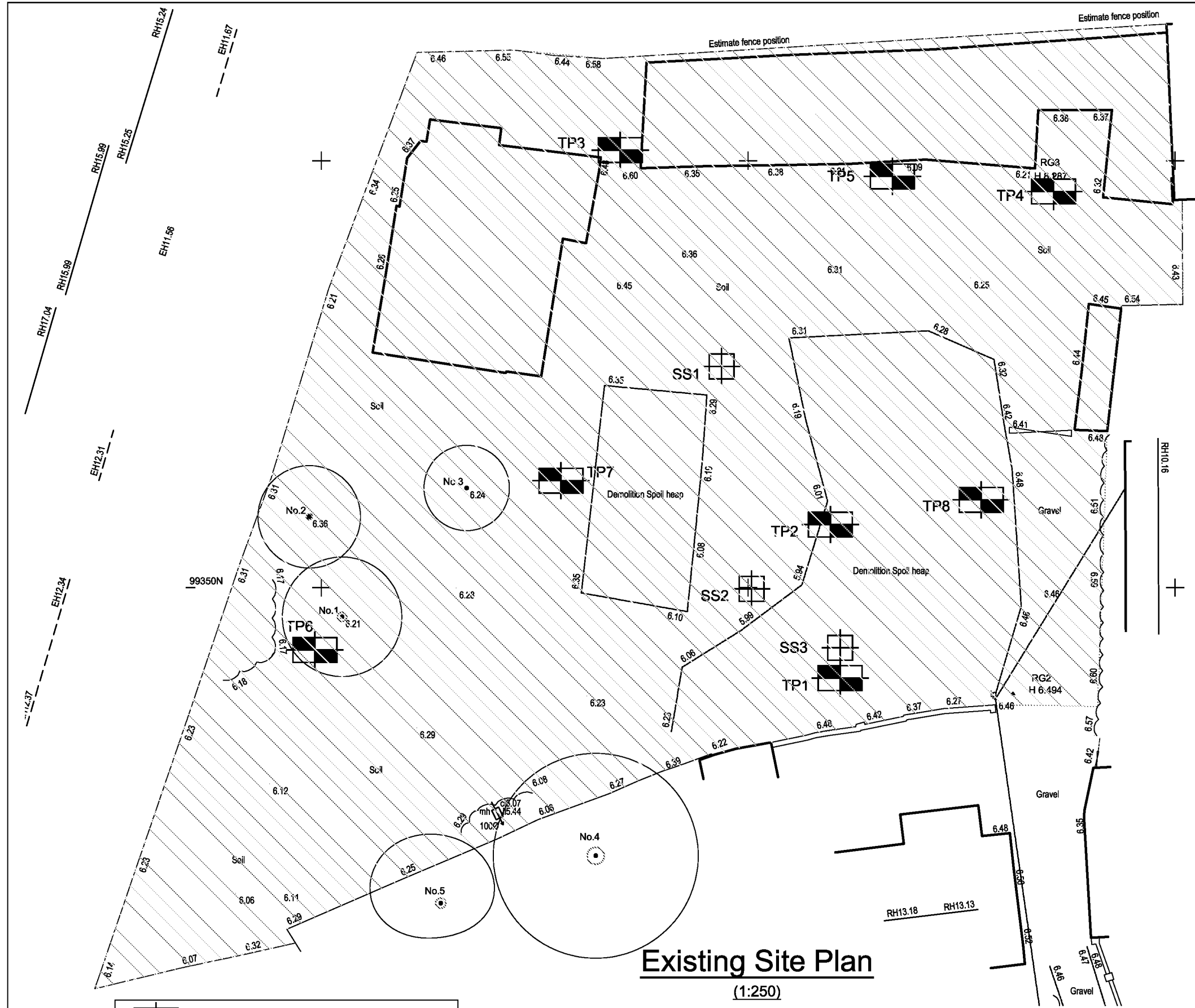
Upon completion of the remedial works, a remediation verification report shall be prepared by the Supervising Engineer, detailing the extent of the remedial works carried out and the verification testing undertaken, including:

- Details of the destination and the quantities of any materials disposed of off-site;
- Confirmation that the full extent of unsuitable soil has been removed from the site; and,
- Information on the sources of the 'certifiably clean' topsoil and subsoil imported (if required), together with chemical analysis results to demonstrate that the materials are chemically suitable.

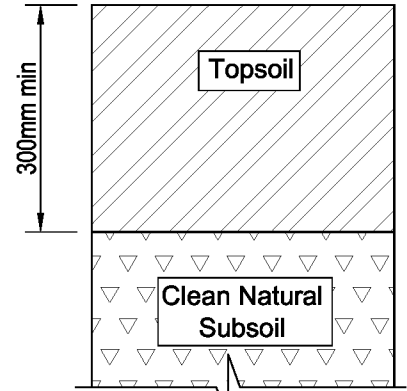
The remediation verification report shall be submitted to Arun District Council and the NHBC (if required) for their review and approval in order to obtain discharge of the planning conditions and land quality conditions respectively.



Drawings



- NOTES:**
1. This drawing is to be read in conjunction with all other OPUS INTERNATIONAL CONSULTANTS drawings, and any other relevant information.
 2. No dimensions are to be scaled from this drawing, but must be taken from site and / or the details.
 3. Unless noted otherwise all dimensions are in millimetres and all levels are in metres from the site datum.
 4. The electronic information from this drawing can not be guaranteed as dimensionally drawn exact. Figured dimensions must be used for setting out and detailing. OPUS logos and company information must be removed from copies if information is re-used.
 5. The Contractor is responsible for the design of all temporary works, and is also responsible for the safe maintenance and stability of the existing buildings at all times.
 6. Until Technical Approval has been obtained from the relevant authority, it should be understood that all drawings issued are Preliminary and Not for Construction.
 7. This Summary Remediation Plan is to be read in conjunction with the OPUS Contamination Land Strategy referenced E-E1644.00 RS dated May 2017 and not used in isolation.



**Schematic Detail within
Gardens Soft Landscaping**
(1:10)

Elevated levels of Lead in the made ground. Asbestos containing materials in the made ground	Elevated levels of Lead in the made ground. Asbestos containing materials in the made ground	Existing structures are unstable. Asbestos containing materials in the building
Construction Risks	Maintenance/Cleaning Risks	Demolition/Adaption Risks
The table above is provided to assist the Principal Contractor to fulfil his obligations under the Construction (Design & Management) Regulations 2015. It does not include residual risks that a competent Contractor will be aware of nor does it absolve the Principal Contractor of his legal responsibilities.		
SAFETY HEALTH AND ENVIRONMENTAL INFORMATION BOX		

DRAWING IN PROGRESS
PLOTTED ON 2017-05-08 AT 8:11 AM
PRELIMINARY

- Trial Pit (TP) undertaken by OPUS
- Surface Samples (SS) undertaken by OPUS
- Made ground to have ACM'S picked out then stripped to natural clean subsoil and removed to appropriate permitted waste disposal facility

Revision	Amendment	Approved	Revision Date
P1	PRELIMINARY ISSUE	CDS	08.05.17

OPUS Fareham Office +44 1329 622021		Modulus House, Salthams Lane, Fareham Hampshire PO18 0QS	90 ROSE GREEN ROAD BOGNOR REGIS	
Designed CDS	Approved CDS	Approved Date MAY 2017	REMEDATION PLAN	
Drawn JEN	Scale 1:250, 1:10	Project No. FA E-E1644	Sheet No. 200	Revision P1

Tables

Table 1

Remediation Criteria for the Retention or Importation of Topsoil and Subsoil to the Site for Use in Private Gardens and Soft Landscaping

Determinand	Maximum Acceptable Soil Concentration (mg/kg unless otherwise stated)				Source of Remediation Criteria
Metals					
Arsenic		37			C4SL
Cadmium		22			C4SL
Hexavalent Chromium		21			C4SL
Lead		200			C4SL
Inorganic Mercury		40			S4UL
Nickel		130			S4UL
Selenium		250			S4UL
Copper		2,400			S4UL
Zinc		3,700			S4UL
Organics (% SOM)	0.25%	1%	3%	6% (SGV Default)	
Benzene	0.084	0.2	0.48	0.87	C4SL
Toluene	43	130	290	660	S4UL
Ethylbenzene	15	47	110	260	S4UL
m-Xylene	18	59	140	320	S4UL
o-Xylene	19	60	140	330	S4UL
p-Xylene	18	56	130	310	S4UL
TPH Aliphatics C ₅ -C ₅	25	42	78	160	S4UL
TPH Aliphatics >C ₆ -C ₈	40	100	230	530	S4UL
TPH Aliphatics >C ₈ -C ₁₀	7.5	27	65	150	S4UL
TPH Aliphatics >C ₁₀ -C ₁₂	34 (12)	130 (48)	330 (120)	760 (280)	S4UL
TPH Aliphatics >C ₁₂ -C ₁₆	280 (5.9)	1,100 (24)	2,400 (59)	4,300 (140)	S4UL
TPH Aliphatics >C ₁₆ -C ₃₅	26,000 (2.1)	65,000 (8.5)	92,000 (21)	110,000	S4UL
TPH Aromatics C ₅ -C ₇	0.084	0.2	0.48	0.87	C4SL Benzene
TPH Aromatics >C ₇ -C ₈	43	130	290	660	S4UL Toluene
TPH Aromatics >C ₈ -C ₁₀	9.3	34	83	190	S4UL
TPH Aromatics >C ₁₀ -C ₁₂	19 (9.7)	74 (37)	180 (90)	380 (220)	S4UL
TPH Aromatics >C ₁₂ -C ₁₆	38	140	330	660	S4UL
TPH Aromatics >C ₁₆ -C ₂₁	74	260	540	930	S4UL
TPH Aromatics >C ₂₁ -C ₃₅	500	1,100	1,500	1,700	S4UL
Naphthalene	0.68	2.3	5.6	13	S4UL
Acenaphthene	56	210	510	1,100	S4UL

Fluorene	44	170	400	860	S4UL
Anthracene	630	2,400	5,400	11,000	S4UL
Fluoranthene	83	280	560	890	S4UL
Pyrene	180	620	1,200	2,000	S4UL
Benzo(a)anthracene	2.7	7.2	11	13	S4UL
Chrysene	5.6	15	22	27	S4UL
Benzo(b)fluoranthene	1.2	2.6	3.3	3.7	S4UL
Benzo(k)fluoranthene	42	77	93	100	S4UL
Benzo(a)pyrene	1.2	2.2	2.7	3.0	S4UL
Indeno(123cd)pyrene	12	27	36	41	S4UL
Dibenzo(ah)anthracene	0.14	0.24	0.28	0.30	S4UL
Cumulative PAHs	40	40	40	40	Arbitrary Value
Others					
Asbestos	Not Present				-

Notes:

1. SOM = percentage Soil Organic Matter.
2. Opus Tier 1 SSV = Opus Tier 1 soil screening values for residential with consumption of home grown produce (Version 2014.2 dated 3rd December 2014).
3. LQM / CIEH S4ULs for Human Health Risk Assessment (2nd Edition) dated 2015 [*Copyright Land Quality Management Ltd reproduced with permission. Publication No S4UL3028. All rights reserved*];
4. Values in **bold** are the Category 4 Screening Values (C4SLs) published by Defra on 27 March 2014 and adjusted by Opus for SOM contents of 0.25%, 1% and 3%.
5. * denotes that remediation criteria exceeds lower saturation limit and vapour pathway is important contributor to exposure. Remediation criteria is limited to soil saturation limit.
6. The cumulative PAH values must not be exceeded in any of the samples (without detailed quantitative risk assessment), even if the remediation criteria for individual PAHs are not exceeded.



Appendix A

Proposed Development Layout

90 Rose Green Road

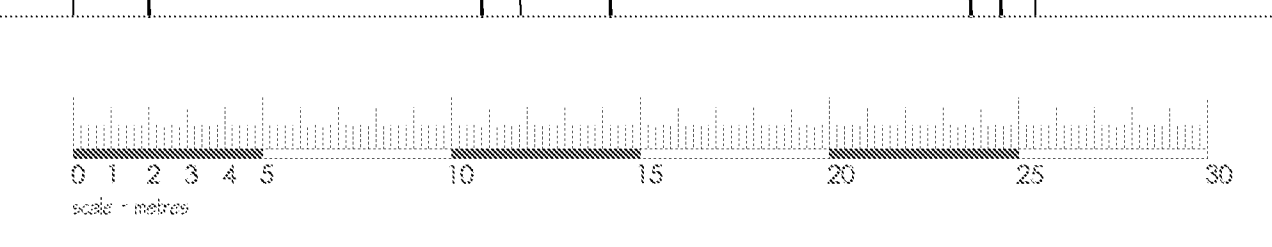
OSBORNE WAY

GROSVENOR WAY

-
- Figure 1: Typical cross-section of a proposed road. The diagram shows a cross-section of a road with various layers and materials. From top to bottom, the layers are: grass (5.87' thick), shrubs, block paving, compacted gravel, and regula sett rumble strips. A proposed tree is shown on the left side of the road. The total width of the road is 5.90'.

[illegible]

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<i>client</i> WILSON DESIGNER HOMES	
<i>job no.</i> 1542	<i>date</i> JAN 17
<i>time</i> 1:200	<i>sheet</i> A1

sherlockboswellarchitecture	
project	90 ROSE GREEN ROAD
drawing	PROPOSED SITE LAYOUT PLAN
drawing no.	100
rev	D



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