



Phase 3 Remediation Strategy

Kilten Cottage

26 May 2021

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DOCUMENT CONTROL SHEET

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EXECUTIVE SUMMARY

Objectives					
Wheal Jane Consultancy was commissioned by Mr & Mrs Noon to undertake a Phase 3 Remediation Strategy.					
Remediation					
Areas of Site Requiring Remediation	Remediation is required in the proposed garden areas of the site. It is also necessary in the areas of non-continuous hardstanding and soft landscaping. The existing access to the site is currently a compacted earth and hardcore surface. Since there is to be no material change to the intended use, it is not considered necessary to remediate this area. The woodland in the north of the site is within a tree root protection zone and therefore requires no remedial measures. Full radon protection measures are required.				
Remedial Requirements	<table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 25%;">Garden Areas</th> <th></th> </tr> </thead> <tbody> <tr> <td></td> <td>it is necessary to excavate existing soils/made ground to a minimum depth of 600mm. A high visibility geo-membrane should be placed over the residual soils and overlain with clean soils.</td> </tr> </tbody> </table>	Garden Areas			it is necessary to excavate existing soils/made ground to a minimum depth of 600mm. A high visibility geo-membrane should be placed over the residual soils and overlain with clean soils.
Garden Areas					
	it is necessary to excavate existing soils/made ground to a minimum depth of 600mm. A high visibility geo-membrane should be placed over the residual soils and overlain with clean soils.				
Remediation Timescale	<ul style="list-style-type: none"> It is expected that the scope of works should be completed at an early stage in the construction works. This remediation strategy should be submitted to the local authority prior to construction commencement. 				
Verification	<ul style="list-style-type: none"> A Phase 4 Verification report is required to complete the phased process. 				

1 INTRODUCTION

- 1.1.1 Wheal Jane Consultancy was commissioned by Mr & Mrs Noon to plan a remediation strategy for the site; "Kiltan Cottage."
- 1.1.2 This report has been prepared by Wheal Jane Consultancy solely for the benefit of the client. It shall not be relied upon or transferred to any third party without the prior written authorisation of Wheal Jane Consultancy.

1.2 Scope and Objectives

- 1.2.1 The objective of this report is to outline a strategy of remediation to mitigate any risks to human health and that of flora and fauna inhabiting the site.
- 1.2.2 This strategy has been prepared with guidance from BS10175:2011 and Environment Agency report CLR11, and as such represents a Phase 3 Remediation Strategy.
- 1.2.3 The conclusions and recommendations of this report are valid for a period of 12 months from the date of issue. Outside of this time frame the report will require reviewing by a suitably qualified geoenvironmental engineer / environmental scientist, to ensure that the report complies with any changes to industry standards, policies and/or guidelines.
- 1.2.4 This report does not constitute an asbestos inspection that may fall within the 'Control of Asbestos' regulations, 2006.

1.3 Background

- 1.3.1 In order to comply with the latest Government guidelines on new building developments, the site needed to be subjected to a phased environmental assessment prior to any development works commencing. This report forms Phase 3 of this process and should be considered in conjunction with the previous Phase 1 and Phase 2 reports, detailed below (section 2.4).

2 THE SITE

2.1 Site Location

- 2.1.1 The site is located in Hugus, approximately 5.30km to the south west of the city centre of Truro. The site is approximately centred on National Grid Reference SW 77516 43640.
- 2.1.2 The site is roughly rectangular in shape and covers an area of approximately 0.22ha.
- 2.1.3 A site location plan (SLP) is contained in Figure 2.1, to the rear of the report.
- 2.1.4 The current site plan is contained in Figure 2.2, to the rear of the report.

2.2 Surrounding Area

Direction	Land Use
North	Agricultural
East	Agricultural, Residential
South	Agricultural, Cycle Track
West	Residential, Agricultural, Historic Mine Workings

2.3 Proposed Development

- 2.3.1 It is proposed to construct a single replacement dwelling in the existing garden area. Further information can be found under planning application number PA20/00759.
- 2.3.2 The proposed site plan is contained in Figure 2.3, to the rear of the report.

2.4 Previous Investigations

2.4.1 The following investigations have taken place on site;

Table 2.1: Previous Site Investigations

Report	Date	Author
Phase 1 Preliminary Investigation – 20052/PH1	March 2020	Wheal Jane Consultancy
Phase 2 Site Investigation – 20077/PH2	April 2021	Wheal Jane Consultancy

2.4.2 The BGS 1:50,000-scale bedrock geological map Sheet 352, Falmouth of the area shows the site to be underlain by the Mylor Slate Formation.

2.4.3 The Phase 2 Site Investigation undertaken in July 2020 involved the excavation of three hand dug trial pits. Samples were collected for laboratory analysis and tested for;

- Heavy Metals (As, B, Cd, Cr, Cu, Hg, Pb, Ni, Se, Zn)

2.4.4 The investigation encountered Topsoil overlying the Mylor Slate Formation to depths of up to 0.90m.

2.4.5 The underlying weathered Mylor Slate Formation and was generally described as 'Brown clayey GRAVEL/gravelly CLAY with occasional cobbles'.

2.4.6 Groundwater was not encountered during the investigation.

2.4.7 Chemical testing revealed that elevated concentrations of arsenic and lead were observed in soil samples across the proposed development. Levels of arsenic and lead are considerably higher than their respective GACs and therefore bioavailability testing is unlikely to bring them to within acceptable levels.

3 RISK ASSESSMENT

3.1 Introduction

3.1.1 The assessment of risk is based upon the principle of the pollutant linkage, which is described in more detail below. This assessment sought to identify plausible pollutant linkages associated with the proposed development. Once this was done, the resultant risk was determined based on the probability and the possible consequence of the pollutant linkages being present. As such, this qualitative risk assessment has been undertaken in accordance guidance published in CIRIA C552.

A summary of the CIRIA C552 risk classification matrix is presented in Table 3.1 below.

Table 3.1 Risk Classification Matrix

		Risk Classification Matrix			
Taken from CIRIA C552	Consequence				
	Severe	Medium	Mild	Minor	
Probability	High Likelihood	Very High	High	Moderate	Moderate / Low
	Likely	High	Moderate	Moderate / Low	Low
	Low Likelihood	Moderate	Moderate / Low	Low	Very Low
	Unlikely	Moderate / Low	Low	Very Low	Very Low

3.2 Refined Conceptual Model

3.2.1 This conceptual site model has been undertaken with due regard to guidance provided in BS10175:2011 and CLR11. The assessment of risk from land contamination also pays due regard to the definition of contaminated land, as defined within Part 2A of the Environment Protection Act 1990. This legislation defines contaminated land as any land that is in such a condition that by reason of substances in, on or under the land:

- Significant harm is being caused or there is a significant possibility of such harm being caused; or

- Pollution of controlled water is being, or is likely to be, caused.

3.2.2 This definition is based on the principles of risk assessment defined as a combination of the probability (or frequency) of occurrence of a defined hazard and the magnitude (including the seriousness) of the consequences. Central to the risk assessment process is the concept of pollutant linkage, which is a linkage between a contaminant and a receptor by means of a pathway.

Table 3.2. Summary of statutory definitions relating to pollution linkage.

Statutory definitions relating to pollution linkage.	
Contaminant	"a substance which is in, on or under the land and which has the potential to cause harm or to cause pollution of controlled waters."
Receptor	"a living organism, a group of living organisms, and ecological system or a piece of property" which meets given criteria. "controlled waters which are, or could be, polluted by a contaminant".
Pathway	"one or more routes or means by, or through, which a receptor: <ul style="list-style-type: none"> • is being exposed to, or affected by, a contaminant, or • could be so exposed or affected".

3.2.3 Without the presence of all three components, there is no linkage and therefore no risk. The relationship between these components is discussed below in order to identify the existence of any source-pathway-receptor linkage on the site, and hence the potential risks associated with any contamination. Following the site investigation, the preliminary

conceptual site model was revised as outlined in the Phase 2 report, with regard to the quantitative risk assessment (SI19490/PH2, Table 6.5, page 20).

3.2.4 A Revised Conceptual Model (included as Table 3.4 overleaf) was produced following the conclusions of the chemical testing discussed above.

3.2.5

Table 3.3: Identified Sources, Pathways and Receptors

Source – Pathway – Receptor Overview	
Contaminant sources	Natural geology – arsenic
	Natural geology – lead
	Natural geology – radon
	Historic Mining – arsenic/lead
Pathways	Dermal contact
	Ingestion
	Ingress into buildings
	Inhalation of dust and soil
Receptors	Flora & Fauna
	Future site users
	Site workers

Table 3.4: Refined Conceptual Model

Preliminary Conceptual Model							
Source(s)	Contaminant(s)	Pathway(s)	Receptor(s)	Probability	Consequence	Risk Assessment	
On Site	Radon gas	Ingress into proposed buildings	Future site users	High Likelihood	Medium	High Risk – Development is within an area where greater than 30% of properties are affected.	
	Natural Geology	Arsenic	Dermal contact Soil and dust ingestion and inhalation Ground & surface waters	Future site users Site workers Site flora and fauna	Likely	Medium	Moderate Risk – Levels of arsenic are considerably higher than their respective GACs and therefore bioavailability testing is unlikely to bring them to within acceptable levels. Remediation will be required in areas of private gardens.
			Lead	Dermal contact Soil and dust ingestion and inhalation Ground & surface waters	Future site users Site workers Site flora and fauna	Likely	Medium
	Historic Mine Workings	Arsenic/Lead	Dermal contact Soil and dust ingestion and inhalation	Future site users Site workers	Unlikely	Medium	Moderate Risk - Levels of arsenic and lead are considerably higher than their respective GACs and therefore bioavailability testing is unlikely to bring them to within acceptable levels. Remediation will be required in areas of private gardens.

4 REMEDIATION

4.1 Remedial Objectives and Options Appraisal

- 4.1.1 The remedial objectives for this site are designed to ensure that the final development greatly reduces the risk from exposure to the contaminants identified in the Phase II investigation by people, flora or fauna.
- 4.1.2 The planning application PA20/00759 show that private gardens are included in the design and these are the most sensitive areas for exposure to contamination (other than indoor radon). Pathways and patios are also proposed to the front and rear of the properties.
- 4.1.3 The existing access to the site (marked in blue in Figure 4.1) is currently a compacted earth and hardcore surface. Since there is to be no material change to the intended use, it is not considered necessary to remediate this area.
- 4.1.4 The woodland in the north of the site is within a tree root protection zone (marked in green on Figure 4.1) and therefore requires no remedial measures.
- 4.1.5 A plan illustrating the remedial requirements is presented as Figure 4.1.
- 4.1.6 Several options to remediate the site have been considered and these are summarised in Table 4.1.

Table 4.1 Remediation Options Appraisal

Overview of Remedial Options	
Option	Assessment
In Situ Capping with Subsurface Barrier System	Excavation of a pre-determined depth of contaminated media before a geo-textile membrane is laid over the exposed soil and capped with clean, cover material. This option ensures the removal of contaminated material and the membrane guarantees the pathway from the soil is broken.
Soil washing	This physical approach to remediation involves the extraction of contaminated soil and then treatment using mechanical and chemical separation of contaminants from uncontaminated soil. This method is

	likely to have constraints particularly regarding timescale, as a treatability study may have to be carried out.
Soil flushing	A flushing solution is delivered to the surface of the soil, utilising infiltration. Leachates are diverted and collected where they are subsequently treated at the surface. This approach may require the addition of further chemical treatment to neutralise acidity. It is also likely to be costly.
Stabilisation and solidification using hydraulic binders	Soil mixing equipment is used to cut and mix the soil. Pre-selected materials are then added to the mix to solidify and stabilise the soil. The area is gradually treated in columns. This technique is also costly and involves careful assessment of soil types and binder additives, usually during a treatability study.

4.1.7 The most suitable remediation methodology for this site is in situ capping with a subsurface barrier system. This method will be suitable for all areas, with a separate consideration for the access road to the development where continuous hardstanding is proposed. The residential buildings will also be considered in relation to radon protection.

4.2 Remediation Strategy

4.2.1 Each of the areas requiring remediation are discussed separately below.

4.3 Private Gardens

4.3.1 The proposed gardens to the west of the development is highlighted in red in Figure 4.1. To break the contamination pathway, it is necessary to excavate existing soils/made ground to a minimum depth of 600mm. A high visibility geo-membrane should be placed over the residual soils and overlain with clean soils, Figure 4.2 depicts the recommended method of remediation. The clean soils should be clean chemically inert topsoil. Alternatively, it is acceptable to use 420mm of clean subsoil with 180mm of topsoil.

4.3.2 The following points should be noted:

4.3.3 The material excavated from the site should be treated as waste and would have to be disposed of at a licensed waste management facility. The materials should be handled in accordance with the Site Waste Management Plan. Waste transfer notes should be retained

for your records. Should ground levels require it material may be required to be excavated in order to install the necessary depth of clean cover. Underlying material should be compacted prior to placement of the clean cover. A layer of sand beneath the geo-membrane may be required to ensure that the barrier is not pierced on stones when it is installed.

- 4.3.4 The geo-membrane and clean cover material must be stored securely if it is to be delivered and stockpiled on site prior to use, to prevent any mixing occurring with contaminated media.
- 4.3.5 The geo-membrane (a permeable synthetic textile sheet), should be of a suitable colour such as orange or white, such as Lotrak high visibility Geofabric. The purpose of the membrane would be to act as a barrier to prevent mixing of the imported clean soil and any contaminated ground beneath. It will also act as a warning device should future site users carry out any excavations.
- 4.3.6 The clean cover placed onto the geo-membrane should be a minimum thickness of 600 mm after firming, a sufficient thickness to allow vegetables and plants to grow. Where trees are planned a minimum area of 2.0 x the maximum mature root spread and at least 1.5 x the maximum mature depth of the roots (minimum 1000 mm) of the stock to be planted should be excavated.
- 4.3.7 The imported clean topsoil should be accompanied by an analysis of its content to prove its suitability for the proposed end-use (no more than 6 months old). The source of the material should also be recorded. The certificate of analysis should be retained for record purposes. The suitability of the soil should be verified prior to it being brought on site. If as part of any landscaping plan, retaining walls or raised beds are considered, it is important to ensure that the encapsulation layer is present across the area.
- 4.3.8 The remedial works are to be periodically inspected and documented by a suitably qualified person (e.g. Environmental Scientist) as part of the Phase IV Verification Report.

4.4 **Hardstanding Areas**

- 4.4.1 The planned *continuous* external hardstanding (beneath the dwelling) will act as a source – receptor barrier, preventing any contact with the contaminated ground by the subsequent occupiers of the property and will prevent any intake via the following pathways:
- Indoor ingestion of soil dust.
 - Inhalation of indoor dust.

- Contact with indoor dust.
- Soil tracked indoors by people and pets.
- Dermal contact with contaminated soil.
- Outdoor ingestion of soil.
- Outdoor inhalation of dust.
- Plant uptake.
- Wind erosion and lifting of soil dust.
- Surface water runoff with suspended soil.
- Wind deposition to surface water.
- The remedial works are to be inspected and documented by a suitably qualified person (e.g. Environmental Scientist) as part of this report.

4.4.2 If as part of any landscaping plan, retaining walls or raised beds are considered, it is important to ensure that the encapsulation layer is present across the area.

4.5 Indoor Areas

- 4.5.1 In the area beneath the property, where a continuous floor slab (either raised or ground bearing) is to be provided, it will act as a source – receptor barrier, preventing any contact with the contaminated ground by the subsequent occupiers of the property. No further remediation will be required in this area for soil contamination.
- 4.5.2 The site is located in an area where greater than 30% of properties are above the action level, therefore full radon protection measures are required. As noted in section 2.4.12 above,

specific assessment of soil contamination against UK WIR guideline values has not been conducted.

4.6 Remediation Timescale

- 4.6.1 It is expected that the scope of works should be completed at an early stage in the construction works.
- 4.6.2 This remediation strategy should be submitted to the local authority prior to construction commencement.

5 REPORTING OF UNEXPECTED CONTAMINATION

- 5.1.1 The Phase 1 and 2 investigations that have taken place on site have identified contamination within the underlying soil. This remediation strategy is aimed at breaking the source-pathway-receptor model and thus reducing risk.
- 5.1.2 Any contamination encountered during the course of construction which differs in type and/or quantity to that already identified on site must be reported in writing to the local planning authority. Development in areas of site affected by the unexpected contamination shall be suspended until a risk assessment has been carried out. Further sampling and analysis may be required.

6 VERIFICATION

- 6.1.1 To complete the phased process, a Verification Report documenting the successful implementation of the outlined works above shall be produced and submitted to the Local Authority.
- 6.1.2 Photo documentation should be taken regularly during the course of the remedial work for the Verification Report.
- 6.1.3 It is paramount that all invoices, analysis certification, waste transfer notices and all other general documentation relating to the remedial process be kept for verification purposes.
- 6.1.4 A suitably qualified person from Wheal Jane Consultancy will monitor the progress of the remediation and conduct a site visit upon completion of all outlined works to ensure compliance has been achieved.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

- 7.1.1 This report has assessed the in-situ capping method is the most effective method to remediate the site in terms of cost, practicability, sustainability and overall reduction of risk. The following criteria are recommended:
- 7.1.2 In the garden areas to break the contamination pathway, it is necessary to excavate the existing soils to a minimum depth of 600mm. A high visibility geo-membrane is to be placed over the residual soils and overlain with clean cover, in private gardens.
- 7.1.3 The woodland in the north of the site is within a tree root protection zone and therefore requires no remedial measures.
- 7.1.4 The existing access to the site is currently a compacted earth and hardcore surface. Since there is to be no material change to the intended use, it is not considered necessary to

remediate this area. Where continuous hardstanding is proposed no remediation measures are necessary.

- 7.1.5 Where the ground level requires modification, it may be necessary to remove some of the existing soil. In which case the material excavated from the site should be treated as waste and would have to be disposed of at a licensed waste management facility.
- 7.1.6 Photographs should be taken during the course of the remediation works for the Phase 4 report.
- 7.1.7 The proposed development is in an area where greater than 30% of properties are above the UK Action Level for radon.
- 7.1.8 Long term monitoring post-remedial works will not be required.
- 7.1.9 On completion of remedial works to the required standard, a Phase 4 Verification report must be obtained before the site can be deemed suitable for its intended use.

7.2 Recommendations

- 7.2.1 The use of in situ capping and subsurface barrier will break the contamination pathway between the soil and the site users.
 - 6.2.2 In areas of the proposed building footprints no further remediation of the soil is required. It will be necessary to install full radon protection measures for all of the proposed buildings.
 - 7.2.2 Any soil removed from site should be disposed of at a licensed waste facility. Waste transfer notices should be kept. The materials should be handled in accordance with the Site Waste Management Plan.
 - 7.2.3 Any soil imported to site should be certified for residential end use with certification to demonstrate it is of suitable composition.
 - 7.2.4 If any unrecorded contamination is encountered during site clearance operations, assessment will be required by a suitably qualified and experienced environmental scientist to ascertain the best procedure for remediation.
 - 7.2.5 It is recommended that a copy of this report should be sent to the regulating authority before any works are commenced.
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8 REFERENCES

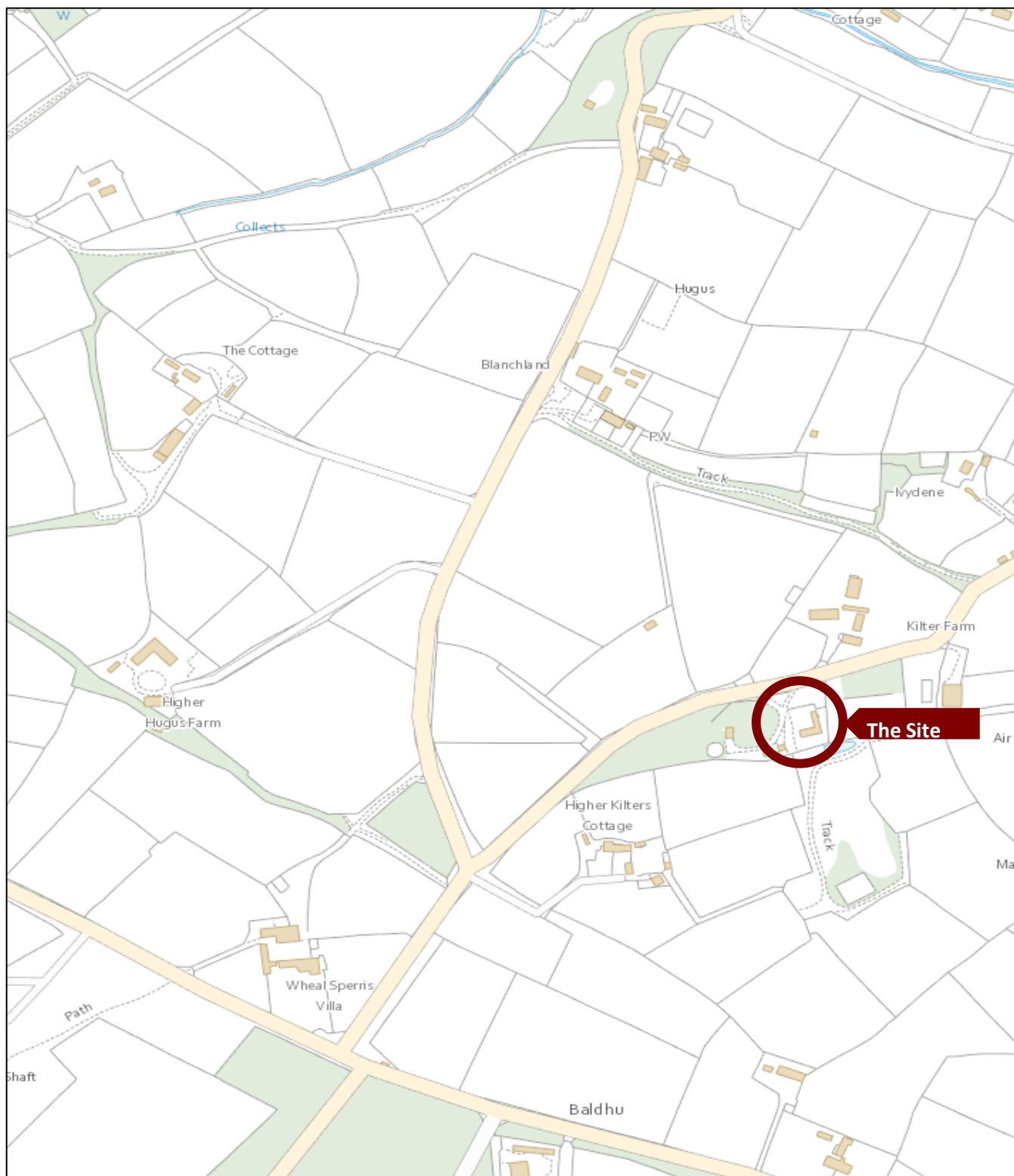
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9 NOTES

- 9.1.1 This report is concerned solely with the property, as defined by this report, or parts thereof examined.
- 9.1.2 The report should not be used in connection with adjacent properties.
- 9.1.3 The information in the Groundsure EnviroInsight and GeoInsight reports, which have been used in compiling this Phase 1 Desk Study report, is derived from a number of statutory and non-statutory sources. While every effort is made by the supplier to ensure accuracy, the supplier cannot guarantee the accuracy or completeness of such information or data, nor to identify all the factors that may be relevant.
- 9.1.4 The conclusions and recommendations relate to the type and extent of development outlined in this report for this specific property only and should not be taken as suitable for any other form or extent of development on this property without further consultation with Wheal Jane Consultancy.
- 9.1.5 This report is confidential to the client, the client's legal and professional advisors, and may not be reproduced or distributed without our permission other than to directly facilitate the sale or development of the property concerned.
- 9.1.6 We have no liability toward any person not party to commissioning this report.
- 9.1.7 Unless otherwise expressly stated, nothing in this report shall create or confer any rights or other benefits pursuant to the Contracts (Rights of Third Parties) Act 1999 in favour of any person other than the person commissioning this report.
- 9.1.8 This report is not an asbestos inspection that may fall within the control of Control of Asbestos Regulations 2006.

FIGURES:



Title: Site Location Plan

Project: Kiltern Cottage

Client: Mr & Mrs Noon

Report Title: Phase III Remediation Scheme

Date: 13/05/2021

Ref:

20587

Figure: 2.1





Legend:

- Existing Access Not Requiring Remediation
- Private Gardens Requiring Remediation
- Tree Protection Zone Not Requiring Remediation



Title:

Remedial Requirments Plan

Project:

Kilten Cottage

20587

Client:

Mr & Mrs Noon

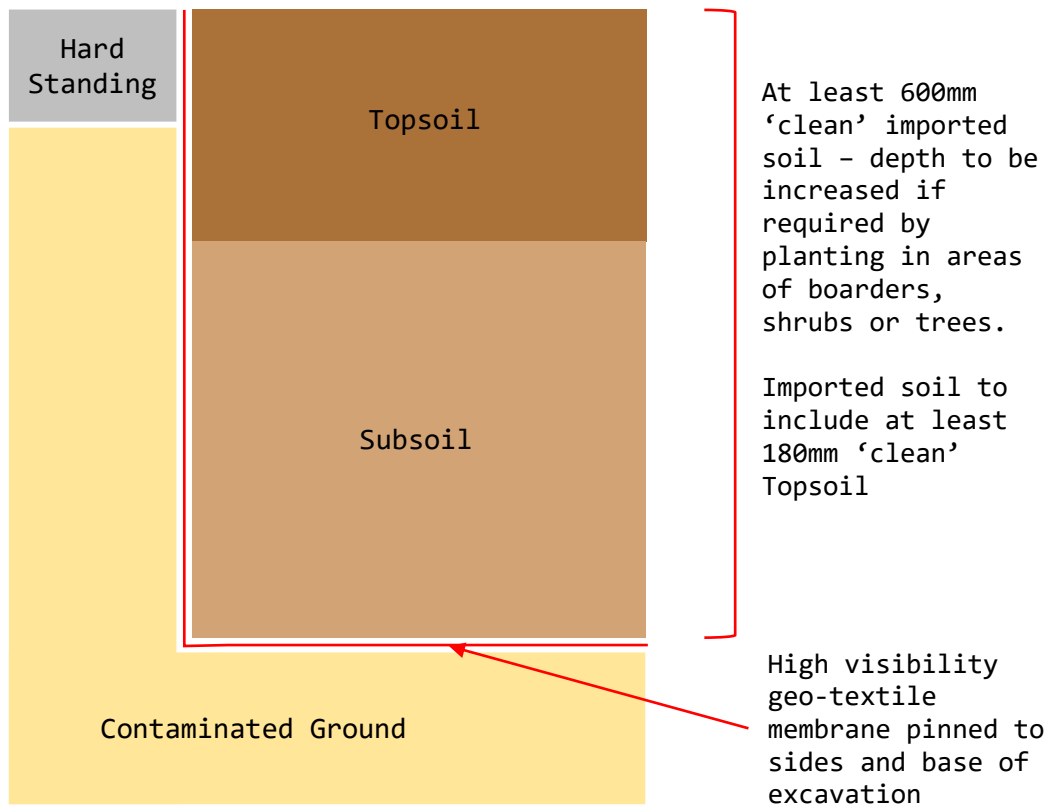
Date: 13/05/2021

Scale: NTS

Drawn by: BH

Revision: A

Figure: 4.1



Title: Private Gardens

Project: Kilten Cottage

Client: Mr & Mrs Noon

Report Title: Phase III Remediation Scheme

Scale: NTS

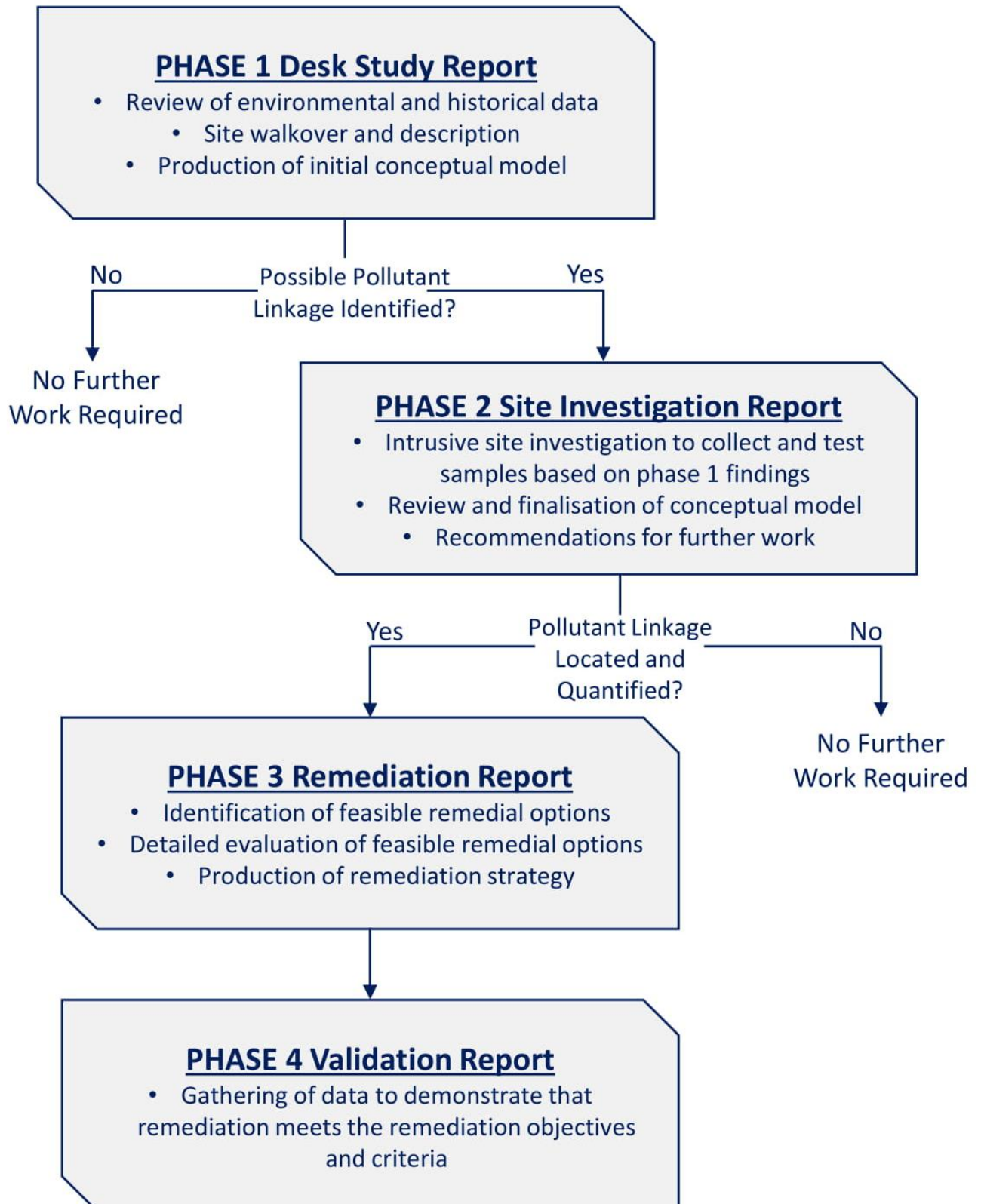
Date: 05/03/2019

Ref: 20587

Figure: 4.2

The Phased Approach to Land Contamination

As set out in Contaminated Land Report 11 - Model Procedures for the Management of Land Contamination. Environment Agency Guidelines





Wheal Jane Consultancy

Part of the Wheal Jane Group

- Laboratory Testing of Soils and Water-
- Mineralogical Surveys and Reports-
- Contaminated Land Assessments-
- Geotechnical Investigation-
- Mine Site Investigations-
- Mine Search Reports-
- Mundic Analysis-

