

GROUND CONTAMINATION INVESTIGATION AND ASSESSMENT PHASE 1 DESK STUDY

for the
Barn Conversion
at
**The Laurels,
Wood Lane,
Quadring Eaudyke
PE11 4SS**



frontispiece – view towards the west from the road

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Report on:

Tier 1 Preliminary Risk Assessment -
Desk Study

Report at:

The Laurels, Wood Lane, Quadring
Eaudyke PE11 4SS

Report for:

Mr. & Mrs. McCreddie, The Laurels,
Wood Lane, Quadring Eaudyke PE11
4SS

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1. INTRODUCTION

1.1 Background

It is proposed to convert the agricultural barn at The Laurels for residential use.

There is potential for contamination from the former use as a *Farmyard* and at the request of the Mr. and Mrs, McCreadie, owners, an assessment of that risk was undertaken.

The Environment Agency Land Contamination: Risk Management (LCRM) guidance prescribes the following three step framework for managing land contamination in England.

LCRM Framework		Planning Condition
Stage 1	Risk Assessment	Site Characterisation
	Tier 1: Preliminary Risk Assessment (PRA)	
	Tier 2: Generic Quantitative Risk Assessment (GQnRA)	
	Tier 3: Detailed Quantitative Risk Assessment (DQnRA)	
Stage 2	Options Appraisal	Submission of Remediation Strategy
Stage 3	Remediation	
	Tier 1: Develop a Remediation Strategy (RS)	Implementation of Approved Remediation Strategy
	Tier 2: Remediation and Verification	
	Tier 3: Long term monitoring and maintenance (if required)	

Table 1 – Stages of risk assessment for contaminated land

This report satisfies Tier 1 – Preliminary Risk Assessment.

1.2 Objectives and limitations

Langdale-Smith and Co Limited has prepared this report solely for the use of the client and/or his agent on the basis of exchange of proposals and instructions, and the company accepts no responsibility or liability for use of this report by any party other than the person for whom it was commissioned, or for the consequences of the report being used for any other purpose other than that for which it was commissioned. Should any third party wish to use or rely on the contents of the report, written approval should be sought. It is strongly recommended that independent advice is sought by that third party with respect to its specific proposals.

The conclusions and recommendations in this report represent our professional opinion, derived from currently accepted industry practices, exercising all reasonable skill and care to be expected of a professional engineering and environmental consultancy of similar size and experience.

The assessments and judgements given in this report are directed by both the finite quantity of data on which they are based and the proposed works to which they are addressed, taking account of the resources devoted to it by agreement with the client or agent, whether in writing or subsequent verbal instructions.

Environmental Desk Studies comprise a study of readily available information obtained from various identified sources, authorities and parties. The information reviewed is not exhaustive and is accepted in good faith as providing representative and true data pertaining to site conditions. Any identified risks in Desk Study reports are 'perceived risks' based on the information available at that time. Actual risks can only be assessed after carrying out a physical intrusive investigation.

1.3 References

<i>BS10175:2011+A2:2017</i>	<i>Investigation of contaminated land</i>
<i>BS5930:2015+A1:2020</i>	<i>Code of practice for site investigations</i>
<i>EA P5-065/TR:2000</i>	<i>Technical aspects of site investigation</i>
<i>BS ISO 18400-104:2018</i>	<i>Sampling strategies</i>
<i>EA TR20:1999</i>	<i>Methodology for the development for soil and groundwater remedial targets</i>
<i>EA/NHBC R&D Report 66:2000</i>	<i>Guidance for the safe development of housing on land affected by contamination</i>
<i>EA TR P336 (BR414)</i>	<i>Protective measures for housing on gas-contaminated land</i>
<i>EA R&D Publication 8:1997</i>	<i>The physical properties of major aquifers in England and Wales</i>
<i>EA R&D Publication 68:1997</i>	<i>The physical properties of minor aquifers in England and Wales</i>
<i>BS 8485:2015+A1:2019</i>	<i>Protection against gasses in new buildings</i>
<i>DEFRA CLR 1-12</i>	<i>CLR reports</i>
<i>DEFRA TOX1-10</i>	<i>Toxicology reports</i>
<i>CIRIA SP103:1995</i>	<i>Remedial treatment for contaminated land - site investigation and assessment</i>
<i>DoE Profiles:1995</i>	<i>Guidance on industry specific contaminants</i>
<i>Inst. Petroleum 1998</i>	<i>Guidelines for the investigation and remediation of petroleum retail sites</i>
<i>BR211:2015</i>	<i>Radon: guidance on protective measures for new developments</i>
<i>BS EN ISO 21365:2020</i>	<i>Soil quality and guidance for Conceptual Models</i>
<i>LQM:2015</i>	<i>Contaminated land management</i>
<i>QRA field guides</i>	<i>Descriptions of shallow soil environments</i>

1.4 Definition of terms

AST/UST:	Aboveground/Underground Storage Tank
Bgl:	below ground level
Conceptual Model:	Textual and/or schematic hypothesis of the nature and sources of contamination, potential migration pathways (including description of the ground and groundwater) and potential receptors, developed on the basis of the Preliminary Investigation and refined during subsequent phases of the investigation which is an essential part of the Risk Assessment.
Contamination:	The presence of a substance which is in, or under land, and which has the potential to cause harm or to cause pollution of controlled water
Controlled Water:	Inland freshwater (any lake, pond or water course above the freshwater limit, water contained in underground strata and any coastal water between the highest tide or freshwater limit to the three mile limit of territorial waters.
Harm:	Adverse affect of the health of living organisms, or other interference with ecological systems of which they form part, and, in the case of humans, including property
Hazard:	Inherently dangerous quality of a substance, procedure or event.
Pathway:	Mechanism or route by which a contaminant comes into with, or otherwise affects, a receptor
Pollution linkage:	A complete source/pathway/receptor scenario
Receptor:	Persons, living organisms, ecological systems, controlled waters, atmosphere, structures and utilities that could be adversely affected by the contaminants.
Risk:	Probability of the occurrence of, and magnitude of the consequences of, an unwanted adverse affect of the receptor
Risk Assessment:	Process of establishing the existence, nature and significance of the risk
Significant harm:	Defined in Draft Circular on Contaminated Land, DETR 2000
Source:	Location from which contamination is, or was, derived

2. SITE PERSPECTIVE

2.1 Location

Quadring Eaudyke is a hamlet located some 13 km southwest of Boston, 8 km north of Spalding and 1.5 km east of the village of Quadring that is sited on the main A152 road.

The region is entirely agricultural, comprising of open flat farm fields growing market garden vegetables.



Fig 1 – Location of site

The site is centred on OS coordinates 524360 334000 and is at approximately 4 m AOD on flat ground.

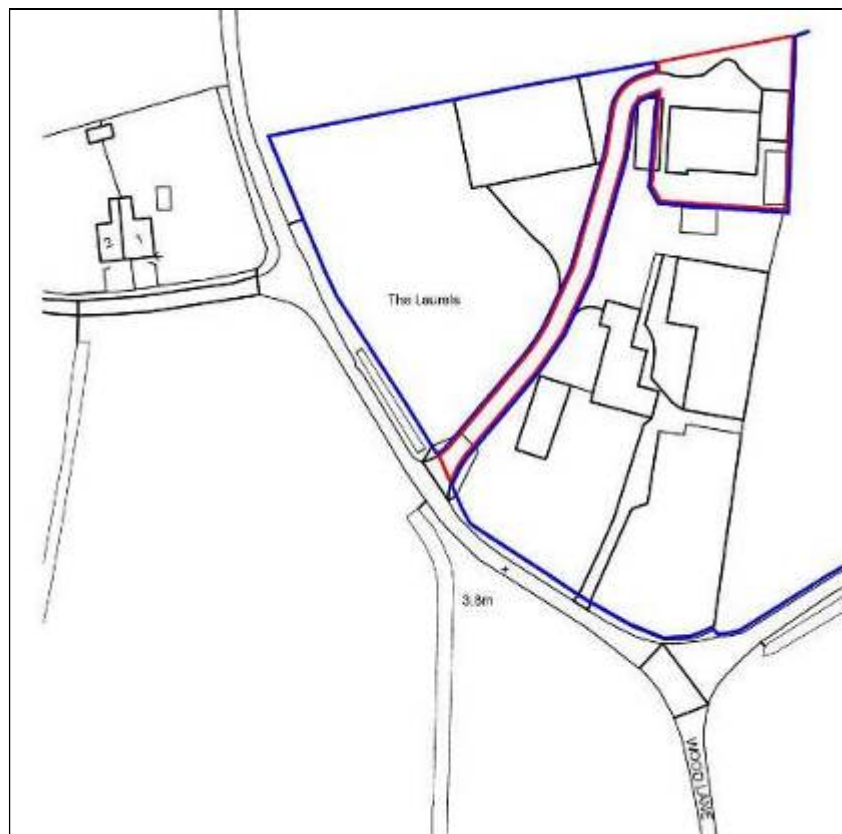


Fig 2 – plan of site



Fig 3 – aerial view of site

2.2 Description

The Laurels comprises of a small cluster of farm buildings and the main farmhouse all operating as a market-garden grower, with green houses and various storage sheds.

The development site is a 25 m x 30 m plot in the northeast corner of the farm yard that is currently occupied by wooden sheds, small brick barns and open-sided barns.

There is no Cement Bound Asbestos (CBA) roofing or cladding on the structures within the development site.

There is a small wooden shed beyond the south boundary that has a corrugated CBA roof and 30 m to the west is a large steel-framed warehouse, clad and roofed with CBA panels.

In all cases the CBA panels and roofing are in good condition, with no cracks or frayed edges.

The floors of all of the on-site buildings are covered with concrete and no discolouration from oil or chemical spills were observed.

There was no evidence of any AST or UST.

There was no evidence of any coal store or burning.

The sheds and buildings are in poor condition.

The sheds and buildings are currently used for storage of old farm implements and general farm materials, none of which have the potential to cause contamination.

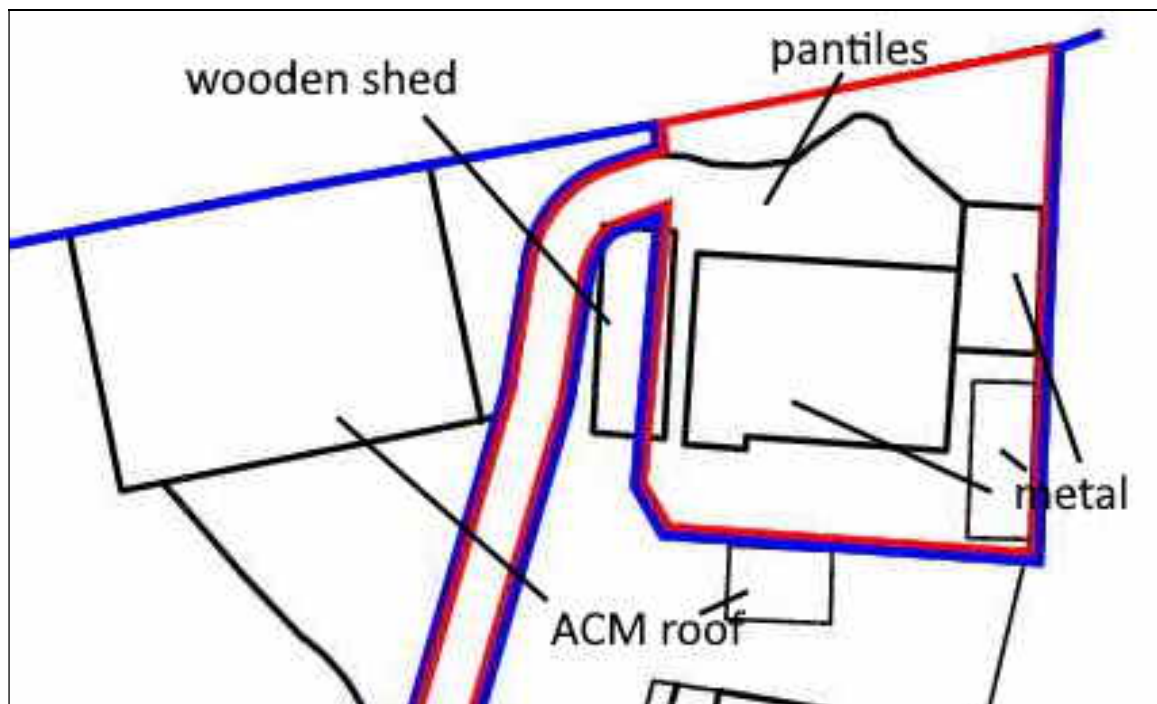


Fig 4 – plan of the development site



Fig 5 – view to northeast along south boundary



Fig 6 – view to east along south boundary with wooden shed with CBA roof beyond



Fig 7 – view to north east of open-sided barn



Fig 8 – concrete floor common in all sheds and barns



Fig 9 – view to south of north elevation

2.3 History

A study of the historical OS maps for the site and environs reveals little evidence of any significant potential for The Laurels or environment up to 250 m radius.

It is understood that the main farmhouse was built in the 1700s and the farm activity has always been at a low ebb and has been unused for the last 30 years.

Period	On site	Off site (250 m)
1888	site known as The Elms. Barns in place	village, sparsely populated
1905	no change	no change
1906	no change	no change
1931	name change to The Laurels	no change
1951	no change	no change
1956	no change	no change
1973	big barn on east side	no change
1977	no change	no change
1190	no change	no change
1995	no change	no change
2000	no change	no change
2000	no change	no change
2006	no change	no change
2020	no change	no change

Table 2 – Summary of historical activity at The Laurels

2.4 Assessment of site use

2.4.1 On-site

There is potential for contamination at this site from:

- TPH, PAH and phenol from hydrocarbons associated with a *vehicle storage/maintenance*; and
- PAH and metals in Hearth Ash.

2.4.2 Off-site

There is potential for contamination from:

- Asbestos from CBA roofing and cladding from nearby.

3. ENVIRONMENTAL CONDITIONS

3.1 Geology

The 1:50 000 BGS map shows the solid geology to comprise the bedrock Jurassic Oxford Clay overlain by Quaternary Glacial Till and capped with the Recent Tidal Flat Deposits.

Boreholes made locally for the 400 KVA overhead electricity pylons suggest that the strata are, approximately:

0.0 – 1.0 m	soft CLAY
1.0 – 9.0 m	medium dense sandy SILT
9.0 – 10.0 m	PEAT
10.0 – 12.0 m	SAND AND GRAVEL
12.0 m +	stiff gravelly CLAY (Boulder Clay)

The Sand is water-bearing, rising to approximately 1 m bgl.

The BGS has presented estimates for the local abundance of some metals.

Element	(mg/kg)
Arsenic	< 15
Cadmium	< 1.8
Chromium	60 - 90
Lead	< 100
Nickel	15 - 30

Table 3 – regional geochemistry



Fig 8 - Geology of the site

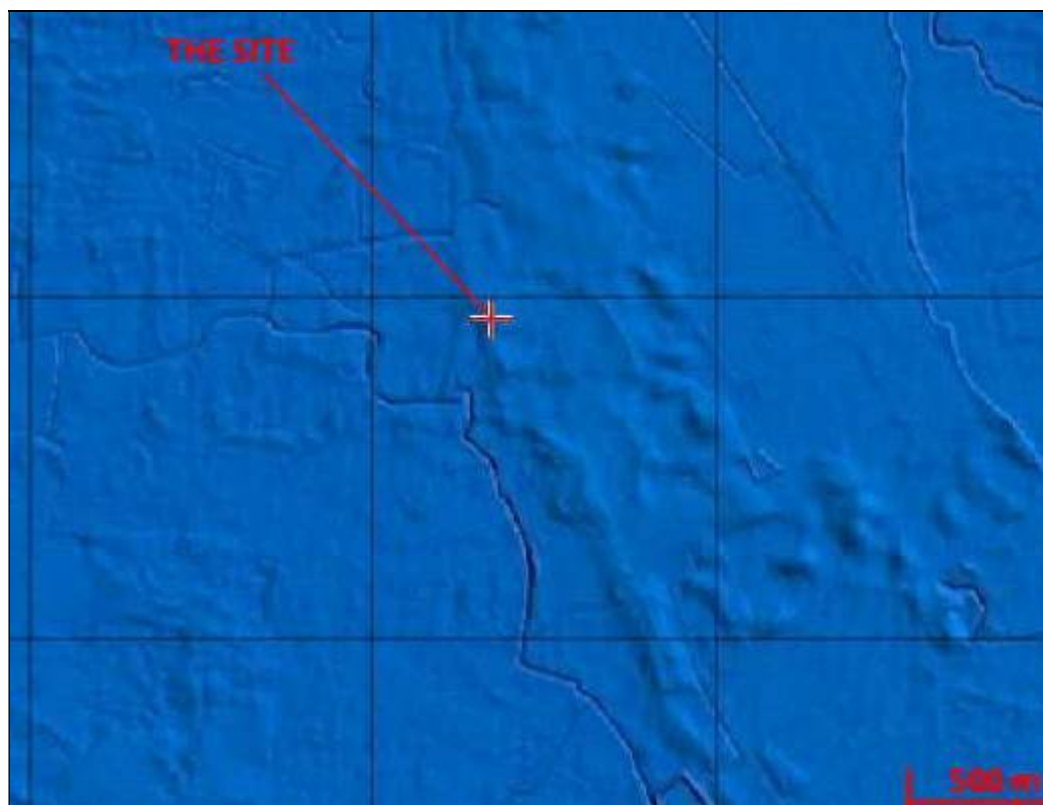


Fig 9 – Regional terrain

3.1.1 Jurassic Oxford Clay (152 – 135 Mya)

The Jurassic Oxford Clay is a pale or dark grey heavily over-consolidated clay which, in its unweathered state, is *very stiff* and geologically may form a shale or mudstone

Beds of fine grained clayey limestone varying in thickness from a few centimetres to as metre or so and, elsewhere, calcareous nodules may be found throughout the sequence.

At the surface it weathers to brown or yellow (due to oxidation of the ferric content of the clay) and reduces in consistency to *firm* or even *soft*.

It is typically fissured and locally laminated and geological discontinuities, such as faults, have also been recorded in it.

At the scale of most sites the material is often regarded as homogeneous with any variation generally being related to its weathering profile.

3.1.2 Recent Tidal Flat Deposits (5 kya – present)

Alluvium comprises a sequence of Recent clay, silt, sand and gravel, which can be found interspersed with subordinate and sometimes extensive peat formed during the last 5000 years as sea level has risen causing river plain aggradation. The soil is typically normally consolidated and therefore in a soft condition, but at surface the effects of intermitted drying by weather and vegetation, often produces a firmer crust as a result of this desiccation.

Alluvium has been laid down since the end of the Pleistocene some 10,000 years ago following the associated worldwide eustatic rise in sea level. In the North Sea the rise, and subsequent sediment deposition, was rapid exacerbated by the very gentle gradients of the east coast shelf. The rate of deposition has generally declined during the Holocene although there have been notable hiatus.

Dating of organic remains has shown freshwater Peat at 10 m BOD to be 6900 years old and then covered by marine sediments. 700 years later, after deposition of another 7 m of sediments, woodland had re-established.

Other marine regressions have been recorded. Peat and 'submerged forest' visible off the Lincolnshire coast have yielded Neolithic implements, showing that the sea was relatively low 4000 years ago. A similar age is assigned to the Bronze Age Peat encountered within the Humber Estuary deposits.

Pollen records show that extensive deforestation took place after this date causing enhanced sedimentation that, in the Humber Estuary, also shows a change in chemical composition with the on-set of the Industrial Revolution.

3.2 Hydrogeology and hydrology

The bedrock Jurassic Mudstone is not water-bearing and is not an aquifer.

The superficial deposit of Tidal Flat deposits are not an aquifer.

According the Environment Agency the site has limited potential for groundwater flooding.

Groundwater Vulnerability	Unproductive strata
Bedrock Aquifer	Unproductive strata - MUDSTONE
Superficial Aquifer	Secondary aquifer - Glacial Till
Source Protection Zone	None
Sensitive Land Use	Nitrate vulnerable zone
Groundwater Flood Data	Potential for groundwater flooding to occur at surface

Table 4 – Aquifer sensitivity

3.3 Ground gas

There are no known landfill sites within 100 m of the site.

Local boreholes show that there is a 0.7 m thick bed of PEAT under 9 m of water-bearing Sand.

The water will prevent the Peat decaying and generating CO₂ and CH₄.

According to Public Health (England) the site is not on ground with potential to generate or transmit radon gas.

4. CONCEPTUAL EXPOSURE MODEL

The following decision matrices are from CIRIA Report C552 'Contaminated Land Risk Assessment – a guide to good practice' 2001.

Highly likely	very likely short term, inevitable long term or already causing harm
Likely	possible short term and likely in the long term
Low likelihood	less likely in short term and unlikely in long term
Unlikely	improbable in the long term

Table 5 - definitions of likelihood of harm being caused

Severe	acute risk to Human Health likely to result in significant harm, short term risk of pollution to sensitive water courses, ecosystems or organisms that are part of that ecosystem, catastrophic damage to buildings or property
Medium	chronic damage to Human Health, long term risk of pollution to sensitive water resources, significant change in the ecosystems or organisms that are part of that ecosystem
Mild	pollution of non-sensitive water resources, significant damage to crop, buildings, structures, services
Minor	harm, not necessarily significant, that could result in unforeseen costs, non-permanent Human Health effects prevented by protective clothing, easily repaired damage to buildings, structures, services

Table 6 - definitions of consequences of harm

		Severe	Medium	Mild	Minor
PROBABILITY	Highly likely	Very high	High	Moderate	Moderate/Low
	Likely	High	Moderate/Low	Moderate/Low	Low
	Low likelihood	Moderate/Low	Moderate/Low	Low	Very low
	Unlikely	Moderate/Low		Very low	Very low

Table 7 – categories of risk used in this assessment

4.1 Sources

4.1.1 On-site

There is potential for contamination at this site from:

- TPH, PAH and phenol from hydrocarbons associated with a *vehicle storage/maintenance*; and
- PAH and metals in Hearth Ash.

4.1.2 Off-site

There is potential for contamination from:

- Asbestos from CBA roofing and cladding from nearby buildings; and
- Ground gas from Peat buried beneath the site.

4.2 Receptors

It is proposed to erect a residential dwelling with a garden at this site.

The *residential* and *infrastructure* receptors will apply.

RECEPTOR	DESCRIPTION
Residential	habitation of dwelling up to 2 storeys with default material/design parameters; access to private and/or communal open space with soil track back to form indoor dust; ingestion of home grown produce
Allotments	default parameters for use and consumption of vegetables but not animals or their produce (e.g. eggs)
Industrial/ commercial	assumes office or light physical work in a permanent 3 storey structure with short external work breaks and no hard cover on outside ground
Infrastructure	buried services such as drinking water pipes, electricity/data cables

Table 8 – definition of receptors used in this assessment

4.3 Pathways

The main pathways for the suspected contaminants to affect man and his environment is through Direct Exposure.

The potential for any sub-surface migration of contamination into groundwater is discounted because:

- The ground is impermeable sandy SILT ;
- There is no sensitive shallow groundwater;
- The bedrock is not an aquifer.

	DIRECT EXPOSURE		SUB-SURFACE MIGRATION
1	Outdoor ingestion of dust	13	Surface infiltration (e.g. from AST)
2	Indoor Ingestion of dust	14	Sub-surface infiltration (e.g. from UST)
3	Consumption of home-grown vegetables	15	Anthropogenic (e.g. pipes, conduits)
4	Ingestion of soil attached to vegetables	16	Permeable ground
5	Outdoor exposure through dermal contact	17	Groundwater (perched)
6	Indoor exposure through dermal contact	18	Groundwater (unrestrained)
7	Outdoor inhalation of fugitive dust		
8	Indoor inhalation of fugitive dust		
9	Outdoor inhalation of soil vapour		
10	Indoor inhalation of soil vapour		
11	Ingestion of surface water		
12	Permeation into plastic water supply pipes		

Table 9 – key to pathways used in this assessment

4.4 Assessment of pollution linkage.

With no sub-surface migration pathways present at this site, the main pathways for the suspected contaminants to affect man and his environment are through Direct Exposure.

Where the risk rating is Moderate, or above, then a strategy for remediation needs to be prepared.

LOCATION	SOURCE	CONTAMINANTS	RECEPTOR	PATHWAYS	RISK RATING
Shed floor	leaks from farm vehicles	TPH, PAH, phenol	Future residents	(Direct Exposure) 1, 2, 3, 4, 5, 6, 7, 8, 9, 10	VERY LOW
Fill beneath concrete floor	Ash	PAH, phenol metals			
Adjacent buildings	CBA roofing and panels	Asbestos fibres		(Inhalation) 1, 2	LOW
9 m below ground level	Peat	methane, carbon dioxide		(Sub-surface migration)16	VERY LOW
Shed floor	leaks from farm vehicles	TPH, PAH, phenol	Plastic water pipes	Permeation (12)	LOW
Gardens	Imported Topsoil	PAH, metals, stones and sharps	Future residents	(Direct Exposure) 1, 2, 3, 4, 5, 6, 7, 8, 9, 10	MODERATE

Table 10 – Assessment of potential pollution linkages

5. RECOMMENDATIONS

5.1 Qualitative risk assessment for the proposed development

It is proposed to demolish the existing agricultural buildings and replace them with a residence with gardens.

The work will entail the removal of the roof and ground floor slab and the retention and strengthening of the existing walls.

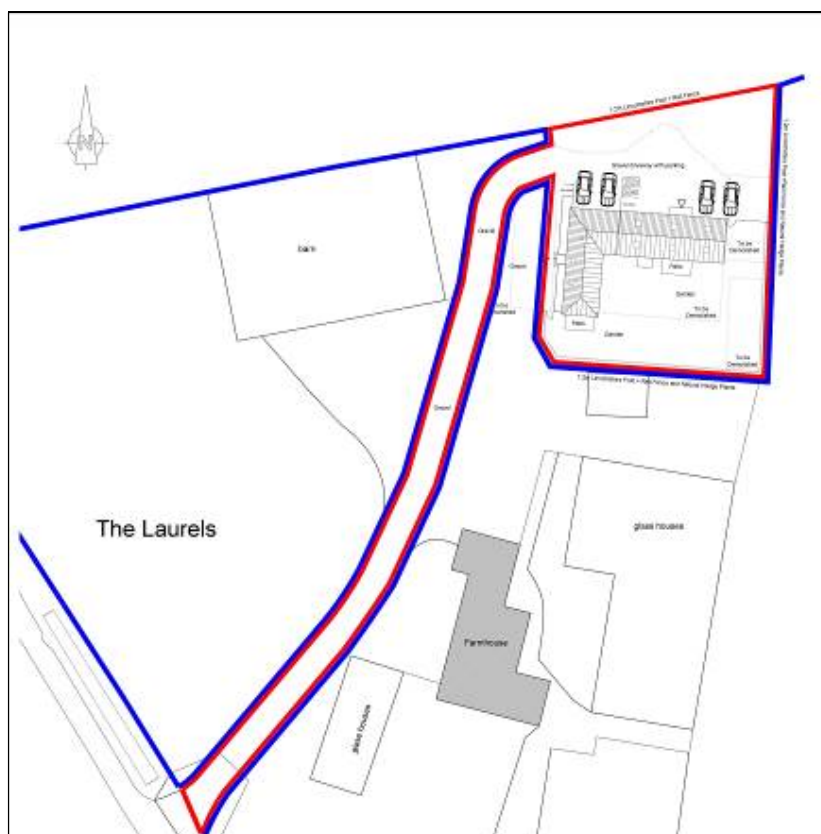


Fig 10 – proposed development

The Pollution Linkage matrix (Table 10) has identified:

- LOW risk for contamination from Asbestos, TPH, PAH and phenols; and
- MODERATE risk for contamination from imported Topsoil.

5.3 Recommendations for remediation

5.3.1 Sampling and analysis

The ground at the site should be investigated after demolition of all of the superstructure in case there are isolated 'hotspots' that would need further investigation.

A Waste Acceptance Criteria (WAC) certificate will be required for any soil that is to be removed from site.

5.3.2 Remediation

Assuming that the degree of contamination at this site is low then it is likely that the site can be made suitable for the proposed use by:

- installation of vapour-proof membranes within the buildings;
- installation of metal-coated HDPE drinking water pipes (as specified by Anglian Water); and
- use of 0.6 m thick top layer of uncontaminated horticultural quality topsoil in the garden areas (see the YALPAG guidance).

5.4 Recommendations for validation

It is necessary to prove that the remedial methods recommended and approved have been implemented and/or installed correctly.

For this site the evidence that adequate barriers have been installed can be provided by:

- plans detailing installation;
- receipts, waybills etc.; and
- photographs of the work undertaken.

The information will need to be presented as a Phase 4 Validation report, to be made by an independent SQP.

<< END >>