

GROUND CONTAMINATION INVESTIGATION AND ASSESSMENT PHASE 1 and 2

at

**Manor Farm,
Main Street,
Timberland
LN4 3RX**



frontispiece - view to the east from Main Street

L-S&Co Project Number: 65 006
Status of Report: **FINAL**
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Report on: Phase 1 and 2 ground contamination assessment

Report at: Manor Farm, Main Street,
Timberland LN4 3RU

Report for: Mr. M. Francis, RM Bespoke Homes
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1. INTRODUCTION

1.1 Background

It is proposed to convert some outbuildings and barns for residential use, together with some demolition, and to construct a new residence, with gardens, at Manor Farm, Timberland.

The ground at the site has the potential to be contaminated from its former use as a farmyard.

At the request of the Heronswood AS, project managers, a contaminated land investigation was undertaken to assess the potential for contamination at the site that could affect the development and future users.

1.2 Objectives and limitations

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.

This report contains the findings from the Phase 1 - Desk Study, undertaken as part of the Preliminary Risk Assessment and following the guidance notes and to the standards set out in references below.

It has been prepared solely for the use of the client and/or his agent on the basis of exchange of proposals and instructions, and Langdale-Smith and Co Limited 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 or requirements. 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 judgments 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 Information sources used

The following sources of information were used to compile this report:

- in-house research procedures;
- Google, geostore.com, old-maps.co.uk, gridreferencefinder.com;
- bgs.gov.uk, environment-agency.gov.uk,
- interviews with current and former owners; and
- local/archive knowledge.

1.4 References

<i>BS10175:2011</i>	<i>Investigation of contaminated land</i>
<i>BS5930:2016</i>	<i>Code of practice for site investigations</i>
<i>EA P5-065/TR:2000</i>	<i>Technical aspects of site investigation</i>
<i>EA P5-066/TR:2000</i>	<i>Secondary model procedure for the development of appropriate soil sampling strategies for contaminated land</i>
<i>EA TR20:1999</i>	<i>Methodology for the development of remedial targets for soil and groundwater to protect</i>

	<i>water resources</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>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>BR211:1999</i>	<i>Radon: guidance on protective measures for new developments</i>
<i>BR212:1991</i>	<i>Construction of new buildings on gas contaminated land</i>
<i>LQM:2012</i>	<i>Contaminated land management</i>
<i>QRA field guides</i>	<i>Descriptions of shallow soil environments</i>

1.5 Definition of terms

ACM/CBA:	Asbestos containing material/Cement bound asbestos (usually white chrysotile)
AOD/bgl:	Above Ordnance Datum/below ground level
AST/UST:	Aboveground/Underground Storage Tank
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/fresh-water limit to the three mile limit of territorial waters.
Harm:	Adverse effect 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 effect of the Receptor
Risk Assessment:	Process of establishing, to the extent possible, 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
UXO:	Unexploded ordnance

2. SITE PERSPECTIVE

2.1 Location and description

Timberland is a small fen-side village located on the ridge of higher ground that is also occupied by the village of Martin, next to the B1189 road, 4 km northwest of Billingham and 15 km northeast of Sleaford.

Manor Farm is located in the centre of the village, between Main Street, on the west side, and Martin Road.

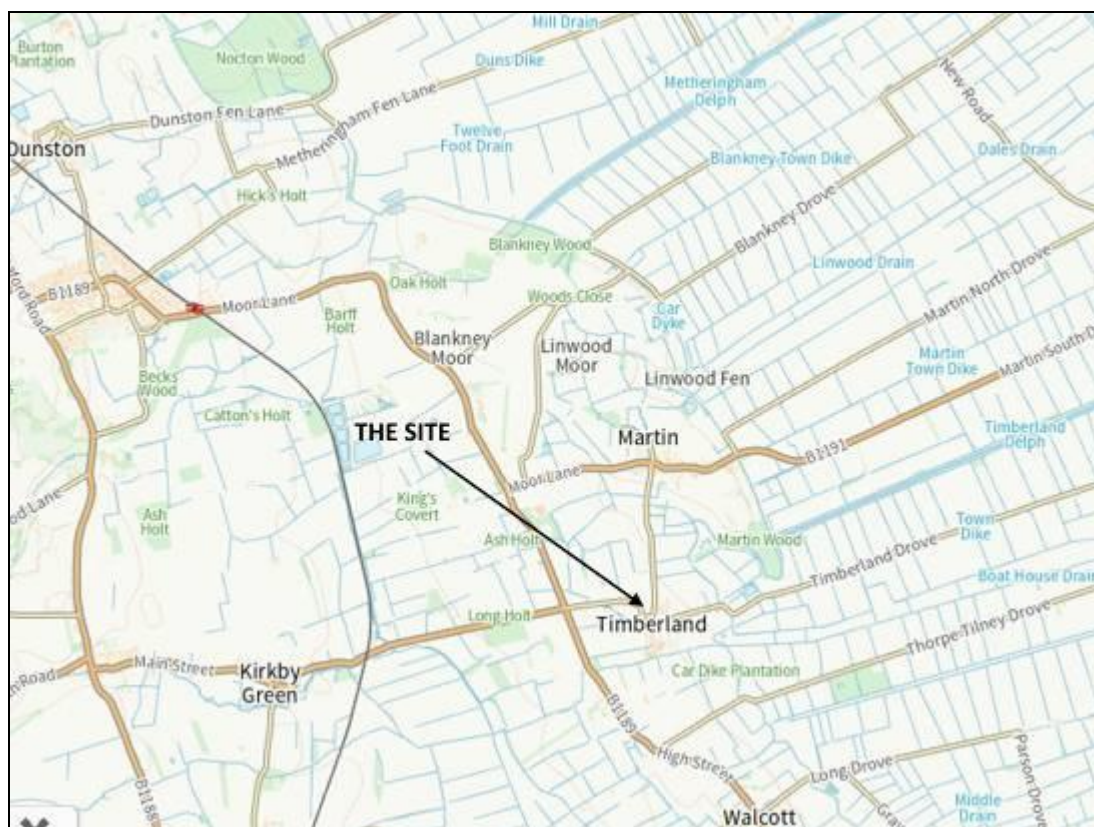


Fig 1 - location of Timberland

The site is centred on OS coordinates 511980 358600 and is on flat ground at approximately 15 m AOD.



Fig 2 – Geostor aerial view of Manor Farm

The site is an irregular east-west orientated rectangle, facing for some 60 m on the west side onto Main Street, and the rear of some of the existing houses along that street, and extending east for 120 m or so up to Martin Road, with a large part of the northeast quadrant cut out so that there is narrow access onto Martin Road.

Most of the site is occupied by the original Manor Farm buildings, set out around a central crew-yard of gravelly un-metalled hard ground, with the main access from the main Street.

The farm is still used for some implement storage and for equestrian pursuits.

The farm was formerly used for cattle and the farm buildings reflect this former use:

- the main barn was used for storing cattle feed and there is a concrete plinth that was the base of a corn-feed silo;
- to the rear of the main barn (on the south side) was the wood store with an electric power saw;
- opposite the main barn was an open-sided dutch barn, used for straw and hay;
- there are single storey cattle sheds on the north and east sides; and
- a row of lock-up garages, with an unused unbunded diesel AST in one of the garages.

The barns and sheds are all concrete floored and show no staining from fuel spills other than the garage with the diesel AST within.

The original buildings are built of red brick with pantiled roofs, and the dutch barn has CBA-panels.

Farm chemicals were not kept on this site.

The rest of the site is under grass, as fields or paddocks, with more open land beyond the north boundary.

To the east, west and south of the overall site are more residences, both old and new and all in the local style.

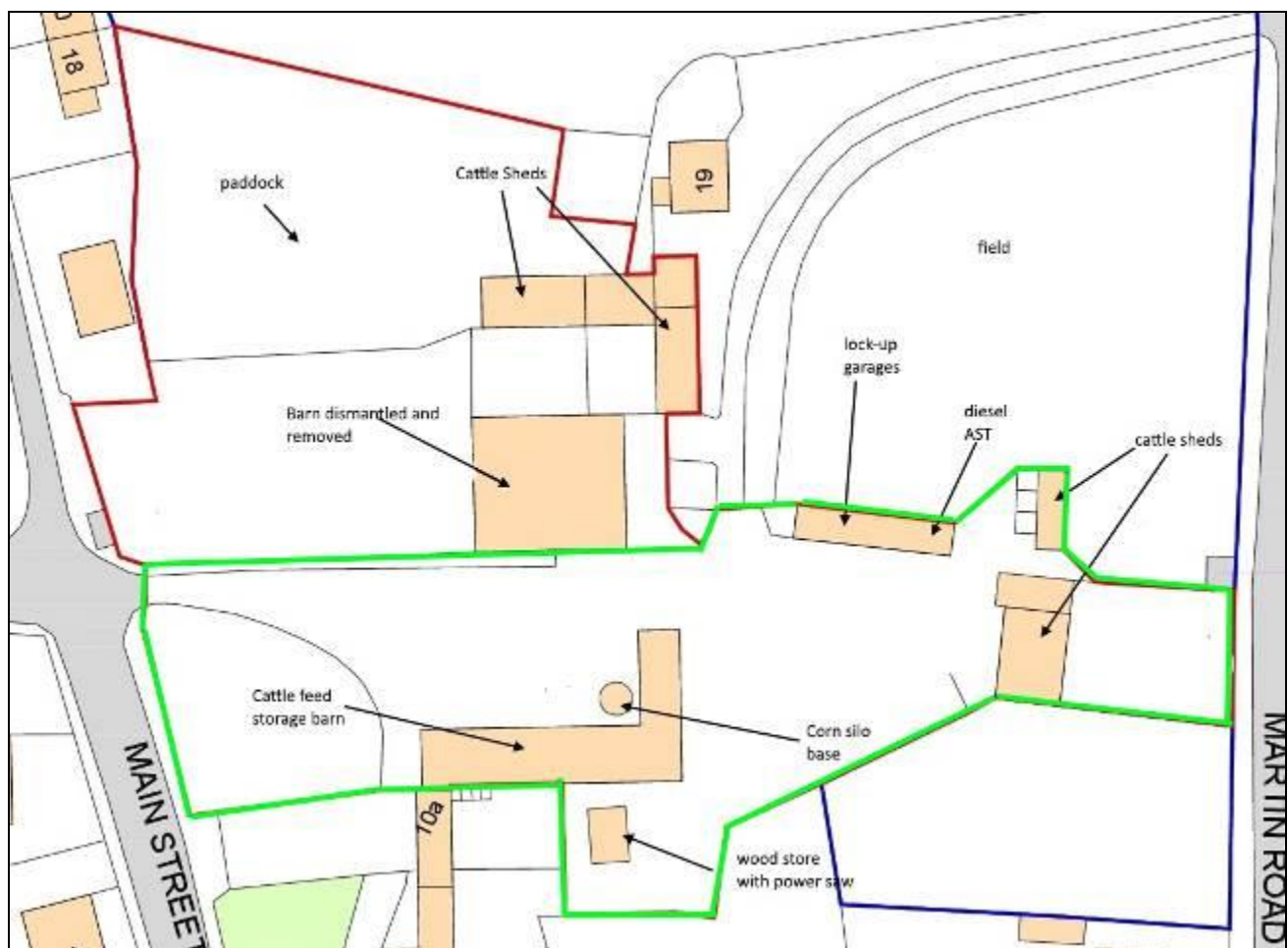


Fig 3 - plan of site (green boundary)



Fig 4 - view to northeast from road across the crew-yard (barn on RHS has been removed)



Fig 5 - concrete plinth of the former corn-feed silo



Fig 6 - interior of the barn showing the solid concrete floor



Fig 7 - view to the north of the former dutch barn, showing CBA-panels



Fig 8 – position of dutch barn after removal



Fig 9 – wood shed on the south side



Fig 10 - remains of the electric-powered saw



Fig 11 - some old 45-gallon drums and tyres loosely stored



Fig 12 - view to the east of the sheds on the east side



Fig 13 - view to the north of the lock-up garages, with concrete floors



Fig 14 - AST within the lock-up garages



Fig 15 - view to southeast across paddock on the north side

2.2 Site history

Most of the Industrial Revolution passed by Timberland,

The farm would have been established after Enclosures and comparison of the 1905 and 1978 OS maps show very little difference and gives no evidence of any potentially contaminating activities.

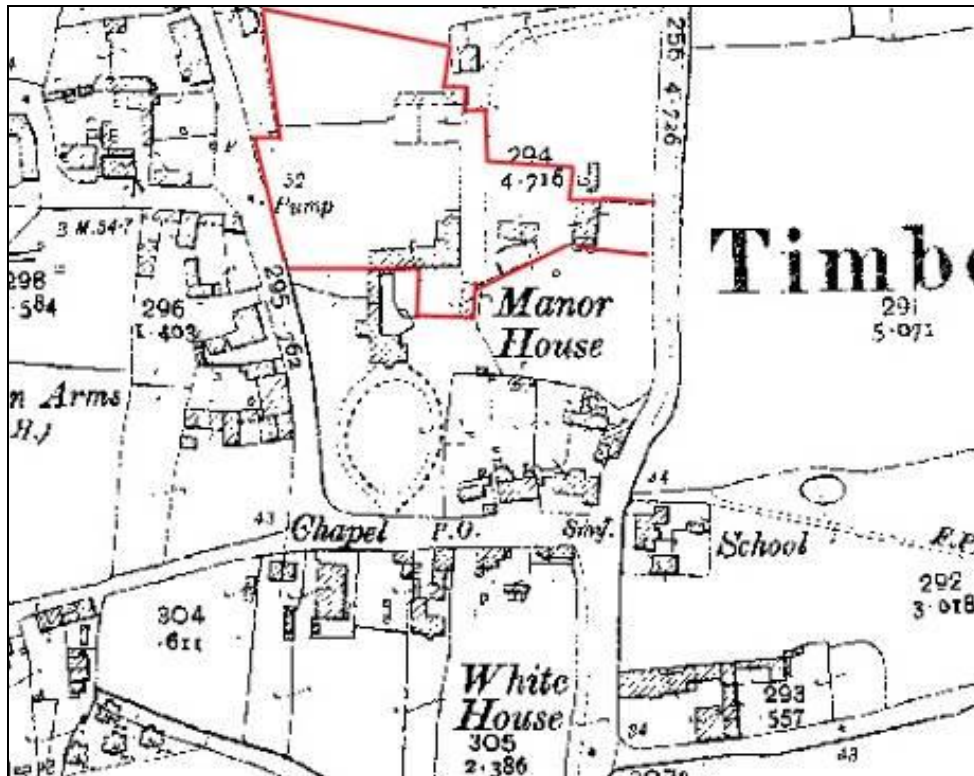


Fig 16- 1905 1:2500 OS map

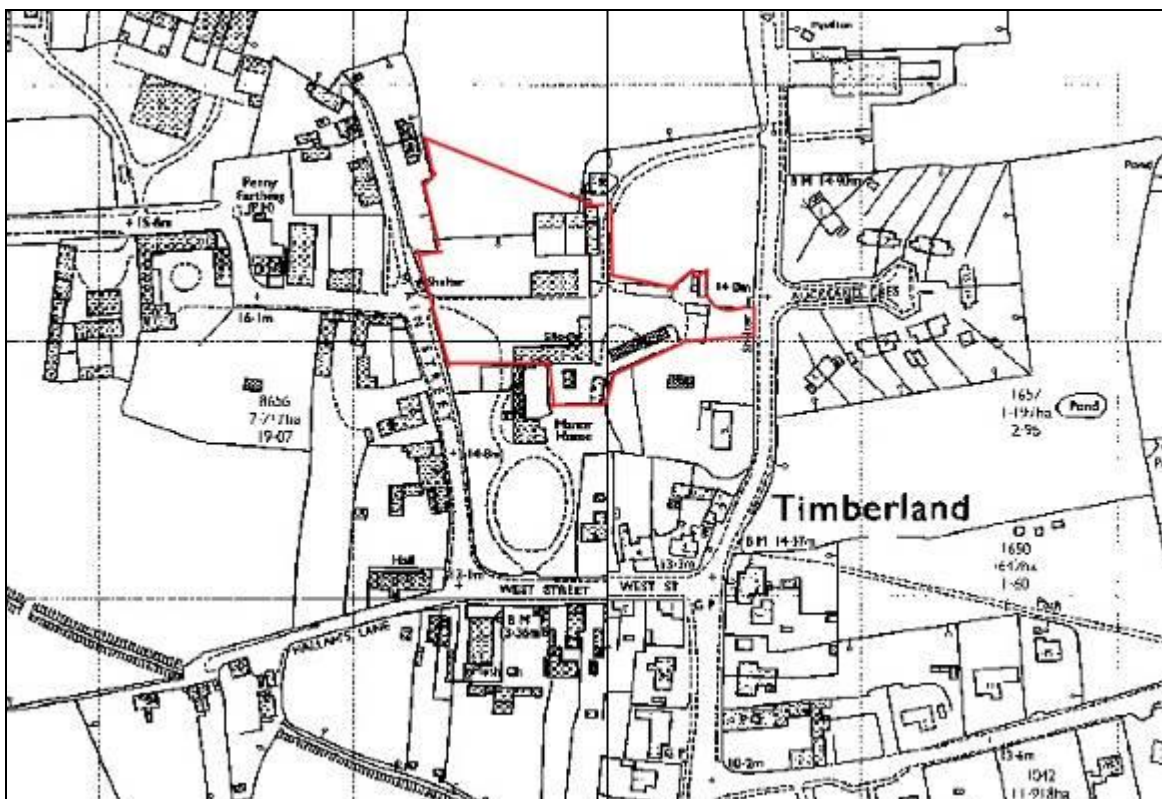


Fig 17 - 1978 1:2500 OS map

3. ENVIRONMENTAL CONDITIONS

3.1 Geology and hydrogeology

The site comprises of the bedrock Middle Jurassic Oxford Clay (from the Ancholme Clay Group) with Quaternary Glacial Till clay overburden and some Recent Sand and Gravel deposits locally.

Borehole records suggest that the Sand and Gravel is no more than 1.5 m thick and is not water-bearing.

The underlying Boulder Clay extends to 16 m depth, overlying the bedrock Mudstone.

It should be noted that the Geological Survey do not record superficial strata that is less than one metre thick, so that the site, which is on the margin of the sand/gravel and clay lithologies, may well have a thin layer of sand and gravel.

Both the Oxford Clay and the Glacial Till clay are impermeable and are not aquifers.



Fig 18 – regional geology

3.1.1 Jurassic Ancholme Clay Group (AmG) (152-135 Mya)

The AmG comprises of over-consolidated, fissured, laminated, silty clays, comprise of: (most recent first):

- up to 70 m of the Kimmeridge Clay Formation (KC).
- 90 m of the Ampthill Clay Formation (AmC);
- 25 m of the West Walton Formation (WW); and
- 55 m of the Oxford Clay Formation (OxC);

Beds of fine grained clayey limestone, or siltstone, and sandstone (*e.g.* the Elsham Sandstone) varying in thickness from a few centimetres to a metre or so and elsewhere calcareous nodules, may be found through the sequence.

The calcareous nodules can grow to a significant size – one the size of a car has been observed at South Ferriby quarry.

The clays weather from the surface and reduce in consistency to *firm* or even *soft*. Geological discontinuities, such as faults have also been recorded in the group, but none have been mapped by the BGS in this area.

At the scale of most sites the material is homogenous, with any variation generally being related to the development of its weathered profile.

3.1.2 Quaternary Glacial Till (3 – 0.01 Mya)

Glacial Till mostly comprises clay deposited by the retreating Ice Sheets. The Till contains abundant granular material as a result of mixing with harder bedrock and is often characterised by a varying content of that debris, giving the name Boulder Clay.

Overall Glacial Till is generally *stiff* with apparent high degrees of over-consolidation although it may contain, or overlie, other glacial materials that can be much softer. The clay is typically low to intermediate plasticity with low to medium shrinkage potential. In chalky Boulder Clay the pH is alkaline and sulphate concentrations are low.

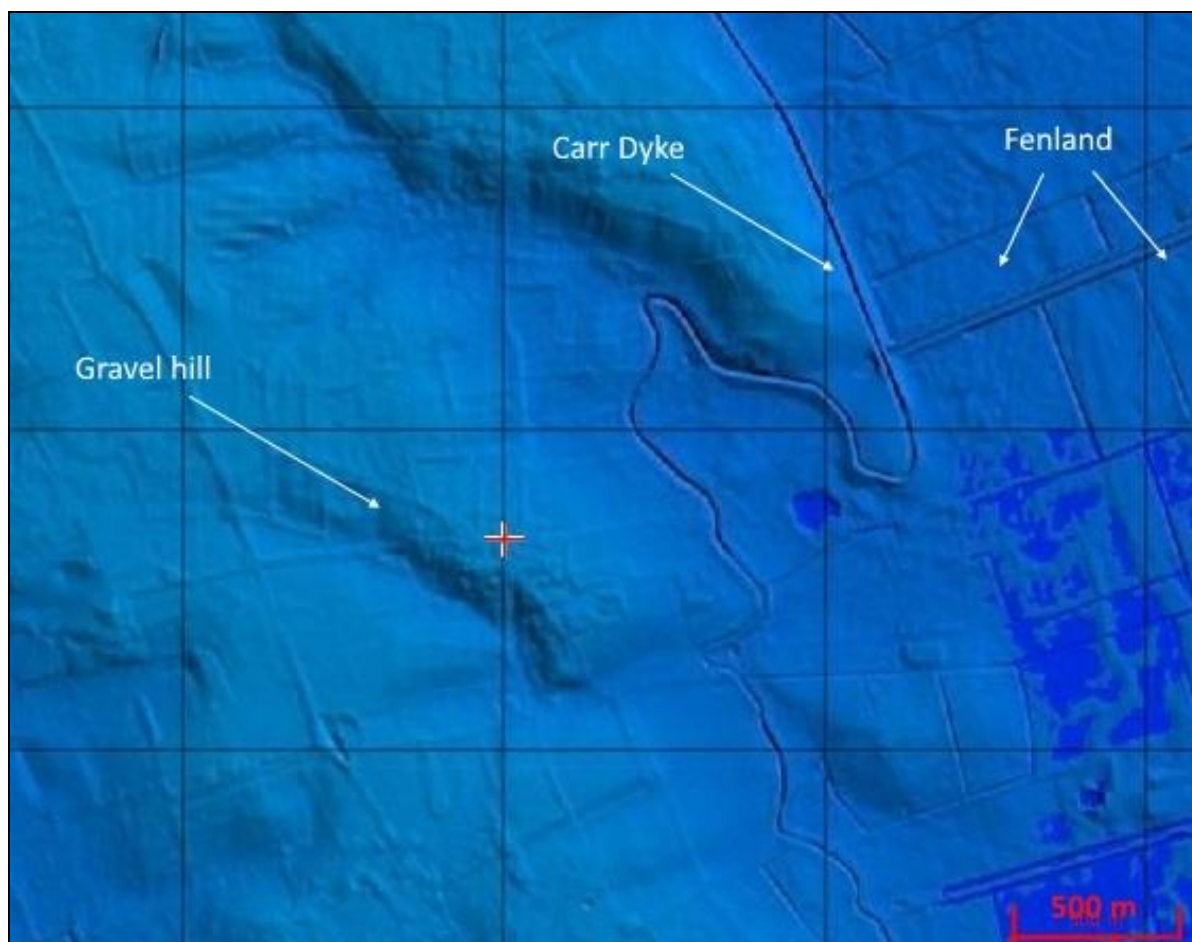


Fig 19 - regional topography

3.2 Other environmental hazards

Timberland has grown along a slight rise of Glacial Till clay and sand and gravel left after the retreat of the Last Glacial Maximum of the Devensian age.

The rise makes it free from risk of flooding.

The site is not at risk from ground gas because:

- it is not in an area of radon gas risk;
- there are no nearby landfill sites that can affect the site; and
- the underlying Boulder Clay has no organic content and is impermeable.



Fig 20 - Flood risk

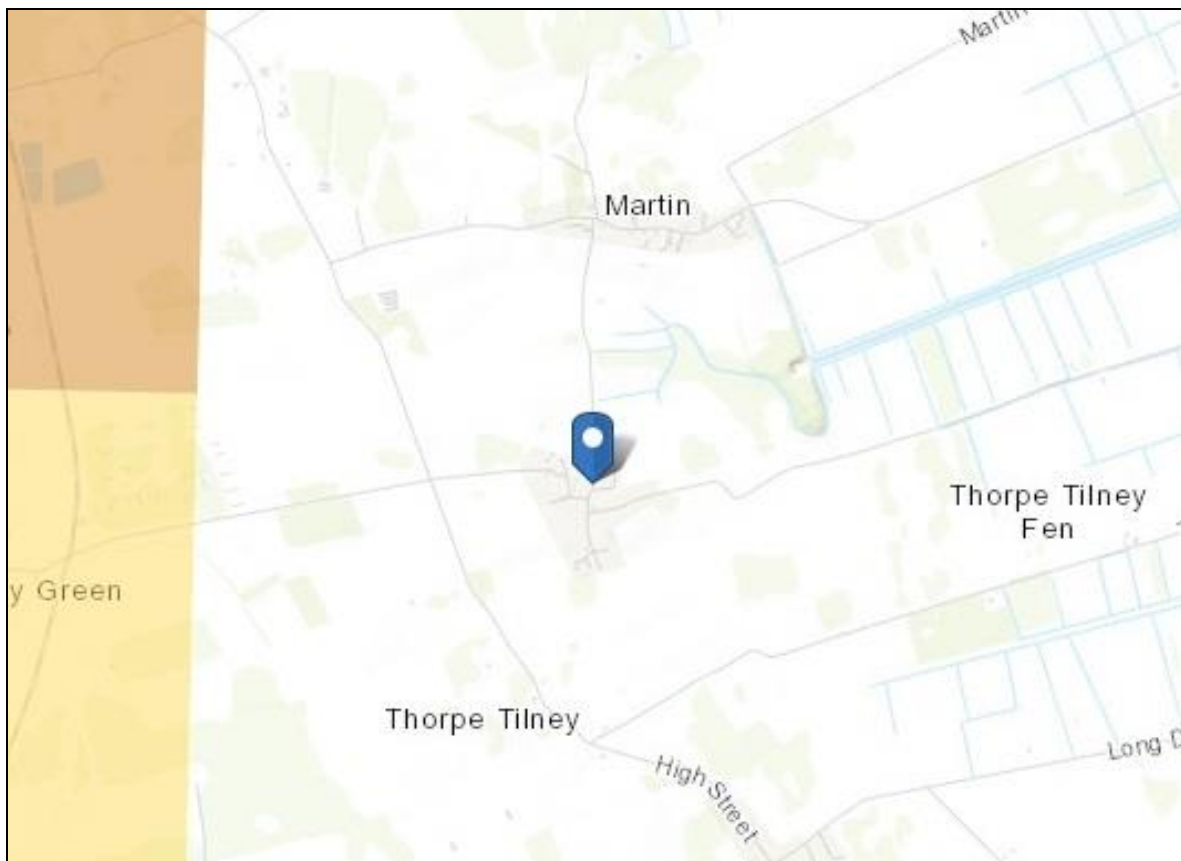


Fig 21 - Radon gas risk

4. CONCEPTUAL EXPOSURE MODEL

4.1 Sources

There is no on-site potential for contamination at this site from current use.

There is potential for contamination from historical use from:

- the former diesel AST in the lock-up garages (fig 12); and
- asbestos fibres from CBA roofing and cladding on the dutch barn (fig 7).

There may be other isolated hot spots of contamination concealed beneath the existing concrete surfaces (*e.g.* fig 13).

There is no risk from flooding.

There is no risk from radon gas or landfill gas.

4.2 Receptors

The site is privately owned and secure, so that all Human Receptors are present for short periods only.

The underlying ground at the site is impermeable Boulder Clay.

4.3 Pathways

The CLEA human health risk assessment models give the generic potential pathways for future human receptors as:

- Indoor and Outdoor accumulation and inhalation of soil vapour and fugitive dust;
- Outdoor exposure to soil through skin;
- Indoor and Outdoor ingestion of contaminated dust and soil.

Potential pathways for contamination of controlled waters are via:

- Surface-water run-off; and
- Infiltration through the un-saturated and saturated zones.

It is very likely that some or the majority of the pathways are not relevant.

5. GROUND INVESTIGATION

5.1 Strategy

The Phase 1 Desk Study has established that there is potential for contamination from:

- the former diesel AST in the lock-up garages (figs 12 and 22);
- asbestos fibres from CBA roofing and cladding on the dutch barn (fig 7); and
- other isolated hot spots of contamination concealed beneath the existing concrete surfaces (fig 13).

The anticipated ground is Boulder Clay, which will have strong attenuating properties for hydrocarbons.

The borehole programme was set out to investigate and sample the ground and groundwater, if any, to 3 m depth, with particular focus on the areas having the greatest potential to be contaminated, such as near to the AST in the lock-up garages.

The selected samples should be analysed for:

- general inorganics;
- CLEA metals;
- TPH; and
- PAH.

The analytical suite is designed to detect the likely potential contaminants.

5.2 Work undertaken

9 No. 101 mm diameter sleeved bores (WS1 to WS9) were made to 2 m depth across the site using the Dando Terrier operated by Site Investigation Services.

The samples were logged to BS5930 and the logs are appended.

The positions were selected to investigate areas with a high potential to be contaminated and near to the future residences.

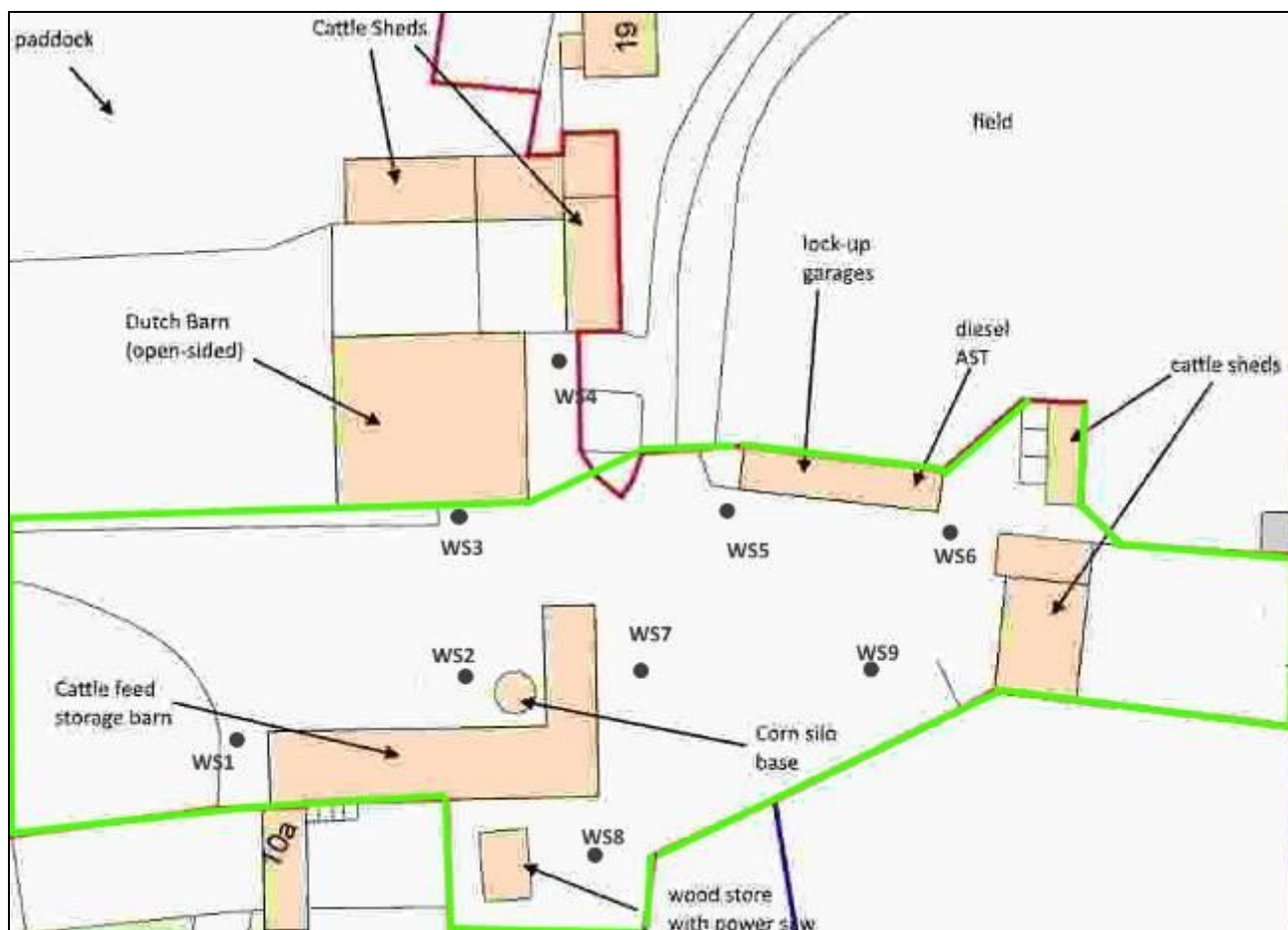


Fig 22 - borehole locations

5.3 Findings and sampling

The ground encountered was not quite as anticipated, with the Boulder Clay not at the surface, as would be expected from the geological maps, but at 1.2 m - > 2.0 m depth, deeper in the centre of the site, and overlain by a layer of soft sandy Clay with a lens of loose Sand.

It should be noted that the Geological Survey do not map superficial strata that is < 1.0 m thick.

The loose Sand was damp, and groundwater was detected in WS2 and WS3 at 0.5 m, and in WS6 at 1 m bgl.

depth at top of (m bgl):	WS1	WS2	WS3	WS4	WS5	WS6	WS7	WS8	WS9
sandy Clay	0.4	0.3	0.0	0.0	0.1	0.1	0.4	0.3	0.3
damp Sand	0.6	1.2	1.2			0.8	1.1	0.6	
Boulder Clay	1.2	1.6	>2.0	1.2	1.5	1.0	>2.0	1.5	1.0

Table 2 - depth of top of each layer encountered

Representative samples of the strata encountered were taken from each borehole.

No evidence of any contamination was detected in the samples recovered other than from WS5, when a hydrocarbon odour was detected.

WS9 was in the area of the tyres and rusty oil drums and no contaminated ground was observed.

sample depths (m bgl):	WS1	WS2	WS3	WS4	WS5	WS6	WS7	WS8	WS9
sandy Clay	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.6	0.4
damp Sand	0.8	1.4	0.8	0.8	1.0	1.0	0.8	1.4	0.8
Boulder Clay					1.5				

Table 3 – depth of samples sent for analysis

The samples were placed in amber glass jars, stored in a cooler box and shipped overnight to i2 Analytical, a well-established UKAS-accredited laboratory.

5.4 Analysis and results

The full results are appended and are shown below in a tabulated form for easier understanding.

An assessment of the risk to Human Health from the concentrations detected can be easily made by comparing the values to the Soil Guidance Values (SGV) prepared by the LQM/CIEH.

The values presented are those for the most sensitive receptors: residents with children and garden produce uptake.

For PAH increasing organic content of the ground reduces the toxicity so the PAH SGV have been selected for 1% organic matter, as detected in the samples.

Any values that exceed the SGV are shown in **RED** to enable the quicker visual assessment of the data.

5.4.1 General inorganics

		WS1	WS1	WS2	WS2	WS3	WS3	WS4	WS4	WS5	WS5	WS5
		0.40	0.80	0.40	1.40	0.40	0.80	0.40	0.80	0.40	1.00	1.50
Stone Content	%	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	12	12	18	12	14	15	16	14	21	18	15
Total mass of sample received	kg	0.64	0.74	0.51	0.88	0.74	0.71	0.59	0.65	0.58	0.54	0.69
Asbestos in Soil	Type	n-d	-	n-d	-	n-d	-	n-d	-	n-d	-	-
pH - Automated	pH Units	7.0	7.3	7.3	7.4	7.3	7.4	7.3	7.4	7.6	7.8	7.7
Total Cyanide	mg/kg	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Free Cyanide	mg/kg	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.0089	0.0070	0.013	0.010	0.016	0.016	0.027	0.021	0.067	0.068	0.021
Organic Matter	%	1.6	0.3	1.8	0.1	2.8	1.4	1.8	1.5	5.3	4.5	0.7
Total Organic Carbon (TOC)	%	0.9	0.2	1.1	< 0.1	1.6	0.8	1.1	0.9	3.1	2.6	0.4

		WS6 0.40	WS6 1.00	WS7 0.40	WS7 0.80	WS8 0.60	WS8 1.40	WS9 0.40	WS9 0.80
Stone Content	%	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	16	13	21	19	12	19	14	16
Total mass of sample received	kg	0.57	0.61	0.53	0.53	0.66	0.68	0.59	0.67
Asbestos in Soil	Type	n-d	-	n-d	-	n-d	-	n-d	-
pH - Automated	pH Units	8.6	8.3	8.0	8.0	7.8	8.3	7.5	7.5
Total Cyanide	mg/kg	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Free Cyanide	mg/kg	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.028	0.038	0.048	0.048	0.041	0.084	0.032	0.031
Organic Matter	%	3.2	1.2	2.7	2.1	2.6	0.9	1.9	1.4
Total Organic Carbon (TOC)	%	1.9	0.7	1.6	1.2	1.5	0.5	1.1	0.8

The organic content ranges 0.3 – 5.3 %, average 2.1 %, although a fairer average would be 1.7 % if the anomalously high values from WS5 are excluded from the data set.

No asbestos fibres were detected in the surface soils at 0.4 m bgl.

5.4.2 PAH

		WS1 0.40	WS1 0.80	WS2 0.40	WS2 1.40	WS3 0.40	WS3 0.80	WS4 0.40	WS4 0.80	WS5 0.40	WS5 1.00	WS5 1.50	LQM SGV
Naphthalene	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.67	< 0.05	5.6
Acenaphthylene	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	510
Acenaphthene	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	420
Fluorene	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	400
Phenanthrene	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.31	< 0.05	< 0.05	1.6	2.6	< 0.05	220
Anthracene	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.50	< 0.05	5400
Fluoranthene	mg/kg	0.54	< 0.05	< 0.05	< 0.05	< 0.05	0.89	< 0.05	0.35	0.59	5.1	< 0.05	560
Pyrene	mg/kg	0.48	< 0.05	< 0.05	< 0.05	< 0.05	0.77	< 0.05	0.32	0.63	4.6	< 0.05	1200
Benzo(a)anthracene	mg/kg	0.30	< 0.05	< 0.05	< 0.05	< 0.05	0.55	< 0.05	0.22	< 0.05	3.4	< 0.05	11
Chrysene	mg/kg	0.31	< 0.05	< 0.05	< 0.05	< 0.05	0.41	< 0.05	0.20	< 0.05	2.4	< 0.05	22
Benzo(b)fluoranthene	mg/kg	0.44	< 0.05	< 0.05	< 0.05	< 0.05	0.45	< 0.05	0.21	< 0.05	3.6	< 0.05	3.3
Benzo(k)fluoranthene	mg/kg	0.17	< 0.05	< 0.05	< 0.05	< 0.05	0.20	< 0.05	0.12	< 0.05	1.6	< 0.05	93
Benzo(a)pyrene	mg/kg	0.35	< 0.05	< 0.05	< 0.05	< 0.05	0.39	< 0.05	0.20	< 0.05	3.3	< 0.05	2.7
Indeno(1,2,3-cd)pyrene	mg/kg	0.19	< 0.05	< 0.05	< 0.05	< 0.05	0.20	< 0.05	< 0.05	< 0.05	1.7	< 0.05	56
Dibenz(a,h)anthracene	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.52	< 0.05	.28
Benzo(ghi)perylene	mg/kg	0.28	< 0.05	< 0.05	< 0.05	< 0.05	0.24	< 0.05	< 0.05	< 0.05	2.2	< 0.05	5.6

		WS6 0.40	WS6 1.00	WS7 0.40	WS7 0.80	WS8 0.60	WS8 1.40	WS9 0.40	WS9 0.80	LQM SGV
Naphthalene	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	5.6
Acenaphthylene	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	510
Acenaphthene	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	420
Fluorene	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	400
Phenanthrene	mg/kg	< 0.05	0.24	0.19	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	220
Anthracene	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	5400
Fluoranthene	mg/kg	< 0.05	0.73	0.38	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	560
Pyrene	mg/kg	< 0.05	0.71	0.28	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	1200
Benzo(a)anthracene	mg/kg	< 0.05	0.47	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	11
Chrysene	mg/kg	< 0.05	0.37	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	22
Benzo(b)fluoranthene	mg/kg	< 0.05	0.48	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	3.3
Benzo(k)fluoranthene	mg/kg	< 0.05	0.30	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	93
Benzo(a)pyrene	mg/kg	< 0.05	0.53	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	2.7
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.05	0.22	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	56
Dibenz(a,h)anthracene	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	.28
Benzo(ghi)perylene	mg/kg	< 0.05	0.29	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	5.6

Only the sample from WS5, at 1 m bgl, has concentrations of PAH that exceed the selected SGV.

5.4.3 Metals

		WS1 0.40	WS1 0.80	WS2 0.40	WS2 1.40	WS3 0.40	WS3 0.80	WS4 0.40	WS4 0.80	WS5 0.40	WS5 1.00	WS5 1.50	LQM SGV
Arsenic (aqua regia extractable)	mg/kg	18	11	5.1	6.2	16	5.9	31	7.1	13	5.9	9.3	37
Cadmium (aqua regia extractable)	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.2	0.2	< 0.2	11
Chromium (hexavalent)	mg/kg	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	11
Chromium (aqua regia extractable)	mg/kg	11	8.4	8.0	11	10	9.1	10	10	12	15	21	910
Copper (aqua regia extractable)	mg/kg	16	6.0	13	6.4	18	13	13	14	21	19	15	2400
Lead (aqua regia extractable)	mg/kg	29	13	22	12	43	18	19	18	120	52	8.6	200
Mercury (aqua regia extractable)	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	1.7	0.3	< 0.3	< 0.3	0.4	< 0.3	< 0.3	1.2
Nickel (aqua regia extractable)	mg/kg	9.9	9.4	7.9	22	12	7.5	7.9	9.5	12	13	23	130
Selenium (aqua regia extractable)	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	250
Zinc (aqua regia extractable)	mg/kg	61	28	55	44	56	46	47	48	68	100	42	3700

		WS6 0.40	WS6 1.00	WS7 0.40	WS7 0.80	WS8 0.60	WS8 1.40	WS9 0.40	WS9 0.80	LQM SGV
Arsenic (aqua regia extractable)	mg/kg	9.9	9.8	9.3	8.7	4.5	9.8	3.9	4.6	37
Cadmium (aqua regia extractable)	mg/kg	< 0.2	0.2	< 0.2	< 0.2	< 0.2	0.2	< 0.2	< 0.2	11
Chromium (hexavalent)	mg/kg	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	11
Chromium (aqua regia extractable)	mg/kg	12	24	13	16	9.3	29	11	10	910
Copper (aqua regia extractable)	mg/kg	20	18	26	18	14	22	15	12	2400
Lead (aqua regia extractable)	mg/kg	38	17	180	39	14	12	16	14	200
Mercury (aqua regia extractable)	mg/kg	< 0.3	< 0.3	0.7	0.6	< 0.3	< 0.3	< 0.3	< 0.3	1.2
Nickel (aqua regia extractable)	mg/kg	13	28	13	18	9.6	31	10	8.9	130
Selenium (aqua regia extractable)	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	250
Zinc (aqua regia extractable)	mg/kg	58	51	64	46	39	60	55	48	3700

No metals exceed the SGV.

5.4.4 TPH

Only the samples from WS5, at 0.4 m and 1.0 m bgl showed concentrations of TPH that exceed the SGV.

The TPH concentration is centred around the C12 – C21 fraction only, suggesting that fuel is old because all of the lighter components have dispersed and/or degraded to below the level of detection.

		WS1 0.40	WS1 0.80	WS2 0.40	WS2 1.40	WS3 0.40	WS3 0.80	WS4 0.40	WS4 0.80	WS5 0.40	WS5 1.00	WS5 1.50	LQM SGV
Benzene	µg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.17
Toluene	µg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	290
Ethylbenzene	µg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	110
p & m-xylene	µg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	130
o-xylene	µg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	140
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	78
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	230
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.51	0.058	< 0.001	< 0.001	65
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	74	42	< 1.0	< 1.0	330
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	9.8	1400	450	< 2.0	2400
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	20	2900	1000	< 8.0	
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0	34	640	320	< 8.0	92000
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	140
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	290
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	83
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	9.8	30	< 1.0	180
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	7.2	420	480	< 2.0	340
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10	< 10	18	720	1000	< 10	540
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	11	< 10	< 10	< 10	< 10	< 10	< 10	14	200	460	< 10	1500

		WS6 0.40	WS6 1.00	WS7 0.40	WS7 0.80	WS8 0.60	WS8 1.40	WS9 0.40	WS9 0.80	LQM SGV
Benzene	µg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.17
Toluene	µg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	290
Ethylbenzene	µg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	110
p & m-xylene	µg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	130
o-xylene	µg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	140
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	78
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	230
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	3.4	< 0.001	< 0.001	< 0.001	65
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	13	< 1.0	< 1.0	< 1.0	330
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	< 2.0	< 2.0	< 2.0	< 2.0	200	< 2.0	< 2.0	< 2.0	2400
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	< 8.0	< 8.0	< 8.0	< 8.0	170	< 8.0	< 8.0	< 8.0	92000
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	< 8.0	< 8.0	< 8.0	< 8.0	1600	< 8.0	< 8.0	< 8.0	
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	140
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	290
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	83
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	8.5	< 1.0	< 1.0	< 1.0	180
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	< 2.0	2.9	< 2.0	< 2.0	140	< 2.0	< 2.0	< 2.0	340
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	< 10	12	< 10	< 10	130	< 10	< 10	< 10	540
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	< 10	12	< 10	< 10	1000	< 10	< 10	< 10	1500

6. RECOMMENDATIONS

6.1 Proposed development

It is proposed to:

- demolish the existing dutch barn and build a detached residence (site C); and
- convert the existing barns and lockup garages for residential use (sites A, B and D).

6.2 Qualitative risk assessment for the proposed development

6.2.1 Sources

The dutch barn was clad in CBA-panels and has since been dismantled and removed by Rilmac, a local licensed contractor..

No asbestos fibres have been detected across the surface of the development site.

TPH and PAH contamination has been detected in the area of the lock-up garages and fuel AST (figs 12, 13), at 0.4 m depth and extending to at least 1.0 m within the superficial soft sandy Clay layer.

6.2.2 Receptors

The proposed development will introduce sensitive Receptors to the site, as:

- construction site workers; and, subsequently
- residential users, with garden uptake.

The ground is not a sensitive Receptor

6.2.3 Pathways

The generic pathways of Direct Exposure will apply:

- indoor and outdoor accumulation and inhalation of soil vapour and fugitive dust;
- outdoor exposure to soil through skin;
- indoor and outdoor ingestion of contaminated dust and soil.

6.3 Recommendations for remediation

The CBA-panels should be removed by qualified personnel and disposed off correctly, with confirmation provided by Chain of Custody forms and waybills.

The Phase 2 investigation has shown that the site is not contaminated except in the area of the lock-up garages so a strategy to remediate that area needs to be prepared.

It is recommended that the ground be inspected after the dutch barn has been demolished and removed.

The ground around and under the lock-up garages may conceal further TPH contamination which will need to be characterised and quantified before any conversion can be made.

The ground should be sampled analysed for:

- metals and general inorganics;
- TPH and PAH; and
- asbestos fibres.

It is likely that a simple barrier system will be adequate to prevent exposure to any contamination that may be encountered, comprising of:

- concrete foundations and pavements;
- metallised barrier drinking water pipes; and
- 0.3-0.6 m of certified clean Topsoil in the garden areas, depending on sub-strate conditions.

Any imported Topsoil should be certified as horticultural quality and free from contamination, as specified by the YALPAG documentation appended.

6.4 Recommendations for validation

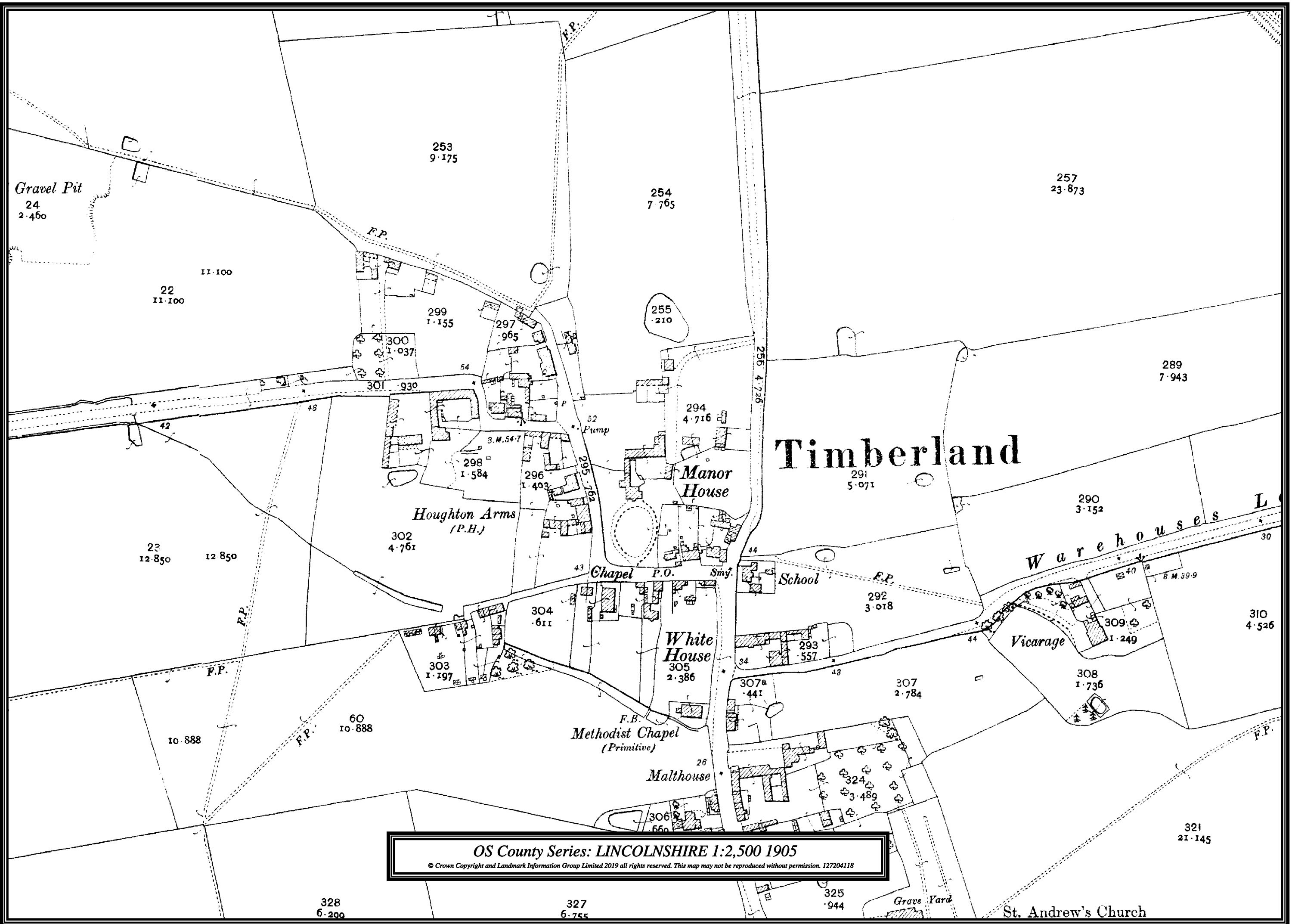
Any remedial works need to be verified that they have been carried out according to the agreed remedial plan.

Typically the remedial works undertaken can be proven by:

- drawings specifying remedial works;
- photographs of the work undertaken;
- receipts for membranes, water pipes etc.; and
- waybills and certificates for material transported to and from the site.

The works should be prepared as a Phase 4 Validation report and presented to the Regulatory Authority.

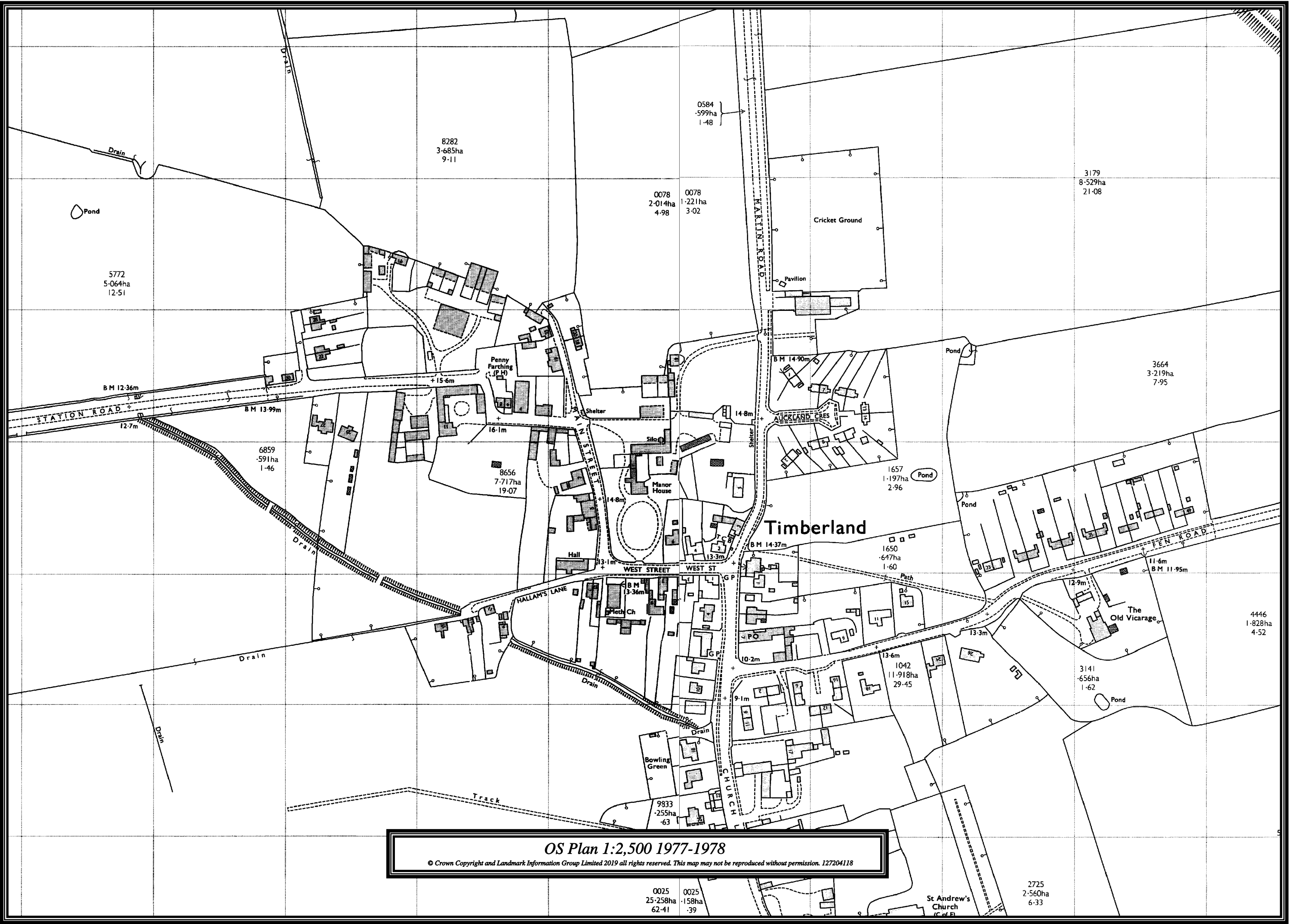
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OS County Series: LINCOLNSHIRE 1:2,500 1905

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St. Andrew's Church

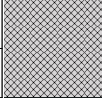

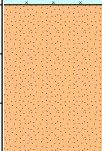



OS Plan 1:2,500 1977-1978
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Project No. 65 006
Project Name: Timberland
Site: Manor Farm
Location: SW
Logged By: TSLS

Date bored: December 6, 2019
Boring by Site Investigation Services WS1
Crew: AL/GC
Diameter 1: 101
Diameter 2: 87

WINDOW SAMPLER BORE: WS1
Elevation (m AOD): 15
OS Coords: 511980 358600

Depth (m)	Elevation (mAOD)	Symbols	SOIL DESCRIPTION	Groundwater	Samples	Comments
1	14		dark brown clayey TOPSOIL with brick gravel			Hole dry
			soft grey/brown sandy CLAY			
			loose orange/brown fine and medium SAND (damp)			
			stiff grey/brown silty CLAY with some fine chalk gravel			
2	13		End of Bore			
3	12					
4	11					
5	10					

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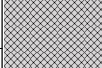
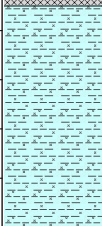

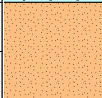
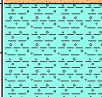
Engineering and Environmental Geologists
 01673 858766

geologist@langdalesmith.co.uk

Project No. 65 006
Project Name: Timberland
Site: Manor Farm
Location: S silo
Logged By: TSLS

Date bored: December 6, 2019
Boring by Site Investigation Services WS2
Crew: AL/GC
Diameter 1: 101
Diameter 2: 87

WINDOW SAMPLER BORE: WS2
Elevation (m AOD): 15
OS Coords: 511980 358600

Depth (m)	Elevation (mAOD)	Symbols	SOIL DESCRIPTION	Groundwater	Samples	Comments
			dark brown clayey TOPSOIL with brick gravel, rootlets			
			soft grey/brown sandy CLAY		1	water at 0.5 m bgl
1	14		loose orange/brown fine and medium SAND (damp)		2	
			stiff grey/brown silty CLAY with some fine chalk gravel			
2	13		End of Bore			
3	12					
4	11					
5	10					

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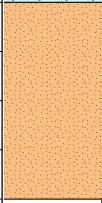
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Project No. 65 006
Project Name: Timberland
Site: Manor Farm
Location: dutch barn
Logged By: TSLS

Date bored: December 6, 2019
Boring by Site Investigation Services WS3
Crew: AL/GC
Diameter 1: 101
Diameter 2: 87

WINDOW SAMPLER BORE: WS3
Elevation (m AOD): 15
OS Coords: 511980 358600

Depth (m)	Elevation (mAOD)	Symbols	SOIL DESCRIPTION	Groundwater	Samples	Comments
1	14		soft grey/brown sandy CLAY		1	water at 0.5 m bgl
					2	
2	13		loose orange/brown fine and medium SAND (damp)			
			End of Bore			
3	12					
4	11					
5	10					

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Engineering and Environmental Geologists
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Project No. 65 006
Project Name: Timberland
Site: Manor Farm
Location: N cattle sheds
Logged By: TSLS

Date bored: December 6, 2019
Boring by Site Investigation Services WS4
Crew: AL/GC
Diameter 1: 101
Diameter 2: 87

WINDOW SAMPLER BORE: WS4
Elevation (m AOD): 15
OS Coords: 511980 358600

Depth (m)	Elevation (mAOD)	Symbols	SOIL DESCRIPTION	Groundwater	Samples	Comments
1	14		stiff dark brown loamy silty CLAY			collapse at 0.5 m bgl
			soft grey/brown sandy CLAY becoming gravelly and damp		1	
					2	
2	13		stiff grey/brown silty CLAY with some fine chalk gravel			
			End of Bore			
3	12					
4	11					
5	10					

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Project No. 65 006
Project Name: Timberland
Site: Manor Farm
Location: W side garages
Logged By: TSLS

Date bored: December 6, 2019
Boring by Site Investigation Services WS5
Crew: AL/GC
Diameter 1: 101
Diameter 2: 87

WINDOW SAMPLER BORE: WS5
Elevation (m AOD): 15
OS Coords: 511980 358600

Depth (m)	Elevation (mAOD)	Symbols	SOIL DESCRIPTION	Groundwater	Samples	Comments
1	14		gravelly TOPSOIL soft grey/blue sandy CLAY (strong odour of hydrocarbon) stiff grey/brown silty CLAY with some fine chalk gravel		1 2 3	collapse at 0.5 m bgl
2	13		End of Bore			
3	12					
4	11					
5	10					

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Project No. 65 006
Project Name: Timberland
Site: Manor Farm
Location: E side garages
Logged By: TSLS

Date bored: December 6, 2019
Boring by Site Investigation Services WS6
Crew: AL/GC
Diameter 1: 101
Diameter 2: 87

WINDOW SAMPLER BORE: WS6
Elevation (m AOD): 15
OS Coords: 511980 358600

Depth (m)	Elevation (mAOD)	Symbols	SOIL DESCRIPTION	Groundwater	Samples	Comments
1	14		brown TOPSOIL with rootlets		1	water at 1 m bgl
			firm grey/brown silty CLAY			
			stiff grey/brown silty CLAY			
			loose orange/brown SAND and GRAVEL, flint rounded			
2	13		stiff grey silty CLAY with some fine chalk gravel	2		
			loose orange/brown SAND and GRAVEL, with rounded flint			
3	12		End of Bore			
4	11					
5	10					

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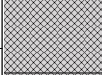
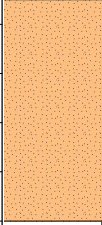
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Project No. 65 006
Project Name: Timberland
Site: Manor Farm
Location: SE
Logged By: TSLS

Date bored: December 6, 2019
Boring by Site Investigation Services W57
Crew: AL/GC
Diameter 1: 101
Diameter 2: 87

WINDOW SAMPLER BORE: W57
Elevation (m AOD): 15
OS Coords: 511980 358600

Depth (m)	Elevation (mAOD)	Symbols	SOIL DESCRIPTION	Groundwater	Samples	Comments
1	14		brown TOPSOIL with rootlets		1	hole dry
			type 1 limestone aggregate FILL soft grey/brown silty sandy CLAY			
2	13		loose yellow/brown fine and medium SAND		2	
			End of Bore			
3	12					
4	11					
5	10					

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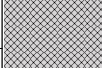

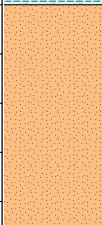
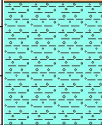
Engineering and Environmental Geologists
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Project No. 65 006
Project Name: Timberland
Site: Manor Farm
Location: S
Logged By: TSLs

Date bored: December 6, 2019
Boring by Site Investigation Services WS8
Crew: AL/GC
Diameter 1: 101
Diameter 2: 87

WINDOW SAMPLER BORE: WS8
Elevation (m AOD): 15
OS Coords: 511980 358600

Depth (m)	Elevation (mAOD)	Symbols	SOIL DESCRIPTION	Groundwater	Samples	Comments
			brown TOPSOIL with rootlets			
			soft grey/brown silty sandy CLAY			
1	14		loose yellow/brown fine and medium SAND		1	hydrocarbon odour in Sand
			stiff grey silty CLAY with some fine chalk gravel		2	
2	13		End of Bore			
3	12					
4	11					
5	10					

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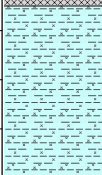

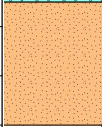
Engineering and Environmental Geologists
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Project No. 65 006
Project Name: Timberland
Site: Manor Farm
Location: central
Logged By: TSLS

Date bored: December 6, 2019
Boring by Site Investigation Services WS9
Crew: AL/GC
Diameter 1: 101
Diameter 2: 87

WINDOW SAMPLER BORE: WS9
Elevation (m AOD): 15
OS Coords: 511980 358600

Depth (m)	Elevation (mAOD)	Symbols	SOIL DESCRIPTION	Groundwater	Samples	Comments
			brown TOPSOIL with sand and gravel			
			soft grey/brown silty sandy CLAY		1	
1	14		stiff grey silty CLAY with some fine chalk gravel		2	hole dry
2	13		loose yellow/brown fine and medium SAND			
			End of Bore			
3	12					
4	11					
5	10					

Langdale-Smith and Co Limited

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Analytical Report Number : 19-76637

Project / Site name:	Timberland	Samples received on:	09/12/2019
Your job number:	65 006	Samples instructed on:	09/12/2019
Your order number:	65 006	Analysis completed by:	19/12/2019
Report Issue Number:	1	Report issued on:	19/12/2019
Samples Analysed:	19 soil samples		

Sig

Katarzyna Lewicka
 Head of Reporting Section

For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 19-76637
Project / Site name: Timberland
Your Order No: 65 006

Lab Sample Number				1387521	1387522	1387523	1387524	1387525
Sample Reference				WS1	WS1	WS2	WS2	WS3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.80	0.40	1.40	0.40
Date Sampled				07/12/2019	07/12/2019	07/12/2019	07/12/2019	07/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	12	12	18	12	14
Total mass of sample received	kg	0.001	NONE	0.64	0.74	0.51	0.88	0.74

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	-	Not-detected
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.0	7.3	7.3	7.4	7.3
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Free Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0089	0.0070	0.013	0.010	0.016
Organic Matter	%	0.1	MCERTS	1.6	0.3	1.8	0.1	2.8
Total Organic Carbon (TOC)	%	0.1	MCERTS	0.9	0.2	1.1	< 0.1	1.6

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.54	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	0.48	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.30	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.31	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.44	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.17	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.35	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.19	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.28	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	3.06	< 0.80	< 0.80	< 0.80	< 0.80
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	18	11	5.1	6.2	16
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	11	8.4	8.0	11	10
Copper (aqua regia extractable)	mg/kg	1	MCERTS	16	6.0	13	6.4	18
Lead (aqua regia extractable)	mg/kg	1	MCERTS	29	13	22	12	43
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	1.7
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	9.9	9.4	7.9	22	12
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	61	28	55	44	56

Analytical Report Number: 19-76637
 Project / Site name: Timberland
 Your Order No: 65 006

Lab Sample Number	1387521				1387522	1387523	1387524	1387525
Sample Reference	WS1				WS1	WS2	WS2	WS3
Sample Number	None Supplied				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.40				0.80	0.40	1.40	0.40
Date Sampled	07/12/2019				07/12/2019	07/12/2019	07/12/2019	07/12/2019
Time Taken	None Supplied				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Monoaromatics & Oxygenates

Compound	Units	Limit of detection	Accreditation Status	1387521	1387522	1387523	1387524	1387525
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic > EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic > EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic > EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic > EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic > EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic > EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic > EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10

TPH-CWG - Aromatic > EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic > EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic > EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic > EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic > EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic > EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic > EC21 - EC35	mg/kg	10	MCERTS	11	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	14	< 10	< 10	< 10	< 10

Analytical Report Number: 19-76637
Project / Site name: Timberland
Your Order No: 65 006

Lab Sample Number				1387526	1387527	1387528	1387529	1387530
Sample Reference				WS3	WS4	WS4	WS5	WS5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.80	0.40	0.80	0.40	1.00
Date Sampled				07/12/2019	07/12/2019	07/12/2019	07/12/2019	07/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	15	16	14	21	18
Total mass of sample received	kg	0.001	NONE	0.71	0.59	0.65	0.58	0.54

Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	-	Not-detected	-
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.4	7.3	7.4	7.6	7.8
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Free Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.016	0.027	0.021	0.067	0.068
Organic Matter	%	0.1	MCERTS	1.4	1.8	1.5	5.3	4.5
Total Organic Carbon (TOC)	%	0.1	MCERTS	0.8	1.1	0.9	3.1	2.6

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.67
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.31	< 0.05	< 0.05	1.6	2.6
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.50
Fluoranthene	mg/kg	0.05	MCERTS	0.89	< 0.05	0.35	0.59	5.1
Pyrene	mg/kg	0.05	MCERTS	0.77	< 0.05	0.32	0.63	4.6
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.55	< 0.05	0.22	< 0.05	3.4
Chrysene	mg/kg	0.05	MCERTS	0.41	< 0.05	0.20	< 0.05	2.4
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.45	< 0.05	0.21	< 0.05	3.6
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.20	< 0.05	0.12	< 0.05	1.6
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.39	< 0.05	0.20	< 0.05	3.3
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.20	< 0.05	< 0.05	< 0.05	1.7
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.52
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.24	< 0.05	< 0.05	< 0.05	2.2

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	4.41	< 0.80	1.62	2.84	32.1
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	5.9	31	7.1	13	5.9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	0.2	0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	9.1	10	10	12	15
Copper (aqua regia extractable)	mg/kg	1	MCERTS	13	13	14	21	19
Lead (aqua regia extractable)	mg/kg	1	MCERTS	18	19	18	120	52
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.3	< 0.3	< 0.3	0.4	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	7.5	7.9	9.5	12	13
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	46	47	48	68	100

Analytical Report Number: 19-76637

Project / Site name: Timberland

Your Order No: 65 006

Lab Sample Number	1387526	1387527	1387528	1387529	1387530			
Sample Reference	WS3	WS4	WS4	WS5	WS5			
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Depth (m)	0.80	0.40	0.80	0.40	1.00			
Date Sampled	07/12/2019	07/12/2019	07/12/2019	07/12/2019	07/12/2019			
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	0.51	0.058
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	74	42
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	9.8	1400	450
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	20	2900	1000
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	34	640	320
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	65	5100	1900

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	9.8	30
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	7.2	420	480
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10	18	720	1000
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	< 10	14	200	460
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	39	1300	2000

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Lab Sample Number	1387531	1387532	1387533	1387534	1387535			
Sample Reference	WS5	WS6	WS6	WS7	WS7			
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Depth (m)	1.50	0.40	1.00	0.40	0.80			
Date Sampled	07/12/2019	07/12/2019	07/12/2019	07/12/2019	07/12/2019			
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	15	16	13	21	19
Total mass of sample received	kg	0.001	NONE	0.69	0.57	0.61	0.53	0.53
Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	-	Not-detected	-

General Inorganics

Parameter	pH Units	N/A	MCERTS	7.7	8.6	8.3	8.0	8.0
pH - Automated								
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Free Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.021	0.028	0.038	0.048	0.048
Organic Matter	%	0.1	MCERTS	0.7	3.2	1.2	2.7	2.1
Total Organic Carbon (TOC)	%	0.1	MCERTS	0.4	1.9	0.7	1.6	1.2

Speciated PAHs

Parameter	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.24	0.19	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.73	0.38	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.71	0.28	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.47	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.37	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.48	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.30	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.53	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.22	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.29	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	4.34	0.85	< 0.80
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Heavy Metals / Metalloids

Parameter	mg/kg	1	MCERTS	9.3	9.9	9.8	9.3	8.7
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	9.3	9.9	9.8	9.3	8.7
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	21	12	24	13	16
Copper (aqua regia extractable)	mg/kg	1	MCERTS	15	20	18	26	18
Lead (aqua regia extractable)	mg/kg	1	MCERTS	8.6	38	17	180	39
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	0.7	0.6
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	23	13	28	13	18
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	42	58	51	64	46

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Lab Sample Number				1387531	1387532	1387533	1387534	1387535
Sample Reference				WS5	WS6	WS6	WS7	WS7
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.50	0.40	1.00	0.40	0.80
Date Sampled				07/12/2019	07/12/2019	07/12/2019	07/12/2019	07/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	2.9	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10	12	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	< 10	12	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	27	14	< 10

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Lab Sample Number	1387536			1387537			1387538			1387539		
Sample Reference	WS8			WS8			WS9			WS9		
Sample Number	None Supplied			None Supplied			None Supplied			None Supplied		
Depth (m)	0.60			1.40			0.40			0.80		
Date Sampled	07/12/2019			07/12/2019			07/12/2019			07/12/2019		
Time Taken	None Supplied			None Supplied			None Supplied			None Supplied		
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status									
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
Moisture Content	%	N/A	NONE	12	19	14	14	16	16	16	16	
Total mass of sample received	kg	0.001	NONE	0.66	0.68	0.59	0.59	0.67	0.67	0.67	0.67	

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	-

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.8	8.3	7.5	7.5
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1
Free Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.041	0.084	0.032	0.031
Organic Matter	%	0.1	MCERTS	2.6	0.9	1.9	1.4
Total Organic Carbon (TOC)	%	0.1	MCERTS	1.5	0.5	1.1	0.8

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	< 0.80
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	4.5	9.8	3.9	4.6
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	9.3	29	11	10
Copper (aqua regia extractable)	mg/kg	1	MCERTS	14	22	15	12
Lead (aqua regia extractable)	mg/kg	1	MCERTS	14	12	16	14
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	9.6	31	10	8.9
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	39	60	55	48

Analytical Report Number: 19-76637

Project / Site name: Timberland

Your Order No: 65 006

Lab Sample Number				1387536	1387537	1387538	1387539
Sample Reference				WS8	WS8	WS9	WS9
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.60	1.40	0.40	0.80
Date Sampled				07/12/2019	07/12/2019	07/12/2019	07/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Monoaromatics & Oxygenates							
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	3.4	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	13	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	200	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	170	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	1600	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	2000	< 10	< 10	< 10

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	8.5	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	140	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	130	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	1000	< 10	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	1300	< 10	< 10	< 10



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Environmental Science

Analytical Report Number : 19-76637**Project / Site name: Timberland**

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1387521	WS1	None Supplied	0.40	Brown sandy clay with gravel and brick.
1387522	WS1	None Supplied	0.80	Light brown sand with gravel.
1387523	WS2	None Supplied	0.40	Brown sandy clay with gravel and vegetation.
1387524	WS2	None Supplied	1.40	Light brown sand with gravel.
1387525	WS3	None Supplied	0.40	Brown sandy clay with gravel.
1387526	WS3	None Supplied	0.80	Brown sandy clay with gravel.
1387527	WS4	None Supplied	0.40	Brown sandy clay with gravel.
1387528	WS4	None Supplied	0.80	Brown sandy clay with gravel.
1387529	WS5	None Supplied	0.40	Brown sandy clay with gravel.
1387530	WS5	None Supplied	1.00	Grey sandy clay with gravel.
1387531	WS5	None Supplied	1.50	Brown clay and sand with gravel and chalk.
1387532	WS6	None Supplied	0.40	Brown clay and sand with gravel and glass.
1387533	WS6	None Supplied	1.00	Brown clay and sand with chalk and gravel
1387534	WS7	None Supplied	0.40	Brown sandy clay with gravel and vegetation.
1387535	WS7	None Supplied	0.80	Brown clay and sand with vegetation and gravel
1387536	WS8	None Supplied	0.60	Brown clay and sand with gravel.
1387537	WS8	None Supplied	1.40	Grey clay and sand.
1387538	WS9	None Supplied	0.40	Brown clay and sand.
1387539	WS9	None Supplied	0.80	Brown clay and sand.



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Analytical Report Number : 19-76637**Project / Site name: Timberland****Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)**

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In-house method based on BS1377 Part 2, 1990, Classification tests	L019-UK/PL	W	NONE
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L009-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L009-PL	D	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.**For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.****Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.**

Sample ID	Other ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
WS1		S	19-76637	1387521	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS1		S	19-76637	1387521	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS1		S	19-76637	1387521	b	TPHCWG (Soil)	L088/76-PL	b
WS1		S	19-76637	1387522	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS1		S	19-76637	1387522	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS1		S	19-76637	1387522	b	TPHCWG (Soil)	L088/76-PL	b
WS2		S	19-76637	1387523	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS2		S	19-76637	1387523	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS2		S	19-76637	1387523	b	TPHCWG (Soil)	L088/76-PL	b
WS2		S	19-76637	1387524	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS2		S	19-76637	1387524	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS2		S	19-76637	1387524	b	TPHCWG (Soil)	L088/76-PL	b
WS3		S	19-76637	1387525	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS3		S	19-76637	1387525	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS3		S	19-76637	1387525	b	TPHCWG (Soil)	L088/76-PL	b
WS3		S	19-76637	1387526	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS3		S	19-76637	1387526	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS3		S	19-76637	1387526	b	TPHCWG (Soil)	L088/76-PL	b
WS4		S	19-76637	1387527	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS4		S	19-76637	1387527	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS4		S	19-76637	1387527	b	TPHCWG (Soil)	L088/76-PL	b
WS4		S	19-76637	1387528	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS4		S	19-76637	1387528	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS4		S	19-76637	1387528	b	TPHCWG (Soil)	L088/76-PL	b
WS5		S	19-76637	1387529	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS5		S	19-76637	1387529	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS5		S	19-76637	1387529	b	TPHCWG (Soil)	L088/76-PL	b
WS5		S	19-76637	1387530	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS5		S	19-76637	1387530	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS5		S	19-76637	1387530	b	TPHCWG (Soil)	L088/76-PL	b
WS5		S	19-76637	1387531	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS5		S	19-76637	1387531	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS5		S	19-76637	1387531	b	TPHCWG (Soil)	L088/76-PL	b
WS6		S	19-76637	1387532	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS6		S	19-76637	1387532	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS6		S	19-76637	1387532	b	TPHCWG (Soil)	L088/76-PL	b
WS6		S	19-76637	1387533	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS6		S	19-76637	1387533	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS6		S	19-76637	1387533	b	TPHCWG (Soil)	L088/76-PL	b
WS7		S	19-76637	1387534	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS7		S	19-76637	1387534	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS7		S	19-76637	1387534	b	TPHCWG (Soil)	L088/76-PL	b
WS7		S	19-76637	1387535	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS7		S	19-76637	1387535	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS7		S	19-76637	1387535	b	TPHCWG (Soil)	L088/76-PL	b
WS8		S	19-76637	1387536	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS8		S	19-76637	1387536	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS8		S	19-76637	1387536	b	TPHCWG (Soil)	L088/76-PL	b
WS8		S	19-76637	1387537	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS8		S	19-76637	1387537	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS8		S	19-76637	1387537	b	TPHCWG (Soil)	L088/76-PL	b



WS9		S	19-76637	1387538	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS9		S	19-76637	1387538	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS9		S	19-76637	1387538	b	TPHCWG (Soil)	L088/76-PL	b
WS9		S	19-76637	1387539	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS9		S	19-76637	1387539	b	Speciated EPA-16 PAHs in soil	L064-PL	b
WS9		S	19-76637	1387539	b	TPHCWG (Soil)	L088/76-PL	b