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Post Demolition Ground Investigation Report

Proposed Residential Development,

Plot 7,

Maple Way,

Donington,

South Holland,

Lincolnshire.

8th June 2023

T. L. P. Ground Investigations.

Proposed Residential Development, Plot 7, Maple Way, Donington, South Holland, Lincolnshire.

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Post Demolition Intrusive Ground Investigation Report

Site: Proposed Residential Development, Plot 7, Maple Way, Donington, South Holland, Lincolnshire.

Client: Paul Barnsdale.

Date: 8th June 2023.

Executive Summary

Introduction	TLP Ground Investigations Ltd. were instructed by Paul Barnsdale to undertake a Phase II Intrusive Survey in connection with a Single Dwelling Proposed Residential Development, Maple Way, Donington, South Holland, Lincolnshire.
Previous Desk Study and former Phase 2 Intrusive Surveys and Local Authority Comments	A Phase I Desk Study undertaken by TLP on 6th December 2021 entitled 'Phase 1 Desk Study - Proposed Residential Development, Maple Way, Donington, South Holland, Lincolnshire', identified pollution linkages at the site associated with its historical use and from potential contamination that may have migrated onto the site from off-site sources. Potential contamination perceived to be associated with these activities that could feasibly impact this study site included metals, semi-metals, poly-aromatic hydrocarbons (PAH's), Total Petroleum Hydrocarbons (TPH), B-TEX, asbestos and harmful TPH vapours. A previous intrusive investigation undertaken at the site (TLP report dated January 2022 entitled '*Proposed Residential Development, Maple Way, Donington, South Holland, Lincolnshire'*) covered two areas of land located to the north and south of the existing established residential dwelling, however, the majority of the investigations were performed within the larger southern area of proposed development leaving only minimal contamination testing in the smaller northern area which is the focus of this Post Demolition Intrusive Ground Investigation Report. On review of the archive report, only one sampling borehole was located in the smaller northern section of the site. At the time of the previous investigation, no layout proposals had been established for the northern part of the site, then designated only as 'Plot 7'. This single borehole was located within an existing vegetable garden somewhere near the centre of the site now indicated as an area proposed to be covered with the new building. Contamination testing of a near surface soil sample from this previous investigation obtained from this location revealed a concentration of Lead, which slightly exceeded the current ATRISK Soil SSV for a *'residential end use with the consumption of home grown produce'.* More recently, the layout for the northern part of the site (Plot 7) has been finalised and the demolition of a number of old out buildings located adjacent to the original vegetable patch has been undertaken in order to make way for the construction of the proposed single detached bungalow. The development will also include the creation of a new private garden, growing area, private driveway, patio and paved areas and other infrastructure associated with a development of this kind. **Site condition and Planning Update** The old outbuildings on Plot 7 have now been cleared and in keeping with the comments made by Jeanette Reith - Environmental Protection Officer - South Holland District Council (24.03.23), '*The Phase*

	2 Investigation found some lead contamination for Plot 7 (this site) and has recommended that remediation is required. I also note that there are outbuildings on the site that will be demolished and there is the potential for further contamination in these areas. Due to the above, before development commences, I recommend that the applicant submit a remediation strategy for this plot now that the layout has been decided' Owing to the above comments by the council officer, it was considered prudent to undertake additional intrusive works within Plot 7 where the new garden areas are now proposed. These supplementary intrusive works were specifically undertaken to establish the current contaminative status of the open / garden areas of proposed new development following the recent demolition of the former out buildings and the surface scraping of the near surface soils. **Previous Investigation and Recent Investigation Outline** The scope of the initial intrusive investigation was designed in accordance with the recommendations of a Phase 1 Desk Study report issued by TLP Ground Investigations Ltd., on 6th January 2022 entitled 'Phase 1 Desk Study - Proposed Residential Development, Maple Way, Donington, South Holland, Lincolnshire'. This initial intrusive investigation was undertaken on 7th December 2021 and involved the excavation of 7 No. borings located within the accessible parts of the wider site area. This investigation included for the collection of soil, groundwater from boreholes followed b y chemical and geotechnical analysis of selected samples. No specific contamination was encountered in the larger southern section of the site, however a single sample tested from approximately the centre of 'plot 7' within a private vegetable garden area did identify a slightly elevated concentration of Lead. TLP Ground Investigations Ltd. have now recently completed a second intrusive investigation specifically in order to inform this Post Demolition Supplementary Report. This involved excavation of a further 7 No. borings and one hand dug excavation located within the northern part of the site (Plot 7) which has now become accessible following demolition of the former outbuildings and preparatory enabling works. This site work was undertaken on the 18th May 2023 and included the collection of soil, groundwater from boreholes followed by chemical and geotechnical analysis of selected samples. This report supplements the information obtained in earlier investigations and presents the results and findings of recent chemical testing of soil / groundwater samples, together with a reassessment of the contamination constraints associated with the residential development of the northern part of the site (i.e. Plot 7).
Intrusive Survey	In accordance with the above recommendations, TLP carried out a Supplementary Intrusive Investigation. The survey included the sinking of sampling boreholes / excavations followed up by chemical analysis of representative soil samples.
Contamination Summary	**Soil** Using the results of the environmental screening from the recent Supplementary Investigation for the northern part of the site (Plot 7) and the results obtained in earlier Intrusive Phase II Investigation, it has been established that the concentrations of contaminants in **the majority of samples** obtained from Plot 7 are within current guideline limits for a 'residential development with the consumption of home grown produce' scenario (res-with SOM 6%). The original Phase II Investigation (Report issued January 2022) did detect a slightly elevated concentration of Lead in a near surface sample obtained from the northern part of the site i.e. Plot7 (former BH7). Now a specific site and building proposed layout has been provided for Plot 7, it can be seen that the previous sampling location is located beneath the proposed building structure where any near surface soils in this location are likely to be covered with either foundation concrete or ground floor construction. In the light of a recent more specific building and site layout plan for Plot 7, it is considered that the more recent intrusive survey data should be exclusively used to inform any remediation strategy owing to sampling locations being in proposed garden areas. Additional samples of the near surface soil from this area analysed as part of this recent Post Demolition Supplementary Investigation confirmed that slightly elevated concentrations of Lead are present in the central and eastern garden areas and more moderate Lead contamination was encountered below the former outhouses. The contamination test results from the recent Supplementary Investigations, the recorded elevated concentrations of Lead in the central and eastern garden areas were recorded between

224mg/kg and 229mg/kg. More moderate Lead contamination was encountered below the former outbuildings where a Lead concentration of 1300.00mg/kg was recorded. These values exceed the current Atrisk SSV of 200mg/kg and as a consequence, some form of remediation will be required in order to render **parts of** Plot 7 suitable for the proposed *'residential end use with the consumption of home grown produce'.*

Controlled Waters

The intrusive survey and associated chemical analysis has demonstrated that generally across the site, the concentrations of potential contaminants are well within current guideline limits for a residential end use with the consumption of home grown produce. Based on groundwater testing at location in BH7 (Phase II Intrusive Survey), the localised slightly elevated concentrations of Lead in the near surface soils are not considered to have had any significant effect on the groundwater beneath the site.

When the development is completed significant areas of the site will be covered with buildings and permanent hard surfacing. This will limit the amount of rainwater entering the near surface deposits and therefore reduce the potential for the generation of contaminated leachate. The Oxford Clay is classified as an unproductive aquifer and is therefore not considered to be highly sensitive. The site is not located within 500m of a groundwater SPZ and no groundwater abstractions have been identified within 2000m of the site.

The nearest active surface water abstraction is situated 1759m southeast of the site where water is obtained from the Marlode Drain for direct spray irrigation. At such a distance this receptor is unlikely to be considered at risk from the study site.

Topsoil Recycling

It is likely the developer will nominate to use site won topsoil from the larger **southern proposed development site** for use in the cover system for area Plot 7 / BH7 as the near surface soil in the southern part of the site has been shown to be compliant with BS3882 topsoil specification and has a low contamination status suitable for residential home growing applications. Near surface topsoil from the southern part of the site can also be used in other landscaping areas of the site.

Any soil excavated from the affected areas of Plot 7 should not be reused within any other sensitive gardens or landscaped areas within the proposed development.

Areas of the future development which will be covered by foundation concrete and permanent hard surfacing will **not** require remediation.

In order to establish the suitability of the surface topsoil for re-use, samples of the existing near surface topsoil from the larger southern part of the site were tested for compliance in accordance with BS3882:2015. The results of the tests have been presented on the declaration of compliance numbered 103661(1)- 5, 10 and 6. The results of the tests indicate that all of the determinands included in the testing schedule are compliant with multi-purpose topsoil. This would indicate that the near surface soil obtained from the larger southern part of the site could be considered for re-use within proposed landscaped areas of the development. Care should be taken to ensure that any stockpiled certified 'clean' topsoil obtained from the southern part of the site is not mixed with surplus soil recovered from other areas where contamination was identified.

Whilst, no particularly stony soils were encountered within the near surface soils, it should, nevertheless, be noted that it is a requirement of the NHBC that any coarse stone or other obstructions will need to be removed from the upper 300mm of soil in any garden or landscaped areas. As per requirements of NHBC Ch. 9.2.

Any imported material / topsoil should have appropriate documentation to confirm that it is contamination free fit for purpose (ref. YALPAG Guidance).

Land Gasses and Vapours

The Groundsure Report from the original Phase 1 Desk Study did not identify any areas of in-filled ground

within 250m of the study site, which may represent a credible potential generation source of harmful ground gasses such as methane and carbon dioxide.

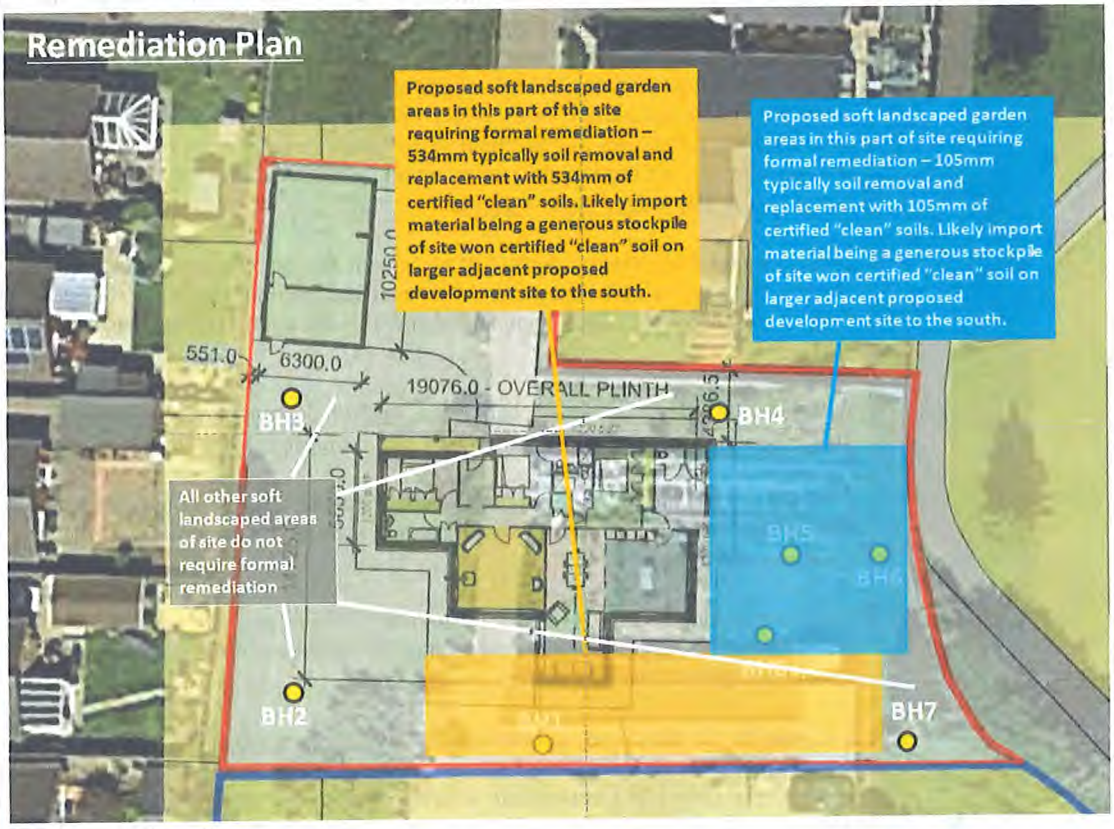
The absence of any significantly elevated TPH and B-TEX fractions within the soil samples submitted for testing suggests that the risk of hydrocarbon vapours entering the proposed new development is negligible. A TPH vapour survey is not considered necessary and no additional protection from hydrocarbon vapours is deemed to be required within the proposed development.

The site is not located within a radon affected area as less than 1% of properties within the specified search area recorded above the action level. The Groundsure report indicates that no radon protection measures are required for new buildings or extensions to those already existing.

Remediation

The design of a simple cover system should take into consideration the methodology outlined in the BRE Publication 'Cover Systems for Land Regeneration' March 2004. The methodology assumes that intermixing of the cover system with the underlying material will occur over time and provides a means to determine a sufficient thickness of cover (given the nature and severity of the contamination) such that even with complete intermixing in the long-term, the concentrations of contaminants within the mixed zone remain within target guideline values.

As the concentration of Lead in the soils beneath the former out building was found to be locally higher than elsewhere on the site, it is proposed that the remediation is zoned in order to economise on the amount of cover placed in areas where Lead contamination is less severe (See attached drawing showing demarked zones).



The contamination tests performed on samples obtained from certain areas outside the 'footprint' of the former outbuildings (Blue Zone), recorded only 'slight' contamination of Lead. Using the procedures outlined in the BRE Publication 'Cover Systems For Land Regeneration' March 2004, it has been determined that the maximum thickness of cover required to mitigate the risk from **Lead** contamination **over the garden, landscaped and growing areas (Blue Zone)** should be approximately **105mm** (see enclosed spread sheet). A 'clean' cover of this thickness will also serve to provide an effective media for

healthy plant growth. The calculation assumes that the imported soils of the cover system contain similar low levels of contamination as those encountered in the southern part of the site. Any surplus soil from the southern area could be considered suitable for use in the cover system.

The contamination tests performed on the samples obtained from locations inside the 'footprint' of the former outbuildings (Orange Zone) encountered slightly more significant Lead contamination. Using the procedures outlined in the BRE Publication 'Cover Systems For Land Regeneration' March 2004, it has been determined that the maximum thickness of cover required to mitigate the risk from **Lead contamination over the garden, landscaped and growing areas (Orange Zone)** should be approximately **534mm** (see enclosed spread sheet). A 'clean' cover of this thickness will also serve to provide an effective media for healthy plant growth. The calculation assumes that the imported soils of the cover system contain similar low levels of contamination as those encountered in the southern part of the site as this material is likely to be used as the cover system soil. *In order to reduce remediation areas, the developer may opt to cover the Orange Zone in permanent hard paving. This being the case, then the direct pathway conduit between end users and exposed soils would be blocked and as such no further remediation should be required. Advice from the local environmental control officer would determine their minimum preferred construction in this regard.*

The BRE publication does not specify materials, which should be used for a cover system other than it should be of 'good quality' and should incorporate a topsoil layer, ideally at least 150mm in thickness or 30% of the cover thickness, whichever is the greater. Reference should be made to Specification for Topsoil BS 3882 2007. Natural soil including sands and gravels and low plasticity clays or mixtures of various soils should be acceptable, provided it has been certified 'clean' at source and **has the appropriate documentation demonstrating it is relatively contamination free and suitable for use within a residential setting (see YALPAG - Verification Requirements for Cover Systems guidance)**. The provision of a layer of granular material within the cover system may also serve to act as a capillary break particularly if the underlying sub-soils are clayey. The existing ground should be suitably compacted prior to placement of the cover system (as set out in CIRIA SP 105). This will inhibit root penetration, infiltration, burrowing animals and instability but should not be compacted to such an extent that it will induce water logging.

Depending on the preferred method of placement (see cover system design above), the provision of a cover system may elevate the general site level and the implications of this should be considered in the light of the proposed development and also within the context of the existing residential setting of the site.

According to NHBC Guidance chapter 9.2, *'the top 300mm of any soil cover in garden and landscaped areas should be free from obstruction of which, at least, the top 100mm must be topsoil'.*

Where soil remediation has been undertaken, **a validation report may be required to verify that the works have been completed to a satisfactory standard in compliance with the above remediation recommendations.**

It is recommended that if imported topsoil and sub-soils are to be considered for use in the designated garden areas then appropriate documentation should be acquired and inspected by ourselves or similar consultants **prior** to its importation to site.

It is possible the developer will nominate to use site won topsoil from the **southern area of development** for use in the cover system for area Plot 7. The near surface soil in the southern part of the site has been shown to be compliant with BS3882 topsoil specification and has a low contamination status suitable for residential applications and as such should not require any further testing for compliance purposes.

1.0 Brief

Following the instructions of Mr. Paul Barnsdale, a supplementary geo-environmental assessment was carried out at a site located at Maple Way /Goxhill Avenue, Donington, Lincolnshire, where a

new residential property is proposed. The site of the proposed new dwelling currently comprises a large residential garden area.

A previous intrusive investigation undertaken at the site (TLP report dated January 2022 entitled '*Proposed Residential Development, Maple Way, Donington, South Holland, Lincolnshire'*) covered two areas of land located to the north and south of the existing established residential dwelling, however, the majority of the investigations were performed within the larger southern area of proposed development leaving only minimal contamination testing in the smaller northern area which is the focus of this investigation.

On review of the archive report, only one sampling borehole was located in the smaller northern section of the site. At the time of the previous investigation, no layout proposals had been established for the northern part of the site, then designated only as 'Plot 7'. This single borehole was located within an existing vegetable garden somewhere near the centre of the site. Contamination testing of a near surface soil sample obtained from this location revealed a concentration of Lead, which slightly exceeded the current ATRISK Soil SSV for a *'residential end use with the consumption of home grown produce'.*

As a consequence, the initial Phase II Intrusive Investigation provisionally recommended that the garden areas on the proposed Plot 7 would require a cover system of 385mm in order to mitigate the potential risk posed by the elevated concentration of Lead.

More recently, the layout for the northern part of the site (Plot 7) has now been finalised which has required the demolition of a number of old out buildings located adjacent to the original vegetable patch in order to make way for the construction of the proposed single detached bungalow and separate garage structure. The development will also include the creation of a new private garden, growing area, private driveway, patio and paved areas and other infrastructure associated with a development of this kind.

Site condition and Planning Update

The old outbuildings on Plot 7 have now been cleared and in keeping with the comments made by Jeanette Reith - Environmental Protection - South Holland District Council (24.03.23), '*The Phase 2 Investigation found some lead contamination for Plot 7 (this site) and has recommended that remediation is required. I also note that there are outbuildings on the site that will be demolished and there is the potential for further contamination in these areas. Due to the above, before development commences, I recommend that the applicant submit a remediation strategy for this plot now that the layout has been decided'*

Owing to the above comments by the council officer, it was considered prudent to undertake additional intrusive works within Plot 7 where the new individual dwelling and garden areas are now proposed. These supplementary intrusive works were specifically undertaken to establish the current contaminative status of the open / garden areas of proposed new development following the recent demolition of the former out buildings and the surface scraping of the near surface soils.

Previous Investigation and Recent Investigation Outline

The scope of the initial intrusive investigation was designed in accordance with the recommendations of a Phase 1 Desk Study report issued by TLP Ground Investigations Ltd., on 6th January 2022 entitled 'Phase 1 Desk Study - Proposed Residential Development, Maple Way, Donington, South Holland, Lincolnshire.', the findings of which are summarised in Section 3.0 of this report. This initial intrusive investigation was undertaken on 7th December 2021 and involved the excavation of 7 No. borings located within the accessible parts of the wider site area. This investigation included for the collection of soil, groundwater from boreholes followed by chemical and geotechnical analysis of selected samples. No specific contamination was encountered in the larger southern section of the site, however a single sample tested from approximately the centre of

'plot 7' within a private vegetable garden area did identify a slightly elevated concentration of Lead.

TLP Ground Investigations Ltd. have recently completed a second intrusive investigation specifically in order to inform this Supplementary Report. This involved excavation of a further 7 No. borings and one hand dug excavation located within the northern part of the site (Plot 7) which has now become accessible following demolition of the former outbuildings and preparatory enabling works. This site work was undertaken on the 18th May 2023 and included the collection of soil, groundwater from boreholes followed by chemical and geotechnical analysis of selected samples. This report supplements the information obtained in earlier investigations investigations and presents the results and findings of recent chemical testing of soil / groundwater samples, together with a reassessment of the contamination constraints associated with the residential development of the northern part of the site (i.e. Plot 7).

2.0 Site Description

The site is located on land to the east of Maple Way, Donington, South Holland, Lincolnshire. The proposed development site is centred at National Grid Reference 520917, 335457. The site is currently accessible through the driveway at the eastern end of Maple Way, which is secured with an electrically operated gate, or via Goxhill Avenue (a side road off High Street), which leads directly to Plot 7. Following the demolition of the former outbuildings and site scrape, the site surface currently comprises bare earth with areas of grassed garden and occasional planted borders. According to anecdotal information, the area occupied by the former vegetable garden had also been scraped to an appropriate level during the demolition of the adjacent out building.

3.0 Supplementary Intrusive Investigation

3.1 Sampling Strategy

In order to provide more detailed information on the contamination status of the northern part of the development now the demolition has been completed, further sampling boreholes have been undertaken. This sampling was performed in general accordance with the Model procedures for the Management of Land Contamination (CLR11), the relevant planning practice guidance (Land Affected by Contamination) and the Development of Land Affected by Contamination (Yorkshire and Lincolnshire Pollution Advisory Group) and the requirements of BS10175(2011)- Code of Practice for the Investigation of Potentially Contaminated Sites. These additional sampling boreholes investigations were undertaken on 18th May 2023 and included a sampling strategy which was designed on the basis of the fundamental objectives of the Phase 1 Intrusive Investigation and comments made by Environmental Protection of South Holland District Council.

The objectives involved the following:-

- Obtain representative samples of soil and where possible groundwater samples from strategic areas in the northern part of the development (Plot 7) for subsequent analysis.
- Gather further information on contaminated land conditions to assist in the design and construction of the proposed new building on Plot 7
- Re-evaluate the preliminary conceptual site model and undertake a qualitative contamination risk assessment for Plot 7.
- Determine whether mitigation measures or remediation is required in areas where soil / groundwater / vapours contamination may exist, in order to render the plot suitable for the proposed residential end use.

For analytical purposes, Plot 7 has been provisionally considered as one 'averaging area' for the contaminants analysed.

The additional boreholes were located in order to provide an overview of the ground conditions prevailing beneath the plot whilst ensuring a number of the borings were located within the areas of the site where garden/ vegetable growing areas and areas of soft landscaping are envisaged. These landscaped /garden areas are considered to be the most sensitive where future users of the site could come into contact with potentially contaminated soils. Borings were also located within areas of the plot where former out buildings were once located and also where the previous investigation had identified slightly elevated concentrations of Lead within the near surface soil samples. The locations of the borings have been indicated on the enclosed site layout drawing / aerial photograph and details of the strata encountered have been provided on the enclosed borehole record sheets.

3.2 Fieldwork

The recent intrusive fieldwork included the following:-

- The sinking of an additional 7 No. shallow sampling boreholes using windowless sampling equipment to depths of 1.10m beneath the ground surface and the excavation of one hand excavation using conventional digging tools. At the borehole locations, soil samples were recovered as continuous cores 100mm in diameter within rigid PVC core liner.

- Fragmental samples were obtained from the recent soil cores using appropriate tools (e.g. stainless steel trowel) and placed in appropriate containers, sealed, labelled and stored in cool boxes at low temperatures. The samples selected for analysis were subsequently transferred under chain of custody to an analytical laboratory.

3.3 Soil Sample Acquisition

In this recent intrusive investigation a number of near surface samples were retained from each location and from these, a total of 9 No. soil samples were selected for chemical (contamination) analysis (these are supplementary to the single soil sample tested during the initial intrusive survey). All of the selected samples were obtained from the near surface soils as these were considered to represent the most likely soils to be contaminated and most likely to come into contact with construction workers and end users of the site. These near surface soils were also deemed to represent a potential source of contaminated leachate which could potentially enter any underlying sensitive groundwater regime.

Although slight groundwater seepages were encountered within the depths penetrated by the borings, the previous investigation had already undertaken groundwater analysis in this part of the site and the results indicated that he groundwater was free from contamination. As a consequence, additional groundwater sampling and testing was not deemed necessary.

4.0 Ground Conditions

4.1 Anticipated Geology

Maps published by British Geological Survey indicated that the superficial deposits beneath the site would comprise Tidal Flat Deposits of clay and silt. The solid geology beneath the site is represented by the Oxford Clay Formation, which is of Callovian age. The maximum permeability of the superficial deposits is designated as 'low' and that of the underlying bedrock also as 'low'. No geological faults or linear features have been identified within 250m of the site.

The Groundsure data report indicates that the only surface ground workings within 250m of the site is a pond situated 184m to 191m east of the site, which is still present. The historical extracts also indicate that a very small pond was once situated a short distance to the west of the site. Historical extracts indicate that this pond was subsequently in-filled during the 1970's however this feature is very small and has been in filled for over 50 years so is therefore not considered a credible source of land gas generation which could feasibly impact the study site. In the wider areas, the Donington Brick & Tile Works situated 376m southeast of the site was also excavated for clay and shale.

Ground Conditions Encountered on Plot 7

Topsoil

At the surface, each of the borings penetrated deposits of topsoil extending to depths of between 0.08m to 0.25m beneath the surface. This generally comprised, dark brown, silty soil containing occasional fine fragments of brick, concrete, broken pottery and other assorted stones.

Made Ground

Deposits of made or slightly disturbed ground were encountered within five of the seven borings extending to depths of between 0.38m and 1.10m beneath the surface. These deposits generally comprised mid brown, buff brown and occasionally dark brown, silty, sandy and clayey soil containing occasional fine fragments of brick, coal and other assorted stones. According to the owner, BH6 was located within an area where, anecdotally a former drainage channel once passed through. Here deposits of made ground extended to the full depth of borehole penetration some 1.10m beneath the surface. This comprised similar deposits of brown and dark brown, silty, sandy clay containing occasional fine fragments of brick and stone. No evidence of biodegradable materials were encountered within the depths penetrated.

Natural Deposits

Beneath the deposits of topsoil / made ground, each of the borings penetrated Tidal Flat Deposits initially comprising a 'crust' of 'loose', brown, mottled rust brown and grey, slightly clayey silt. In some of the sampling boreholes, these upper deposits were either slightly more silty or clayey in composition and occasionally pockets of silt were also encountered. Tidal Flat Deposits subsequently extended to the full depth of borehole penetration some 1.10m beneath the surface.

4.2 **Groundwater**

Moderate groundwater seepages were encountered in all of the sampling boreholes with initial seepages encountered at depths of approximately 1.00m beneath the surface. On completion of the borings the side walls of the borings became unstable and partially collapsed. Groundwater levels in the open holes were subsequently measured at depths of between 0.70m and 0.92m beneath the surface.

5.0 Geotechnical Testing

All Geotechnical Aspects for the site have been previously discussed in the Phase 2 Intrusive Ground Investigation Report for the wider site area (report dated Jan 2022) and will not be repeated in this report.

6.0 Contamination

6.1 Preliminary Conceptual Site Model

The preliminary Conceptual Site Model (PCSM) detailed in the Phase 1 Assessment Report dated 6th December 2021 provided information regarding the potential 'source-pathway- receptor' linkages that may be present at the site. it was established that the contaminants that might be associated with the past activities at the site and the surrounding areas could include, but were not necessarily limited to the following:-

- **Metals, metalloids and asbestos** associated with the construction and demolition of structures which have occupied parts of the site and the possible presence of 'disturbed/made ground' that may be present over parts of the site surface. It is possible that some minor contamination may have been released from the structures located between the areas of proposed development. The possible migration of contamination from commercial activities that have taken place nearby, in particular the small Gas Works once located just to the north of the site.

- **Polycyclic Aromatic Hydrocarbons (PAH's)** derived from the incomplete combustion of organic materials, i.e. from bonfires or stubble burning that may have taken place at the site in the historical past.

- **Possible Total Petroleum Hydrocarbon (TPH's)** contamination emanating from accidental leaks or spillages from the use of agricultural equipment, plant and equipment.

6.2 Contamination Testing and Assessment Strategy

In accordance with the recommendations of Phase 1 Desk Study, a programme of chemical analysis was adopted that would target certain contaminants present in the soil that might be associated with the past and current activities at the site and in the immediate surrounding area.

The original Phase II Investigation (Report issued January 2022) did detect a slightly elevated concentration of Lead in a near surface sample obtained from the northern part of the site i.e. Plot7 (former BH7). Now a specific site and building proposed layout has been provided for Plot 7, it can be seen that the previous sampling location is located beneath the proposed building structure where any near surface soils in this location are likely to be covered with either foundation concrete of ground floor construction. In the light of a recent more specific building and site layout plan for Plot 7, it is considered that the more recent intrusive survey data should be exclusively used to inform any remediation strategy owing to sampling locations being in proposed garden areas and not beneath the proposed structure.

From the 7 No. boreholes and 1 No hand excavation, 9 No. soil samples were selected for chemical (contamination) analysis. The majority of the selected samples were obtained from the near surface soils as these were considered to represent the most likely soils to be contaminated and most likely to come into contact with construction workers and end users of the site. These near surface soils were also deemed to represent a possible source of contaminated leachate which could potentially enter any underlying sensitive groundwater regime.

All soil samples were placed in approved containers and cool boxes and despatched under a chain of custody to an accredited laboratory (Chemtech Environmental Ltd) for the range of tests outlined above. The results of the analyses have been provided on the enclosed laboratory certificate with contract number 123028 – Maple Way Donington.

Once the dwelling on Plot 7 is completed, large parts will be covered with either foundation concrete or areas of permanent hard surfacing including driveway / parking areas, patio and other areas of permanent paving. However, the development will also include private garden areas where future users could potentially grow produce for human consumption. With this in mind, **the proposed land use has been considered as a residential development with the potential that 'produce' could be grown within residential gardens for human consumption, i.e. 'residential with the consumption of home grown produce' (res-with) end use scenario**. The current contamination guideline values applicable to this end use have been adopted for the assessment of the contamination test data. The dataset has been compared to 6% soil organic matter (SOM) 'res-with' values as the majority of the recorded OMC concentrations were above 3% so this approach was considered appropriate. These are among the most conservative values with which to compare the results.

BRE Digests Special Digest 1 can be reference to assess the risk from sulphate and acid attack on buried concrete.

Guidance issued by UKWIR Publication 2010 'Guidance for the selection of water supply pipes to be used in Brownfield sites can be used to assess the risk to underground water supply pipes.

6.3.1 Analysis of Dataset

For the assessment of human health, each determinand within the dataset has been compared directly to Soil Screening Values (SSV's) developed by **ATRISK**^{SOIL}. Atkins soil screening values (SSV's) have been derived in line with the EA 2009 guidance (SR2, SR3, SR4, and SR7) using the CLEA v1.071 software. The modelling inputs were made compliant with the SR3 residential, commercial and other conceptual site models and follow the guidance provided within SR3 where possible. The SSV's currently available include values for a range of metals and semi metals, speciated PAH's, characterized TPH, BETX and other organic contaminants.

6.4 Contamination Results

6.4.1 Soils

6.4.1.1 *Metals and Semi metals and General Contaminants*

Three of the nine soil samples were submitted for testing and analysed for the full suite of metals, semi metals and general contaminants, however, owing to an elevated Lead concentration identified in a sample obtained from Plot 7 in the previous intrusive survey, all nine samples were submitted for Lead analysis.

The results indicate that the majority of the determinands included in the testing schedule are in concentrations well below the current Atrisk SSV's for a 'res-with' end use scenario and a soil organic matter (SOM content of 6%).

However, three of the nine near surface soil samples submitted for testing recorded concentrations of Lead which exceed the current ATRISKSoil SSV of 200mg/kg. In the samples obtained from BH1 (0.20-0.40m), Lead concentrations were recorded at 1300.0mg/kg in the location of the former outhouses, where as in BH6 (0.45-0.60m) and BH8 (0.10-0.30m), concentrations of Lead were recorded between 224mg/kg and 229mg/kg (garden and former vegetable growing area).

Owing to elevated concentrations of Lead in the former outbuildings area and central / eastern garden area of the proposed development, the garden and the relevant landscaped areas intended on plot (Plot 7) will require appropriate remediation for Lead contamination.

6.4.1.2 ***Polycyclic Aromatic Hydrocarbons***

Three of the nine soil samples were submitted for testing and analysed for speciated PAH's (EPA16) and the results compared to current Atrisk SSV's. The results indicate that all of the determinands included in the testing schedule were in concentrations well below the current Atrisk SSV's for a 'res-with' end use scenario and a soil organic matter (SOM content of 6%).

With respect to PAH contaminants, the site can be considered suitable for its proposed end use without the need for any specific remediation.

6.4.1.3 ***Total Petroleum Hydrocarbons and BTEX***

Three of the nine soil samples were submitted for testing and analysed for TPH and B-TEX compounds and the results compared to current SSV's. On comparing the recorded values with current guideline values, **none** of the determinands included in the suite of tests were found to be in concentrations which exceed the current Atrisk SSV's for a 'res-with' end use scenario (SOM 6%). Indeed the vast majority of the determinands were found to be in concentrations which were below the limit of analytical detection and **with respect to TPH contaminants, the site can be considered suitable for its proposed end use without the need for any specific remediation.**

The absence of any significantly elevated TPH or B-TEX fractions within the soil samples submitted for testing suggests that the risk of hydrocarbon vapours entering the proposed new buildings is very low. A TPH vapour survey is not considered necessary at this stage and no specific protection from hydrocarbon vapours is considered to be warranted for the proposed new development.

6.4.1.4 ***Asbestos***

Three of the nine soil samples were submitted for examination for the presence of asbestos in soil using polarised light microscopy. **No traces of asbestos were detected in any of the samples submitted for testing.**

6.4.1.5 ***Sulphate***

Chemical tests performed on representative samples of the near surface soils as part of the environmental screening, recorded water-soluble sulphate concentrations between 15mg/l and 56mg/l (2:1water / soil extract) with pH between 8.1 and 8.3. In the previous Phase II Investigation, the sample obtained from this part of the site recorded a (2:1 water soluble) sulphate concentration of 49mg/kg was recorded with a pH of 7.7. In the groundwater sample obtained from BH7 (Phase II 1.23m), a total sulphate concentration of 68mg/l was recorded with a pH value of 7.7. In accordance with the guidelines contained in Part 1 of the Digest and taking into account the geology and specific soil and groundwater conditions and the number of samples within the dataset (See section C5.1.1 of BRE Special Digest 1), the site can be assigned a **Design Sulphate Class DS-1** and an ACEC (Aggressive Chemical Environment for Concrete) Class AC-1.

6.4.1.6 ***WIR Suite***

In the original Phase II Intrusive Survey (Jan 2022) a soil samples (BH7 0.90-1.00m) was obtained from slightly greater depth and submitted for a UKWIR suite of tests that are commonly used to assist in the materials selection for potable water supply pipes. The results of the tests would suggest that PVC could be suitable for underground potable water supply pipes, however, this should be confirmed at an early stage with the local water company.

6.4.3 **Vapours**

The absence of any significantly elevated TPH and B-TEX fractions within the soil and groundwater samples submitted for testing suggests that the risk of hydrocarbon vapours entering the proposed new development is negligible. A TPH vapour survey is not considered necessary and

no specific protection from hydrocarbon vapours is considered necessary with regard to the proposed development.

6.4.4 Groundwater

A sample of the groundwater was obtained from Plot7 during the previous Phase II Intrusive Survey (BH7 1.23m) and analysed for a similar range of contaminants as the soil samples.

The results of the analysis have been compared to current ATRISK WSV's for a residential end use, EQS for fresh and salt water and also UK Drinking water standards.

All of the determinands were recorded either below their respective limit of analytical detection or well below current ATRISK WSV's, EQS freshwater / saltwater standards or UK DWS for consumers taps.

It is interesting to note that despite elevated concentrations of Lead recorded within the near surface soil sample at the location of BH7 and now more widely in the central eastern part of the site and within the near surface soils beneath the former outhouses, the sample of groundwater obtained from BH7 (Phase II) did not contain an elevated concentration of dissolved Lead. This demonstrates that the observed Lead contamination within the near soil samples is not readily mobile and has not affected the quality of the perched groundwater or indeed the sample obtained from slightly greater depth at the same location.

7.0 Contamination Summary, Revised Conceptual Site Model & Risk Assessment

Soil

Using the results of the environmental screening from the recent Supplementary Investigation for the northern part of the site (Plot 7) and the results obtained in earlier Intrusive Phase II Investigation, it has been established that the concentrations of contaminants in **the majority of samples** obtained from Plot 7 are within current guideline limits for a 'residential development with the consumption of home grown produce' scenario (res-with SOM 6%).

The original Phase II Investigation (Report issued January 2022) did detect a slightly elevated concentration of Lead in a near surface sample obtained from the northern part of the site i.e. Plot7 (former BH7). Now a specific site and building proposed layout has been provided for Plot 7, it can be seen that the previous sampling location is located beneath the proposed building structure where any near surface soils in this location are likely to be covered with either foundation concrete of ground floor construction. In the light of a recent more specific building and site layout plan for Plot 7, it is considered that the more recent intrusive survey data should be exclusively used to inform any remediation strategy owing to sampling locations being in proposed garden areas.

Additional samples of the near surface soil from this area analysed as part of this recent Post Demolition Supplementary Investigation confirmed that slightly elevated concentrations of Lead are present in the central and eastern garden areas and more moderate Lead contamination was encountered below the former outhouses. The contamination test results from the recent Supplementary Investigations, the recorded elevated concentrations of Lead in the central and eastern garden areas were recorded between 224mg/kg and 229mg/kg. More moderate Lead contamination was encountered below the former outbuildings where a Lead concentration of 1300.00mg/kg was recorded. These values exceed the current Atrisk SSV of 200mg/kg and as a consequence, some form of remediation will be required in order to render **parts of** Plot 7 suitable for the proposed '*residential end use with the consumption of home grown produce'.*

Groundwater

All determinands were recorded either below their respective limit of analytical detection or well below current ATRISK WSV's, EQS freshwater / saltwater standards or UK DWS for consumers taps or WHO Guidelines for Drinking Water Quality.

Remediation

Following completion of the development on Plot 7, **those parts of the site surfaced with either foundation concrete, structures or permanent hard pavements such as driveways / parking areas and footpaths will not require any specific remediation, as an effective barrier will be established between potential soil contamination and end users of the site.**

However, **the proposed garden areas, landscaped areas and growing areas will require some form of remediation in order to render it suitable for their proposed residential 'res-with' end use. This will most likely take the form of a 'simple soil cover system'.**

It was noted that the sample obtained from the area where a former out building was once located recorded the highest recorded Lead concentration of 1300mg/kg. This is somewhat higher than the rest of the elevated concentrations, which ranged between 224mg/kg and 229mg/kg. It is therefore recommended that remediation for the site is zoned in order to economise on the amount of cover placed in areas where Lead contamination is less severe. It would seem logical that the highest concentration of Lead could be a result of the activities that have taken place within the former outbuildings on the site and its is **the former outbuildings areas which have been isolated for more significant cover thickness.**

In order to reduce the volumes of soil that are exported off-site, it may be possible to reuse some of the slightly contaminated soils which is removed from garden areas, in the less sensitive areas of the site, such as beneath concreted/ permanently paved areas. Any contaminated soil which is exported off site should be to an appropriate receiving facility. Soil from contaminated areas of the site should not be mixed with stockpiled soil from other areas which were found to be free from contamination or distributed or placed over any part of the southern development area.

Site Workers and Operations

The temporary risk to construction / ground workers from identified Lead contamination and potential contamination which may be encountered during site development is minimal and could be mitigated through the use of adequate PPE and the provision of suitable welfare facilities. However, basic dust suppression measures should still be adopted for the duration of any earth works as a precaution, particularly if undertaken during dry and / or windy conditions. Haulage vehicles removing any excavated soils from site should be provided with a cover sheet to reduce the possibility of release of potentially contaminated airborne particulates during transportation

Existing Natural Protection of the Underlying Aquifer and Leachate Results

Percolation trials in the near surface silty soils (undertaken as part of the previous investigation Report - January 2022), have demonstrated that these materials are modestly permeable and as such, these soils may not be providing an effective barrier to the vertical and lateral migration of any potentially mobile surface generated contamination that may be present. However, a groundwater sample from a borehole where Lead contamination was identified in the near surface soils did not contain elevated concentrations of dissolved Lead. Moreover, the Lead concentration within a sample obtained from slightly greater depth from the same borehole did not contain elevated concentrations of Lead. This demonstrates that the observed Lead contamination is, in all likelihood, contained within the near surface soil and is not readily leachable. The underlying solid geology i.e. Oxford Clay is designated as an Unproductive Aquifer and would not be considered particularly sensitive to any contamination that is ultimately revealed.

Samples of the 'perched' groundwater were analysed for a similar range of contaminants as the soil samples. The results of the analysis have been compared to current ATRISK WSV's for a residential end use, EQS for fresh and salt water and also UK Drinking water standards. All determinands were recorded either below their respective limit of analytical detection or well below current ATRISK WSV's, EQS freshwater / saltwater standards, WHO standards or UK DWS for consumers taps.

Revised Conceptual Site Model Based on available information gathered in the Phase 2 Intrusive Investigation 2022 and Recent Post Demolition Supplementary Investigation

Source	Pathway	Receptor	Any significant contamination present Y/N	Previous Risk Class Phase 1 Desk study	New Risk Class Based on Phase 2 Investigation
Contamination resulting from the use of the site as agricultural land and residential garden and the use of agricultural plant and equipment. Contamination that may have been generated through the construction and historical demolition of structures that occupy the site. Contamination that may have migrated onto the site from the drainage ditches that once flowed along the various site boundaries. The possible presence of deposits of made ground that may exist beneath parts of the site surface. Burning processes that have taken place within the site boundaries. Residual contamination from natural weathering of geological strata. Possible contamination that has migrated onto the site from the nearby historical commercial areas and possible 'fall out' from construction and demolition of the structures that surround parts of the site (Residential). Potential Contaminants Include – PAH, TPH, B-TEX, metals, semi-metal,	Ingestion, Inhalation (dust) and / or Dermal Contact and Migration of Potentially Contaminated Leachate	Construction / Maintenance Workers / General Public during Excavations	Yes	Moderate / Low	**Low (with PPE) –** The intrusive surveys and associated chemical analysis have demonstrated that generally across the site, the concentrations of potential contaminants are well within current guideline limits for a residential end use. However, slightly elevated concentrations of Lead were identified in the near surface soils in the proposed central and eastern garden areas and moderate levels of Lead contamination were encountered beneath the former outbuildings. Whilst the risk is minimal, site / ground workers should be made aware of the minor risks and be equipped with appropriate PPE (overalls, gloves, dust masks, eye protection) during the earth works. Sufficient welfare facilities such as hand washing facilities should also be provided. Exposure to the contamination discovered within this survey would only be temporary and if the above precautions are adopted then the risk could be reduced to Low. If earthworks are carried out during very dry and dusty conditions, dust suppression measures should be put in place and all haulage vehicles removing soils from site should be covered to limit the release of airborne particulates.
		Future Site Users	Yes	Moderate / Low	**Low (provided cover system is introduced in affected area).** The intrusive surveys and associated chemical analysis have demonstrated that generally across the site, the concentrations of potential contaminants are well within current guideline limits for a residential end use. However, slightly elevated concentrations of Lead were identified in the near surface soils in the proposed central and eastern garden areas and moderate levels of Lead contamination were encountered beneath the former outbuildings It is therefore envisaged that localised garden areas for Plot 7 will require remediation to ameliorate the risk posed by Lead. **(See Remediation Strategy & Plans below).** Any soil excavated from the affected areas of Plot 7 should not be reused within any other sensitive gardens or landscaped areas within the proposed development. Areas of the future development which will be covered by foundation concrete and permanent hard surfacing will **not** require remediation.

asbestos and TPH vapours.		Landscaping Plants	Yes	Very Low	**Very Low (provided cover system is introduced in affected area).** The intrusive surveys and associated chemical analysis have demonstrated that generally across the site, the concentrations of potential contaminants are well within current guideline limits for a residential end use. However, slightly elevated concentrations of Lead were identified in the near surface soils in the proposed central and eastern garden areas and moderate levels of Lead contamination were encountered beneath the former outbuildings It is therefore envisaged that localised garden areas for Plot 7 will require remediation to ameliorate the risk posed by Lead. **(See Remediation Strategy & Plans below).** Any soil excavated from the affected areas of Plot 7 should not be reused within any other sensitive gardens or landscaped areas within the proposed development. Areas of the future development which will be covered by foundation concrete and permanent hard surfacing will **not** require remediation. In order to establish the suitability of the surface topsoil for re-use, samples of the existing near surface topsoil from the larger southern part of the site were tested for compliance in accordance with BS3882:2015. The results of the tests have been presented on the declaration of compliance numbered 103661(1)- 5, 10 and 6. The results of the tests indicate that all of the determinands included in the testing schedule are compliant with multi-purpose topsoil. This would indicate that the near surface soil obtained from the larger southern part of the site could be considered for re-use within proposed landscaped areas of the development. Care should be taken to ensure that any stockpiled certified 'clean' topsoil obtained from the southern part of the site is not mixed with surplus soil recovered from other areas where contamination was identified. Whilst, no particularly stony soils were encountered within the near surface soils, it should, nevertheless, be noted that it is a requirement of the NHBC that any coarse stone or other obstructions will need to be removed from the upper 300mm of soil in any garden or landscaped areas. As per requirements of NHBC Ch. 9.2. Any imported material / topsoil should have appropriate documentation to confirm that it is contamination free fit for purpose (ref. YALPAG Guidance).
		Water supply Pipes	No	Low	Very Low – The intrusive survey and associated chemical analysis has demonstrated that generally across the site, the concentrations of potential contaminants are well within current guideline limits for a residential end use with the consumption of home grown produce. Nevertheless, the local Water Authority may need to be contacted to ascertain the most appropriate materials for use in potable water supply pipes. During the Phase II Intrusive Survey (2022), a sample of soil from Plot 7 was obtained from slightly greater depth and submitted for a UKWIR suite of tests that

					are commonly used to assist in the materials selection for potable water supply pipes. The results of the tests would suggest that PVC could be suitable for underground potable water supply pipes, however, this should be confirmed at an early stage with the local water company. Provided the correct procedures are implemented to protect water pipes from any observed contamination, then the risk class attributed to future site users would be Low.
		Underground Structures	No – sulphate does not exceed DS-1	Low	Very Low – Analysis of soil and groundwater samples, has recorded water-soluble sulphate concentrations within the design sulphate class DS-1 of the BRE Digest Special Digest 1 classification 'Concrete in Aggressive Ground'. In accordance with the guidelines contained in Part 1 of the Digest and taking into consideration the specific soil and groundwater conditions (pH), the site can be assigned an ACEC Class AC-1.
		Controlled waters (Surface / Groundwater / Off Site Drains)	No	Low	Low – The intrusive survey and associated chemical analysis has demonstrated that generally across the site, the concentrations of potential contaminants are well within current guideline limits for a residential end use with the consumption of home grown produce. Based on groundwater testing at location in BH7 (Phase II Intrusive Survey), the localised slightly elevated concentrations of Lead in the near surface soils are not considered to have had any significant effect on the groundwater beneath the site. When the development is completed significant areas of the site will be covered with buildings and permanent hard surfacing. This will limit the amount of rainwater entering the near surface deposits and therefore reduce the potential for the generation of contaminated leachate. The Oxford Clay is classified as an unproductive aquifer and is therefore not considered to be highly sensitive. The site is not located within 500m of a groundwater SPZ and no groundwater abstractions have been identified within 2000m of the site. The nearest active surface water abstraction is situated 1759m southeast of the site where water is obtained from the Marlode Drain for direct spray irrigation. At such a distance this receptor is unlikely to be considered at risk from the study site.
	Migration of harmful ground gasses / vapours through permeable made ground and natural strata and accumulation in confined spaces.	Construction / Maintenance Workers and Future End Users	No	Moderate / Low	Low – The Groundsure Report has **not** identified any areas of in-filled ground within 250m of the study site, which may represent a credible potential generation source of harmful ground gasses such as methane and carbon dioxide. The absence of any significantly elevated TPH and B-TEX fractions within the soil samples submitted for testing suggests that the risk of hydrocarbon vapours entering the proposed new development is negligible. A TPH vapour survey is not considered necessary and no additional protection from hydrocarbon vapours is deemed to be required within the proposed development. The site is not located within a radon affected area as less than 1% of properties within the specified search area recorded

					above the action level. The Groundsure report indicates that no radon protection measures are required for new buildings or extensions to those already existing.

7.1 Cover System Design Remediation Strategy

The recent Supplementary Ground Investigation has revealed that the previously identified slightly elevated concentrations of Lead are present in the central and eastern garden areas and more moderate Lead contamination was encountered below the former outhouses . As a consequence, certain areas of the site will require some form of remediation in order to render these areas suitable for their proposed residential 'res-with' end use. This will most likely take the form of a 'simple soil cover system'.

As the severity of the contamination in near surface soils was found to be generally **slight to moderate,** rather than severe, the most feasible remedial strategy would be the provision of a **simple cover system** of appropriate thickness over the garden areas identified above. This could be achieved by:-

- Removal of the surface soil / made ground in the garden areas to a depth equivalent to the design thickness of the cover system, and replacing it with the material of the cover system. This option would not result in any increase site surface level following completion of the development.

- The provision of a cover system of appropriate design and thickness over the existing ground surface in intended garden / landscaped areas. This option would result in an increase in the site surface level equivalent to that of the cover system thickness, the implications of which should be considered in the context of the specific nature and setting of the development as a whole.

- A compromise between the above, i.e. removal of a nominal thickness of the surface soil in garden and landscaped areas prior to the placing of the full cover system thickness.

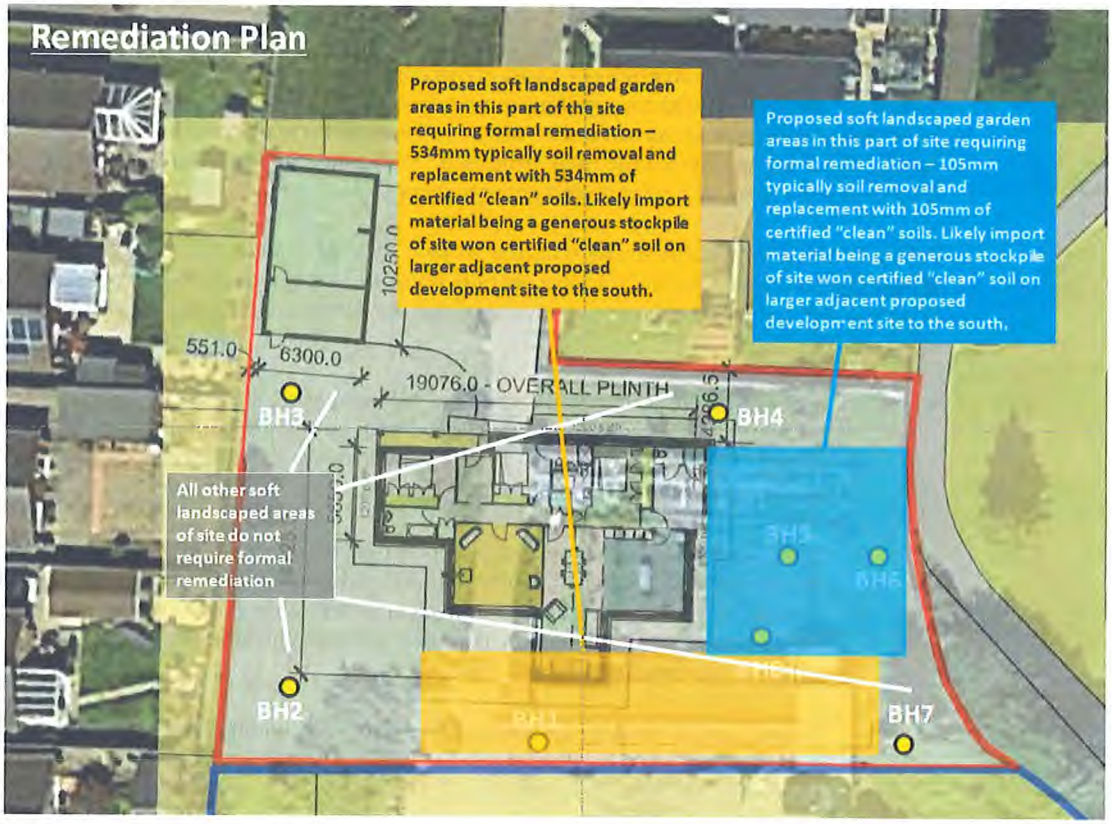
Bearing in mind the current environmental pressures on waste disposal sites and the availability of natural replacement materials, economy in design, without compromising safety, is crucial at the present time, in order to limit the impact of remediation on the environment. Consequently if the layout of the development permits, it may be possible to dispose of some of the slightly contaminated material beneath less sensitive areas of the site, i.e. areas of permanent hard cover, thereby reducing the volumes of soil which would otherwise need to be exported to landfill. Any soil excavated from the affected areas of Plot 7 should not be reused within any sensitive private garden or landscaped areas within the proposed development.

The principal exposure pathways at this site are considered to be the possibility of direct contact with, and the ingestion of contaminated material and the inhalation of contaminated dust. In this scenario, it is considered that the principal requirement would be the provision of a cover system of appropriate design and thickness to reduce the potential long-term exposure to contaminants by end users of the site to acceptable levels and to provide a suitable media for plant growth.

7.2 Cover System Design

The design of a simple cover system should take into consideration the methodology outlined in the BRE Publication 'Cover Systems for Land Regeneration' March 2004. The methodology assumes that intermixing of the cover system with the underlying material will occur over time and provides a means to determine a sufficient thickness of cover (given the nature and severity of the contamination) such that even with complete intermixing in the long-term, the concentrations of contaminants within the mixed zone remain within target guideline values.

As the concentration of Lead in the soils beneath the former out building was found to be locally higher than elsewhere on the site, it is proposed that the remediation is zoned in order to economise on the amount of cover placed in areas where Lead contamination is less severe (See attached drawing showing demarked zones).



The contamination tests performed on samples obtained from certain areas outside the 'footprint' of the former outbuildings (Blue Zone), recorded only 'slight' contamination of Lead. Using the procedures outlined in the BRE Publication 'Cover Systems For Land Regeneration' March 2004, it has been determined that the maximum thickness of cover required to mitigate the risk from **Lead** contamination **over the garden, landscaped and growing areas (Blue Zone)** should be approximately **105mm** (see enclosed spread sheet). A 'clean' cover of this thickness will also serve to provide an effective media for healthy plant growth. The calculation assumes that the imported soils of the cover system contains similar low levels of contamination as those encountered in the southern part of the site. Any surplus soil from the southern area could be considered suitable for use in the cover system.

The contamination tests performed on the samples obtained from locations inside the 'footprint' of the former outbuildings (Orange Zone) more significant Lead contamination. Using the procedures outlined in the BRE Publication 'Cover Systems For Land Regeneration' March 2004, it has been determined that the maximum thickness of cover required to mitigate the risk from **Lead** contamination **over the garden, landscaped and growing areas (Orange Zone)** should be approximately **534mm** (see enclosed spread sheet). A 'clean' cover of this thickness will also serve to provide an effective media for healthy plant growth. The calculation assumes that the imported soils of the cover system contain similar low levels of contamination as those encountered in the southern part of the site as this material is likely to be used as the cover system soil. *In order to reduce remediation areas, the developer may opt to cover the Orange Zone in permanent hard paving. This being the case, then the direct pathway conduit between end users and exposed soils*

would be blocked and as such no further remediation should be required. Advice from the local environmental control officer would determine their minimum preferred construction in this regard.

The BRE publication does not specify materials, which should be used for a cover system other than it should be of 'good quality' and should incorporate a topsoil layer, ideally at least 150mm in thickness or 30% of the cover thickness, whichever is the greater. Reference should be made to Specification for Topsoil BS 3882 2007. Natural soil including sands and gravels and low plasticity clays or mixtures of various soils should be acceptable, provided it has been certified 'clean' at source and **has the appropriate documentation demonstrating it is relatively contamination free and suitable for use within a residential setting (see YALPAG - Verification Requirements for Cover Systems guidance)**. The provision of a layer of granular material within the cover system may also serve to act as a capillary break particularly if the underlying sub-soils are clayey. The existing ground should be suitably compacted prior to placement of the cover system (as set out in CIRIA SP 105). This will inhibit root penetration, infiltration, burrowing animals and instability but should not be compacted to such an extent that it will induce water logging.

Depending on the preferred method of placement (see cover system design above), the provision of a cover system may elevate the general site level and the implications of this should be considered in the light of the proposed development and also within the context of the existing residential setting of the site.

According to NHBC Guidance chapter 9.2, *'the top 300mm of any soil cover in garden and landscaped areas should be free from obstruction of which, at least, the top 100mm must be topsoil'.*

Where soil remediation has been undertaken, **a validation report may be required to verify that the works have been completed to a satisfactory standard in compliance with the above remediation recommendations.**

It is recommended that if imported topsoil and sub-soils are to be considered for use in the designated garden areas then appropriate documentation should be acquired and inspected by ourselves or similar consultants **prior** to its importation to site.

It is possible the developer will nominate to use site won topsoil from the **southern area of development** for use in the cover system for area Plot 7. The near surface soil in the southern part of the site has been shown to be compliant with BS3882 topsoil specification and has a low contamination status suitable for residential applications and as such should not require any further testing for compliance purposes.

8.0 Precautionary Measures

Some precautionary measures are recommended and these are listed:-

- Ground workers involved in the development should be provided with appropriate personal protective equipment in order to mitigate the risk of temporary exposure to the slight soil contamination identified at the site.

- If any new areas suspected of being significantly contaminated are revealed during site preparation, then it will be necessary to take representative samples and carry out additional analysis. All such occurrences should be photographed, carefully logged and the extent shown on a copy of the site plan. Remediation work should not take place until this potential 'new' contamination has been fully identified and a remediation strategy approved by the local authority. Any soils suspected of being contaminated, which are stockpiled, should be placed on sheeted areas and representative samples submitted for

analysis. Upon receipt of the results, these materials will be either available for re-use or exported to an authorized landfill.

- **If** it is necessary to export excavated soil from the site, this should be to an appropriate receiving facility. Any documentation relating to the export of soils from site should be retained for possible future inspection by the local authority Environmental Protection Unit. Changes in legislation concerning hazardous waste may have an effect on the disposal costs of any materials from the site. Compliance testing may be required in order to classify materials within the Waste Acceptance Criteria (WAC).

- The risk to site users, neighbouring occupants, and 'general' public and to construction workers from airborne pollution is considered to be generally 'low' provided basic dust suppression measures are adopted for the duration of any earth works particularly during dry and dusty conditions. Haulage vehicles removing any excavated soils from site should be provided with a cover sheet to reduce the possibility of release of potentially contaminated airborne particulates during transportation.

- If potable water supply pipes are to be placed within the surface soils, these are likely to necessitate protection. A soil sample was submitted for a UKWIR suite of tests that are commonly used to assist in the materials selection for potable water supply pipes. The results of the test would suggest that PVC would be suitable for underground potable water supply pipes, however, this should be confirmed at an early stage with the local water company who may wish to review all available contamination test data.

Provided the measures detailed above are implemented, then the long term risk to human health and other environmental receptors is considered to be generally Low.

Foundation Concrete

Chemical tests performed on representative samples of the near surface soils as part of the environmental screening, recorded water-soluble sulphate concentrations between 15mg/l and 56mg/l (2:1water / soil extract) with pH between 8.1 and 8.3. In the Phase II Investigation, the sample obtained from this part of the site recorded a (2:1 water soluble) sulphate concentration of 49mg/kg was recorded with a pH of 7.7. In the groundwater sample obtained from BH7 (Phase II) (1.23m), a total sulphate concentration of 68mg/l was recorded with a pH value of 7.7. In accordance with the guidelines contained in Part 1 of the Digest and taking into account the geology and specific soil and groundwater conditions and the number of samples within the dataset (See section C5.1.1 of BRE Special Digest 1), the site can be assigned a Design Sulphate Class DS-1 and an ACEC (Aggressive Chemical Environment for Concrete) Class AC-1.

The opinions expressed in this Report are consistent with guideline standards available at the time of its preparation and assume that the ground conditions do not vary significantly beyond the range revealed within the agreed scope and budget for the investigation. There may, however, be conditions at the site, which have not been identified by the investigation and therefore will not have been considered in the report. Accordingly a careful watch should be maintained during any future ground works at the site and the report and its conclusions reviewed and / or modified accordingly within the context of the nature any development intended at the site.

Prepared by: ....**R. L. Trattles** (Director)

Reviewed by: ....**S. P. Trattles** (Director)

TLP Ground Investigation Ltd. RT/PB/MWD/SUPP /06/23

Site Location Plan

Proposed Residential Development, Plot 7, Maple Way, Donington, South Holland, Lincolnshire



Site Location Plan

Proposed Residential Development, Plot 7, Maple Way, Donington, South Holland, Lincolnshire



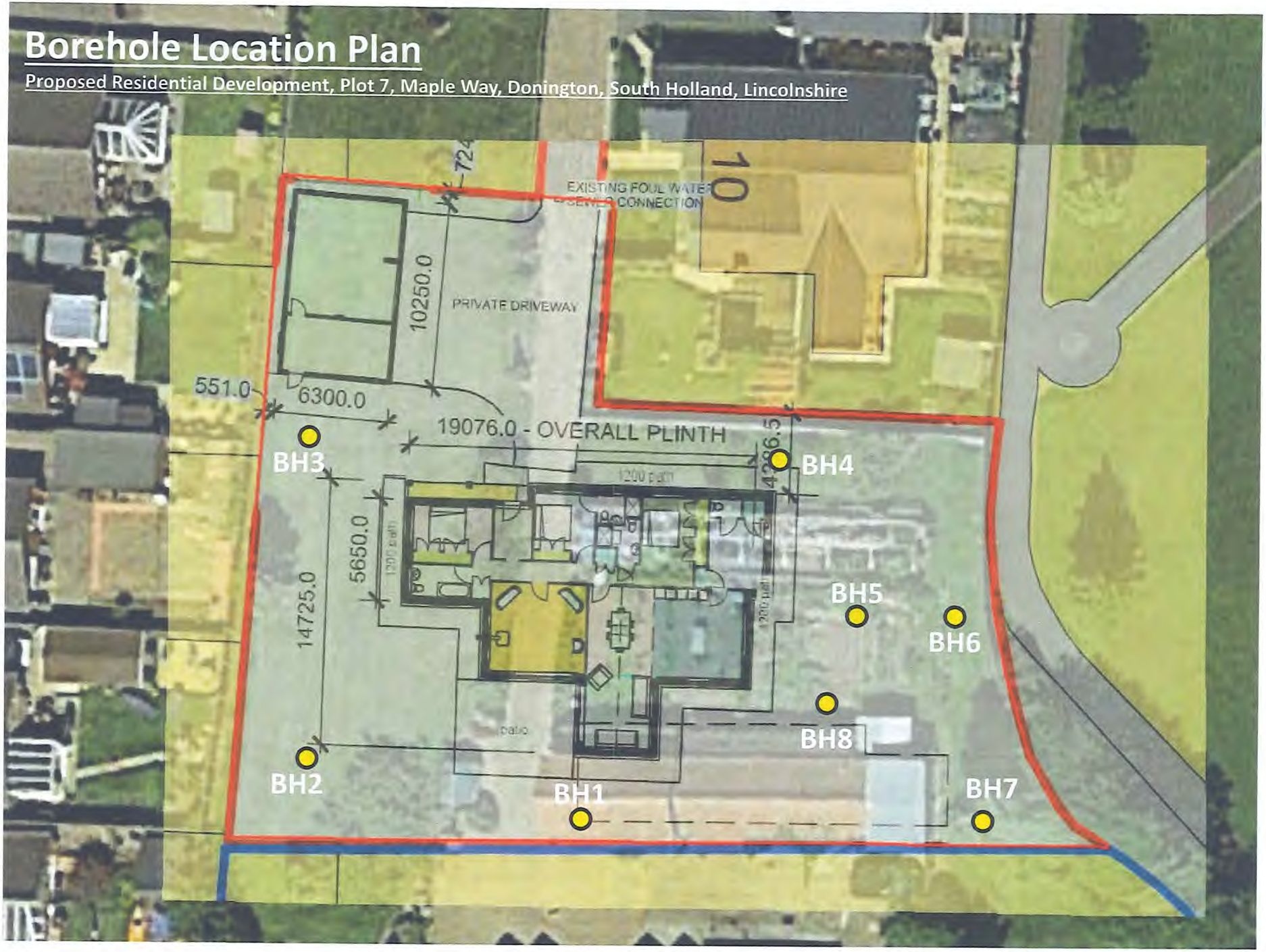
Borehole Location Plan

Proposed Residential Development, Plot 7, Maple Way, Donington, South Holland, Lincolnshire



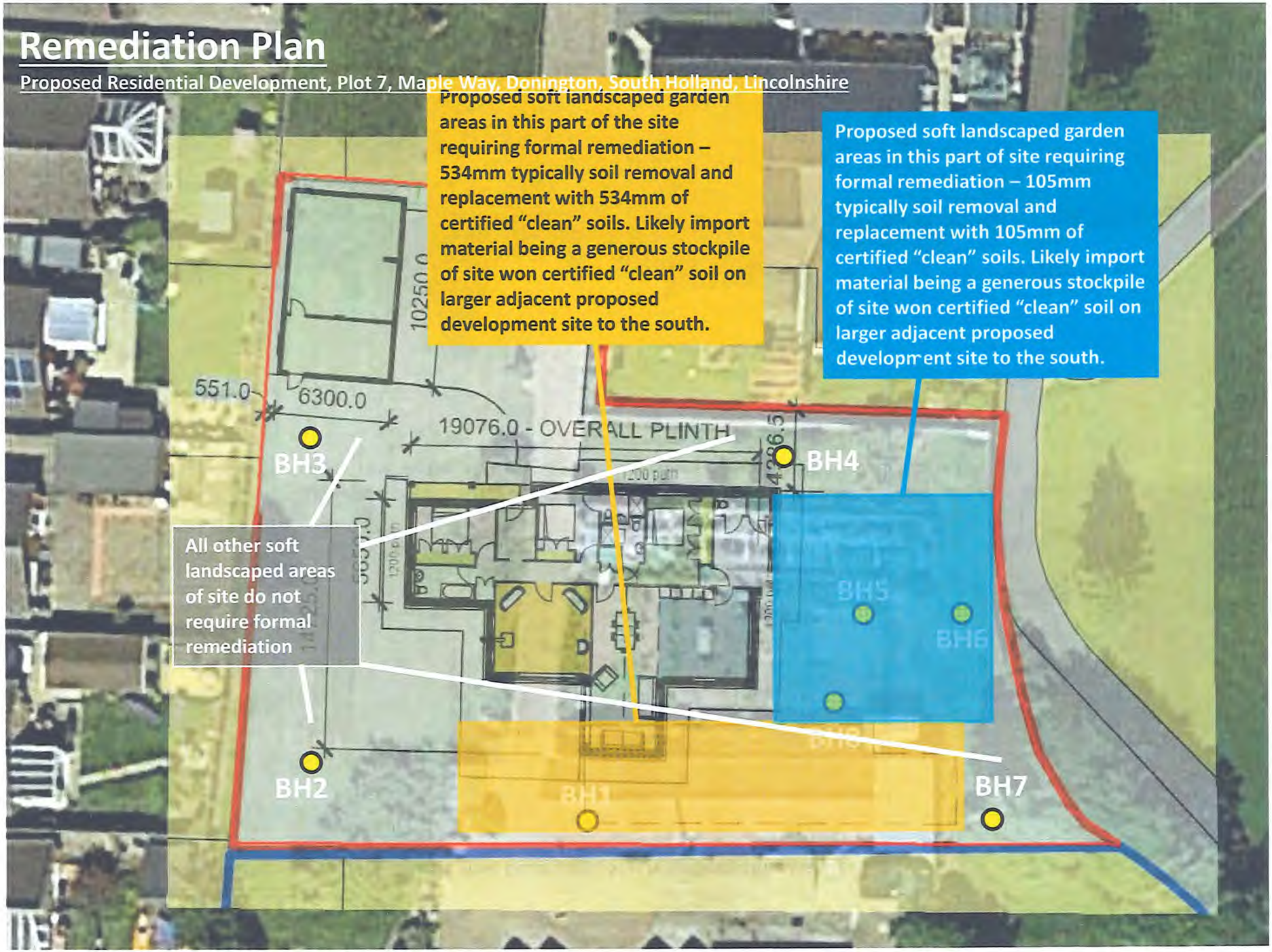
Borehole Location Plan

Proposed Residential Development, Plot 7, Maple Way, Donington, South Holland, Lincolnshire



Remediation Plan

Proposed Residential Development, Plot 7, Maple Way, Donington, South Holland, Lincolnshire



Photographic Log

Proposed Residential Development, Plot 7, Maple Way, Donington, South Holland, Lincolnshire



Panoramic view of proposed development area now cleared of out buildings – note green structure is wooden toilet hut for site workers



Panoramic view of proposed development area now cleared of out buildings

Photographic Log

Proposed Residential Development, Plot 7, Maple Way, Donington, South Holland, Lincolnshire



Panoramic view of proposed western garden area – Photo from proposed double garage looking southwest



Panoramic view of proposed western garden area – Photo from southwest corner looking northeast

T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Probe / Sampler.	**Location :** Proposed Residential Development, Maple Way, Donington.	**Borehole No.** BH1.
Carried out For Paul Barnsdale.		Ground Level	Co-ordinates	Date : 18.05.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Loose, dark brown, silty, sandy **Topsoil** containing very occasional fine fragments of brick and concrete.			(0.08) 0.08	0.00 - 1.10	U	1		
Topsoil / Disturbed Ground Loose, mid brown and occasionally dark brown, very silty and sandy clay containing occasional fine to medium fragments of brick.			(0.52) 0.60					
Buff brown and rust brown, silty **Clay** containing pockets of brown silt. **Tidal Flat Deposits**			1.10 **End of Borehole**					

Observations

Perched groundwater seepages were encountered at a depth of 1.00m and on completion the side walls of the borehole partially collapsed to a depth of 0.92m and the base of the boring remained dry.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Probe / Sampler.	**Location :** Proposed Residential Development, Maple Way, Donington.	**Borehole No.** BH2.
Carried out For Paul Barnsdale.		Ground Level	Co-ordinates	Date : 18.05.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Loose, dark brown, silty, sandy **Topsoil** containing very occasional fine assorted stone fragments.			(0.20)	0.00 - 1.10	U	1		
Topsoil / Disturbed Ground			0.20					
Loose, mid brown, buff brown and occasionally dark brown, very silty and sandy clay containing occasional fine to mediur fragments of brick, coal and other assorted stones.			(0.38)					
			0.58					
Buff brown, mottled brown **Silt.**								
Tidal Flat Deposits			1.10					
			End of Borehole					

Observations

Perched groundwater seepages were encountered at a depth of 1.00m and on completion the side walls of the borehole partially collapsed to a depth of 0.91m with groundwater standing at a depth of 0.81m b.g.l.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Probe / Sampler.	**Location :** Proposed Residential Development, Maple Way, Donington.	**Borehole No.** BH3.
Carried out For Paul Barnsdale.		Ground Level	Co-ordinates	Date : 18.05.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Loose, dark brown, silty, slightly sandy and clayey **Topsoil** containing very occasional fine fragments of stone.			(0.26)	0.00 - 1.10	U	1		
Topsoil / Disturbed Ground			0.26					
Buff brown, mottled grey, very silty **Clay.**			(0.29)					
Tidal Flat Deposits			0.55					
Buff brown, mottled brown **Silt.**			1.10					
			End of Borehole					

Observations

'Perched' groundwater seepages were encountered at a depth of 1.00m and on completion the side walls of the borehole partially collapsed to a depth of 0.90m with groundwater standing at a depth of 0.75m b.g.l.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Probe / Sampler.	**Location :** Proposed Residential Development, Maple Way, Donington.	**Borehole No.** BH4.
Carried out For Paul Barnsdale.		Ground Level	Co-ordinates	Date : 18.05.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Loose, dark brown, silty, slightly sandy and clayey **Topsoil** containing very occasional fine assorted stone fragments.			(0.25)	0.00 - 1.10	U	1		
Topsoil / Disturbed Ground Mixed, brown, dark brown and buff brown, very silty and sandy clay containing occasional fine brick fragments.			0.25 (0.13) 0.38					
Buff brown, mottled greyish brown, very silty **Clay.**								
Tidal Flat Deposits			1.10					
			End of Borehole					

Observations

'Perched' groundwater seepages were encountered at a depth of 1.00m and on completion the side walls of the borehole partially collapsed to a depth of 0.75m and the base of the boring remained dry.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Probe / Sampler.	**Location :** Proposed Residential Development, Maple Way, Donington.	**Borehole No.** BH5.
Carried out For Paul Barnsdale.		Ground Level	Co-ordinates	Date : 18.05.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Loose, dark brown, silty, slightly sandy and clayey **Topsoil** containing very occasional fine assorted stone fragments.			(0.25)	0.00 - 1.10	U	1		
Topsoil			0.25					
Mid brown and buff brown, silty, sandy **Clay.**			(0.08)					
			0.33					
Buff brown, mottled grey, silty, sandy **Clay.**			(0.29)					
			0.62					
Buff brown, mottled greyish brown, very silty **Clay.**								
Tidal Flat Deposits			1.10					
			End of Borehole					

Observations

'Perched' groundwater seepages were encountered at a depth of 1.00m and on completion the side walls of the borehole partially collapsed to a depth of 1.00m and water rose to within 0.90m of the surface.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Probe / Sampler.	**Location :** Proposed Residential Development, Maple Way, Donington.	**Borehole No.** BH6.
Carried out For Paul Barnsdale.		Ground Level	Co-ordinates	Date : 18.05.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Loose, dark brown, silty, slightly sandy **Topsoil** containing very occasional fine assorted stone fragments.			(0.14)	0.00 - 1.10	U	1		
Mixed, dark brown and buff brown, silty, slightly clayey sand containing occasional fine fragments of brick and stone.			0.14 (0.14) 0.28					
Topsoil / Disturbed Ground								
Dark brown, silty, sandy and clayey soil containing medium fragments of brick and stone.								
			1.10					
End of Borehole								

Observations

'Perched' groundwater seepages were encountered at a depth of 0.90m and on completion the side walls of the borehole partially collapsed to a depth of 0.85m with groundwater level settling out at 0.70m beneath the surface.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Probe / Sampler.	**Location :** Proposed Residential Development, Maple Way, Donington.	**Borehole No.** BH7.
Carried out For Paul Barnsdale.		Ground Level	Co-ordinates	Date : 18.05.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Loose, dark brown, silty, slightly sandy and clayey **Topsoil** containing very occasional fine fragments of brick.			(0.23)	0.00 - 1.10	U	1		
Mixed dark brown and buff brown, silty, sandy clay.. **Topsoil / Disturbed Ground**			0.23 (0.27)					
Buff brown, silty, sandy **Clay.** **Tidal Flat Deposits**			0.50					
			1.10 **End of Borehole**					

Observations

'Perched' groundwater seepages were encountered at a depth of 1.00m and on completion the side walls of the borehole partially collapsed to a depth of 0.90m and the base of the borehole remained dry.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

ANALYTICAL TEST REPORT

Contract no: 123028

Contract name: Maple Way, Donington

Client reference: 22052023

Clients name: TLP Ground Investigations

Clients address: 64 Wentworth Road
South Park Industrial Estate
Scunthorpe
DN17 2AZ

Samples received: 23 May 2023

Analysis started: 23 May 2023

Analysis completed: 05 June 2023

Report issued: 05 June 2023

Key

U	UKAS accredited test
M	MCERTS & UKAS accredited test
$	Test carried out by an approved subcontractor
I/S	Insufficient sample to carry out test
N/S	Sample not suitable for testing
NAD	No Asbestos Detected

Approved by:

Abbie Neasham-Bourn
Senior Reporting Administrator

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
123028-1	BH1	0.20-0.40	Sandy Clay	-	-	22.3
123028-2	BH2	0.15-0.25	Sand with Root	-	-	22.2
123028-3	BH3	0.20-0.30	Loamy Sand with Root	-	-	20.0
123028-4	BH4	0.20-0.40	Sand with Root	-	-	19.1
123028-5	BH5	0.25-0.35	Sand	-	-	18.4
123028-6	BH6	0.15-0.25	Sand with Gravel Root	-	-	17.0
123028-7	BH6	0.45-0.65	Sand with Gravel Root	-	-	21.4
123028-8	BH7	0.20-0.40	Sand and Root	-	-	19.6
123028-9	BH8	0.10-0.30	Sand	-	-	21.7

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SOILS

Lab number			123028-1	123028-2	123028-3	123028-4	123028-5	123028-6
Sample id			BH1	BH2	BH3	BH4	BH5	BH6
Depth (m)			0.20-0.40	0.15-0.25	0.20-0.30	0.20-0.40	0.25-0.35	0.15-0.25
Date sampled			22/05/2023	22/05/2023	22/05/2023	22/05/2023	22/05/2023	22/05/2023
Test	**Method**	**Units**						
Boron (water soluble)	CE063 U	mg/kg B	1.6	-	0.9	-	-	1.0
Chromium (VI)	CE146	mg/kg CrVI	<1	-	<1	-	-	<1
Arsenic	$ M	mg/kg	13.4	-	14.9	-	-	13.1
Cadmium	$ M	mg/kg	< 0.2	-	0.3	-	-	0.2
Chromium	$ M	mg/kg	28.1	-	25.8	-	-	28.7
Copper	$ M	mg/kg	33.4	-	29.1	-	-	22.3
Lead	$ M	mg/kg	1300.0	196.0	141.0	48.4	52.2	59.5
Mercury	$ M	mg/kg	0.6	-	0.6	-	-	0.2
Nickel	$ M	mg/kg	15.8	-	16.4	-	-	18.3
Selenium	$ M	mg/kg	< 1.0	-	< 1.0	-	-	< 1.0
Zinc	$ M	mg/kg	101.0	-	98.6	-	-	74.5
pH	CE004 M	units	8.3	-	8.1	-	-	8.3
Sulphate (2:1 water soluble)	CE061 U	mg/l SO_4	56	-	17	-	-	15
Sulphate (acid extractable)	CE062 M	mg/kg SO_4	756	-	541	-	-	489
Sulphide	CE016	mg/kg S^{2-}	16	-	88	-	-	24
Cyanide (free)	CE077	mg/kg CN	<1	-	<1	-	-	<1
Cyanide (total)	CE077	mg/kg CN	<1	-	<1	-	-	<1
Thiocyanate	CE145 M	mg/kg SCN	<1	-	<1	-	-	<1
Phenols (total)	CE078	mg/kg PhOH	<0.5	-	<0.5	-	-	<0.5
Total Organic Carbon (TOC)	CE197	% w/w C	2.7	-	3.6	-	-	0.6
Estimate of OMC (calculated from TOC)	CE197	% w/w	4.6	-	6.2	-	-	1.1
Loss On Ignition at 440°C	CE006 U	% w/w	5.0	-	7.0	-	-	4.2
PAH								
Naphthalene	CE087 M	mg/kg	0.08	-	0.65	-	-	0.04
Acenaphthylene	CE087 M	mg/kg	0.02	-	0.35	-	-	<0.02
Acenaphthene	CE087 M	mg/kg	0.02	-	0.13	-	-	<0.02
Fluorene	CE087 U	mg/kg	0.03	-	0.18	-	-	<0.02
Phenanthrene	CE087 M	mg/kg	0.29	-	1.22	-	-	0.13
Anthracene	CE087 U	mg/kg	0.12	-	0.98	-	-	0.04
Fluoranthene	CE087 M	mg/kg	0.44	-	6.79	-	-	0.28
Pyrene	CE087 M	mg/kg	0.44	-	9.39	-	-	0.25
Benzo(a)anthracene	CE087 U	mg/kg	0.53	-	8.32	-	-	0.18
Chrysene	CE087 M	mg/kg	0.52	-	7.23	-	-	0.18
Benzo(b)fluoranthene	CE087 M	mg/kg	0.37	-	5.79	-	-	0.20
Benzo(k)fluoranthene	CE087 M	mg/kg	0.17	-	2.33	-	-	0.08
Benzo(a)pyrene	CE087 U	mg/kg	0.51	-	4.33	-	-	0.19
Indeno(123cd)pyrene	CE087 M	mg/kg	0.21	-	2.24	-	-	0.12
Dibenz(ah)anthracene	CE087 M	mg/kg	0.07	-	0.75	-	-	0.02
Benzo(ghi)perylene	CE087 M	mg/kg	0.24	-	2.39	-	-	0.12
PAH (total of USEPA 16)	CE087	mg/kg	4.06	-	55.06	-	-	1.82

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SOILS

Lab number			123028-1	123028-2	123028-3	123028-4	123028-5	123028-6
Sample id			BH1	BH2	BH3	BH4	BH5	BH6
Depth (m)			0.20-0.40	0.15-0.25	0.20-0.30	0.20-0.40	0.25-0.35	0.15-0.25
Date sampled			22/05/2023	22/05/2023	22/05/2023	22/05/2023	22/05/2023	22/05/2023
Test	**Method**	**Units**						
BTEX & TPH								
Benzene	CE192 U	mg/kg	<0.01	-	<0.01	-	-	<0.01
Toluene	CE192 U	mg/kg	<0.01	-	<0.01	-	-	<0.01
Ethylbenzene	CE192 U	mg/kg	<0.01	-	<0.01	-	-	<0.01
m & p-Xylene	CE192 U	mg/kg	<0.02	-	<0.02	-	-	<0.02
o-Xylene	CE192 U	mg/kg	<0.01	-	<0.01	-	-	<0.01
VPH Aromatic (>EC5-EC7)	CE067	mg/kg	<0.01	-	<0.01	-	-	<0.01
VPH Aromatic (>EC7-EC8)	CE067	mg/kg	<0.01	-	<0.01	-	-	<0.01
VPH Aromatic (>EC8-EC10)	CE067	mg/kg	<0.01	-	<0.01	-	-	<0.01
EPH Aromatic (>EC10-EC12)	CE250	mg/kg	<10	-	<10	-	-	<10
EPH Aromatic (>EC12-EC16)	CE250	mg/kg	<10	-	37	-	-	35
EPH Aromatic (>EC16-EC21)	CE250	mg/kg	<1	-	196	-	-	181
EPH Aromatic (>EC21-EC35)	CE250	mg/kg	18	-	816	-	-	776
EPH Aromatic (>EC35-EC44)	CE250	mg/kg	<1	-	115	-	-	130
VPH Aliphatic (>C5-C6)	CE067	mg/kg	<0.1	-	<0.1	-	-	<0.1
VPH Aliphatic (>C6-C8)	CE067	mg/kg	<0.1	-	<0.1	-	-	<0.1
VPH Aliphatic (>C8-C10)	CE067	mg/kg	<0.1	-	<0.1	-	-	<0.1
EPH Aliphatic (>C10-C12)	CE250	mg/kg	<6	-	<6	-	-	<6
EPH Aliphatic (>C12-C16)	CE250	mg/kg	<6	-	9	-	-	8
EPH Aliphatic (>C16-C35)	CE250	mg/kg	<15	-	<15	-	-	<15
EPH Aliphatic (>C35-C44)	CE250	mg/kg	<10	-	<10	-	-	<10
Subcontracted Analysis								
Asbestos (qualitative)	$	-	NAD	-	NAD	-	-	NAD

Chemtech Environmental Limited

SOILS

Lab number			123028-7	123028-8	123028-9
Sample id			BH6	BH7	BH8
Depth (m)			0.45-0.65	0.20-0.40	0.10-0.30
Date sampled			22/05/2023	22/05/2023	22/05/2023
Test	**Method**	**Units**			
Boron (water soluble)	CE063 U	mg/kg B	-	-	-
Chromium (VI)	CE146	mg/kg CrVI	-	-	-
Arsenic	$ M	mg/kg	-	-	-
Cadmium	$ M	mg/kg	-	-	-
Chromium	$ M	mg/kg	-	-	-
Copper	$ M	mg/kg	-	-	-
Lead	$ M	mg/kg	224.0	142.0	229.0
Mercury	$ M	mg/kg	-	-	-
Nickel	$ M	mg/kg	-	-	-
Selenium	$ M	mg/kg	-	-	-
Zinc	$ M	mg/kg	-	-	-
pH	CE004 M	units	-	-	-
Sulphate (2:1 water soluble)	CE061 U	mg/l SO_4	-	-	-
Sulphate (acid extractable)	CE062 M	mg/kg SO_4	-	-	-
Sulphide	CE016	mg/kg S^{2-}	-	-	-
Cyanide (free)	CE077	mg/kg CN	-	-	-
Cyanide (total)	CE077	mg/kg CN	-	-	-
Thiocyanate	CE145 M	mg/kg SCN	-	-	-
Phenols (total)	CE078	mg/kg PhOH	-	-	-
Total Organic Carbon (TOC)	CE197	% w/w C	-	-	-
Estimate of OMC (calculated from TOC)	CE197	% w/w	-	-	-
Loss On Ignition at 440°C	CE006 U	% w/w	-	-	-
PAH					
Naphthalene	CE087 M	mg/kg	-	-	-
Acenaphthylene	CE087 M	mg/kg	-	-	-
Acenaphthene	CE087 M	mg/kg	-	-	-
Fluorene	CE087 U	mg/kg	-	-	-
Phenanthrene	CE087 M	mg/kg	-	-	-
Anthracene	CE087 U	mg/kg	-	-	-
Fluoranthene	CE087 M	mg/kg	-	-	-
Pyrene	CE087 M	mg/kg	-	-	-
Benzo(a)anthracene	CE087 U	mg/kg	-	-	-
Chrysene	CE087 M	mg/kg	-	-	-
Benzo(b)fluoranthene	CE087 M	mg/kg	-	-	-
Benzo(k)fluoranthene	CE087 M	mg/kg	-	-	-
Benzo(a)pyrene	CE087 U	mg/kg	-	-	-
Indeno(123cd)pyrene	CE087 M	mg/kg	-	-	-
Dibenz(ah)anthracene	CE087 M	mg/kg	-	-	-
Benzo(ghi)perylene	CE087 M	mg/kg	-	-	-
PAH (total of USEPA 16)	CE087	mg/kg	-	-	-

Chemtech Environmental Limited

SOILS

Lab number			123028-7	123028-8	123028-9
Sample id			BH6	BH7	BH8
Depth (m)			0.45-0.65	0.20-0.40	0.10-0.30
Date sampled			22/05/2023	22/05/2023	22/05/2023
Test	**Method**	**Units**			
BTEX & TPH					
Benzene	CE192 U	mg/kg	-	-	-
Toluene	CE192 U	mg/kg	-	-	-
Ethylbenzene	CE192 U	mg/kg	-	-	-
m & p-Xylene	CE192 U	mg/kg	-	-	-
o-Xylene	CE192 U	mg/kg	-	-	-
VPH Aromatic (>EC5-EC7)	CE067	mg/kg	-	-	-
VPH Aromatic (>EC7-EC8)	CE067	mg/kg	-	-	-
VPH Aromatic (>EC8-EC10)	CE067	mg/kg	-	-	-
EPH Aromatic (>EC10-EC12)	CE250	mg/kg	-	-	-
EPH Aromatic (>EC12-EC16)	CE250	mg/kg	-	-	-
EPH Aromatic (>EC16-EC21)	CE250	mg/kg	-	-	-
EPH Aromatic (>EC21-EC35)	CE250	mg/kg	-	-	-
EPH Aromatic (>EC35-EC44)	CE250	mg/kg	-	-	-
VPH Aliphatic (>C5-C6)	CE067	mg/kg	-	-	-
VPH Aliphatic (>C6-C8)	CE067	mg/kg	-	-	-
VPH Aliphatic (>C8-C10)	CE067	mg/kg	-	-	-
EPH Aliphatic (>C10-C12)	CE250	mg/kg	-	-	-
EPH Aliphatic (>C12-C16)	CE250	mg/kg	-	-	-
EPH Aliphatic (>C16-C35)	CE250	mg/kg	-	-	-
EPH Aliphatic (>C35-C44)	CE250	mg/kg			
Subcontracted Analysis					
Asbestos (qualitative)	$	-	-	-	-

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE063	Boron (water soluble)	Hot water extract, ICP-OES	Dry	U	0.5	mg/kg B
CE146	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
$^M	Arsenic	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg
$^M	Cadmium	Aqua regia digest, ICP-MS	Dry	M	0.2	mg/kg
$^M	Chromium	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg
$^M	Copper	Aqua regia digest, ICP-MS	Dry	M	4	mg/kg
$^M	Lead	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg
$^M	Mercury	Aqua regia digest, ICP-MS	Dry	M	0.1	mg/kg
$^M	Nickel	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg
$^M	Selenium	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg
$^M	Zinc	Aqua regia digest, ICP-MS	Dry	M	4.5	mg/kg
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO_4
CE062	Sulphate (acid extractable)	HCl extract, analysed by ICP-OES	Dry	M	100	mg/kg SO_4
CE016	Sulphide	Distillation, Titration	Dry		10	mg/kg S^{2-}
CE077	Cyanide (free)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE077	Cyanide (total)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE145	Thiocyanate	Weak acid extraction, Colorimetry	Dry	M	1	mg/kg SCN
CE078	Phenols (total)	Extraction, Continuous Flow Colorimetry	As received		0.5	mg/kg PhOH
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w
CE006	Loss On Ignition at 440°C	Based on BS 1377, Gravimetry	Dry	U	0.1	% w/w
CE087	Naphthalene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(b)fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(k)fluoranthene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	As received		0.34	mg/kg
CE192	Benzene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	Toluene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	Ethylbenzene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	m & p-Xylene	Headspace GC-FID	As received	U	0.02	mg/kg
CE192	o-Xylene	Headspace GC-FID	As received	U	0.01	mg/kg

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE067	VPH Aromatic (>EC5-EC7)	Headspace GC-FID	As received		0.01	mg/kg
CE067	VPH Aromatic (>EC7-EC8)	Headspace GC-FID	As received		0.01	mg/kg
CE067	VPH Aromatic (>EC8-EC10)	Headspace GC-FID	As received		0.01	mg/kg
CE250	EPH Aromatic (>EC10-EC12)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC12-EC16)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC16-EC21)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC21-EC35)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC35-EC44)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE067	VPH Aliphatic (>C5-C6)	Headspace GC-FID	As received		0.1	mg/kg
CE067	VPH Aliphatic (>C6-C8)	Headspace GC-FID	As received		0.1	mg/kg
CE067	VPH Aliphatic (>C8-C10)	Headspace GC-FID	As received		0.1	mg/kg
CE250	EPH Aliphatic (>C10-C12)	Solvent extraction, GCxGC-FID	As received		6	mg/kg
CE250	EPH Aliphatic (>C12-C16)	Solvent extraction, GCxGC-FID	As received		6	mg/kg
CE250	EPH Aliphatic (>C16-C35)	Solvent extraction, GCxGC-FID	As received		15	mg/kg
CE250	EPH Aliphatic (>C35-C44)	Solvent extraction, GCxGC-FID	As received		10	mg/kg
$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-

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DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.
For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.
Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
123028-1	BH1	0.20-0.40	N	
123028-2	BH2	0.15-0.25	N	
123028-3	BH3	0.20-0.30	N	
123028-4	BH4	0.20-0.40	N	
123028-5	BH5	0.25-0.35	N	
123028-6	BH6	0.15-0.25	N	
123028-7	BH6	0.45-0.65	N	
123028-8	BH7	0.20-0.40	N	
123028-9	BH8	0.10-0.30	N	

Chemtech Environmental Limited

ADDITIONAL INFORMATION

Notes

Opinions and interpretations expressed herein are outside the UKAS accreditation scope.

Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.

All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.

Methods, procedures and performance data are available on request.

Results reported herein relate only to the material supplied to the laboratory.

This report shall not be reproduced except in full, without prior written approval.

Samples will be disposed of 4 weeks from initial receipt unless otherwise instructed.

BTEX compounds are identified by retention time only and may include interference from co-eluting compounds.

For soils and solids, all results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

For soils and solids, analytical results are inclusive of stones, where applicable.

Moisture Content Calculated on a Wet Weight basis

Calculations based on mixed zone (M)	600	mm

Maple Way, Donington

Contaminant	Site Data				Expressed as a Factor of Target Guideline Value				Cover Thickness Required for Compliance to Specified Target Guideline Value	
	Contamination of Ground (Cg)	Contamination of Cover (Cc)	Target Guideline Value 1 RESIDENTIAL WITH PLANT	Target Guideline Value 2 REESIDENTIAL RES WITHOUT	Target Guideline Value Soil / 1 RESIDENTIAL WITH PLANT	Target Guideline Value Cover / 1 RESIDENTIAL WITH PLANT	Target Guideline Value Soil / 2 REESIDENTIAL RES WITHOUT	Target Guideline Value Cover / 2 REESIDENTIAL RES WITHOUT	Target Guideline Value 1 RESIDENTIAL WITH PLANT	Target Guideline Value 2 REESIDENTIAL RES WITHOUT
	Units		Units		Fraction				(mm)	
Arsenic	14.9	11	37	39.9	0.4	0.3	0.4	0.3	None	None
Cadmium	0.3	0.9	22.1	149	0.0	0.0	0.0	0.0	None	None
Chromium	28.7	110	14300	16700	0.0	0.0	0.0	0.0	None	None
Chromium (VI)	1	0.5	3.62	3.62	0.3	0.1	0.3	0.1	None	None
Mercury	0.6	1.5	8.81	10	0.1	0.2	0.1	0.2	None	None
Selenium	1	1.2	375	595	0.0	0.0	0.0	0.0	None	None
Copper	33.4	50	4730	9060	0.0	0.0	0.0	0.0	None	None
Nickel	18.3	22	136	188	0.1	0.2	0.1	0.1	None	None
Zinc	101	91	20000	47000	0.0	0.0	0.0	0.0	None	None
Lead	229	63	200	313	1.1	0.3	0.7	0.2	105	None
Boron (Water sol)	1.6	2.1			No TV	No TV	No TV	No TV	No TV	No TV
Sulphate (total)		0.1	0.2	1	No Cg	0.5	No Cg	0.1	No Cg	No Cg
Phenols	0.5	0.1	267	570	0.0	0.0	0.0	0.0	None	None
Sulphide	10	5	250	500	0.0	0.0	0.0	0.0	None	None
Cyanide	1	0.4	34	34	0.0	0.0	0.0	0.0	None	None
Chrysene	7.23	8			No TV	No TV	No TV	No TV	No TV	No TV
dibenzo(a,h)anthracene	0.75	0.1			No TV	No TV	No TV	No TV	No TV	No TV
benzo(a)pyrene	4.33	0.08	4.95	5.34	0.9	0.0	0.8	0.0	None	None
benzo(a)anthracene	8.32	0.5			No TV	No TV	No TV	No TV	No TV	No TV
indeno(1,2,3,cd)pyrene	2.24	0.45			No TV	No TV	No TV	No TV	No TV	No TV
benzo(b)fluoranthene	5.79	0.8			No TV	No TV	No TV	No TV	No TV	No TV
napthalene	0.65	0.02	2.3	2.3	0.3	0.0	0.3	0.0	None	None
TPH ALI C10 - C12	6	1	81.7	81.8	0.1	0.0	0.1	0.0	None	None
TPH ALI C12 - C16	9	1	385	385	0.0	0.0	0.0	0.0	None	None
TPH ARO C5 - C7	0.01	0.01	0.137	0.31	0.1	0.1	0.0	0.0	None	None
Barium		4	110	1340	No Cg	0.0	No Cg	0.0	No Cg	No Cg

Summary		
	Target Guideline Value 1 RESIDENTIAL WITH PLANT	Target Guideline Value 2 REESIDENTIAL RES WITHOUT
Number of contaminants	26	26
Number of contaminants **with no** thickness calculation	8	8
Breakdown - Number for which no TV specfied	6	6
Breakdown - Number for which no soil specified	2	2
Breakdown - Number for which no cover specified	0	0
Breakdown - Number for which cover > TV	0	0
Number of contaminants **with** thickness calculation	18	18
Breakdown - Number for which no cover required	17	18
Breakdown - Number for which cover required	1	0

Overall thickness of cover required	**105**	**0**

Calculations based on mixed zone (M)	600	mm

Maple Way, Donington

Contaminant	Site Data				Expressed as a Factor of Target Guideline Value				Cover Thickness Required for Compliance to Specified Target Guideline Value	
	Contamination of Ground (Cg)	Contamination of Cover (Cc)	Target Guideline Value 1 RESIDENTIAL WITH PLANT	Target Guideline Value 2 REESIDENTIAL RES WITHOUT	Target Guideline Value Soil / 1 RESIDENTIAL WITH PLANT	Target Guideline Value Cover / 1 RESIDENTIAL WITH PLANT	Target Guideline Value Soil / 2 REESIDENTIAL RES WITHOUT	Target Guideline Value Cover / 2 REESIDENTIAL RES WITHOUT	Target Guideline Value 1 RESIDENTIAL WITH PLANT	Target Guideline Value 2 REESIDENTIAL RES WITHOUT
	Units		Units		Fraction				(mm)	
Arsenic	14.9	11	37	39.9	0.4	0.3	0.4	0.3	None	None
Cadmium	0.3	0.9	22.1	149	0.0	0.0	0.0	0.0	None	None
Chromium	28.7	110	14300	16700	0.0	0.0	0.0	0.0	None	None
Chromium (VI)	1	0.5	3.62	3.62	0.3	0.1	0.3	0.1	None	None
Mercury	0.6	1.5	8.81	10	0.1	0.2	0.1	0.2	None	None
Selenium	1	1.2	375	595	0.0	0.0	0.0	0.0	None	None
Copper	33.4	50	4730	9060	0.0	0.0	0.0	0.0	None	None
Nickel	18.3	22	136	188	0.1	0.2	0.1	0.1	None	None
Zinc	101	91	20000	47000	0.0	0.0	0.0	0.0	None	None
Lead	1300	63	200	313	6.5	0.3	4.2	0.2	534	479
Boron (Water sol)	1.6	2.1			No TV	No TV	No TV	No TV	No TV	No TV
Sulphate (total)		0.1	0.2	1	No Cg	0.5	No Cg	0.1	No Cg	No Cg
Phenols	0.5	0.1	267	570	0.0	0.0	0.0	0.0	None	None
Sulphide	10	5	250	500	0.0	0.0	0.0	0.0	None	None
Cyanide	1	0.4	34	34	0.0	0.0	0.0	0.0	None	None
Chrysene	7.23	8			No TV	No TV	No TV	No TV	No TV	No TV
dibenzo(a,h)anthracene	0.75	0.1			No TV	No TV	No TV	No TV	No TV	No TV
benzo(a)pyrene	4.33	0.08	4.95	5.34	0.9	0.0	0.8	0.0	None	None
benzo(a)anthracene	8.32	0.5			No TV	No TV	No TV	No TV	No TV	No TV
indeno(1,2,3,cd)pyrene	2.24	0.45			No TV	No TV	No TV	No TV	No TV	No TV
benzo(b)fluoranthene	5.79	0.8			No TV	No TV	No TV	No TV	No TV	No TV
napthalene	0.65	0.02	2.3	2.3	0.3	0.0	0.3	0.0	None	None
TPH ALI C10 - C12	6	1	81.7	81.8	0.1	0.0	0.1	0.0	None	None
TPH ALI C12 - C16	9	1	385	385	0.0	0.0	0.0	0.0	None	None
TPH ARO C5 - C7	0.01	0.01	0.137	0.31	0.1	0.1	0.0	0.0	None	None
Barium		4	110	1340	No Cg	0.0	No Cg	0.0	No Cg	No Cg

Summary	Target Guideline Value 1 RESIDENTIAL WITH PLANT	Target Guideline Value 2 REESIDENTIAL RES WITHOUT
Number of contaminants	26	26
Number of contaminants **with no** thickness calculation	8	8
Breakdown - Number for which no TV specfied	6	6
Breakdown - Number for which no soil specified	2	2
Breakdown - Number for which no cover specified	0	0
Breakdown - Number for which cover > TV	0	0
Number of contaminants **with** thickness calculation	18	18
Breakdown - Number for which no cover required	17	17
Breakdown - Number for which cover required	1	1

Overall thickness of cover required	**534**	**0**