REPORT C6397/01
MAY 2015

REMEDIATION STRATEGY

for land adjacent to
MANCHESTER ROAD, HAPTON, BURNLEY

prepared for
GLEESON HOMES
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STRATEGY FOR REMEDIAL AND PREPARATORY WORKS

for land adjacent to

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HAPTON, BURNLEY

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<th>Scale</th>
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<td>Site Location Plan</td>
<td>1:25,000</td>
</tr>
<tr>
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<td>Site Features Plan showing Exploratory Hole Locations</td>
<td>1:500</td>
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<tr>
<td>C6397/01/03</td>
<td>Constraints Plan</td>
<td>1:500</td>
</tr>
<tr>
<td>2561-0-001B</td>
<td>Schematic Site Layout, produced by Niemen Architects, dated December 2012</td>
<td>1:500 @ A1</td>
</tr>
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1. INTRODUCTION

Sirius was commissioned by Gleeson Homes (Gleeson), to produce a Strategy for Remedial and Preparatory Works required to facilitate development of land adjacent to Manchester Road, Hapton, Burnley (the “site”).

It is understood that Gleeson are proposing to acquire the site for redevelopment as a residential end use, comprising 202 low rise houses with private gardens, associated areas of hardstanding and access roads. A sketch proposed development layout plan has been provided to Sirius by Gleeson (produced from Niemen Architects, Drawing No. 2561-0-001B, dated December 2012), and is included in Appendix A.

This report refers to a larger site area, referred to as the investigation area, which comprises three distinct zones. For the purposes of this report, the three zones have been designated as the ‘proposed development area’ (i.e. the “site” proposed for purchase), the ‘landfill area’, and the ‘greenbelt area’. The landfill and greenbelt areas are to remain as undeveloped adopted green belt, and remain outside of the “site” proposed for purchase.

Proposed foundations are likely to comprise a combination of options such as strips / trench fill / piles etc. or undertaking ground improvement by vibro-stone columns to allow shallow foundations, subject to depths of made ground, final development levels, tree influence and the potential for shallow mineworkings.

The site has been subject to previous assessments and investigation as detailed below:

- William Blythe, Chemical Factory, Hapton, Phase 1 Environmental Review, Report Ref. 10681R01-(00), by RSK ENSR, dated 17th November 2004, for William Blythe Ltd (the Phase 1 report includes a review of previous reports for the site, including Site Investigation Report, Geotechnical Services Unit, Sheffield City Council, Church and Hapton, Accrington, dated June 1993 (DHV Burrow-Corker Consulting), and Risk Assessment of Existing Landfill Site at William Blythe Works, Church by Bullen Consultants, dated October 1996. The previous reports were not appended to the 2004 RSK desk study).

- Site Investigation, William Blythe Chemical Works, Hapton, Burnley, Report Ref. 10777R1-(01) by RSK ENSR, dated 13th July 2005, for Elite Homes (North) Limited.

- Landfill Restoration, William Blythe Chemical Works, Hapton, Lancashire, Report Ref. 10777R02-(05) by RSK ENSR, dated 9th February 2007, for Yule Catto Plc.
• Revised Geo-Environmental Site Assessment, Manufacturing Area, Former William Blythe Works, Hapton, Report Ref. 16510-R1-(00) by RSK Environment Limited, dated November 2011, for Yule Catto & Co. Plc.


The documents above are the principal sources of information used in the preparation of this Remediation Strategy. These documents should be read in conjunction with this report. This document summarises the works undertaken to date and details the further reclamation works required to provide a site considered suitable for low rise residential development.

The main aims of this Remediation Strategy are summarised as follows:

• To enable the ground at the site to be prepared to a condition ready for development and which is suitable for the proposed end use (residential properties with gardens, POS and associated infrastructure) whilst ensuring construction workers and environmental receptors are not put at an unacceptable short term risk during the remediation and redevelopment of the site; and

• To satisfy the Local Planning Authority Environmental Health Department and National House Building Council (NHBC), or other insurer, that the remediated site will provide a site ready and suitable for the proposed development.

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2. SITE DETAILS AND DESCRIPTION

2.1. Site Overview

Table 2.1  Current Site Overview

<table>
<thead>
<tr>
<th>Location</th>
<th>The site is located off Manchester Road, Hapton approximately 6km to the west of Burnley town centre. A site location plan is included as Drawing No. C6397/01/01 within Appendix A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Grid Reference</td>
<td>379670E, 432110N.</td>
</tr>
<tr>
<td>Topography and Features</td>
<td>The area of investigation is irregular in shape, and comprises three distinct zones. For the purposes of this report, the three zones are designated as the ‘proposed development area’, the ‘landfill area’, and the ‘greenbelt area’. Each zone is described separately below, with the extents of each area approximated on Drawing No. C6397/01/02. The landfill and greenbelt areas are outside of the proposed purchase and development area. Proposed Development Area (i.e. Site Proposed for Purchase) The area proposed for development formerly comprised a historical chemical works, and is located within the south and southwest of the site. The works has recently been demolished and cleared, leaving a surface covering of concrete and tarmacadam hardstand / granular sub-base and rough overgrown grassed / vegetated ground. The northern and northwestern area of the development zone comprises overgrown mature / semi-mature trees, bushes and shrubbery. Site levels fall by approximately 7m from south to north within the west of the development area, tying into adjacent ground levels along Manchester Road to the west, whilst levels within the east of the development area are generally flat. The difference in levels indicates that cut and fill operations may have historically been undertaken to form a plateau development platform centrally and within the east of the site. Former tarmacked access roads remain in-situ within the development area. A brick built above ground structure is located within the south of the site, forming an access point to a culverted stream (Shaw Brook) passing beneath the site, flowing northwards. The southern boundary of the proposed development area is formed by a stone-built retaining wall, retaining the adjacent Leeds-Liverpool Canal. The canal</td>
</tr>
</tbody>
</table>
towpath is generally level with the site, with the exception of the southern area, where the site is approximately 2m lower than the canal level. The stone wall appears to be locally in disrepair.

Landfill Area

The former works landfill is located within the east and northeast of the site, and comprises undeveloped, partly vegetated land which rises steeply (up to 1V:2H / 26°) centrally, forming a large embankment approximately 10m high. A drainage ditch is located at the base of the mound, draining into a lagoon constructed within the northeast of the landfill area.

Overhead pylons cross the landfill area, orientated in an approximate northwest-southeast direction.

The landfill has recently undergone restoration, with several areas of saplings evident. The reprofiling works were undertaken in 2011, and comprised landfill waste being placed in layers and proof rolled to avoid voids and subsequent settlement. A clay cut off wall was installed along the southern and western elevations of the landfill in order to isolate the landfill mass from adjacent areas, and prevent the lateral migration of mobile contaminants and ground gases from the landfill to the proposed development area / off-site. The trench for the cut off wall was excavated into natural clays along the western and southern boundaries.

Following reprofiling of the landfill material, imported materials were added to achieve a 1.0m thick capping layer. The cap comprised a 0.5m thick low permeability clay layer, overlain by a 0.35m thick gravel drainage layer and a 0.15m thick subsoil layer. Additional subsoil and topsoil was reported to be added in areas proposed for tree planting.

Surface water management ditches were reinstated for the restored landfill, comprising clay lined ‘v’-ditches that intercept surface water runoff. New drainage systems were constructed to take landfill runoff and leachate off site to foul sewer.

Following restoration of the landfill, landscaping works were reported to have been undertaken to provide both stabilisation of the landfill profile through root-binding, and to satisfy planning conditions relating to landscaping, ecology and bio-diversity.

Environmental monitoring is on-going to date, at agreed frequencies. All monitoring data is to be documented by the landfill license holder (i.e. the land owner, William Blythe, part of Synthomer Plc) and presented to the Environment
Agency (EA) in the form of an annual report. The license holder has responsibility for the maintenance of the stability of the landfill slopes and the monitoring of the degree of settlement taking place.

Greenbelt Area

The greenbelt area is located within the north of the site, and comprises undeveloped, partly vegetated roughly grassed land. A tarmacked access road is located centrally within the greenbelt area, orientated approximately north-south. Evidence of former development is apparent within the northern most area of the site, with indications of historical stone structures. An electricity substation is located within the northwestern corner of the greenbelt zone, adjacent to Manchester Road.

Shaw Brook is located at ground level centrally within the greenbelt zone, issuing out of culvert from the central and southeastern area of the greenbelt area and flowing north

<table>
<thead>
<tr>
<th>Approximate Site Area</th>
<th>Proposed development area approx. 5.7 hectares.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Boundaries</td>
<td>The site is bounded by the Leeds-Liverpool canal to the south, beyond which is the M65 motorway. Manchester Road forms the site’s western boundary. The northern and eastern site boundaries are formed by undeveloped vegetated / agricultural land.</td>
</tr>
<tr>
<td>Current Land Use</td>
<td>Disused.</td>
</tr>
<tr>
<td>Adjacent Land Uses</td>
<td>Residential and agricultural.</td>
</tr>
</tbody>
</table>

The main site features are shown on Drawing No. C6397/01/02 within Appendix A.

2.2. Historical Development

The proposed development area was formerly developed as Hapton Chemical Works since the mid 1800’s, which was subsequently demolished and cleared in approximately 2010. The landfill located to the east of the proposed development area was used for associated disposal of wastes generated from the works. The landfill has recently undergone closure and restoration (in approximately 2012).

Although not shown on historical plans, a mine shaft is inferred to be located within the southwest of the proposed development area.
2.3. Recorded Geology

Table 2.2 Geological Summary

| Sources of Information | BGS 1:10,000 scale geological map (Sheet SD73SE).  
|                        | BGS 1:50,000 scale geological map (Sheet 76 - Rochdale).  
| Made Ground            | An area of made ground is shown within the eastern area of the site, associated with the recorded landfill.  |
| Drift Geology          | The majority of the site is shown to be underlain by Glacial Till deposits. No drift deposits are shown to underlie the most western corner of the site however.  |
| Solid Geology          | The underlying bedrock is shown to comprise Carboniferous Lower Coal Measures (LCM) strata, principally comprising Dandy Rock (sandstone). Undifferentiated LCM strata are conjectured to crop out within the southeastern most corner of the site.  
|                        | The Arley Mine coal seam is conjectured to crop out approximately 100m to the south of the site, orientated northeast-southwest, dipping to the northwest below the site. The Arley Mine seam is recorded at an approximate thickness of between 4-5 feet (approx. 1.5m).  |
| Mining and Quarrying   | Recorded Coal Mining:  
|                        | “The property is in the likely zone of influence from workings in 2 seams of coal at 220m to 280m depth, the last date of working being 1956. Ground movement from the above mentioned past coal workings should by now have ceased. In addition, you may wish to know that the property is in an area where coal is believed to exist at or close to the surface that may have been worked at some time in the past.”  
|                        | “Within or within 20 metres of the property, there is 1 mine entry, the approximate position of which is shown on the attached plan. We have no record of what steps, if any, have been taken to treat the mine entry.”  
|                        | Quarrying:  
|                        | The historical OS maps do not indicate the presence of quarrying on site, although earthworks associated with the former landfill were undertaken.  |
2.4. Hydrology and Hydrogeology

The nearest EA GQA Classified watercourse is the Leeds-Liverpool Canal located to the south of the site. The Leeds-Liverpool Canal is classified as River Quality C. Shaw Brook (partly culverted) and drainage features are located within the site. Shaw Brook is classified as a Secondary River. A lagoon is located in the northeast of the landfill area, which is assumed to be associated with drainage from the on-site landfill.

The solid geology underlying the site is classified as a Secondary A Aquifer. The superficial deposits (glacial till) are classified as unproductive strata.

There are six surface water abstraction licenses within 1km of the site. The three closest surface water abstractions are located 480m to the southwest, operated by William Blythe Ltd. The abstractions are used for industrial / commercial purposes (including general cooling / process water). One groundwater abstraction licence is recorded to be located within 1km. The groundwater abstraction licence is recorded 939m to the north, for industrial purposes.

A spring was recorded within the site on OS maps dated between approximately 1931 and 1978, close to the Shaw Brook culvert portal.

The site is not indicated within the Envirocheck report as being within indicative Zone 2 (extreme flooding from river or sea without defences) or Zone 3 (flooding from river or sea without defences) floodplains.

2.5. Landfilling and Waste Management

Two registered landfill sites are recorded to be located on site (i.e. within the currently designated 'landfill' area), registered to William Blythe and Co. Ltd. One landfill record located on site is dated from August 1993, and classified as ‘small’ (between 10,000 and 25,000 tonnes of waste per year). The second record is dated September 1977, with an ‘undefined’ maximum input rate.

In reality, the landfill has received industrial wastes from Hapton Chemical Works, since the late 1800s and early waste deposition is unlikely to have been subject to any specific controls. The landfill on site is understood to have been closed and restored, to an approved restoration specification in approximately 2012.
2.6. Other

A number of potentially contaminative activities or environmental constraints are listed which relate to activities located on site. These include a Control of Major Accident Hazards (COMAH) site, a Notification of Installations Handling Hazardous Substances (NIHHS) facility and three planning hazardous substance consents. Given that that site has now been cleared of all historical features associated with the chemical works, the recorded activities / consents are assumed to now be inactive.

2.7. Previous Site Investigations

Several previous phases of site investigation / assessments have been undertaken at the site by DHV Burrow-Corker Consulting, Bullen Consultants, RSK Environment Limited (RSK) and Sirius. The previous reports were summarised and updated in accordance with current guidance within the Sirius report (ref. C6397 RevA), dated May 2015.

The most salient points of the investigations / works undertaken to date, are summarised below.

**July 2005:**

- A site investigation was carried out by RSK on behalf of Elite Homes (North) Limited and reported in July 2005. The investigation was undertaken whilst the chemical works remained operational, and covered the existing proposed development area, the current greenbelt area and the currently designated 'landfill' area. The client proposed to redevelop the site for a residential end use with public open space.

  Site investigation work was carried out between 10th and 27th May 2005, comprising the mechanical excavation of eighteen trial pits (TP1 to TP18), twenty-nine window sample boreholes (PH1 to PH29), and five cable percussion boreholes (BH1 to BH5). Gas and groundwater monitoring wells were installed within eight of the window sample boreholes and all five cable percussion boreholes. Gas monitoring was undertaken on three occasions between May and June 2005.

  Based on the findings of the investigation, RSK recommended a number of remediation measures, including remediation of the landfill area, the manufacturing area and the greenbelt area.

**October 2014:**
RSK were commissioned by Yule Catto and Co. Plc (later named as Synthomer Plc) to design and validate works at the site to close and restore the recorded landfill. The works were undertaken by Buckingham Group Contracting between February 2011 and August 2012, and was reported within the Landfill Restoration Verification Report - Volume 1, Ref. 16628-R01(01) by RSK in October 2014.

The verification report represents the CQA certification for the landfill restoration, and is recommended to be read in conjunction with the Landfill Closure Report Ref. 16628-R02(02) by RSK, dated October 2014 (as detailed further below).

In summary, the restoration works were recorded to include the following:

- Re-profiling of the landfill site by cut and fill;
- Installation of a low permeability cut-off wall at the western end of the landfill;
- Placement of a low permeability mineral capping layer (comprising imported clay), drainage layer (comprising granular material) and restoration layer (subsoil, and in areas of proposed tree planting, topsoil);
- Upgrading of the existing run-off and leachate drainage system; and,
- Addition of hydro-seed in the final soil horizon / planting of trees.

Validation of the restoration works was undertaken by RSK by means of the following works:

- Chemical and geotechnical laboratory testing of import materials;
- Compaction trials for proposed clay layer; and,
- Validation trial pits and surveys of clay and drainage / restoration layers.

In addition to the validation works summarised above, RSK undertook environmental monitoring during the restoration phase of the works to confirm no adverse environmental impacts. These included the following:

- Leachate monitoring;
- Surface water monitoring;
- Groundwater monitoring; and,
- Dust and noise monitoring.
In order to support the closure of the landfill, RSK also prepared a separate Landfill Closure report (dated October 2014), which provided long term information regarding environmental monitoring and assessment of the landfill and capping system.

It is understood that environmental monitoring is ongoing to date, at agreed frequencies (quarterly for gas, leachate and groundwater monitoring, and every 6 months for surface water monitoring). All monitoring data is to be documented by the license holder, and is proposed to be presented to the Environment Agency (EA) in the form of an annual report. Any exceedances of agreed ‘trigger’ concentrations established for gas and groundwater, together with proposed actions for further investigation or remediation is proposed to be communicated immediately to the EA.

RSK report that the license holder has responsibility for the maintenance of the stability of the landfill slopes and the monitoring of the degree of settlement taking place. This is reported by RSK to be undertaken by means of topographic surveys and visual assessments undertaken annually.

May 2015:

- Sirius were commissioned by Gleeson Homes to undertake an updated geoenvironmental appraisal of the site. The works were intended to provide an updated summary and reassessment of previous site investigations undertaken at the site, and to undertake further targeted investigations of both shallow ground and groundwater conditions, and the potential for shallow mine workings within the area of proposed development.

Fieldwork was undertaken by Sirius in two phases between 6th and 9th August 2013, and between 1st and 3rd October 2014, and comprised the excavation of 11 trial pits (reference S.TP1 to S.TP11) to a maximum depth of 4.20m bgl, and the drilling of 25 open rotary boreholes (reference RH1 to RH12 and RH100 to RH112) to a maximum depth of 30.0m bgl. Gas and groundwater monitoring wells were installed within fourteen selected open rotary boreholes.

Selected samples of groundwater and surface water were sampled and tested by Sirius for a range of potential contaminants.

The two phases of investigation were intended to supplement the previous intrusive investigation works undertaken by RSK, following demolition and clearance of the site thereby allowing unrestricted access.
A combined exploratory hole location is included as Drawing No. C6397/01/02 within Appendix A of this report.

2.8. Proven Ground Conditions

Proposed Development Area

Topsoil and/or made ground was recorded across the proposed development area, recorded to depths of between 0.20m and 6.00m, generally deepening towards the northeast and east. Granular made ground appeared to predominate across the area. Granular made ground appeared to predominate across the area, typically comprising grey-brown sandy gravel and cobbles with fragments of clinker, brick, concrete, sandstone, wood, metal and ash, with occasional slag noted (also described partly as ‘boiler slag’ by RSK). Cohesive made ground soils were recorded to comprise soft to firm orange-grey-brown sandy gravelly clays and silts with cobbles/fragments of brick, clinker, sandstone, metal and occasional slag.

Frequent brick, concrete and sandstone sub-structures/obstructions were encountered within the made ground soils.

Cohesive glacial till deposits were recorded underlying the made ground soils across the proposed development area, generally comprising firm to stiff red-brown-grey sandy gravelly clays, in turn underlain by Lower Coal Measures bedrock (mudstones and sandstones) identified at depths of between approximately 10.5m and 27.5m bgl. The Arley Mine coal seam and/or associated mineworkings were identified underlying the proposed development area at depths of between 16.3m and 27.1m bgl.

Greenbelt Area

Topsoil (locally reworked) was recorded across the majority of the greenbelt area of the site, to depths of between 0.10m and 0.40m bgl. Localised made ground was recorded to underlie the topsoil in TP3, recorded to a depth of 0.25m bgl. Topsoil and/or made ground soils were recorded to be underlain by cohesive glacial till deposits, comprising firm to stiff grey clay with occasional gravels, cobbles and boulders.

Landfill Area

Made ground was recorded at ground level to depths of between 4.80m and 10.50m bgl across the landfill area as part of the 2005 RSK site investigation. Many of the exploratory holes terminated within made ground soils therefore not proving its thickness.
Glacial till deposits comprising both cohesive and granular soils were recorded to underlie the made ground soils, proven to a maximum depth of 30.70m bgl.

Since the completion of the 2005 site investigation, the landfill has undergone restoration, as detailed further in Section 2.7 above. Surface covering of the landfill is now reported to comprise a combination of a low permeability mineral capping layer (comprising imported clay), a granular drainage layer, and a restoration layer (comprising subsoil and topsoil).

2.9. Contamination Considerations

Proposed Development Area

Localised marginally elevated concentrations of 1,2,4-trimethylbenzene identified within made ground encountered within PH11 (at a depth of 2.80m bgl) pose a potential risk to proposed end users via ingestion, inhalation and dermal contact. In addition, localised evidence of residual free-phase hydrocarbons were identified in exploratory hole locations PH8 and (Sirius trial pit) TP5 (at depths of 1.0m and 2.8m bgl respectively), which are considered as unsuitable to remain within the area of proposed development.

In addition, both granular and cohesive made ground within the proposed development area has been found to contain significantly elevated concentrations of heavy metals, pH, PAH’s, and locally possible asbestos containing materials (ACMs). Additionally, natural shallow soils have been found to be impacted by elevated concentrations of arsenic.

The results of shallow groundwater testing within the proposed development area indicate elevated concentrations of heavy metals, ammonia, sulphates and localised organic compounds, whilst the results of ‘deep’ groundwater testing have revealed elevated concentrations of ammonia, sulphate and arsenic.

Greenbelt Area

Localised made ground and natural shallow soils across the greenbelt area have been found to contain elevated concentrations of arsenic.

The greenbelt area of the site currently comprises existing landscaping / POS which is understood to be retained as part of the development proposals. Assuming this area remains outside of any earthworks operation, and will remain undisturbed / undeveloped within the future, the undertaking of any remedial works could be omitted, subject to regulatory approval, given that the impact to existing vegetation could be significant and potentially detrimental.
It is assumed that the existing sub-station located within the greenbelt area will remain in-situ as part of the development proposals.

**Landfill Area**

The landfill has been restored and capped in approximately 2012, with all capping materials being chemically tested and validated prior to placement by RSK. Leachate and shallow perched groundwater is reportedly drained and sent to foul sewer. On this basis, the risk to site end users is currently considered to be low, requiring no further action. Environmental monitoring (including gas, leachate, surface water and ‘deep’ groundwater monitoring) and assessment of the landfill is on-going by the license holder, reporting directly to the EA.

As such, the landfill area will not undergo any form of remedial / earthworks (other than anything agreed between the license holder and the EA).

**2.10. Hazardous Ground Gas**

In accordance with CIRIA Report C665 ‘Assessing Risks Posed by Hazardous Ground Gas to Buildings’, the proposed development area has been assessed under Situation B for ‘low-rise housing with a ventilated underfloor void (min 150mm)’ end-use. The proposed development area is considered representative of ‘Green’ conditions using the NHBC traffic light system, indicating that no gas precaution measures are necessary.

Radon protection measures are not required for the proposed development on this site.
3. REMEDIATION STRATEGY AND OBJECTIVES

It should be noted that the landfill has been recently restored and capped, indicating that the risks to human health are considered to be low. The landfill drainage has been restored and updated as part of the restoration works, so that leachate associated with the landfill is collected and drained directly to foul sewer. Additionally there is a cut off trench along the western and southern boundaries of the landfill, meaning that the proposed development area is protected from lateral migration of any impacted shallow groundwater. On this basis, the potential risk to the proposed development from contaminated water sourced from the landfill is also considered to be low.

On-going environmental monitoring within the landfill area will continue by the landfill license holder (i.e. William Blythe (part of Synthomer Plc) with all monitoring data to be documented, and presented to the EA in the form of an annual report. Any exceedances of agreed ‘trigger’ concentrations established for gas and groundwater, together with proposed actions for further investigation or remediation is proposed to be communicated immediately to the EA. In the unlikely event that the landfill becomes orphaned, the EA commonly take responsibility for any on-going maintenance.

The primary objective of the remediation works is to render the proposed development area suitable for residential development whilst mitigating the transient and long term risks to receptors including human health and the environment from chemical contaminants within soils and groundwater at the site. In brief, this will be achieved by the remedial earthworks and provision of a clean cover system as described herein.

The main requirements of the remediation works are given below in the approximate sequence of works. Pertinent elements of the works are discussed in greater detail in subsequent sections of this document.

- Service location disconnection and/or protection.
- The presence or absence of invasive plant species should be confirmed by a qualified consultant and their advice taken on appropriate treatment if necessary.
- Erection of temporary tree protection fencing for any retained trees.
- Removal of remaining existing vegetation (trees / bushes etc.) from the proposed development area necessary to facilitate the works.
• Investigation and treatment of the recorded mine shaft in accordance with the Sirius specification for the treatment of shallow mineworkings (included as Appendix C of this report).

• Localised treatment and further investigation of shallow coal mineworkings within the Arley Mine coal seam, in accordance with the Sirius specification for the treatment of shallow mineworkings (included as Appendix C of this report).

• Safe demolition / breaking out of remaining above ground structures, remnant slabs and areas of hardstanding within the proposed development area.

• Excavate made ground to a typical depth of 2.5m below existing or proposed levels, whichever is deeper within the proposed development area, and breakout relic foundations, substructures and below ground obstructions, in addition to any gross contamination encountered, and stockpile on site for further classification and / or treatment.

• Where possible and practical, on site crushing, screening and classification of all suitable materials won from the above works, to provide fills suitable for re-use. Alternatively such materials to be removed off-site for possible processing and re-use elsewhere.

• Reprofile site to produce desired finished ground levels, re-engineering suitable fill materials back into place in accordance with the requirements of the Sirius Specification for Engineered Fills (included within Appendix B of this report) to the proposed development levels. This strategy assumes that foundations will extend below any fill / made ground and placed within natural soils of suitable bearing capacity.

• Where applicable, removal or relocation to suitable areas (i.e. non-structural), any material which fails to achieve the requirements set out within the Sirius specification for engineered fills for re-use.

• On site treatment and / or removal (where required) from site of identified hydrocarbon hotspots, in addition to any other previously unrecorded grossly contaminated soils and groundwater encountered with the potential to pose a significant risk to site end users and / or controlled waters.

• Localised groundwater treatment (where required), in accordance with site specific clean up criteria.
• Following re-profiling of the site and prior to placement of the full clean cover system, placement of a minimum 100mm cover of clean soils at ground surface where asbestos impacted made ground soils remain.

• Undertake all geotechnical and chemical testing as required throughout the remedial earthworks.

• Carry out a watching brief during all of the above, to identify any previously unidentified sources of contamination.

• A validation report produced by a suitably qualified geoenvironmental engineer on completion of the works. This initial report will provide a record of the remediation works including the results of testing to demonstrate the integrity of the work and confirm the work has been carried out in accordance with the relevant legislation, the remediation specification and planning conditions.

The scope of works above may have to be amended to suit final design levels, adoptable highway design/ construction and the implementation of any designed retaining structures.

Subsequent to the above works, additional phases of remedial works will be required to ensure that the site is suitable for re-use. These are:

• Where made ground soils are present, placement of a minimum 1000mm of “clean” cover in areas proposed for private gardens and soft landscaping across the proposed development area (comprising suitable topsoil and subsoil). Given the assumed presence of ACMs within the made ground, a dense granular ‘no dig’ layer (of at least 100mm thickness) to be incorporated into the clean cover system within all areas of gardens / soft landscaping. This will also act as a capillary break layer.

• Where natural soils are present, placement of a minimum 600mm of “clean” cover in areas proposed for private gardens and soft landscaping across the proposed development area (comprising suitable topsoil and subsoil). The requirement for a capping system where natural soils are present may be negated, subject to further sampling and the findings of bio-accessible arsenic testing. This would be subject to regulatory consultation.

• Construction of clean cover soil capping layer and no dig/ capillary break layer to be validated on completion by a suitably qualified geoenvironmental engineer. Thickness of
the capping layer should be validated physically on site, and a programme of laboratory testing will be implemented to confirm chemical suitability.

Additional reports will be produced by a suitably qualified geoenvironmental engineer as gardens/landscaped areas are completed/validated.
4. GEOENVIRONMENTAL ENGINEER

A suitably experienced and qualified Geoenvironmental Engineer (GE) will be appointed for the works, to supervise and advise on relevant matters.

The GE shall attend site as required to ensure that the requirements of this strategy are complied with. The responsibilities of the GE shall include, but not be limited to, the following:

- Liaison with the client and statutory bodies in relation to the remedial and ground preparatory works;
- Supervision and quality control of the remedial and ground preparatory works;
- Advice on the correct handling of materials and conditions encountered;
- Supervision of soil sampling as required under the Remediation Strategy;
- Implementation of contingency measures if unexpected contamination is found during the works; and
- Review of site records and test results as they become available and make comment and act upon those results accordingly.
5. CONSTRAINTS TO DEVELOPMENT

5.1. Proven On-site Contamination (Proposed Development Area)

Hydrocarbon Contamination

Hydrocarbon contaminated material identified (principally within PH8, PH11 and Sirius TP5, as shown on Drawing No. C6397/01/03, included within Appendix A of this report) should be excavated and subjected either to on-site treatment or be removed for off-site treatment or disposal at a suitably licensed landfill facility.

It is recommended that an experienced geoenvironmental engineer be in attendance during excavation and removal of contaminated soils. Following removal of any hydrocarbon impacted soils encountered, and prior to any infilling works, validation samples for chemical analysis shall be taken by the GE from the exposed surfaces (i.e. base and sidewalls) on a nominal 5m grid (with at least 1 sample per side wall / base) to confirm that all potentially hazardous hydrocarbon contamination has been removed. Samples shall be tested for speciated TPH, VOC's, PAHs and BTEX / MTBE at a UKAS and MCERTS accredited laboratory, and the results compared to the appropriate Stage 1 GACs listed in the tables in Appendix E of this strategy. Analysis for other determinands may be appropriate and should be undertaken as necessary.

If the referenced GACs are exceeded then additional soils should be removed and further validation samples recovered. This shall be an iterative process until validation test results fall below the GACs across the entire face and base of the excavation. If soil / incidental perched groundwater removal is viewed as excessive by volume / cost, then detailed quantitative risk assessment could be undertaken to derive site specific target levels for the contaminants of concern.

Any incidental groundwater encountered whilst removing hydrocarbon hotspots in soils, exhibiting significantly elevated concentrations of TPH or free product, should be removed/treated.

Asbestos

Asbestos containing materials were visually identified locally within the made ground in the proposed development area (principally within Sirius trial pit TP8 at a depth of between 0.2m and 2.5m bgl as shown on Drawing No. C6397/01/03, included within Appendix A of this report). This should not pose a risk to end users, if left undisturbed and covered by hardstanding. However, if it
is to be disturbed and/or is located within a proposed area of soft landscaping, then it is recommended that appropriate remedial measures are adopted.

The possibility of asbestos sheeting, used as shuttering, and/or further fragments of asbestos-containing materials within made ground or fill materials beneath concrete slabs cannot be discounted. If encountered, advice should be sought from an appropriately qualified asbestos specialist and an appropriate strategy developed for the safe removal/disposal of the material.

Construction workers involved in the groundworks and demolition/construction during the site redevelopment are at high risk from exposure to asbestos-contaminated soils given their more intensive exposure. These risks can be reduced by appropriate PPE and hygiene precautions and good working practices. Similarly, during earthworks (i.e. excavation, sorting and placement of potentially asbestos impacted fill) and construction of foundations (more specifically piles and/or vibro stone columns) all reasonable measures, which may include the wetting of the impacted material, air monitoring etc., should be put in place in order to minimise, as far as practicable, the release of asbestos fibres.

All groundworkers who could potentially come into contact with such materials shall be required to submit appropriate method statements and risk assessments clearly stating how any such risks will be addressed, and they shall be prevented from carrying out any works until such documents are approved by the CDM coordinator.

Appropriate remedial measures should be taken to hand pick any visual evidence of ACMs (if observed) within exposed made ground soils. Sampling and chemical testing for asbestos containing materials within made ground soils during enabling works is recommended to be undertaken.

Following completion of earthworks, a minimum 100mm sacrificial layer of clean subsoil should be placed at the surface within areas where asbestos impacted made ground is present. This sacrificial layer would prevent air borne asbestos fibres posing a risk to construction workers and adjacent site users during the construction phase and prior to the placement of the final capping layer.

Groundwater

The identified concentrations of heavy metals (in particular, arsenic), sulphates and ammonia within groundwater are considered to pose a risk to off-site controlled waters, albeit a potential theoretical risk, given that no evidence of significant contamination has been identified within the
historically undeveloped northern area of the proposed development area, or within the samples taken from Shaw Brook. It is considered unlikely to present any significant risk, however, as a confirmatory measure it is recommended that a detailed quantitative controlled waters risk assessment (DQRA) be undertaken. The DQRA would identify principal risk drivers and assess the risk to off-site controlled waters, in addition to deriving site specific remedial target concentrations for principal risk drivers in groundwater, should localised groundwater treatment be considered necessary.

A watching brief is recommended during the enabling works to assess the potential for significant sources of contamination which may be impacting groundwater quality.

**General**

Both granular and cohesive made ground at the site has been found to contain elevated concentrations of heavy metals, pH, PAH’s, and locally ACMs. Additionally, natural shallow soils have been found to be impacted by elevated concentrations of arsenic.

It is recommended that a minimum 1000mm of “clean” cover be assumed in areas proposed for private gardens and soft landscaping across the proposed development area (comprising suitable topsoil and subsoil) where made ground soils are present (reducing to 600mm thickness of clean cover where natural soils are present). In addition, given the assumed presence of ACMs within the made ground, it is considered that the clean cover system should incorporate a dense granular ‘no dig’ capillary breaklayer, where made ground is present. Deep rooted plants would need to be “potted”. The design of the capping layer is subject to regulatory consultation.

Given the historical site uses and the potential for associated contamination, vigilance should be maintained during site clearance and enabling / construction works for currently unknown hotspots of hydrocarbon contamination. It is also likely that other areas of contamination will be encountered, associated with the former chemical works. If any areas of noxious, odorous, brightly coloured, fibrous, liquid or other suspect contamination are encountered (other than those detailed within this report), then these are to be reported and advice should be sought from a suitably qualified consultant.

**5.2. Invasive Plants**

No evidence of invasive plants was observed by the geoenvironmental engineer at the time of the fieldworks within the proposed development area. A horticultural survey should be carried out to confirm if any invasive plant species are present on site.
5.3. Shallow Coal Mineworkings

The ground investigation works undertaken to date has confirmed that the Arley Mine coal seam and/or workings associated with the seam lie below the site at depths of between 16.3m and 27.1m bgl, at recorded thicknesses of between 0.40m and 1.50m (or a maximum combined thickness of 2.00m, where a spilt seam was identified). The Arley Mine coal seam has been proven to be worked beneath the southwest of the site (identified as ‘broken ground’ within rotary boreholes RH1, RH2 and RH3 at a maximum recorded thickness of 2.20m).

Although the Arley Mine coal seam is within influencing depth beneath the proposed development area, mine workings have been identified locally within the southwestern area of the site only. As such, mine workings stabilisation is recommended in this zone where mine workings have been identified and are within influencing distance of the surface. Mine stabilisation works will then proceed across the remainder of the proposed development area on an exploratory basis.

Investigation and treatment shall be undertaken in accordance with the Sirius specification for the treatment of shallow mineworkings (included as Appendix C).

5.4. Mine Entry

Information provided by the Coal Authority indicates the presence of a mine entry adjacent to the site boundary within the southwest. There are no details with regards to any mine shaft treatment.

If within the site, the inferred mine shaft feature requires locating with confirmation of depth, dimensions, construction and backfill details, in order to devise an appropriate treatment methodology. Attempting to locate the shaft should proceed with care due to implications of the stability of the adjacent canal. Investigation and treatment of the mine shaft shall be undertaken in accordance with the Sirius specification for the treatment of shallow mineworkings (included as Appendix C).

The location of the inferred mine shaft is shown on Drawing No. C6397/01/03, included within Appendix A of this report.

During remedial works observations should be made of all excavations for evidence of any unrecorded mine entries / bell pitting / shallow crop workings. If any disturbed ground is suspected, advice regarding treatment / foundation precautions should be sought from a suitably qualified engineer.
5.5. Shaw Brook / Culvert

It is recommended that the exact course of the culverted Shaw Brook is ascertained, and development layout proposals take the course of this feature and any associated wayleaves into account. A structural survey of the culvert should be undertaken by a suitably qualified and experienced engineer.

5.6. Existing Retaining Wall

It is assumed that as part of the proposed redevelopment of the site the existing stone retaining wall located along the southern boundary will be kept and incorporated into the proposed development. It is recommended that a detailed structural assessment of the retaining wall be undertaken, within context of proposed development levels and foundation loads.

During the enabling works/foundation construction, control measures may have to be put in place in order to prevent the potential undermining/damage of the retaining wall.

5.7. Landfill Area

The landfill area is located to the east of the proposed development area, and has undergone closure and restoration under licence and to the satisfaction of the EA. The landfill license holder has a long-term requirement to manage and monitor the landfill, reporting directly to the EA. On this basis, no additional specific remedial works are considered necessary within the site due to the presence of the landfill.

5.8. Greenbelt Area

The greenbelt area of the site currently comprises existing landscaping / POS which is understood to be retained as part of the development proposals. Assuming this area remains outside of any earthworks operation, and will remain undisturbed / undeveloped within the future; the undertaking of any remedial works could be omitted, subject to regulatory approval, given that the impact to existing vegetation could be significant and potentially detrimental.
6. PREPARATORY WORKS

6.1. Tree Protection

Trees to be retained should be identified prior to works commencing. The trees should be protected by means of a robust fence (herras fencing) to avoid accidental impact damage and prevent excavation within the root zone.

6.2. Site Clearance

Following the construction of the tree protection, all remaining vegetation shall be stripped/cleared and stockpiled on site for re-use (where applicable) or subsequent removal from site. Any general debris shall be cleared and placed in skips for off-site disposal.

6.3. Topsoil Strip

The limited topsoils at the site should be considered unsuitable for re-use at this stage, subject to further chemical testing and assessment. If considered chemically suitable for use, such soils should be screened if necessary and carefully stockpiled at an agreed quarantined area, for future re-use. The topsoil should be suitably sheeted to avoid any potential future cross contamination.
7. **EARTHWORKS**

7.1. **General Requirements**

Earthworks shall be undertaken in accordance with the Sirius Specification for Engineered Fills presented in Appendix B of this Strategy. Method Compaction shall be used generally for granular general fill. Cohesive general fill shall be compacted in accordance with an end product specification. Any deviation from this shall be subject to the approval of the GE.

7.2. **Grubbing up of Slabs/Hardstands and Foundations**

It is proposed that any remnant hardstanding, foundations, sub-structures, drainage and other relic structures associated with the former uses of the site shall be broken out / removed to typical depth of approx. 2.5m below existing or finished ground levels, whichever is the deeper. Selected materials suitable for re-use or recycling shall be retained on site for potential reuse within the works.

Any deeper buried structures / obstructions encountered which extend below 2.5m shall be inspected by the GE, made safe, accurately surveyed and marked on a plan to see where these are situated with regard to the proposed layout. Any such features that may require additional breaking out due to structural / build implications (i.e. may hinder foundations) shall be discussed with the client.

All hard arisings/ materials, where appropriate, shall be stockpiled, crushed and processed in an agreed location(s). Materials shall be processed to have a maximum particle size of 125mm down.

All unsuitable material, including, but not limited to, metal, steel reinforcement, rags, plastic, timber or degradable material shall be removed. The crushed product shall be inspected by the GE to confirm such materials have been removed as far as practicable.

7.3. **General Excavations**

Site levels fall by approximately 8m from south to north within the western and central parts of the development area, tying into adjacent ground levels along Manchester Road to the west, whilst levels within the east of the development area are generally flat and level. The difference in levels indicates that cut and fill operations may have historically been undertaken to form a plateau development platform centrally and within the east of the site. The southern boundary of the
proposed development area is formed by a stone wall, retaining the canal (which is either level or
topographically higher than the site).

It is anticipated that as part of the proposed development, earthworks (comprising cut and fill
operations) will be required to achieve proposed remediation levels. Final design levels shall be
provided to the contractor by the client prior to commencement of works.

To achieve the desired remediation formation levels, it is proposed to excavate made ground to a
typical depth of approx. 2.5m across the proposed development area, in order that the materials
can be processed and classified for re-use, and expose any grossly contaminated materials for
appropriate treatment and / or removal, where required. Made ground has been recorded to depths
of up to approx. 6m within the east and northeast of the proposed development area and as such,
some areas of the made ground will remain in-situ. The foundation designs will need to take this
into account.

All suitable arisings, if reused in the works, should have a maximum particle size of 125mm.
Oversized hard material shall be crushed to generate a suitable granular material for re-use within
the works.

Asbestos has been locally visually identified within made ground soils. Any visible asbestos
fragments identified during the earthworks should be carefully handpicked by an appropriately
trained operator, double bagged and placed into a secure area for subsequent disposal. During the
works, all of the made ground soils should be kept sufficiently damp to avoid any possible fugitive
fibre / dust release.

Made ground soils should be sampled by the GE at an initial rate of 1 per 1000m$^3$ during the
earthworks operation to test for asbestos screen. Chemical testing shall be carried out at a UKAS
and MCERTs accredited laboratory. The GE shall review the results and adjust the test frequency
as required, and based on an appropriate risk assessment.

During the excavation works, the materials excavated should be inspected by the GE to ensure
there are no areas of previously undetected contamination. Any soils exhibiting visual and/ or
olfactory evidence of gross contamination shall be placed in temporary stockpiles on hardstanding
or heavy-duty Visqueen sheeting, suitably covered and bunded with appropriate signage and
identification. The GE shall advise the contractor of any testing requirements to adequately classify
the materials for potential re-use or removal from site.
If any evidence of unrecorded mining features are encountered, appropriate stabilisation by drill and grout treatment shall be carried out. Treatment of identified mineworkings shall meet the requirements of relevant regulators, namely the Coal Authority, NHBC and the local authority. If such mine workings are identified then works shall cease immediately in those areas and the advice sought from the GE.

7.4. Adoptable Highways

With regard to adoptable roads, in order to minimise the risk of any future settlements and also negate any future soil management issues regarding service arisings, it is proposed to excavate made ground from below all adoptable highways down to natural soils (or 0.5m below the base of proposed adoptable drainage) and re-placed with suitable site won fill.

A minimum CBR of 3% will be required on engineered fill (as measured at formation level) within adoptable highway, estate roads or external hardstanding areas.

7.5. Re-profiling / In-Filling

Any areas requiring infilling shall be made level, by terracing if necessary with a nominal fall of 1 in 50. The base of all excavations shall be surveyed, prior to the placement of any engineered fill.

The base of any excavation or surface, prepared by the contractor, to accept fill material shall be proof-rolled using a vibratory roller and any soft spots encountered investigated, removed as necessary and replaced with suitable fill materials.

Once a clean working surface has been exposed, inspected and approved by the GE, suitable fill materials shall be laid and compacted in accordance with the “Sirius Strategy for Engineered Fills” presented in Appendix B to this Strategy.

Areas of fill shall be benched into adjacent areas in accordance with BS6031:1981 “Code of Practice for Earthworks”.

Any materials excavated not immediately placed in the deposition area shall be stored in stockpiles clearly identified. Surveys of any stockpiles shall be undertaken at regular intervals through the remediation works and provided to the GE, together with a description of their intended use.

Any stockpile of made ground soils shall be assumed to contain elevated concentrations of contaminants. It shall be ensured that such materials are not allowed to cross-contaminate any clean areas of the site, nor are they allowed to contaminate any off-site areas or controlled waters.
7.6. **Compaction Requirements**

Compaction works shall be undertaken in accordance with the Sirius Specification for Engineered Fills presented in Appendix B of this Strategy.

7.7. **Control Testing**

The contractor shall undertake earthworks control testing in accordance with Table 1 included within the Sirius Specification for Engineered Fills, presented in Appendix B of this Strategy.

All control testing shall be carried out in accordance with the relevant British Standard or other relevant guidance, except where the specification adopts alternative methodologies.

If the results of control / validation tests indicate that the fill is being placed and compacted in such a way that the desired level of compaction is not being achieved, the contractor shall further compact or, if necessary, shall excavate the affected work and replace with new fill, compacted to meet the specification requirements.

7.8. **Control of Contaminated Water**

Any groundwater or leachate arising from the site shall be considered to be contaminated and therefore potentially hazardous until proven otherwise. The contractor shall ensure that potentially contaminated waters and leachate from excavations or stockpiling areas do not reach watercourses, surface water drains, etc. The contractor shall ensure that potentially contaminated waters or leachate do not discharge onto ground external to the site or on the site, or reach surface water features (such as Shaw Brook).

All such waters will be treated on site as necessary for subsequent disposal to the foul sewer or alternatively removed from site by tanker to a suitable disposal facility.

The contractor will be responsible for obtaining all necessary permits, licenses and consents for disposal to the foul sewer.

Contaminated waters pumped from excavations should be stored in a holding tank and chemically tested prior to disposal. Any discharges to foul sewer should be recorded in relation to date, time, quantity and quality. All records should be maintained at all times and be made available to the GE upon request.
Potentially mobile free-phase liquid hydrocarbon or similar contamination is not known to be present at the site in any significant quantity. However, should any such material be encountered during the remediation works it should be recovered, treated (if applicable) and removed from site to an appropriate disposal facility.
8. COVER SOILS

8.1. General

Previous investigation works have revealed chemically unsuitable made ground and shallow natural soils across the proposed development area associated with the former site uses. These soils would need to be placed below a suitable ‘clean’ cover system within areas of soft landscaping / private gardens.

As ACMs have been locally visually identified within made ground soils, in order to negate any possible future risks to groundworkers or site end users, asbestos impacted soils should not be placed within highways or areas where service / drainage runs will be excavated.

The makeup of the required clean cover system across the proposed development area shall be as shown in Table 8.1.

Table 8.1 Clean Cover Layer Thickness

<table>
<thead>
<tr>
<th>Minimum Thicknesses</th>
<th>Subsoil (mm)</th>
<th>Topsoil (mm)</th>
<th>Soil Cover Thickness (mm)</th>
<th>Demarcation layer</th>
<th>Total Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gardens / Soft Landscaping where made ground soils present</td>
<td>650</td>
<td>150</td>
<td>800</td>
<td>200mm granular no dig/ capillary break layer</td>
<td>1000</td>
</tr>
<tr>
<td>Gardens / Soft Landscaping where natural soils present at surface</td>
<td>450</td>
<td>150</td>
<td>600</td>
<td>N/A</td>
<td>600</td>
</tr>
</tbody>
</table>

8.2. Topsoil and Subsoil

Topsoil and subsoil shall be placed by the contractor responsible for the construction phase of the works. It shall be ensured that topsoil/subsoil material is of an appropriate quality and that concentrations of contaminants do not exceed the maximum concentrations stipulated in tables provided within Appendix D for a residential end-use with plant uptake for garden areas or for a residential end-use without plant uptake for landscaped/POS areas.
Any capping materials shall be inspected to ensure that it meets the required specification. It shall be clean and free of foreign debris, building waste materials, timber or other deleterious matter. It is assumed at this stage that site won soils are unsuitable for use as clean cover materials, subject to further testing and assessment (including bio-accessible arsenic testing).

The re-use of any site won natural soils within the clean cover layer would require careful control of excavation arisings and soil management during the development. Clean cover soils won on site, or imported, that are not immediately placed, should be stored in stockpiles at agreed locations and sealed, by ‘blading’, to reduce water ingress and softening. The sealed stockpiles should be suitably sheeted to avoid any potential cross contamination. The re-use of site won soils should be agreed with the relevant regulators prior to placement.

For any imported materials required to complete the cover soils, then these shall be tested in accordance with the guidance given in the YAHPAC document Verification Requirements for Cover Systems, Version 3.2 dated October 2014. These are summarised in Table 8.2.

Table 8.2   Sampling and Testing for Imported Soils

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of Samples</th>
<th>Testing Schedule</th>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virgin Quarried Material</td>
<td>1 or 2 depending on the type of stone used</td>
<td>Standard metals/metalloids (As, Cd, Cr, Cr(VI), Cu, Hg, Ni, Pb, Se, Zn)</td>
<td>As per Tables 1 and 2 Appendix D</td>
</tr>
<tr>
<td>Crushed Hardcore, Stone, Brick</td>
<td>Minimum 1 per 1000m³</td>
<td>Standard metals/metalloids (As above) PAH (16 USEPA speciation) Asbestos</td>
<td></td>
</tr>
<tr>
<td>Greenfield/ Manufactured Soils</td>
<td>Minimum 3 or 1 per 250m³ (whichever is greater)</td>
<td>Standard metals / metalloids (As above) PAH (16 USEPA speciation) Asbestos</td>
<td></td>
</tr>
<tr>
<td>Brownfield/ Screened Soils</td>
<td>Minimum 6 or 1 per 100m³ (whichever is greater)</td>
<td>Standard metals / metalloids (As above) PAH (16 USEPA speciation) TPH (CWG banded) Asbestos Any additional analysis dependant on the history of the donor site.</td>
<td></td>
</tr>
</tbody>
</table>

The test results shall be made available to the GE prior to any material being delivered to site.

8.3.   Placement and Validation

Clean cover capping layers shall be placed in all areas of gardens and soft landscaped areas.
The demarcation layer (i.e. the no dig layer) and cover soil materials shall be placed by the contractor, and shall be lightly compacted following placement, to ensure minimal future settlements.

It is envisaged that the demarcation layer and capping soil layers shall be placed within individual areas of garden and landscaping on completion of development of individual plots. This will act to minimise the potential for disturbance of the capping system and physical destruction of topsoil structure i.e. via plant trafficking, following placement. **NB: any remediated areas of made ground known to contain asbestos fibres / containing materials shall be covered with a minimum thickness of 100mm of clean inert soil on completion of remedial works and prior to the construction phase commencing.**

Verification of quality, chemical suitability and depth of topsoil and subsoil, in addition to verification of the placement of the demarcation layer shall be carried out by a suitably qualified GE by excavation of a small trial pit following placement, with appropriate samples taken of both topsoil and subsoil. Trial pits shall be excavated within gardens and soft landscaping areas at a frequency agreed with the regulators. Evidence for validating the depth and quality of cover shall accord with the YAHPAC document Verification Requirements for Cover Systems, Version 3.2 dated October 2014.

The results of chemical analysis of both topsoil and subsoil should be assessed against the relevant table within Appendix D of this report.
9. GENERAL SITE REQUIREMENTS

9.1. Introduction

The contractor shall comply at all times with this Strategy, the Conditions of Contract and all relevant health and safety requirements. Site works will be supervised by a GE appointed by the client.

The contractor shall prepare and submit a programme for the works to the client prior to the commencement on site.

Site cabins, stores and welfare facilities shall be established at a convenient location to be agreed between the contractor and the client.

Prior to commencement of works, the contractor shall establish the boundaries of the site and working areas and shall make adequate provision to secure the site boundary and prevent unauthorised access to the site during the course of the works.

If works are anticipated to extend beyond the hours of 07.30 to 18.00 Monday to Friday and 08.00 to 13.00 Saturday, then the site working hours shall be discussed and agreed with the LA prior to commencement. No works shall take place on Sunday or Bank Holiday.

9.2. Adjacent Carriageways and Properties

The contractor is to undertake a dilapidation survey of site boundaries, adjacent properties and highways prior to starting works on site. Such a survey shall include roads, footpaths, street lighting and road signs. A copy of the survey, including a record of photographs shall be provided to the client within seven days of commencement of site works.

An appropriate traffic management system should be agreed with the Local Authority Highways Section and employed for traffic entering/exiting the site.

9.3. Services

The client shall be responsible for obtaining all relevant service records for the site and undertake any consultation with the statutory undertakers in relation to identifying the location of live services, including those to any adjacent properties. The client shall ensure the safe disconnection of all existing services entering the site, except for those which are to remain operational.
Prior to site works commencing, the position and depth of all services shall be determined and clearly identified on site by the contractor. The locations should be confirmed on site by appropriate investigation and observations. The following should be undertaken:

- Copies of a consolidated services location drawing should be retained and displayed in the contractor’s office.

- Cable Avoidance Tool (CAT) scanning of areas where works are to be carried out.

- Hand dug holes to expose services location shall be undertaken (where possible).

- Physical marking out on the site of service routes on the ground and appropriate lay-offs/easements using paint, pegging, bunting etc.

- Retaining on the site drawings showing locations of all services.

- Where services are being re-routed during the works both the drawings and site markings must be kept up to date.

- When works commence on a new area of the site the site manager or relevant foreman must brief all operatives on the location of services in this area.

- Method statements/risk assessments must be read by all relevant personnel and their understanding of them confirmed in writing.

- If coloured sands, service ductwork or services are exposed during operations then work must cease until the site manager has confirmed it is safe to continue.

All manholes to remain should be located and clearly identified on site to prevent damage. The location, overall depth and diameter of each manhole, and the size and depth of all connections, shall be recorded.

Service providers shall be contacted by the contractor to determine any precautions, safe working distances etc. relating to services, both underground and overhead.

9.4. Health and Safety

The earthworks shall be undertaken in accordance with all relevant legislation including, but not limited to:
• The Health and Safety at Work etc. Act, 1974.

• The most current Construction (Design and Management) Regulations.

• Construction (Health Safety and Welfare) Regulations, 1996.

• The Control of Substances Hazardous to Health Regulations, 2002, and

• The Control of Asbestos at Work Regulations, 2012.

Contaminated materials are present on site, possibly including asbestos fibres. During the remediation and construction it will be necessary to protect the health and safety of site personnel. General guidance on these matters is given in the Health and Safety Executive (HSE) document ‘Protection of Workers and the General Public during the Redevelopment of Contaminated Land (HS(G)66)’. In summary, the following measures are suggested to provide a minimum level of protection.

• All ground workers should be issued with high visibility clothing, hard hats, safety glasses, protective footwear and impermeable heavy duty gloves. Personnel should be instructed as to how they are to be used;

• Hand washing and boot cleaning facilities shall be provided;

• No smoking on site other than in designated areas if any are present on site; and,

• Good practices relating to personal hygiene shall be adopted.

Before site operations are commenced the necessary COSHH Assessment, Method Statements and Health and Safety Plans should be completed and issued by the contractor in accordance with the current CDM Regulations.

All site personnel shall undergo a site specific health and safety induction prior to commencement of work on site.

Gas monitoring of deep confined excavations, where man entry is required (including plant operators), shall be undertaken prior to commencement of work each day or after short-term suspension of works and shall be continuous throughout the working day.

Gas monitoring shall include:
• Methane;

• Carbon dioxide; and,

• Oxygen.

The results of the gas monitoring shall be recorded in the site diary. The gas monitor shall emit both audible and visual warnings. Alarm levels shall be set with due regard to the Occupational Exposure Limits provided in EH40/2005 (2011).

In the event of a gas alarm sounding, all personnel shall immediately evacuate the area. No personnel shall return to the area until advised by the site manager.

The contractor shall provide details of emergency procedures. Emergency Services shall be informed of the site operations prior to commencement.

9.5. Mobile Plant

Mobile plant shall be operated by competent personnel for each item of plant. When not in use all plant shall be locked to prevent unauthorised access.

All traffic entering or working on site shall obey a maximum 10mph speed limit.

Fuelling of any plant shall be undertaken in a designated area and all above ground fuel storage tanks shall comply with the requirements of the Pollution Prevention Guidelines PPG2 (August 2011).

Specifically, any fuel storage tanks should:

• Be situated within an oil-tight secondary containment system such as an impermeable bund.

• The secondary containment must provide storage of at least 110% of the tank’s maximum capacity.

• Be located within a secured area.

• All taps and valves should be fitted with a lock and be adequately secured when not in use.
Waste oil, hydraulic fluid etc. should not be tipped directly or otherwise discharged onto site. Such materials shall be stored separately, in a secure bunded area, for off-site disposal. Waste oil is a Hazardous Waste, and disposal shall be undertaken by a registered carrier in accordance with the Duty of Care (DoC) Regulations (2006) and the Waste (England and Wales) Regulations (2011).

Contractors shall provide a fuel spill kit, to be kept on site in an accessible place near to the designated refuelling area.

9.6. Dust

As some soils on site are thought to contain asbestos containing materials, appropriate background air monitoring shall be undertaken within the site and on the site boundaries during the earthworks below the cover system. Asbestos containing materials shall not knowingly be put through the crusher, or other similar equipment with the potential to produce significant dust. The GE will supervise, control and advise on all relevant matters and liaise with the statutory bodies as required (i.e. HSE, local authority).

Appropriate measures shall be implemented at all times during the remediation works, to minimise any dust emissions. During all operations, the risk of dust release will be continually assessed and appropriate mitigation measures will be put in place. This is typically a bowser with hose attachment to wet down and suppress dust, although other alternative techniques may be considered as necessary.

Any haul roads, shall where practical to do so, be constructed of crushed hardcore products. These haul roads shall be maintained for the duration of their use to minimise any build up of mud, loose spoil etc. Mobile water bowsers and sprayers shall be made available to dampen unpaved haul roads and working areas. An adequate supply of clean water shall be maintained on site at all times to allow dust suppression activities to be carried out at short notice.

Traffic both entering and working on the site shall obey a maximum speed limit of 10 mph.

Regular inspections of the public highway adjacent to the site entrance shall be carried out by the contractor. If deemed necessary, the highway shall be swept regularly to remove any mud, slurry or dust deposited by vehicles entering or departing the site, and a wheel wash provided for exiting vehicles if required. If the contractor considers that significant amounts of any detritus have been deposited on the public highway then operations shall be temporarily suspended until appropriate cleaning operations have been undertaken.
Any wagons that are to be used for the haulage of potentially contaminated material from the site shall be sheeted to prevent the release of fugitive dust.

9.7. Odour

In general terms the excavation works are not considered likely to give rise to any significant odour problems.

Whilst considered unlikely, if highly odorous materials are encountered which may give rise to nuisance to neighbouring properties, odour control measures can be considered at that time and an appropriate method statement supplied by the contractor.

Any odorous materials shall be covered at the end of each working day and any stockpiles will be located away from any residential properties. This shall be continually assessed through the programmed works.

9.8. Noise

The requirements of BS 5228:2009 ‘Noise and vibration control on construction sites’ shall be adhered to at all times.

All machinery shall be fitted with effective silencers and shall be serviced at regular intervals. No items of plant shall be operated with engine covers raised.

The location of any crushing plant shall take into consideration the location of neighbouring properties and other noise sensitive receptors and shall be located away from these areas and located adjacent to proposed stockpile locations, where possible and practicable.

9.9. Surface Waters

Shaw Brook (partly culverted) is located within the site, whilst Leeds-Liverpool Canal is located adjacent to the south of the site (although generally at a topographically higher level). Protection of these watercourses shall be required throughout the works.

The contractor shall take all appropriate measures to ensure that no surface run-off from the operational site shall affect the watercourses. Prior to commencement of operations, the contractor shall submit a Method Statement for approval by the GE of the proposed actions.

A visual inspection of the watercourses, and the surrounding ground, shall be undertaken daily by the GE. Observations shall be made of the following:
• Any film or oily iridescent sheen on the surface of the water or surrounding soils.

• Any clear evidence of fuel spillage / free product that could impact upon the watercourse.

• Any evidence of discharge into the watercourse.

A written record of the inspection shall be maintained by the GE. The contractor shall take all required actions to ensure that the watercourses are not polluted by materials washed off site or by accidental or other tipping of material on site. Should a surface water pollution incident occur, the GE shall be informed immediately. The Environment Agency shall also be kept fully informed of any such incidents. Action shall be taken to absorb, contain or disperse, if appropriate, any incident that occurs. An emergency plan shall be developed to deal with any potential contamination incidents.

Appropriate consents shall be obtained prior to discharge of surface or groundwater from the site. Any pumping of any waters into the surface water drainage should be undertaken in accordance with the consent for the site.

9.10. Off-Site Disposal

Materials for off-site disposal shall be sampled and analysed, by the contractor, at a frequency sufficient to allow the material to be adequately categorised.

The contractor shall ensure that any material exported from site to a suitably licensed landfill is hauled by a registered waste carrier in accordance with the requirements of the Duty of Care Regulations, the Landfill Directive and where appropriate the Hazardous Waste Regulations, 2005 and the List of Waste Regulations 2005. A transfer note shall be completed, signed and retained by all parties involved. The transfer note shall state the volume of waste, the nature of the material and statement of its chemical composition. The waste transfer notes shall be kept by the contractor for a period of at least two years.

9.11. General

No fires shall be permitted on site, unless previously agreed with the local authority.

Details of all monitoring will be retained on site by the contractor and made available to the Local Authority Environmental Health Department on request.
10. CONTRACTOR’S RESPONSIBILITIES

10.1. Introduction

The following regulations, guidance and legislation relating to the works shall be complied with at all times:

- Health and Safety Executive “Protection of Workers and the General Public during Redevelopment of Contaminated Land”, HS(G)66, HMSO 1991;
- The most current Construction, Design and Management Regulations and the Pre-tender and Construction Phase Health and Safety Plans;
- The Control of Substances Hazardous to Health Regulations 2002; and,
- The Control of Asbestos at Work Regulations, 2012.

10.2. Surveying

The contractor shall be responsible for the following survey work:

- Establishment of profile boards;
- Setting out of building footprints;
- Surveying the base and extent of all excavations following proof rolling and prior to placement of any fill to be engineered;
- Areas of localised overdig, i.e. areas required to remove deep relic structures etc;
- Any obstructions encountered in the works that are not possible to remove, i.e. piles;
- The finished surface (remediation level and interim capping layer) prior to handover to the client;
- Interim surveys to be undertaken during the infilling works to provide information on issues such as progress, earthworks quantities, base/top of made ground etc.; and,
- The location and elevation of test and sample locations.
10.3. Testing

The contractor shall be responsible for undertaking all geotechnical and chemical testing necessary to satisfy the GE that the works have been carried out in accordance with, and comply with the specification.

All soils and chemical testing shall be carried out by a UKAS and MCERTS accredited laboratory to the approval of the GE.

10.4. General

The contractor shall also be responsible for the following:

- Provision of method statements and reports;
- Environmental Permits (waste and remediation) are in place prior to works commencing;
- The provision of health and welfare facilities;
- Obtaining the relevant permits/ consents/ licenses i.e. discharge consents;
- Environmental monitoring; and,
- Mitigation measures.
11. VALIDATION AND REPORTING

The GE and/or site manager will maintain records of the works to include the following:

- Daily record sheets to include a summary of the day’s activities;
- Weather conditions;
- Plant, personnel and visitors present;
- Aspects relating to Health and Safety, environmental control or non-compliance with the General Specification or the contractors Method Statement; and,
- Test results.

The GE shall ensure that the requirements of this strategy are complied with. On satisfactory completion of all of the remediation works, the GE will provide an initial validation report, comprising relevant site records and act as certification that the remedial and ground preparation works have been carried out in accordance with this specification.

The validation report shall include the following:

- A description of the works undertaken;
- Records of the works;
- Progress photographs;
- Waste transfer notes;
- Chemical and geotechnical validation test results;
- As built surveys, including base of excavation and final level survey, base and top of made ground; and,
- A statement that the works have been undertaken in accordance with the agreed specification.

Subsequent validation reports will be required following the final placement of the demarcation layer / clean cover cap in order to confirm its suitability (chemically, textually and thickness). This needs to be carried out in accordance with Section 8 of this report.
12. POST RECLAMATION REQUIREMENTS

A validation report will be provided to the client on satisfactory completion of the remediation works.

The client and their sub-contractors shall be responsible for all construction works following handover of the works. Elements that need to be included in any subsequent method statements shall include:

- Compliance with environmental issues;
- Construction of foundations;
- Placement of a clean cover system;
- Health and Safety;
- Appropriate protection of underground services; and,
- Disposal of any contaminated arisings.

The client and their sub-contractors shall be responsible for the final placement of the upper layers of the clean cover layer. The placement, final thickness, chemical suitability etc. of this capping layer will require validation.

Should the excavation of foundations, drainage and services etc. extend below the “clean” capping layer, and therefore encounter the underlying made ground materials, then there is a potential for cross-contamination. This should be avoided where possible. In addition soils below the capping layer should be assumed to contain asbestos containing materials unless highlighted otherwise in the validation / completion report. Detailed risk assessments and method statements shall be provided for this work by the client and their specialist sub-contractors to avoid cross contamination and the release of asbestos fibres.

13. REGULATORY APPROVAL

A copy of this specification shall be forwarded to the Local Planning Authority (LPA), and other regulators as appropriate for their approval prior to the works.
APPENDIX A

FIGURES AND DRAWINGS