REPORT C6485A RevA/RS
OCTOBER 2017

REMEDIATION STRATEGY

For land at
OUGHTIBRIDGE MILL

prepared for
COMMERCIAL ESTATES GROUP

REPORT NUMBER:	C6485A RevA/RS	**REPORT STATUS:**	FINAL
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PREPARED FOR:	COMMERCIAL ESTATES GROUP		
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STRATEGY FOR REMEDIAL AND PREPARATORY WORKS

for land at

OUGHTIBRIDGE MILL, SHEFFIELD

Prepared for

COMMERCIAL ESTATES GROUP

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1. INTRODUCTION

Sirius Geotechnical Ltd (Sirius) was commissioned by Commercial Estates Group (CEG), to produce a Strategy for Remedial and Preparatory Works required to facilitate residential development of land at Oughtibridge Mill, Oughtibridge, Sheffield (the "site"). Although no proposed development layout is currently available, it is understood that proposals for the site allow for up to 320 residential dwellings.

Piled foundations (locally pre-bored, where necessary) are considered suitable across the majority of the site, with the exception of the southeastern site corner, where strip / trench fill foundations may be utilised (subject to further assessment for the influence of trees, final depths of made ground, etc.). An indicative foundation zoning plan is provided as Drawing No. C6485A RevA/RS/05 in Appendix A of this report.

A risk of long-term settlement exists to the development, in particular to adoptable highways, residential plot external areas (i.e. gardens and driveways) and public open space. This risk has been evaluated in detail as part of a settlement report by Sirius (ref. C6485D RevA, dated October 2017), which has been reproduced within Appendix B of this report.

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

- Report on Ground Investigation at Oughtibridge Paper Mill (Factual Report), IPPC Phase 1B, for Fort James (UK) Limited dated March 2001, report reference 16105, prepared by Structural Soils Limited.

- Hydrocarbon Contamination Assessment at Oughtibridge Mill, for Georgia Pacific GB Ltd, dated February 2005, report reference RCM4120-004 R DRAFT, prepared by RPS Health, Safety and Environment.

- Surrender Site Condition Report at Oughtibridge Site, for Georgia Pacific Corporation, dated February 2009, report reference 49306614, prepared by URS Corporation Limited.

- Findings of Diethanolamine Dye Investigation at Oughtibridge Mill, for Lotus Professional, dated 22nd December 2010, letter reference 49309365/LERP0001/PG, prepared by URS.

- Briefing Book (overview report) at Oughtibridge Paper Mill, for Georgia Pacific dated April 2012, report reference 805101_17, prepared by Arcadis (UK) Limited.

- Preliminary Environmental and Geotechnical Risk Assessment at Oughtibridge Papermill for Svenska Cellulosa Aktiebolaget, dated September 2014, report reference 70006973, prepared by WSP UK Ltd.

- Geoenvironmental Assessment at Oughtibridge Papermill for Svenska Cellulosa Aktiebolaget, dated April 2015, report reference 70006973 v1.2, prepared by WSP UK Ltd.

- Factual Environmental Ground Investigation Report - Retained Land at the Former Oughtibridge Mill Site for Georgia Pacific LLP dated February 2015, report reference 3178910006_02, prepared by Arcadis EC Harris.

- Targeted Ground Investigation at Oughtibridge Mill, Main Road, Sheffield for Commercial Estates Group dated 1st July 2015, letter report reference C6485/JL/6826, prepared by Sirius.

- Geoenvironmental Appraisal report of land at Oughtibridge Mill, report ref. C6485A RevA dated March 2016, for CEG, prepared by Sirius.

- Hazardous Ground Gas Risk Assessment for land at Oughtibridge Mill, report ref. C6485A/GRA, dated July 2016 for CEG, prepared by Sirius.

- Supplementary Site Investigation Letter Report for land at Oughtibridge Mill, letter ref. C6485A/GH/7423, dated 25th July 2016, for CEG (c/o Nathaniel Lichfield and Partners) prepared by Sirius.

- Bridge Ground Investigation Report of land at Oughtibridge Mill, ref. C6485B dated July 2016 for CEG, prepared by Sirius.

- Geotechnical Retaining Wall Report of land at Oughtibridge Mill, ref. C6485C dated July 2016 for CEG, prepared by Sirius.

- Settlement Report of land at Oughtibridge Mill, ref. C6485D RevA, dated October 2017 for CEG, prepared by Sirius (a copy is provided within Appendix B of this report).

- Stockpile Testing Letter Report for land at Oughtibridge Mill, ref. C6485E/GH/7785 dated 10th March 2017 for CEG, prepared by Sirius (a copy is provided within Appendix B of this report).

- Slope Stability Analysis for land at Oughtibridge Mill, ref. C6485/6633/CL dated April 2017 for CEG, prepared by Sirius.

The documents above are the principal sources of information used in the preparation of this Strategy and should be read in conjunction with this Strategy. These documents should be read in conjunction with this report. However, this Strategy does provide a summary of the works undertaken to date.

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

- To discharge the relevant planning condition;
- To minimise the impact to the environment and human health whilst undertaking the works;
- To satisfy the Local Planning Authority Environmental Health Department and other appropriate bodies that the remediated site will provide a site ready and suitable for the proposed development; and
- In the interests of sustainability, to reduce requirements for excavation, off-site disposal and promote the use of existing site-won materials providing they are suitable for the proposed end use.

A Method Statement should be prepared, in order to detail how the objectives contained herein will be achieved. The Method Statement should be accompanied by a Designer's Risk Assessment in accordance with the current CDM Regulations. The Method Statement and Risk Assessment should be submitted to and approved by a suitably qualified geoenvironmental consultant.

It has been assumed in the production of this report that the site as a whole is to be developed for a low rise residential with gardens end-use. The remediation works outlined would also be suitable for alternative land uses (e.g. residential apartments, retail facilities, offices) but, should these be proposed for (parts of) the site, then alternative remediation approaches could also be appropriate.

Although no proposed development levels have been provided, this report assumes that the proposed development will consider minimum acceptable flood levels. It should be noted that assumed design levels may be subject to adjustment by the developer. Consequently, the scope of works described within this report may have to be adjusted to suit any additional requirements such as final design levels, foundation options and adoptable highway design/construction.

It is recommended that no works should be undertaken on site until this Strategy is approved by the relevant regulators.

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2. SITE DETAILS AND DESCRIPTION

2.1. Pre-Remediation Site Overview

Table 2.1 Current Site Overview (Pre-Remediation)

Location	The site is located off Main Road and Langsett Road North, Oughtibridge, approximately 10km northwest of Sheffield City Centre. A site location plan is included as Drawing No. C6485A RevA/RS/01 within Appendix A.
National Grid Reference	430223mE, 393975mN.
Features	The site is irregular in shape, with approximate dimensions of 900m in length and 200m in width, and comprises a number of existing and recently demolished structures and features associated with the former Oughtibridge Paper Mill, including a former landfill located within the northeast of the site. The southern boundary of the site runs approximately northwest-southeast, parallel to the road. The River Don runs through the site, splitting it into two portions. The river flows towards the southeast. A mill race, reservoirs and ponds were historically present within the northwest of the site. A bridge for vehicle access is present across the river. There are three woodland areas present to the southeastern, northern and northeastern perimeters of the site, which are densely covered by trees and shrubs. These woodland areas will be retained as part of the proposed development. For the purpose of this report, the areas of the site proposed for development have been split into four distinct zones (the 'landfill' zone, the 'mill' zone, the 'northwestern' zone and the 'southwestern' zone), as indicated on Drawing No. C6485A RevA/RS/02, included within Appendix A of this report.
Approximate Site Area	13.8 hectares.

Site Boundaries	The site is bordered by woodland to the north and east, Main Road / Langsett Road North to the south and residential properties and a public house to the north / northwest.
Current Land Use	Disused.
Adjacent Land Uses	Residential and woodland. A pub (Wharncliffe Arms) is located adjacent to the northwest of the site.

The main pre-remediation site features are shown on Drawing No. C6485A RevA/RS/02 within Appendix A. A detailed summary of the site setting is included within the Sirius Geoenvironmental Appraisal report, ref. C6485A RevA, dated March 2016.

2.2. Historical Development

The site is shown to be developed with a small, centrally located building denoted as Spring Grove Paper Mill, on the earliest available Ordnance Survey (OS) map, dated 1855. The paper mill is shown to be significantly expanded from 1894 up until at least 2006, with the construction of an associated mill race, reservoirs, effluent tanks and on-site landfill. Although the area of landfilling in the northeast of the site is not indicated on historical OS maps until 1981, available historical aerial photographs appear to indicate that the landfill was in use prior to 1969.

The western areas of the site have recently undergone partial demolition and clearance, in addition to mill buildings within the southwest and effluent tanks within the northwest of the site. The former mill race and reservoirs were infilled in approximately 2014 as part of decommissioning works.

2.3. Recorded Geology

A summary of available published geological information indicates that the central area of site is underlain by alluvium, described by the BGS as comprising "*Normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger, desiccated surface zone may be present".*

The solid geology is recorded as comprising Carboniferous Millstone Grit Formation, described by the BGS as comprising *"fine- to very coarse-grained feldspathic sandstones, interbedded with grey siltstones and mudstones, with subordinate marine shaly mudstone, claystone, coals and seatearths"*. An un-named sandstone unit (within the Millstone Grit Formation unit) is shown to be present beneath the northwest of the site.

An approximate east-west orientated fault is conjectured within the south of the site. Coal seams (including Pot Clay and Soft Bed coal) associated with the stratigraphically younger Lower Coal Measures are indicated approximately 250m to the north and 150m to the south of the site, dipping away from the site.

A Coal Authority mining report for the site states that: "*The property is not within the zone of likely physical influence on the surface from past underground workings".* Based on the mining report, and recorded geology at the site, the risk of past coal mining affecting surface stability is considered to be low to negligible.

There is no evidence of quarrying / pitting within the site on available historical OS maps. Former sandstone quarries exist to the south of the site, which are recorded by the BGS as 'ceased' mineral sites. These correlate with the outcrop of the Rough Rock Sandstone. It is recommended that future excavations are examined for evidence of quarrying / pits. If a quarry / pit is suspected, advice should be sought from a suitably qualified engineer.

2.4. Hydrology and Hydrogeology

Surface Water

The River Don runs through the site, which was classified by the EA in 2000 as River Quality B (good) under the GQA grading system. The current and predicted EA ecological assessment for the River Don is 'moderate', whilst the current and predicted chemical assessment is 'good'.

The Envirocheck Report reveals that there are a number of recorded discharge consents to the River Don in the vicinity of the site. One is located to Oughtibridge Mill itself, dated September 2009 for 'trade discharges - site drainage'. A number of pollution incidents to controlled waters are recorded in close proximity to the site, most of which are classified as minor incidents.

The Envirocheck Report records eight surface water abstractions relating to Oughtibridge Mill itself, for 'paper and printing: general use' and 'other industrial/commercial/public services: general use'.

A detailed flood risk assessment has been undertaken for the site by Weetwood Services Ltd (Weetwood), ref. 2992/FRA/Final/v1.0, dated 18th March 2016, which accompanied a planning application for the site.

Groundwater

The site is recorded as being partly underlain by superficial alluvial soils with the underlying bedrock comprising strata of the Millstone Grit Formation. Under the aquifer classification system developed by the EA, the superficial drift deposits and the bedrock are both classified as Secondary A Aquifers. Secondary A Aquifers are defined as '*permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers*'.

The Envirocheck report indicates that there is one groundwater abstraction in the vicinity of the site. The record is registered to Napier Steels (Sheffield) Limited, and relates to the abstraction of groundwater for 'general industrial' purposes. The license is recorded as revoked.

According to the Envirocheck Report, the site is not located within a Source Protection Zone.

2.5. Landfilling and Waste Management

Information provided by the Envirocheck report and the Environment Agency indicates that there are two historical landfills within approximately 1km. The landfills are registered as Delph Hill Quarry, located approximately 350m to the southwest of the site (recorded as operating between 1982 and 1991), and Church Street, located approximately 650m to the southeast (recorded as operating between 1978 and 1980). Recorded wastes included inert and commercial.

Delph Hill Quarry is also recorded within the Envirocheck report as a registered landfill site, with the licence lapsed / cancelled in 1982.

A registered waste transfer site is recorded on site, licensed to British Tissues Ltd. The licence is lapsed / cancelled, last dated November 1977. Authorised wastes included industrial non-hazardous wastes, scrap metals and wooden pallets. Prohibited wastes included 'any type of asbestos'.

Desk study information indicates the northeastern area of the site was used for landfilling prior to 1969 up until approximately 1992.

2.6. Other

A number of potentially contaminative activities or environmental constraints are listed which relate to activities located on site. These include an enforcement and prohibition notice, and integrated pollution controls.

Given that that site has now been cleared of a number of historical features associated with the former mill and given that the site is no longer in operation as a paper mill, the recorded activities / consents are assumed to now be inactive.

2.7. Invasive Plant Species

It is understood that invasive plant species (Japanese Knotweed, Himalayan Balsam and Giant Hogweed) have been recorded at the site. Further information is provided within the Japanese Knotweed Solutions and Ebsford Environmental reports / proposals, included within Appendix B.

It is recommended that updated assessments and / or treatment be undertaken in accordance with the findings and recommendations of the invasive species survey reports for the site (both dated July 2017), included within Appendix B of this report.

2.8. Previous Site Investigations

Several phases of site investigation / assessments have been undertaken at the site by Sirius and other parties, as summarised below. The previous reports were summarised and updated in accordance with current guidance where appropriate within Sirius Geoenvironmental Appraisal report (ref. C6485A RevA), dated March 2016.

A combined exploratory hole location plan is included as Drawing No. C6485A RevA/RS/03, included within Appendix A of this report.

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

Report on Ground Investigation dated March 2001, prepared by Structural Soils Limited.

A factual ground investigation was undertaken by Structural Soils Limited on behalf of Ove Arup and Partners at the site in January 2001. Fieldworks comprised seven cable percussion boreholes (ref. BH101 to BH104, BH106, BH106A and BH106B), five window sample boreholes (WS101 to WS104 and WS109) and nine machine excavated trial pits (TP101 to TP108 and TP110).

The exploratory hole logs indicate hydrocarbon odours within BH101 to a depth of 1.0m bgl, TP102 below a depth of 1.2m bgl, and TP105 to a depth of 1.6m bgl.

Hydrocarbon Contamination Assessment dated February 2005 prepared by RPS Health, Safety and Environment.

RPS Health, Safety and Environment were commissioned to undertake a specific assessment following a request by the EA for further work to investigate hydrocarbon contamination previously identified under the waste storage area (i.e. the former landfill area). Further details are provided within the Sirius Geoenvironmental Appraisal report (ref. C6485A Rev A, dated March 2016).

Surrender Site Condition Report dated February 2009, prepared by URS Corporation Limited.

This report was produced under a PPC permit for the site and was intended to demonstrate that, following completion of the decommissioning works, the site would be left in a satisfactory state for the surrender of that permit. These decommissioning works, including the removal of all chemicals from the site, were completed in December 2008.

The report indicates that the site contained a number of bulk storage tanks, including: a resin tank located in the basement of a paper machine line; two above ground storage tanks (ASTs) located adjacent to a package unit boiler house; sulphuric acid and caustic soda ASTs; diesel, paraffin and turbine oil ASTs (located in the waste yard) and a caustic AST. As of December 2008, all of the tanks were reported to have been emptied and decommissioned. It was recorded that the tanks were all bunded and had been subject of regular visual inspection and repair. There were no underground storage tanks reported to be located on site.

Findings of Diethanolamine Dye Investigation dated 22nd December 2010, prepared by URS.

URS were commissioned in December 2010 to undertake targeted ground and groundwater investigation at the site. The fieldworks comprised the drilling of three window sample boreholes (MW101 to MW103) to a maximum depth of 7.0m bgl, to investigate reports of 'vivid pink discolouration' being noted. This was within an area formerly occupied by a bunded dye store located within a warehouse that was also used to store IBCs containing diethanolamine .

Based on an assessment of ground conditions and the results of subsequent chemical analysis, it was considered by URS that '*the impact to ground of any diethanolamine is negligible…"*. No further actions were recommended.

Briefing Book dated April 2012, prepared by Arcadis (UK) Limited.

Arcadis were commissioned in 2012 to provide a summary overview of the previous historical environmental assessment reports for the site.

Preliminary Environmental and Geotechnical Risk Assessment dated September 2014, prepared by WSP UK Ltd.

WSP was commissioned to undertake a preliminary appraisal (desk study) of the site (referenced as 'Lot 8A'), which formed part of a wider site area (divided into twelve 'lots').

WSP reported that the site was, at the time of reporting, *'currently a paper mill in the process of being demolished, with the last machine scheduled to be decommissioned in November 2014*'. This is understood to refer to the former mill area. In addition, WSP reported that '*anecdotal evidence indicates the presence of an underground water pipe which runs northwest to southeast approximately parallel with the River Don in the southwest of the site. Historically, this pipe was used to flush paper, acids, oil, grease and polymers into the River Don, and therefore the current demolition works classed the remaining contents as 'Contaminated Waste'. This is scheduled to be decommissioned and backfilled with quarry stone'*. It is unclear if these works have been undertaken.

At the time of reporting, WSP described the presence of *'three reservoirs immediately adjacent to the River Don, bounded to the north and south by two sluice gates, beyond which is a former effluent tank and former slurry pond. The use of the reservoirs is unknown but they may have been pulp settlement tanks'*, within the northwest of the site. These features have since been decommissioned, removed and infilled. Photographs of some of the site features prior to demolition and clearance are included within the WSP 2014 report.

Geoenvironmental Assessment, dated April 2015, prepared by WSP UK Ltd.

WSP was instructed to undertake an intrusive ground investigation in 2015 at the site. Fieldworks comprised nine rotary boreholes (BH201, BH202, BH202A and BH203 to BH208), nine machine excavated trial holes (TP204 to TP212, although the logs for TP209 and TP210 are omitted from the report) and two hand dug pits (HP201 and HP202). It should be noted that the WSP exploratory hole location plan makes reference to boreholes installed at the site in 1999 by Sub Soil Survey. Sirius has not been provided with any details of that particular investigation.

The exploratory hole logs indicate hydrocarbon and/or 'coal tar' odours within exploratory holes BH202A (at depths of between 1.0m and 3.0m bgl), BH203 (at a depth of between 2.0m and 3.0m bgl), BH204 (at a depth of between 0.7m and 0.8m bgl), TP204 (from ground level, exceeding 3.0m bgl), TP205 (at a depth of between 0.2m and 2.5m bgl) and TP207 (from ground level to the base of the excavation at 2.8m bgl).

WSP noted that asbestos-containing materials were recorded within a natural soil sample obtained from BH205 at 3.4m bgl. This was considered likely to have been cross-contaminated from the overlying made ground soils. Consequently, the asbestos result within this sample was discounted from the Sirius assessment within report ref. C6485A RevA, dated March 2016.

Factual Environmental Ground Investigation Report - Retained Land, dated February 2015, prepared by Arcadis EC Harris.

Arcadis was commissioned to undertake a geoenvironmental ground investigation and present a factual report on the disused landfill.

Fieldworks were undertaken in November 2014 which comprised the drilling of four cable percussion boreholes (BH101, B102A, BH103 and BH104) to a maximum depth of 8.0m bgl, including the installation of monitoring wells, and the excavation of nine trial pits (TP101 to TP107, TP109 and TP110) to a maximum depth of 3.0m bgl.

Ground conditions were recorded to comprise made ground to depths of between 0.9m and 5.15m bgl, comprising 'assumed landfill material' and 'reworked natural ground'. The 'assumed landfill material' was identified in all of the exploratory holes. In general, this was encountered as gravelly sand, sandy gravel and sandy gravelly clay with cobbles and boulder-sized materials, which included concrete, bricks, ash, clinker and plastics. In addition to the general waste, a white jelly-like substance with a 'strong chemical odour' was encountered at 1.0m bgl in TP101 and a 'large amount of compressed paper' was identified at 2.0m bgl in TP104. A hydrocarbon odour was noted at 0.75m bgl in BH101 and 0.7m bgl in BH102A. 'Reworked natural ground' was identified in each borehole, underlying the landfill material. This generally consisted of sandy, gravelly clay with sandstone and occasional clinker.

Targeted Ground Investigation dated 1st July 2015, prepared by Sirius.

Sirius was commissioned to undertake a targeted ground investigation in the area of the former effluent treatment plant within the northwestern part of the site. It was understood that this area had housed three ponds, a mill race/goyt and two circular tanks.

The targeted investigation was undertaken to investigate the presence of underground structures associated with the former effluent treatment plant and the nature and chemical composition of materials used to backfill the structures.

The fieldworks were undertaken by Sirius in June 2015 and comprised the excavation of nine trial pits (Ref. TPA-TPI) to a maximum depth of 4.40m bgl. Exploratory hole locations were positioned close to and within the former sub-structures.

The investigation locations recorded mixed cohesive, and locally granular fill, to depths of between 0.50m and 4.40m bgl. Natural soils comprising clayey sandy gravel/sandy gravelly clay were recorded below this in TPD, TPF and TPI.

In a number of the trial pits (namely TPA, TPC, TPE, TPG and TPH), evidence of former structures was recorded at depths between 0.20m and 4.10m bgl. These structures were considered representative of former walls/bases and it could not be wholly excluded that further unmapped structures could be encountered elsewhere in this area.

Geoenvironmental Appraisal, dated March 2016, prepared by Sirius

Sirius was commissioned in 2015 to undertake a geoenvironmental appraisal of the site to accompany a planning application.

The investigation took place between November 2015 and January 2016. The fieldworks were undertaken across the site as a whole (including the former landfill area, former mill area, southwestern area, northwestern area, and peripheral woodland, where safe access was possible) and comprised the mechanical excavation of 42 trial pits to a maximum depth of 3.50m bgl, the drilling of 49 window sample boreholes to a maximum depth of 9.00m bgl and 17 cable percussive boreholes to a maximum depth of 11.20m bgl. 18 hand dug trial pits were excavated within the three areas of existing woodland / proposed public open space (POS) to a maximum depth of 0.40m bgl.

Gas and groundwater monitoring wells were installed within boreholes across the site (excluding the woodland areas).

Gas Risk Assessment Report, dated July 2016, prepared by Sirius

Sirius was commissioned to undertake a gas risk assessment of the site. Twelve gas and groundwater monitoring visits were completed by Sirius between January 2016 and June 2016.

These monitoring visits supplemented the results of five monitoring visits previously undertaken by WSP between December 2014 and February 2015, and four monitoring visits undertaken by Arcadis between December 2014 and January 2015, within their own monitoring installations.

The monitoring results obtained indicate that ground gas conditions at the site do not preclude residential development, subject to the adoption of appropriate protection within the design. A summary of the site zones and their Characteristic Situation classifications for ground gas is presented below in Table 2.2.

Table 2.2 Summary of Hazardous Ground Gas Assessment

Site Zone		Characteristic Situation (CS) [1]	Minimum Gas Protection Score [2]
Landfill		CS3	4.5
Mill	Southern	CS3	4.5
	Central and Northern	CS2	3.5
South West		CS2	3.5
North West		CS1	0

1. Taken from Table 2 of BS8485:2015
2. Table 4 of BS8485:2015, assuming a high risk 'Type A' building (i.e. private ownership with no building management controls, such as low-rise private housing).

The zones were recommended to be applied to the proposed development layout, once available, and once approved by the local authority/warranty provider, prior to development commencing.

Supplementary Ground Investigation Letter Report, dated 25th July 2016, prepared by Sirius

Following receipt of comments from Sheffield City Council (SCC) Environmental Protection Service (EPS), Sirius undertook supplementary *pre-demolition* investigation works at the site, comprising targeted intrusive investigation works and groundwater monitoring.

2.9. The electricity sub-stations and above-ground storage tank areas were recommended to undergo investigation once demolition and clearance allows access. These are detailed further in Section 5.0 of this report. Proven Ground Conditions by Sirius

Former Landfill

Made ground is understood to have been tipped between approximately 1960-1990 within the landfill area, which was recorded to variable depths of between 0.60m and 5.60m bgl, comprising both cohesive and granular soils. Cohesive made ground soils typically comprised soft, sandy gravelly clay, including gravels of brick, concrete, sandstone, limestone, mudstone and locally coal, ash, clinker, wood, plastic, metal, textiles, tiles, ceramics, charcoal and asbestos containing materials (ACMs). A black gelatinous substance was recorded within SWS29 between 3.00 and 4.00m bgl.

Reworked alluvial soils were locally encountered within the northern portion of the former landfill area, comprising sandy clay, including localised peat and/or organic debris. SWS28 identified decayed paper between 1.00m and 3.00m bgl.

Granular fill was recorded to generally comprise loose to medium dense, locally very loose, sandy gravel / gravelly sand, sand & gravel and gravel & cobbles with gravels of anthropogenic materials, with large proportions of ash and clinker. This material was recorded at depths between ground level and 5.60m bgl. Both the cohesive and granular made ground were recorded to contain low to high content of sub-angular to sub-rounded cobbles and boulders of sandstone, brick and concrete.

Cohesive alluvial soils were recorded underlying made ground soils across the majority of the former landfill area, generally comprising sandy clay / silt with localised organic debris and peat. Where encountered, granular alluvial soils were recorded to comprise sandy gravels of sandstone. Alluvial soils were underlain by residual and / or competent bedrock at variable depths of between 3.6m and 10.8m bgl.

Former Mill Area

Granular made ground predominated across this area, typically comprising sand and gravels of ash, clinker, concrete, brick and locally wood. The granular fill was also noted to comprise a large proportion of ash and clinker. Cohesive fill was recorded to typically comprise sandy gravelly clay with brick, concrete, sandstone and locally wood fragments. A reworked alluvial soil was locally

encountered comprising gravelly sandy clay with occasional organic inclusions. A number of the window sample boreholes and trial pits were terminated within the made ground soils and subsequently did not prove the full thickness of the fill materials.

Natural cohesive alluvial soils generally comprised sandy clay / silt with gravel sized fragments of sandstone. Locally the alluvial soils (identified as Area B2 on Drawing C6485D RevA/02 within the Settlement Report) were noted to contain organic inclusions (including peat) at depths between 0.55m and >4.00m bgl. Granular alluvial soils were recorded to comprise gravelly sand or silty gravel of sandstone. Alluvial soils were absent within the northeastern extent of the mill area.

Natural residual soils, were found below either the granular and / or the cohesive alluvial soils across parts of the mill area. Residual Millstone Grit Formation soils were found immediately below the made ground within the northeast of the mill area. The cohesive residual soils were described as stiff to very stiff, locally firm, sandy clay with gravel sized fragments of sandstone and mudstone, whilst the granular residual soils typically comprised medium dense to very dense clayey sandy gravel of mudstone.

South West Area

The granular fill within the southwestern site area was generally described as silty sandy gravel, typically described as demolition rubble fill. The demolition fill comprised sandy gravel and cobbles of brick, concrete, metal and locally wood. Cohesive fill comprised sandy clays with sandstone, brick and concrete.

Underlying natural cohesive alluvial soils were recorded to comprise sandy gravelly clays at a depth of 2.80m bgl. Granular alluvial soils were also noted in the lower plateau part of this site, comprising sandy gravels of sandstone, proven to a maximum depth of 4.60m bgl.

North West Area

Infilling of made ground has only recently been completed within former structures in the northwestern site area (*circa* 2014), which were recorded to variable depths of between approximately 0.5m and 6.3m bgl, typically comprising sandy clay/silty clay with gravel sized fragments of plastic, brick, concrete, ceramics, mudstone, sandstone, old clay pipes, wood, timber, coal, sandstone, limestone, tiles, flints, slate, metal, glass, ash, clinker and wires. Granular fill was also encountered comprising clayey sands and gravel, of ash, clinker, concrete, brick and sandstone.

A band of soft slightly organic sandy silt, with reeds was recorded at depths of between 2.50m and 2.80m bgl, whilst a gravelly sandy silt/clay with organic and wood inclusions was encountered at depths of between 2.00m and 3.30m bgl within the areas of the former reservoirs. These materials were considered representative of basal sediment deposits and / or a reworked alluvial soil associated with the former reservoirs.

Natural cohesive alluvial soils were recorded within a number of the exploratory holes comprising sandy clay with gravels of sandstone and mudstone. Gravel sized inclusions of organic debris were locally encountered. The granular alluvial soils comprised clayey sandy / silty gravels of sandstone. Natural residual soils were found either directly below the made ground soils and / or the granular / cohesive alluvial soils at depths of between 4.80m and 7.70m bgl.

General

Based on the historical information available for the site and the previous intrusive investigations undertaken, it is anticipated that extensive former structures including foundations, underground services etc. will exist below the site.

Potential obstructions including cobbles and boulders were recorded within natural cohesive and granular soils encountered across the site. In addition, a number of large tree roots/trunks were recorded within the natural alluvial soils. These were generally noted within the soils underlying the mill building, toward the River Don.

The Sirius Geoenvironmental Appraisal report ref. C6485A RevA, dated March 2016 (and subsequent supplementary (*pre-demolition)* investigation letter report, dated 25th July 2016) should be referred to for a detailed account of ground conditions.

Sirius were commissioned by CEG in February 2017, to undertake investigation of recently stockpiled materials, to assess their suitability for re-use. The results of the investigation indicated that the materials tested were considered chemically suitable for use as general fill at the site. However, due to the presence of man-made materials such as concrete, metal, timber, etc., the material was not considered to be textually suitable for use in a clean cover layer or growing medium. The investigation is reported within letter report reference C6485E/GH/7785, dated 10th March 2017, a copy of which is included within Appendix B of this report.

Groundwater

Monitoring of the standpipes installed within selected cable percussive and window sample boreholes revealed perched water or groundwater, where present, to be standing at depths of between 0.15m and 8.95m bgl.

2.10. Contamination Considerations

Elevated concentrations of metals/metalloids and polycyclic aromatic hydrocarbons (PAHs) have been detected within both granular and cohesive made ground soils (and made ground topsoils) across the majority of the site, which are considered to pose a potential risk to human health through dermal contact, dust inhalation and soil ingestion pathways. In addition, asbestos-containing materials (ACMs) and asbestos fibres have been identified within a number of made ground samples. These will be mitigated by the placement of either hardstanding or a clean cover system, as detailed further in Section 8.0.

A surface sample of granular made ground (HDP06 at a depth of 0.10m bgl) collected within the southeastern area of woodland was found to contain asbestos fibres. Supplementary delineation testing surrounding this location did not encounter any further asbestos. As no formal capping is proposed within the woodland areas, asbestos-impacted material identified at HDP06 is to be excavated and either placed under hardstanding (where it will remain undisturbed), or be removed, for off-site disposal at a suitable licensed landfill facility. This is detailed further within Section 5.1.

A localised area of hydrocarbon-contaminated soils, associated perched groundwater and free-product in the vicinity of SBH11 within the southwestern site area, is considered to pose a potential risk to site end users and controlled waters, and should be removed and treated either on-site or be removed from site to an authorised off-site treatment or disposal facility. This is detailed further in Section 5.1.

No specific remedial works are required to protect controlled waters, other than the removal/treatment of the identified hydrocarbon hotspot within SBH11, as detailed above.

Localised elevated calorific values were detected within granular ash-rich made ground typically encountered within the landfill, northwestern and mill areas across the site, which may pose a risk

of combustion due to heating by electrical cables or bonfires. Mitigation of this risk is discussed in Section 5.4.

A *post-demolition* supplementary site investigation is proposed within currently inaccessible areas including electricity sub-stations and above-ground storage tanks, as detailed further within Section 5.0. The supplementary site investigation will be reported and reviewed by the LPA, prior to enabling works commencing within those areas.

2.11. Unknown Contamination

In addition to the above identified contamination, there is the possibility that as yet undiscovered sources of contamination may be present which will require remediation. It is therefore recommended that the following actions should be undertaken during site reclamation and preparatory works.

A watching brief should be carried out during breaking out of the existing concrete floor slabs, above ground tank (AST) bases, together with relic structures/ foundations as well as former drain runs/ pipes.

The watching brief should be carried out by an experienced geoenvironmental engineer (GE) with particular attention to:

- Made ground differing significantly in nature from that previously identified during the previous site investigation works.
- Evidence of asbestos-containing materials.
- Visual or olfactory evidence of hydrocarbons notably around areas previously occupied by ASTs, and within / below former drain runs / pipes.

The GE shall carefully inspect soils during the watching brief and advise the Earthworks / Remediation Contractor of any testing requirements to adequately classify the materials for potential re-use or removal from site. Subject to the results of this testing, the current risk assessment may need to be re-evaluated.

2.12. Hazardous Ground Gas

A summary of the site zones and their Characteristic Situation classifications for ground gas is presented in Table 2.2 above.

Details of the proposed gas protection measures, including materials and construction method, and details of the proposed validation, should be submitted to the Local Planning Authority for their approval prior to installation.

Installation and subsequent verification should be undertaken by appropriately trained/qualified contractors, in accordance with the CIRIA Document C735, 2014 'Good practice on the testing and verification of protection systems for buildings against hazardous ground gases', and Sheffield City Council - Environmental Protection Service document, dated 16th February 2009, Verification of Gas Protection Measures (or updated version if relevant).

Radon protection measures are not required for the proposed development on this site.

3. REMEDIATION STRATEGY AND OBJECTIVES

The primary objective of the remediation works is to render the site suitable for residential development whilst mitigating the transient and long-term risks to receptors including human health and controlled waters from historical chemical contaminants within soils and groundwater. 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, and are designated into zones within the site, where necessary. Pertinent elements of the works are discussed in greater detail in subsequent sections of this document, and within the Sirius Settlement Report (ref. C6485D RevA, dated October 2017), reproduced within Appendix B, which should be read in conjunction with this Strategy.

It should be noted that this Strategy assumes that, under appropriately controlled conditions, the appointed Demolition Contractor will carefully remove and dispose of all asbestos-containing materials arising from the existing buildings and site surface, in accordance with the findings and recommendations of a suitable asbestos survey.

The remediation works should be undertaken under a CL:AIRE Development Industry Code of Practice Materials Management Plan (MMP); the MMP will need to be declared to CL:AIRE prior to commencement of earthworks.

- Service location/disconnection and/or protection.
- An updated assessment of the presence / absence of invasive plant species should be completed by a qualified consultant and their advice taken on appropriate treatment/mitigation, if necessary.
- Erection of temporary tree protection fencing.
- Removal of remaining existing vegetation (trees, bushes etc.) from the proposed development area necessary to facilitate the works.
- Safe demolition / breaking out of remaining above ground structures, remnant slabs and areas of hardstanding.

- Making safe and removing all above ground storage tanks (and associated fuel lines, pipe work, oil stores etc.) and electricity sub-stations.

- Post-demolition investigation / assessment and treatment (if required) of any hydrocarbon / PCB contamination (soil and/or groundwater) associated with the above features (as indicated on Drawing No. C6485A RevA/RS/04) to achieve target concentrations acceptable for re-use.

- **Landfill**

    - Referenced as 'Area D' within Sirius Settlement Report (included within Appendix B of this report).

    - Breakout relic concrete hardstand and foundations, and stockpile on site for further classification and / or treatment. Safe excavation and management / disposal of any landfill arisings / wastes to be considered. Placement of a suitable capping layer notwithstanding, final site levels shall be achieved with classified and appropriately compacted materials in accordance with an approved engineering specification / the Sirius Specification for Engineered Fill.

    - Any materials considered to be significantly geotechnically unsuitable (such as the localised 'gelatinous' materials within the landfill) which are encountered during the earthworks, should be excavated and disposed off-site or treated to an acceptable standard, with resultant excavations backfilled and re-engineered with suitable granular materials.

    - Highways to be excavated to a minimum 2.0m below existing or proposed levels, whichever is the lower of the two, for their entire width and re-engineered with suitable materials in accordance with the Sirius Specification for Engineered Fill to achieve the proposed remediated level of 500mm below finished design levels. Materials re-engineered within adoptable highways must not contain asbestos at levels above the minimum quantifiable threshold of 0.001% by mass.

    - Geogrid reinforcement should be used at the base of excavation / below invert level of any drainage beneath the highway whichever is the deepest. All proposed works are subject to approval with the Local Authority Section 38 Engineers.

- **Mill area**

    - Referenced as Areas ‘A’, ‘B1’, ‘B2’ and ‘C’ within the Sirius Settlement Report. In light of a significant proportion of alluvium being organic in nature, surcharging is proposed within Area B2 as part of enabling works. Aspects of surcharging in terms of residual and rates of settlement are discussed further in Section 7.6.

    - Excavate made ground to a typical minimum depth of 1m below existing or proposed levels, (whichever is lower) 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. Final site levels shall be achieved with classified and appropriately compacted materials in accordance with an approved engineering specification / the Sirius Specification for Engineered Fills and shall take account of any capping requirements to address contamination concerns in relevant area.

    - Presence of low strength / soft cohesive made ground below extent of turnover to undergo removal and / or soil stabilisation where necessary, in accordance with the recommendations provided within the Sirius Settlement Report.

    - Made ground beneath proposed highways will be excavated to a minimum depth of 2m below existing or proposed levels, whichever is the lower of the two, for their entire width and re-engineered with suitable materials in accordance with the Sirius Specification for Engineered Fill to achieve the proposed remediated level of 500mm below finished design levels. Materials used within adoptable highways must not contain asbestos at levels above the minimum quantifiable threshold of 0.001% by mass.

    - Presence of low strength / soft cohesive made ground in excess of 2m to be considered, where below proposed highways, with subsequent removal and / or soil stabilisation where necessary.

    - All proposed works are subject to approval with the Local Authority Section 38 Engineers.

- **North Western area**

    - Referenced as ‘Area E’ within Sirius Settlement Report.

- Excavate full depth of made ground within the lower plateau, and breakout relic foundations, substructures and below ground obstructions (where feasible). Any remnant substructures which cannot be safely removed should be punctured to permit drainage.

- Removal / treatment of any gross contamination encountered, and stockpiling on site for further classification and / or treatment. Placement of a suitable capping layer notwithstanding, final site levels shall be achieved with classified and appropriately compacted materials in accordance with an approved engineering specification / the Sirius Specification for Engineered Fill.

- Excavate made ground within the upper plateau to a typical minimum depth of 1m below existing or proposed levels, whichever is deeper, 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. Placement of a suitable capping layer notwithstanding, final site levels shall be achieved with classified and appropriately compacted materials in accordance with an approved engineering specification / the Sirius Specification for Engineered Fill.

- Presence of low strength / soft cohesive made ground below extent of turnover to undergo removal and / or soil stabilisation where necessary, in accordance with the recommendations provided within the Sirius Settlement Report.

- Highways and drainage runs within the lower plateau to be subject to a full turnover for their entire width, with likely excavation, classification and ex situ soil modification and / or disposal. Excavations to be backfilled and re-engineered with suitable materials in accordance with the Sirius Specification for Engineered Fill to achieve the proposed remediated level of 500mm below finished design levels.

- Made ground beneath proposed highways within the upper plateau will be excavated to a minimum depth of 2m below existing or proposed levels, whichever is the deeper of the two, for their entire width and re-engineered with suitable materials in accordance with the Sirius Specification for Engineered Fill to achieve the proposed remediated level of 500mm below finished design levels.

- Materials used within adoptable highways on both upper and lower plateaus must not contain asbestos at levels above the minimum quantifiable threshold of 0.001% by mass.

- Presence of low strength / soft cohesive made ground to be considered where below proposed highways, with subsequent removal and / or soil stabilisation where necessary.

- All proposed works are subject to approval with the Local Authority Section 38 Engineers.

- **South Western area**

  - Referenced as 'Area F' within Sirius Settlement Report.

  - Excavate made ground to a typical minimum depth of 1m below existing or proposed levels and breakout relic foundations, substructures (including infilled former Mill Race where feasible) and below ground obstructions, in addition to any gross contamination encountered, and stockpile on site for further classification and / or treatment. Placement of a suitable capping layer notwithstanding, final site levels shall be achieved with classified and appropriately compacted materials in accordance with an approved engineering specification / the Sirius Specification for Engineered Fill.

  - Presence of low strength / soft cohesive made ground below extent of turnover to undergo removal and / or soil stabilisation where necessary, in accordance with the recommendations provided within the Sirius Settlement Report.

  - Made ground beneath proposed highways will be excavated to a minimum depth of 2m below existing or proposed levels, whichever is the deeper of the two, for their entire width and re-engineered with suitable materials in accordance with the Sirius Specification for Engineered Fill to achieve the proposed remediated level of 500mm below finished design levels. Materials used within adoptable highways must not contain asbestos at levels above the minimum quantifiable threshold of 0.001% by mass.

- Presence of low strength / soft cohesive made ground to be considered where below proposed highways, with subsequent removal and / or soil stabilisation where necessary.

- All proposed works are subject to approval with the Local Authority Section 38 Engineers.

General (All Site Areas)

- Consideration of (locally impacted) perched water / groundwater ingress during enabling works, requiring treatment / disposal.

- 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 C of this report) to 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 contamination (southwestern area of the site) and surface asbestos fibre (woodland area) hotspots (as indicated on Drawing No. C6485A RevA/RS/04 included within Appendix A), 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.

- 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 / hard dig layer at ground surface within the landfill area, where asbestos impacted made ground soils remain. Materials used within the minimum 100mm cover must not contain asbestos at levels above the minimum

quantifiable threshold of 0.001% by mass, and detectable asbestos fibres must not be present in greater than 20% of samples analysed from a minimum of 20 screened samples.

- 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 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:

- Appropriate management of all excavation, piling and foundation arisings and other works to ensure that risks from potential residual contamination (including asbestos) within underlying made ground materials does not present a risk to site workers or result in cross contamination of other areas of the site or clean imported soils.

- A minimum 600mm of clean cover to be placed in areas proposed for private gardens and a minimum 450mm of clean cover within proposed soft landscaping across the development area (comprising suitable topsoil and subsoil), where made ground is present. In addition, given the presence of asbestos containing materials within the made ground, it is considered that this clean cover system should be underlain at its base by a geotextile marker or a dense granular ‘no dig’ layer of at least 150mm in thickness. Deep-rooted plants will need to be potted.

- Where the site is underlain directly by natural ground, a nominal 150mm depth of clean topsoil should be provided in gardens / soft landscaping areas to provide a suitable medium for plant growth.

- Construction of clean cover soil capping 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, in accordance with relevant guidance and Sheffield City Council Environmental Protection Service document “Acceptable Methods of Validating Capping Thickness”, dated May 2013.

- Chemical validation of any imported subsoil and topsoils could be undertaken prior to import to site, provided that the contractor can supply relevant supporting documentation, and evidence that the source of the imported soils is maintained from a quarantined stockpile. Assuming the soils are suitable, this could remove the requirement for chemical validation of imported soils once placed in-situ.

- Design and installation of appropriate gas protection measures within each proposed plot (as specified within Sirius Gas Assessment Report, ref. C6485A/GRA, dated July 2016), in accordance with the requirements of BS8485:2015. Design of gas measures will be subject to regulatory approval.

- Installation of appropriate gas protection measures to be suitably validated on completion. Validation works to be undertaken in accordance with Sheffield City Council - Environmental Protection Service document “Verification of Gas Protection Measures”, dated 16th February 2009 (included within Appendix B of this report) and CIRIA C735.

Additional verification reports for both clean cover placement and gas protection measures installation will be required as plots, gardens and landscaped areas are completed.

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;
- Review of site records and test results as they become available and make comment and act upon those results accordingly; and,
- Production of the initial validation report, covering the general remedial earthworks. Additional reports validating the clean cover and installation of gas protection measures to be produced once plots are completed.

5. CONSTRAINTS TO DEVELOPMENT

5.1. Proven On-site Contamination

Hydrocarbon Contamination

Hydrocarbon-contaminated material (including free-phase hydrocarbons) has been identified in a localised area around investigation locations SBH11 and TP209, as shown on Drawing No. C6485A RevA/RS/04, included within Appendix A of this report. This 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 one sample per side wall / base) to confirm that all potentially hazardous hydrocarbon contamination has been removed. Samples shall be tested for speciated TPH 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 and incidental perched groundwater removal is viewed as excessive by volume / cost, or if the practicalities of removing such contamination poses a risk to adjacent structures / features such as the river, 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 that exhibits significantly elevated concentrations of TPH and/or free product, shall also be removed/treated as part of the excavation works.

Controlled Waters

Other than the remedial works described above within the vicinity of SBH11 and TP209 in the southwest zone of the site, no other works are considered necessary to ensure the protection of groundwater. Mitigation measures to prevent contamination of / run-off to the River Don should be maintained at all times, which are detailed further in Section 5.8.

Asbestos

ACMs were locally visually identified during site investigation works, and recorded as fibres within made ground soils across each site area. The results of quantification testing indicated mass percentage volumes of asbestos within the landfill of between <0.001% and 0.053%; between <0.001% and 0.011% within the mill area; 0.004% and 0.035% within the southwestern site area and <0.001% within the northwestern site area.

Asbestos 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 gardens / 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) all reasonable measures 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.

Following completion of earthworks, a minimum 100mm layer of clean soils / hard dig layer should be placed at the surface within the landfill area, as significant quantities of asbestos-impacted made ground is present below post-remediation ground levels. This cover 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.

Appropriate management of all excavation / foundation arisings and other works shall be considered to ensure that risks from asbestos within underlying made ground materials does not present a risk to site workers or result in cross contamination of other areas of the site or clean imported soils.

Woodland Area (located to southeast of mill area)

A sample of granular made ground (HDP06 at a depth of 0.10m bgl) collected within the southeastern area of woodland was found to contain asbestos fibres. Supplementary delineation testing surrounding this location did not encounter any further asbestos. The asbestos-impacted material identified at HDP06 should be excavated and either placed under hardstanding (where it will remain undisturbed), or be removed, in accordance with prevailing legislation, for off-site disposal at a suitable licensed landfill facility.

Materials within the areas should be carefully excavated to a minimum depth of 0.5m below existing ground levels (or to the base of the known impacted made ground soils, whichever is shallower), with arisings placed on heavy duty plastic sheeting. Any visible asbestos fragments should be carefully picked by the CAT B trained operative, double bagged and placed into a secure area for subsequent disposal.

Following excavation of impacted soils, samples shall be taken from each exposed surface, to validate that the area of asbestos impact has been fully removed, with the recovered samples being sent to an UKAS and MCERTS accredited laboratory for asbestos identification.

During the above works all of the soils should be kept sufficiently damp to avoid any possible fugitive fibre / dust release.

Where the results of laboratory testing indicate asbestos fibres / containing materials remain present, additional soils shall be excavated from the sidewalls or base of the excavation following which, further validation samples shall be recovered and tested in accordance with the method described above. This shall be an iterative process until validation test results confirm asbestos is

not present across the face and base of the excavation. All materials excavated, if stockpiled, should be kept sufficiently damp and covered until such time that they can be removed from site.

Asbestos or other wastes have not been observed elsewhere within the woodland areas but the presence of small amounts of such materials (e.g. due to fly tipping) cannot be precluded and a watching brief should be maintained during further works.

General

Granular and cohesive made ground across the site has been found to contain locally elevated concentrations of metals, metalloids and PAHs. The presence of ACMs and asbestos fibres has also been recorded. Mitigation of the risks posed to human health by these contaminants is required.

Visible ACMs should be picked from exposed made ground soils, where encountered during the remediation and enabling works. A clean cover ('capping') layer shall subsequently be placed in all areas where made ground is present when the ground is not otherwise covered by buildings or hardstanding (i.e. gardens and areas of soft landscaping).

A minimum 600mm of clean cover should be placed in areas proposed for private gardens and a minimum 450mm of clean cover within proposed soft landscaping across the development area (comprising suitable topsoil and subsoil), where made ground is present. In addition, given the presence of ACMs within the made ground, this clean cover system should be underlain at its base by a geotextile marker. Deep rooted plants would need to be 'potted'.

Elsewhere, where the site is underlain directly by natural ground, a nominal 150mm depth of clean topsoil should be provided in gardens and areas of soft landscaping to provide a suitable medium for plant growth.

Given the historical site uses and the potential for associated contamination, vigilance should be maintained during site clearance, remediation, enabling and construction works for currently unknown hotspots of contamination. If any unexpected areas of noxious, odorous, brightly coloured, fibrous, liquid or other suspect contamination are encountered, then these are to be reported and advice sought from a suitably qualified consultant.

5.2. Above-Ground Storage Tanks

Drawing No. C6485A RevA/RS/04 in Appendix A to this Strategy shows the approximate location of known and/or presumed above ground storage tanks. It is reported that the tanks were emptied and decommissioned in 2008.

It is recommended however that before any work is commenced on removing the above-ground tanks, that they are checked for any residual product. Any residual product within the tank shall be removed as far as is practically possible (i.e. bottoming). In addition, it may be also then necessary to treat the base of the storage tank with a proprietary emulsifier or hydrocarbon adsorbent to ensure, so far as is practicable, that all residual hydrocarbons are removed. Emptying and making safe of tanks should be carried out by a specialist sub-contractor.

The procedures detailed in the Institute of Petroleum publication “Guidelines for the Uplift of Product from Petrol Filling Stations and Customer Tanks, January 2006” should be followed, if appropriate to the works.

The tanks and all associated pipework shall then be excavated and removed off-site to a suitable licensed waste facility. The Earthworks Contractor shall ensure that the recipient of the tank is made aware of the tank’s previous use, the hazards, and the need to take adequate precautions against fires and explosions when handling and disposing of it. HSE Guidance note GS/29/2 details guidance in safety on tank demolition.

Following removal of any storage tank(s), intrusive investigation should be completed by the GE, and reported to the LPA for their review and approval, as part of a *post-demolition* targeted investigation.

Following approval of the *post-demolition* investigation report by the LPA, any underlying or surrounding soils exhibiting hydrocarbon contamination and/or free phase product which are considered to pose a risk to site end users / controlled waters should be excavated and placed in temporary stockpiles on hardstanding or heavy-duty plastic sheeting. This should be suitably covered to minimise the potential for dust/odour nuisance and to prevent surface water run-off. The GE should advise the Earthworks / Remediation Contractor as to the testing requirements to adequately classify the materials for either potential re-use or removal from site.

Subsequent to the removal of any soils exhibiting hydrocarbon contamination, 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). Samples shall be tested for

speciated total petroleum hydrocarbons (TPH) at a UKAS and MCERTS accredited laboratory accredited laboratory.

The results should then be compared to the corresponding assessment criteria included within the Sirius GAC's within Appendix E of this Strategy.

If any of the referenced assessment criteria 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 assessment criteria across the entire face and base of the excavation.

With regard to the stockpiled soils following validation, these should be treated, as required, in order to achieve the treated assessment criteria as detailed in Appendix E allowing re-use, or, alternatively removed from site, if considered appropriate.

Unsuitable materials shall be exported from site to a suitably licensed facility, in accordance with the Duty of Care requirements.

5.3. Existing Electricity Sub-Stations

Existing electricity sub-stations are located within the northern extent of the mill and the southern area of the landfill of the site. Speciated polychlorinated biphenyl (PCB) analysis was performed on selected soil samples taken in close proximity to both sub-stations as part of previous investigations, with recorded concentrations not considered to pose a risk to site end users. Further investigation was recommended, however, to confirm this.

If development proposals allow for the removal / replacement of the existing sub-stations, the GE shall inspect the underlying and surrounding shallow soils for any historical hydrocarbon contamination, and appropriate intrusive investigations be undertaken. Where detectable concentrations of PCBs are recorded these should be assessed against the PCDDs, PCDFs and dioxin-like compounds CLEA worksheet for a residential land use scenario. This shall be an iterative process until validation test results are suitable for the proposed end use across the entire face and base of the excavation. Any excavations backfilled prior to receipt and review of laboratory validation test results by the GE, are at the risk of the Earthworks / Remediation Contractor.

A subsequent *post-demolition* investigation report shall be submitted to the LPA for review and approval.

If any significant PCB or hydrocarbon contamination is present (based on visual / olfactory observations and the results of laboratory testing) then the soils should be excavated and removed from site to an appropriately licensed waste disposal facility or appropriately treated for reuse on site subject to concentrations being below GACs provided in Appendix E.

Following the removal of any impacted soils, 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 to confirm that all potentially hazardous hydrocarbon contamination has been removed. Samples shall be tested at a UKAS and MCERTS accredited laboratory for the suite of 12 PCB compounds detailed within the Environment Agency Science Report: SC050021/Dioxin SGVs.

The approximate locations of the existing sub-stations are shown on Drawing No. C6485A RevA/RS/04 within Appendix A.

5.4. Potentially Combustible Ash-Rich Soils

Locally elevated calorific values were recorded within ash-rich made ground, which poses a risk to proposed services. The maximum concentration recorded in an individual sample is 18.7MJ/kg.

The guidance indicates that an appropriate remedial technique to protect the built development is by capping the potentially combustible material to prevent materials becoming exposed after development and laying electrical cables within corridors of suitable fill.

It is recommended that additional calorific value testing is undertaken at a rate of one sample per 500m^3 during enabling works where ashy made ground soils are encountered during earthworks. If consistently elevated values are recorded in the vicinity of proposed service trenches, then made ground should be removed for 1.0m in all directions and be replaced with suitable fill. In addition, ash-rich made ground should be placed at a minimum depth of 1.0m below final levels within areas of gardens and soft landscaping, to mitigate the risk of combustible materials becoming exposed to bonfires.

5.5. Invasive Plants

Invasive plant species surveys for the site are reproduced within Appendix B of this report. The recommendations for treatment provided within the July 2017 reports and any updated subsequent reports should be followed prior to any enabling works commencing on site.

Subject to discussion and agreement with a suitably qualified contractor/consultant, Himalayan Balsam impacted soils located within the northwestern site area could be excavated and placed at depth during enabling works.

5.6. Ecology

An ecological survey has been undertaken for the site (Oughtibridge Mill, Sheffield, Ecological Appraisal, report ref. 689 dated 21st March 2016 by Baker Consultants), which has been updated by subsequent various surveys (including a bat survey). The ecological survey is reproduced within Appendix B of this report.

The recommendations provided within the survey should be followed as part of any enabling / construction works at the site.

5.7. Tree Preservation Orders

An arboricultural survey has been undertaken for the site (Arboricultural Report at Oughtibridge Mill, Sheffield, report ref.12563-D/AJB, dated May 2017 by JCA Limited), in addition to a TPO tree retention and removal plan. The survey and associated drawings are reproduced within Appendix B of this report.

The recommendations provided by JCA Limited should be followed as part of any enabling / construction works at the site in order to ensure the protection of trees with preservation orders.

5.8. River Don

Mitigation measures (such as the use of absorbent booms etc.), should be put into place to prevent potentially contaminated waters and leachate from excavations or stockpiling areas reaching watercourses, surface water drains, etc. Contractors 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 (i.e. the River Don).

In addition, measures should be in place to prevent the run-off of site water containing dust or silt into the river. Such measures could include the use of, for example, appropriate site drainage (including sedimentation tanks), silt control fencing and on-going monitoring of river water quality. The appointed Earthworks / Remediation Contractor should produce detailed Method Statements describing how these objectives will be achieved.

Should any surface water features, such as springs or issuing waters be encountered during enabling and earthworks, it is recommended that the appointed Earthworks / Remediation Contractor should appropriately divert these. Any works undertaken should be recorded by the GE, and reported to the relevant authority.

5.9. Retaining Walls / Slopes

A number of existing retaining structures and slopes are present along Langsett Road North, which will require detailed consideration as part of development proposals. A Geotechnical Retaining Wall Report incorporating detailed slope stability assessment (ref. C6485C dated July 2016) and a Slope Stability Analysis letter report (ref. C6485/6633/CL dated April 2017), have previously been produced by Sirius, the findings and recommendations of which should be considered as part of any design works / development proposals.

Based on the findings of the slope stability analysis undertaken for the existing slope within the northwestern site area, a recommended 'no-build' zone should be incorporated along the crest of the slope. This zone of proposed 'no-build', is demonstrated on the constraints to development plan (Drawing No. C6485A RevA/RS/04), included within Appendix A of this report.

During the enabling works/foundation construction, control measures may have to be put in place in order to prevent the potential undermining/damage of existing retaining walls and the river located centrally within the site. Careful consideration will also have to be given to the potential risk of undermining existing neighbouring buildings, infrastructure, adjacent highways and existing slopes, prior to any proposed cut and fill earthworks at the site.

The appointed Earthworks / Remediation Contractor should produce relevant detailed Method Statements for the approval of the relevant regulatory authorities prior to works commencing.

5.10. Services

The location of any services which may be present within the site boundary should be included with the Pre-Construction Information Pack (PCIP) and included with the Earthworks / Remediation Contractors Health and Safety File.

5.11. Existing Bridge

It is understood that the existing access bridge spanning the River Don is proposed to be demolished and the existing abutments be made safe. An assessment of the existing bridge has been completed by GHD Livigunn (Existing Access Bridge Assessment, ref. LS1611, dated July 2016), which is included within Appendix B of this report. The recommendations should be considered as part of proposed demolition / enabling works at the site.

6. PREPARATORY WORKS

6.1. Tree Protection

Any trees which are to be retained should be identified prior to commencement of site works and should be protected where necessary by means of a suitable robust fence to avoid accidental impact damage and prevent excavation within the root zone. Where the presence of trees to be retained could affect proposed remedial measures i.e. excavations or placement of future capping layer then early discussions should be held with the Local Planning Authority with regard to a suitable solution.

6.2. Site Clearance

Following the erection of the required tree protection, all remaining vegetation within the development footprint shall be stripped/ cleared and stockpiled on site for subsequent removal. Any general debris shall be cleared and placed in skips for off-site disposal.

6.3. Topsoil Strip

Any potentially suitable (both chemically and texturally) topsoil excavated during the works shall be carefully stockpiled at an agreed location away from other intrusive works, for subsequent confirmatory testing.

Made ground topsoil which is considered texturally and/or chemically unsuitable for re-use within gardens and/or soft landscaping shall be subject to treatment and further assessment where possible, or, alternatively removed from site to a suitably licensed facility.

6.4. Demolition

Removal of all ACMs identified in a pre-demolition asbestos survey and the subsequent safe demolition of the existing structures should be addressed under separate cover within the plan of works and method statements submitted, by others, in support of the agreed demolition notice for the site.

Hard arisings resulting from the demolition are to be stockpiled for subsequent processing and re-use on-site.

7. EARTHWORKS

7.1. General Requirements

Earthworks shall be undertaken in accordance with the Sirius Specification for Engineered Fills presented in Appendix C 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 fully broken out / removed, where feasible. 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 the depth of turnover (such as piles and / or any remnant structures, particularly within the northwest of the site) 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. Such features should be cropped to a minimum of 2m below proposed remediated levels, and punctured where necessary, to permit drainage.

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. Pre-bored piled foundations may be necessary in such instances.

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

Previous investigation works have revealed that made ground is unsuitable to remain at shallow depth within the context of the proposed residential development, predominantly due to the presence of asbestos within these materials.

Made ground soils, if retained on site, would need to be placed below suitable hardstanding or appropriate cover system within areas of soft landscaping/private gardens. Final remediation levels will allow for the placement of a minimum depth of 600mm of clean validated topsoil/subsoil in addition to a suitable basal geotextile separator within gardens and soft landscaped areas where made ground is present.

Landfill Area

With regards to the landfill area, these made ground soils present a potential significant risk to site / groundworkers primarily due to the presence of residual asbestos fibres.

Any excavations within these materials will require due care and attention during site preparatory/enabling works and appropriate mitigation to negate any possible release of fibres to the atmosphere.

An asbestos CAT B trained operative should undertake a watching brief during any excavation of these soils in order to identify any possible ACM fragments of suspect debris/material. Any visible ACMs identified should be carefully picked by the CAT B trained operative, double bagged, which shall be sealed and clearly labelled as containing asbestos waste, and placed into a secure area for subsequent removal from site to a suitable disposal facility.

As previous investigation works have revealed asbestos fibres to be widely present within the landfill, reassurance asbestos air monitoring will be carried out in accordance with Control of Asbestos Regulations 2012 and HSG248 Asbestos: The Analysts' Guide for Sampling, Analysis and Clearance Procedures.

Upon commencement of earthworks within the landfill area, an UKAS accredited analyst will be present on site for at least 2 days during the first week collating 'real time' analytical data. A minimum of 2 no. monitors will be run during the period of the earthworks; one will run at the boundary edge at the downwind side of the works with a second monitor installed at or close to working area. A third monitor may be utilised depending upon the weather conditions and the works been undertaken. This will be advised by the asbestos surveyor/analyst.

The purpose of the re-assurance air monitoring is to confirm the effectiveness of the control measures being employed to mitigate the risk of airborne asbestos fibres within the landfill area and ensure human health receptors are not put at any unacceptable risk. The results of the recorded data will be utilised to determine following consultation with the analyst a suitable frequency of monitoring required thereafter.

In accordance with the current guidelines and based upon the control measures to be implemented the recorded exposure limit is expected to be well below the accepted clearance indicator of 0.01 fibres per cubic centimetre. If, however, recorded readings exceed the accepted control limit then works should be suspended until control procedures are revised.

During all operations the risk of dust release will be continuously assessed and appropriate mitigation measures will be put in place. This is typically a bowser with hose attachment to wet down working areas and suppress dust although other alternative techniques (i.e. atomisers) will be considered as necessary. Potential dust emissions from soils should be mitigated by the application of water or stabilizing agents and/or by covering with tarpaulin sheeting or other appropriate cover material. The materials must not be allowed to dry out throughout any of the above operations.

Wind speed measurements should be taken and recorded at locations within close proximity to, and representative of, the work area in which the soil is being excavated. Should wind speeds impact the ability of engineering/ mitigation controls to work as designed then excavations should immediately and temporarily cease and they should not re-start until such time the asbestos surveyor and/or analyst has agreed it is safe to do so.

All site operatives undertaking the above works should be suitably trained for the task been undertaken and should wear the appropriate PPE/ RPE as required, taking into account any ongoing advice from the qualified and experienced asbestos surveyor/ analyst.

All Site Areas

Notwithstanding the above, if any areas of significant asbestos contamination are identified or suspected during the preparatory works (within either the landfill, or elsewhere across the site), then works should cease within that area, the soils adequately covered (heavy duty plastic sheeting or similar) and advice sought from the GE and/or a qualified asbestos surveyor/analyst.

In addition to the above, any soils exhibiting visual and/or olfactory evidence of gross contamination encountered during preparatory/enabling works shall be placed in temporary stockpiles on suitable hardstanding or heavy duty plastic sheeting, suitably covered and bunded with appropriate signage and identification. The GE shall inspect the soils and advise the Earthworks / Remediation Contractor of any testing requirements to adequately classify the materials for potential re-use or removal from site.

Any made ground excavated as part of the preparatory/ enabling works, and which are to be re-used on site as engineered fill, should be processed/ screened (as required) to remove oversized materials or any other unsuitable material. All arisings, if re-used in the works, should have a maximum particle size of 125mm. Oversized hard material shall be crushed to generate a 6F2 graded material for re-use within the works, or alternatively removed from site.

All materials to be re-used as an engineered fill should be classified in accordance with the Department of Transport's Manual of Contract Documents for Highway Works (MCHW): Series 600, Volume 1, dated November 2009.

Granular and cohesive soils should be safely stockpiled separately.

7.4 Interim Cover Layer

On completion of site re-profiling within the landfill area, an interim cover layer comprising 100mm of recycled aggregate will be placed across the surface. This layer will act as an interim cover to reduce the potential for release of asbestos fibres during dry periods during the ongoing development of the landfill area and prior to the placement of the final capping layer in gardens and landscaped areas.

In order to be fit for this purpose and to provide a meaningful reduction in potential fibre release relative to the underlying made ground, materials used must not contain asbestos at levels above the minimum quantifiable threshold of 0.001% by mass, and detectable asbestos fibres must not be present in greater than 20% of samples analysed from a minimum of 20 screened samples.

7.5 Adoptable Highways

Reference should be made to the Sirius Settlement Report (included within Appendix B) for recommendations in specific site areas in relation to treatment of adoptable roads.

In summary, with the exception of the northwestern site area, highways are proposed to be excavated to a minimum depth of 2m below existing or proposed levels, whichever is the deeper of the two, for their entire width and re-engineered with suitable materials. Where made ground exceeds a depth of 2m along highway alignments, the use of geogrid reinforcement at the base of excavation / below invert level of any drainage beneath the highway, whichever is the deepest should be included.

Highways within the lower plateau within the northwestern site area are proposed to be subject to a full turnover for their entire width, with likely excavation, classification and ex situ soil stabilisation and / or disposal.

All excavations are to be backfilled and re-engineered with suitable materials in accordance with the Sirius Specification for Engineered Fill to achieve the proposed remediated level of 500mm below finished design levels. Materials used within adoptable highways must not contain asbestos at levels above the minimum quantifiable threshold of 0.001% by mass.

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

It should be noted, that at this time, the above proposals have not been approved by the Local Authority Section 38 Engineering department. This shall be gained prior to commencement of works beneath highways.

Future infrastructure works within the landfill area (outwith proposed 'clean corridors' installed within proposed adoptable highways) will encounter made ground potentially containing asbestos. In order to prevent future cross contamination of shallow materials and to safeguard the health of site workers, detailed Risk Assessments and Method Statements outlining the soil management plan for the site, with particular significance placed on the possibility of asbestos fibres within made ground soils, shall be provided.

7.6 Surcharging

The prevailing ground conditions in the southwestern extent of the mill area (i.e. 'Area B2', as classified within Sirius Settlement Report, included within Appendix B), contains a proportion of organic alluvium. In view of the fact it is proposed to raise site levels in this Area to A) lie above minimum flood levels, B) achieve a sensible development platform, a possible solution to excessive settlement is to undergo accelerated consolidation, to reduce potential settlement to acceptable levels within the underlying natural organic-rich alluvial soils. This could include surcharging prior to construction commencing, subject to regulatory approval.

On the basis of initial settlement calculations, surcharging of Area B2 by up to 2-3 metres above existing site levels for between c.1.5 - 2.5 months, would provide a residual primary settlement of approximately 25mm. This would be subject to approval by the Local Authority.

7.7 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 Earthworks / Remediation 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 C 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.

7.8 Compaction Requirements

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

7.9 Control Testing

The Earthworks / Remediation Contractor shall undertake earthworks control testing in accordance with Table 1 included within the Sirius Specification for Engineered Fills, presented in Appendix C 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 Earthworks / Remediation

Contractor shall further compact or, if necessary, shall excavate the affected work and replace with new fill, compacted to meet the specification requirements.

7.10 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. Contractors shall ensure that potentially contaminated waters and leachate from excavations or stockpiling areas do not reach watercourses, surface water drains, etc. Contractors 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 (the River Don).

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.

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.

The Earthworks / Remediation Contractor will be responsible for obtaining all necessary permits, licenses and consents for disposal to the foul sewer.

Out with areas specified for remedial works, 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 and texturally unsuitable made ground and made ground topsoil 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 significant volumes of ACMs have been identified within made ground soils, in order to negate any possible future risks to groundworkers or site end users, materials used within adoptable highways must not contain asbestos at levels above the minimum quantifiable threshold of 0.001% by mass.

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

Table 8.1 Clean Cover Layer Thickness

	Minimum Thicknesses				
	Subsoil (mm)	**Topsoil (mm)**	**Soil Cover Thickness (mm)**	**Demarcation layer**	**Total Thickness (mm)**
Gardens where made ground soils present *	450	150	600	Geotextile membrane	600
Soft Landscaping where made ground soils present *	300	150	450	Geotextile membrane	450
Gardens / Soft Landscaping where natural soils present at surface	N/A	150	150	N/A	150

* Note ash-rich made ground soils should be placed at a minimum depth of 1.0m below final levels within areas of gardens and soft landscaping.

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 (unless agreed otherwise, with the relevant regulatory bodies).

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.

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 YALPAG document Verification Requirements for Cover Systems, Version 3.3 dated October 2016. These are summarised in Table 8.2.

Table 8.2 Sampling and Testing for Imported Soils

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

		history of the donor site.	

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 geotextile membrane), 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.

Any remediated areas of made ground within the landfill 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 shall be carried out by a suitably qualified GE. Evidence for validating the quality of cover shall accord with the YALPAG document Verification Requirements for Cover Systems, Version 3.3 dated October 2016, whilst evidence for validating the depth of cover shall accord with the Sheffield City Council, Environmental Protection Service document dated 22nd May 2013, Acceptable Methods of Validating Capping Thickness (option 1 or 2).

Chemical validation of any imported subsoil and topsoils could be undertaken prior to import to site, provided that the contractor can supply relevant supporting documentation, and evidence that the source of the imported soils is maintained from a quarantined stockpile. Assuming the soils are suitable, this could remove the requirement for chemical validation of imported soils once placed in-situ.

The results of chemical analysis of both topsoil and subsoil should be assessed against either Table 1 or 2 within Appendix D of this report.

Should any excavation of foundations, drainage and services etc. extend below any placed “clean” capping layer, and therefore encounter underlying made ground materials, then there is a potential for cross-contamination. This should be avoided where possible (in particular, within the landfill area).

Detailed Risk Assessments and Method Statements outlining the soil management for the site, with particular significance to the possible fibres within made ground soils, shall be provided for this work by the developer and their specialist sub-contractors.

9. GENERAL SITE REQUIREMENTS

9.1. Introduction

The Earthworks / Remediation 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 Earthworks / Remediation 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 Earthworks / Remediation Contractor and the client.

Prior to commencement of works, the Earthworks / Remediation 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 those hours agreeable to the planners, 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 Earthworks / Remediation 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 Earthworks / Remediation 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 Earthworks / Remediation 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, 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 Earthworks / Remediation 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 Earthworks / Remediation 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 tanks 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. Air Monitoring

Appropriate background air monitoring shall be undertaken during all operations/excavations within the landfill area as detailed within Section 7.3 of this Strategy.

A qualified asbestos surveyor should continually monitor and assess the effectiveness of the mitigation measures and also the results obtained each day from the air monitoring filters to efficiently manage the on-site activities within current guidelines and legislation (<0.01f/ml air).

9.7. Dust

Appropriate measures shall be implemented at all times during the remediation works, to minimise any dust emissions (see Section 7.3). During all operations, the risk of dust release will be continually assessed and appropriate mitigation measures will be put in place, particularly in respect to any asbestos containing soils / materials. 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 Earthworks / Remediation 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.

9.8. Odour

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

Whilst considered unlikely, if significant quantities of 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 Earthworks / Remediation 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.

9.9. 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.

9.10. Surface Waters

The River Don is located centrally within the site. Protection of this watercourse shall be required at all times throughout the works.

Contractors shall take all appropriate measures to ensure that no surface run-off from the operational site shall affect the watercourse. Prior to commencement of operations, the Earthworks / Remediation Contractor shall submit a Method Statement for approval by the GE / regulatory authorities of the proposed actions.

A visual inspection of the watercourse (including photographic record), 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 Earthworks / Remediation Contractor shall take all required actions to ensure that the watercourse is 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.

9.11. Off-Site Disposal

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

Any materials removed from site should be undertaken in accordance with current Duty of Care requirements and the EA Technical Guidance Document WM3, dated 2015.

The waste may also be subject to Waste Acceptance Criteria (WAC) testing. In light of the new regulations it is recommended that discussion with landfill operators takes place at an early stage. 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.

9.12. 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 Earthworks / Remediation 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 Earthworks / Remediation Contractor shall be responsible for the following survey work:

- Establishment of profile boards;
- 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 Earthworks / Remediation 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 Earthworks / Remediation 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 clean cover cap in order to confirm its suitability (chemically, textually and thickness), and the installation of the required gas protection measures.

The following specific requirements must be observed for the validation of the placement of clean cover and the installation of gas measures:

- Evidence for validating the quality of clean cover shall accord with the YALPAG document Verification Requirements for Cover Systems, Version 3.3 dated October 2016, whilst evidence for validating the depth of cover shall accord with the Sheffield City Council, Environmental Protection Service document dated 22nd May 2013, Acceptable Methods of Validating Capping Thickness (option 1 or 2).

- Installation of appropriate gas protection measures are to be validated on completion by a suitably qualified GE. Validation works to be undertaken in accordance with Sheffield City Council - Environmental Protection Service document, dated 16th February 2009, Verification of Gas Protection Measures (or updated version if applicable), and CIRIA C735.

12. POST-REMEDIATION 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;
- The provision of appropriate gas protective measures;
- 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 placement of the clean cover layer and the installation of appropriate gas protection measures within proposed plots. The placement, final thickness, chemical suitability etc. of this capping layer, in addition to the correct installation of the required gas protection measures will require validation.

Chemical validation of any imported subsoil and topsoils could be undertaken prior to import to site, provided that the contractor can supply relevant supporting documentation, and evidence that the source of the imported soils is maintained from a quarantined stockpile. Assuming the soils are suitable, this could remove the requirement for chemical validation of imported soils once placed in-situ. Validation of capping thicknesses would still be required following placement.

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 Strategy shall be forwarded to the Local Planning Authority (LPA), and other regulators as appropriate for their approval prior to the works.

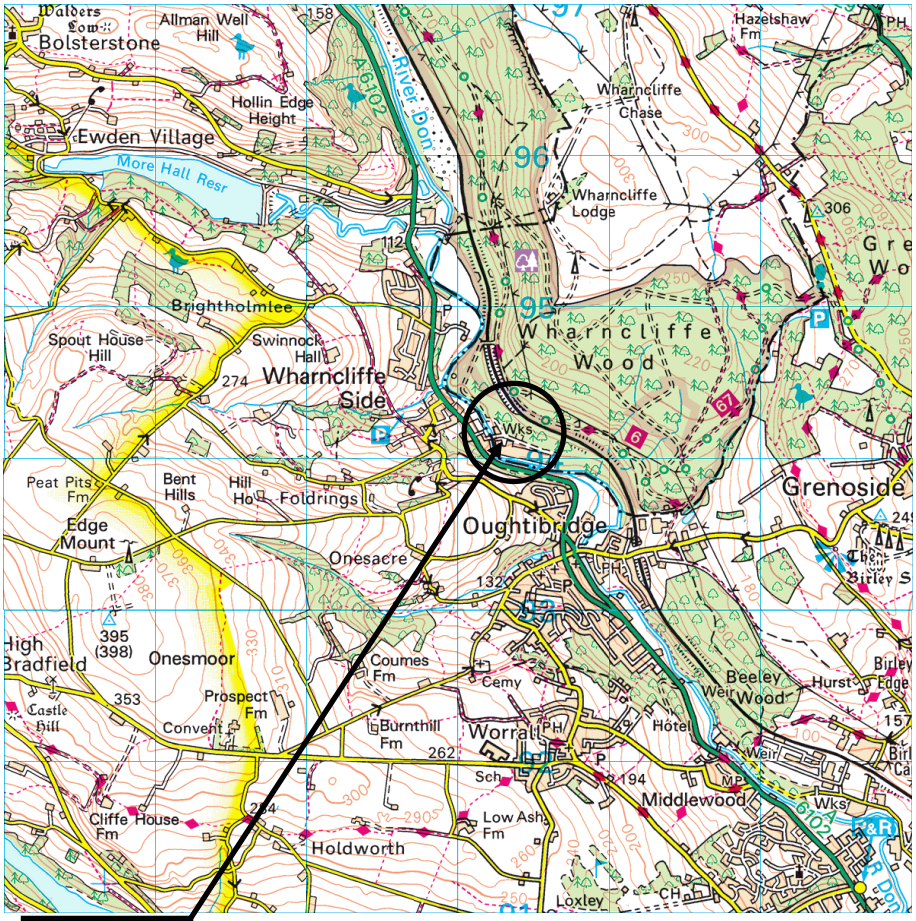
Detailed method statements from the Earthworks/Remediation Contractor and any nominated subcontractors may also be required to be submitted in writing by the LPA prior to commencement of these works. Sufficient time should be allowed for regulatory approval to be obtained during the redevelopment programme.

APPENDIX A

DRAWINGS

Site Location Plan

Contract Number	**C6485A RevA/RS**
Contract	**Oughtibridge Mill**
Client	**CEG**



Scale	**1:50,000**		
Drawn by	**SH**	**Approved**	**JF**
Drawing Number	**C6485A RevA/RS/01**		

NOTES

Existing Site Features

- Above Ground Storage Tank (AST)
- Electrical Sub-Station
- Weigh Bridge
- Flow Direction
- Oil Interceptors

Historical Site Features

- Former Boiler House
- Approximate Location of Former Diethandamine Bund / Tank c.3x3m
- Former Effluent Tanks
- Former Reservoirs
- Unknown Features
- Former Mill Race
- Former Railway Line / Sidings
- Former Chimneys
- Former Oil Store
- Former Mill Building / Engine / Machinery House Dated Between 1894-2015

Site Zones

- Site Boundary
- North West Area - Former Effluent Tanks / Reservoirs
- Woodland Areas
- Former Landfill Area (Approximate Location)
- South West Area - Former Buildings Machinery / Engine House
- Mill Area

REVISION	
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CLIENT

CEG

SITE

Oughtibridge Mill

DRAWING TITLE

Site Features & Zoning Plan

DRAWING NO.	REVISION NO.
C6485A RevA/RS/02	0
DRAWN BY: DT	APPROVED BY: GH
DATE: October 2017	SCALE: 1:1000
	PAPER SIZE: A0