REPORT C8781
MAY 2022

STRATEGY FOR REMEDIAL AND PREPARATORY WORKS

for land at
CENTRE 27, BANKWOOD WAY, BIRSTALL

prepared for
LIDL GB LIMITED

QA Sheet

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1. INTRODUCTION

Sirius Geotechnical Ltd (Sirius) was commissioned by Lidl GB Limited (Lidl) to produce a Strategy for Remedial and Preparatory Works required to facilitate the development of land at Centre 27, off Bankwood Way, Birstall (the "site").

The site is currently undergoing planning for a proposed low rise retail development, with associated parking, servicing areas and soft landscaping (in accordance with planning application ref. 2021/62/92528/E), as detailed within SMR Architect's Proposed Site Plan (drawing ref. 7404-SMR-00-ZZ-DR-A-2003-S3-P2, last dated April 2021). A copy of the proposed development plan is included within Appendix A. The site boundary is shown on SMR Architects Existing Site Plan, (drawing ref. 7404-SMR-00-ZZ-DR-A-2002-S3-P2, last dated April 2021), a copy of which is also included within Appendix A.

Based on proposed levels shown on SMR Architects Proposed Site Sections plan (Drawing No. 7404-SMR-00-ZZ-DR-A-2007-A3-C4), it is understood that site levels are to be raised between approximately 1.5m to 2.0m in the east of the site, and cut between approximately 1.0m and 2.0m within the western site area to form a level development plateau (at proposed floor levels of between 150.8m and 151.0m Above Ordnance Datum (AOD)). Retaining structures up to c.2.2m in height are proposed along the eastern and western site boundaries to accommodate the proposed level changes.

The depths of made ground across the site vary significantly due to historic earthworks and opencast operations. Previous reports have advised of the potential for ongoing settlement in areas of deeper made ground, which may impact on external site areas. Detailed design for ground improvement and foundations, taking into consideration the risk of ongoing settlement, has been addressed by third party contractors on behalf of Lidl (Vibro Menard and Beam Consulting).

It is understood that foundation solutions for the proposed development are proposed to comprise a ground improvement solution utilising Controlled Modulus Columns (CMCs) beneath building footprints and service yard, and Bi-Modulus Columns (BMCs) beneath pavement areas. The ground treatment will allow the use of shallow reinforced concrete spread foundations and a ground bearing floor slab.

Previous ground investigation and geotechnical assessment reports undertaken for the site, and provided to Sirius for review, are detailed below. It is understood that the following information has been assigned to Lidl and can be relied upon:

- Geo-environmental Assessment, Centre 27, Birstall, completed by Delta Simons Environmental Consultants Ltd (Delta Simons) on behalf of AEW UK, report ref. 14-0672.03, dated July 2018.

- Combined Phase 1 & Phase 2 Ground Investigation Report, Bankwood Way, Birstall, completed by Curtins on behalf of Lidl GB Ltd, report ref. 076893-CUR-00-XX-RP-GE-002-V01, dated October 2020.

- Geotechnical Assessment of Proposed Ground Improvement Works, Proposed Lidl Store, Bankwood Way, Birstall, West Yorkshire, completed by GB Card and Partners Ltd (GB Card), on behalf of Beam Consulting, ref. GB/661, dated December 2020.

- Detailed Coal Mining Risk Assessment for Land at Centre 27, off Bankwood Way, Birstall, Batley completed by Sirius Geotechnical Ltd. Ref C8781/GH/9715/Rev B dated 28th October 2021.

- Supplementary Coal Mining Investigation for Land at Centre 27, off Bankwood Way, Birstall, Batley completed by Sirius Geotechnical Ltd. Ref C8781/AW/9824 dated 28th March 2022.

- Hazardous Ground Gas Risk Assessment for Land at Centre 27, off Bankwood Way, Birstall, Batley completed by Sirius Geotechnical Ltd. Ref C8781/MB/9853 dated 6th May 2022.

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.

This Strategy summarises the works undertaken to date and details works required to remediate soils at the site to a condition considered suitable for the proposed low-rise commercial development.

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

- To discharge the relevant planning conditions pertaining to contaminated land and shallow coal mining;

- To minimise the impact to the environment and human health whilst undertaking the works;

- To satisfy the Local Planning Authority Environmental Health Department, Coal Authority 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.

This remedial strategy is designed to ensure the site undergoes appropriate remedial works in preparation for the proposed ground improvement solution, and should be read in conjunction with the Geotechnical Assessment of Proposed Ground Improvement Works letter report, completed by GB Card and Partners Ltd on behalf of Beam Consulting.

This document is written for the sole use of Lidl GB Limited. No other third party may rely on or reproduce the contents of this report without the prior written approval of Sirius. If any unauthorised third party comes into possession of this report they rely on it at their own risk and the authors do not owe them a Duty of Care or Skill. No works should be undertaken on site until the strategy is approved by the relevant regulators.

2. SITE DETAILS AND DESCRIPTION

Table 2.1 Summary of Site Details and Description

Site Overview	The site is located off Bankwood Way, Birstall, Batley, approximately 9km southwest of Leeds City Centre at NGR ref. 423694, 427432. A site location plan, Drawing No. C8781/01 is included within Appendix A. The site covers an area of approximately 1.5 hectares and currently comprises open disused land with stockpiles of demolition rubble. Until recently the site comprised seven office units. It is understood that the former office units and external hardstand suffered damage/distortion associated with settlement of the underlying made ground. The site topography falls gently from c.152m above ordnance datum (AOD) in the northwest to 148m AOD in the southeast. The north-western site area is raised by approximately 1m above the remainder of the site. A culverted watercourse is recorded within previous reports to be present at an approximate depth of 8mbgl, running parallel to the eastern boundary. Review of historical Ordnance Survey (OS) mapping indicates that from c.1893 / 1894, an area of earthworks is shown crossing the site assumed to be associated with the opencast mining of the Flockton Thin coal seam. Further earthworks are shown from 1956 within the north and northeast of the site, indicating sloped ground. In addition, significant areas of earthworks and refuse heaps are also shown to the east and south of the site. Environmental records indicate landfilling operations (Nab Lane Refuse Disposal Tip) commenced in 1970 at the site, accepting inert, industrial, commercial, liquid and household waste. A further record lists the site as a registered landfill from 1982. Neither record indicates when operations ceased. From 1992 the site is shown to have been developed with commercial / office units, which appear from online aerial images to have been subsequently demolished/cleared some time prior to 2018. British Geological Survey (BGS) maps show the site to be underlain by made ground, in turn underlain by strata of the Pennine Lower Coal Measures Formation (PLCMF). The Flockton Thin (or Black Bed Coal) is conjectured to outcrop within the site, trending approximately south to north from the southern corner of the site, before turning abruptly in an approximately easterly direction, crossing the site boundary in the area of the eastern corner. The thickness of the Flockton Thin coal seam is recorded to range between 0.3m and 0.8m. A site constraint summary plan is included as Drawing No. C8781/RS/03 within Appendix A of this report.
Mining and Quarrying	A previously obtained Coal Authority (CA) Mining Report states that the site is located within a “High Risk Development Area”. The shallowest recorded worked coal seams underlying the site are the Flockton Thin and the Top Fenton (or First Brown Metal) Coal Seams, recorded to have been mined at a depth of 10m and 30m beneath the site, respectively. In addition, an adit is recorded to be located within the northeast of the site (CA ref. 423427-054), with a recorded bearing of 24°. The CA hold no details of any past treatment of the adit. Several phases of mining investigation have been undertaken at the site, which has identified the Flockton Thin and deeper Top Fenton (or First Brown Metal) coal seams and / or evidence of associated mine workings within a number of rotary boreholes and selected trial pits. The Flockton Thin coal seam was found to be absent within the southern, eastern and central parts of the site and is assumed to have been removed as part of historic excavations at the site. A risk to surface stability exists within the northern and western parts of the site, which are underlain by the Flockton Thin and / or associated coal / seatearth workings. It is recommended that these are stabilised by drilling and pressure

	grouting to mitigate the risk of surface instability. Confirmatory probe holes are recommended to be drilled within the areas of the former opencast (to the south of the conjectured Flockton Thin outcrop) to prove the absence of the coal seam. No evidence of the adit was identified as part of the most recent Sirius investigation, and it was concluded that the adit may have been removed as part of historical earthworks within the north eastern site area. The possibility of encountering unrecorded mine entries/bell pits on site cannot be discounted. Excavations should be inspected for any disturbed ground, associated with possible historic bell pits/mine entries/ crop workings of the shallow coal. A detailed mineworkings drill and grout specification is included as Appendix D within this report.
Proven Ground Conditions	Three phases of previous investigation have been undertaken at the site, by Delta Simons in 2018, Curtins in 2020, and Sirius in 2022 with exploratory hole positions shown in Drawing No. C8781/02 included in Appendix A. Made ground soils, of variable thickness, were encountered in the majority of exploratory holes ranging between 0.3m and 14m thick, and was generally noted to become thicker towards the east. The made ground generally comprised mixed cohesive fill (firm and stiff gravelly clay) and occasionally mixed granular fill (sandy gravel). Within the south eastern part of the site landfill waste (including plastic bags, metal, brick, cloth, tyres etc) was encountered up to a maximum depth of 12.5m bgl. The variation in made ground is considered to be associated with earthworks identified on the historical mapping. Cross sections reproduced from the Delta Simons report (Drawing Refs 14 60723.03 – 7c & 7f contained within Appendix A of this report), illustrate the general profile of the infilled excavation, along with the inferred former location of the Flockton Thin Coal seam, having since been removed by either opencast or underground mining. Similarly, the sections show the steeply-sloping highwall in the northeast of the site, and the thicker landfill waste deposits in the east / southeast. Natural strata comprising weathered and competent PLCM mudstone, sandstone and coal bands was recorded underlying the made ground soils.
Identified and Proven Contamination	Chemical testing has not identified any contaminants of concern above the assessment criteria for a commercial end-use, with the exception of elevated PAH (including benzo(a)pyrene) in one sample of landfill waste. A clean cover layer was recommended by Delta-Simons to be placed within any areas of proposed soft landscaping. No groundwater analysis was undertaken as part of the previous investigations. The risk to controlled waters from contaminants within the site was considered to be very low by Curtins, not requiring further consideration.
Invasive Plant Species	None noted as part of the most recent site investigations. It is recommended however that an invasive species survey be undertaken prior to enabling works to confirm their absence / presence.
Hazardous Ground Gas	On the basis of monitoring data obtained and a subsequent risk assessment by Sirius, the site has been concluded to fall within Characteristic Situation (CS) 4 as defined in BS8485:2019. Further details are provided within Sections 6.4 and 8.0 of this report. In accordance with current guidance radon protection measures are not considered necessary in the construction of new retail premises. Prior to undertaking any construction on the site, the proposed design of gas protection measures and strategy for verification must be agreed with the local authority. All existing monitoring wells should be fully decommissioned prior to development commencing.

3. REMEDIATION STRATEGY AND OBJECTIVES

The primary objective of the remediation works is to discharge the relevant planning conditions whilst mitigating the transient and long-term risks to receptors, including human health and the environment from any chemical contaminants at the site.

It should be noted that this Strategy assumes that any previously unidentified asbestos containing materials will be addressed by an appropriately qualified contractor in accordance with an agreed method statement.

The remediation works should be undertaken under a Materials Management Plan (MMP) produced under the CL:AIRE Development Industry Code of Practice. The completed MMP will need to be reviewed and declared to CL:AIRE by a Qualified Person prior to commencement of remedial and preparatory works.

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

- Service location disconnection and/or protection.
- The presence or absence of invasive plant species should be confirmed by a qualified consultant and their advice taken on appropriate treatment if necessary.
- Removal of any remnant vegetation from the proposed development area as necessary to facilitate the works.
- Removal of any remaining waste materials from the site.
- Chemical and geotechnical investigation of existing stockpiles located on site, to assess their suitability for re-use on site as general fill.
- Break out relic foundations, remove below ground obstructions and oversized / unsuitable materials encountered which could hinder subsequent foundation, utility / service, road and pavement construction, to an agreed depth.
- Where possible and practical, on-site crushing, screening and classification of all suitable materials won from the above works, to provide fill materials suitable for re-use on site in accordance with an agreed specification for the works.

- Undertake a cut / fill regrade exercise across the development area to create the required levels, with excavation and re-engineering of the upper 2m of made ground soils. Excavated materials will be processed and screened (as required) to produce suitable engineering fill and placed in accordance with an appropriate earthwork specification. Prior to filling, the base of the excavation shall be proof-rolled, and any soft / hard spots encountered investigated, removed as necessary and replaced with suitable fill materials.

- Treatment and stabilisation of identified shallow coal mine workings, in accordance with the specification included within Appendix D of this report.

- Placement of a granular working platform / load distribution mat at the remediated ground surface in preparation of the proposed ground improvement solution, placed in accordance with Vibro Menard's design specification.

Technical Support

- Carry out a watching brief during the above to identify any potential previously unidentified sources of contamination and evidence of disturbed natural ground / varying ground conditions.

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

- A validation report produced by a suitably qualified GE on completion of the works. This report will provide a record of the remediation works including the results of any required 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.

Post-Remediation Works

- Where the site is underlain directly by natural ground a nominal 100mm depth of clean suitable topsoil should be provided in soft landscaping areas to provide a suitable medium for plant growth.

- Should any texturally unsuitable (but chemically acceptable) non-landfill waste type made ground be left in situ in proposed soft landscaping areas, it should be covered with 300mm depth of clean topsoil/subsoil to provide a suitable growing medium. Landfill waste type made ground is anticipated to remain below areas of hardstanding, and not exposed within landscaping.

- Suitable validated site won soils stockpiled on-site during the enabling works will not require additional testing / validation once placed. Any imported materials used within the growth media on the site shall be tested and validated in accordance with Section 7 of this report.

- Design and installation of appropriate gas protection measures in accordance with the requirements of BS8485:2015+A1:2019. Design of gas measures will be subject to regulatory approval.

- Installation of appropriate gas protection measures to be suitably validated on completion, in accordance with an agreed gas verification plan.

An additional verification report detailing the installation of gas protection measures will be required as construction of the buildings are completed.

4. GEOENVIRONMENTAL ENGINEER

A suitably experienced and qualified 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;
- inspection of excavations (where feasible) for any disturbed ground associated with possible historic bell pits/shallow crop workings of the shallow coal / evidence of highwalls associated with the former opencast operations;
- 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.

Verification of installation of gas protection measures should be undertaken by a suitably qualified consultant or independent third-party installer, as described in Section 8 of this document.

On completion of the shallow coal mineworkings drill and grout programme, a drill and grout validation report will be produced.

5. PREPARATORY WORKS

5.1. Site Clearance

Any remnant vegetation within the development footprint shall be stripped / cleared and stockpiled for subsequent removal from site. Any remaining wastes / general debris shall be cleared and placed in skips for off-site disposal.

5.2. Invasive Species

The presence / absence of any invasive plants should be confirmed by a qualified consultant ecologist and their advice taken on appropriate treatment, where necessary. The treatment of any invasive species should take place in advance of the proposed construction works.

5.3. Underground Services

Prior to any works, the location of all known services should be clearly marked on site (and on drawings) and discussed as part of the site induction. Any services which remain live as works progress should be protected and have a suitable easement / stand-off, with works undertaken in proximity to them carried out under an approved method statement.

5.4. Existing Stockpiles

Existing stockpiles are located across the site, associated with recent demolition of the former commercial development.

The stockpiles should be subject to investigation by means of trial pitting / trenching to assess their composition and chemical suitability for re-use as general fill below hardstand or a growing medium. The investigation should be supervised by a suitably qualified GE, with soil samples taken at a frequency of 1 per 500m^3. In addition, a visual / olfactory inspection should be undertaken to ensure that stockpiled materials are free from obvious contamination i.e., staining/free product, free of odours, and do not comprise any evidence of asbestos containing materials (ACMs) and potentially degradable materials.

The stockpiles should also be subject to geotechnical testing to assess their suitability for re-use on site. The testing requirements should be in accordance with an agreed earthworks specification.

Samples shall be tested for a suite of contaminants (as specified within Table 7.1 of this report), at a UKAS and MCERTS accredited laboratory, and the results compared to the appropriate GAC

included within Appendix B of this report. Analysis for other determinants may be applicable. Should any analyte exceed the concentrations shown, then the GE will advise upon further works required, including possible excavation of impacted materials for removal, in accordance with prevailing legislation, for off-site disposal at a suitable licensed landfill facility.

If the stockpiled materials are deemed chemically acceptable for re-use as general fill, a watching brief should be maintained during the earthworks. The GE shall carefully inspect stockpiled materials during their re-use and advise the contractor of any additional testing requirements to adequately classify the materials for potential re-use or removal from site.

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

5.5. Earthworks

All earthworks should be undertaken in accordance with an appropriate engineering specification, which should be agreed prior to commencement of any works.

Any remnant hardstanding, slabs, foundations, drainage runs, and other relic structures, obstructions and oversized material encountered during the proposed works should be broken out where required and removed to an agreed depth. Consideration should be given to segregation and stockpiling of all hard arisings / materials on site for crushing, where appropriate. A minimum 2m turnover of made ground (from existing or proposed levels, whichever is the deepest) should be undertaken in order to identify remaining obstructions. Any obstructions identified by the turnover should be fully removed where practicable to facilitate proposed development works (e.g., foundation construction, drainage installation, etc.). All unsuitable materials encountered as part of the turnover should be removed.

Consideration should be given to the near-surface presence of landfill-waste type made ground within the most-southern site area (i.e. less than 2m depth from existing ground level). Such material was identified at depths of between c.0.5m and 1.8m bgl within exploratory hole refs TT202, TT203, RT106, RO304 and TP107, as highlighted on Drawing No. C8781/RS/03 included within Appendix A.

Excavation arisings that are potentially suitable for re-use as fill materials shall be stockpiled, inspected and subject to appropriate chemical classification analysis, to verify their suitability as a fill material, if required.

Materials excavated should be inspected by the GE to identify areas of previously undetected contamination. Any soils exhibiting visual and / or olfactory evidence of gross contamination shall be placed in temporary stockpiles on hardstanding or heavy-duty Visqueen sheeting, suitably covered and bunded with appropriate signage and identification. The GE should advise the contractor of any testing requirements to adequately classify the materials for potential re-use, treatment or removal from site.

The possibility of encountering unrecorded mine entries/bell pits on site cannot be discounted. Excavations should be inspected for any disturbed ground, associated with possible historic bell pits/mine entries/ crop workings of the shallow coal. It is recommended that areas beneath proposed buildings have overlying made ground removed (where feasible, and in particular where within the conjectured sub-crop of the underlying Flockton Thin coal seam), in order to expose the natural ground.

If any evidence of unrecorded mining features are encountered, appropriate stabilisation by drill and grout treatment shall be carried out in accordance with the mineworkings drill and grout specification included within Appendix D. Treatment of identified mine-workings shall meet the requirements of relevant regulators, namely the Coal Authority and the local authority. If such mine-workings are identified, then works shall cease immediately in those areas and the advice sought from the GE.

6. CONTAMINATION CONSIDERATIONS

6.1. PAH Impacted Made Ground Soils

Chemical testing has not identified any contaminants of concern above the assessment criteria for a commercial end-use, with the exception of elevated PAH (including benzo(a)pyrene) in one sample of landfill waste type made ground (Delta Simons exploratory hole ref. DS104 at 3.2m-3.3m depth). Based on current development proposals, the landfill waste type made ground is anticipated to remain below hardstanding (including the proposed food store and service yard) and not exposed within landscaping. On this basis, the risk to site end users is considered to be low, requiring no further consideration.

Other made ground types across the site were found to be chemically suitable for the proposed end use, although texturally unsuitable for areas of proposed soft landscaping.

6.2. Previously Unidentified Contamination

There is the possibility that as yet undiscovered sources of contamination may be present which will require remediation. It is therefore considered that the following actions should be undertaken during site reclamation and preparatory works.

A watching brief should be carried out during the enabling works, with particular attention to;

- Evidence of asbestos containing materials.
- Visual or olfactory evidence of hydrocarbons.
- Made ground differing significantly in nature from that previously identified during the site investigation works.

If previously unidentified contamination is encountered during any of the proposed works by any site personnel, the GE shall be notified immediately and works in the vicinity of the suspected contamination should be temporarily suspended. Additional laboratory analysis of previously unidentified contamination sources will be required in order to determine the requirements for remediation, assessed against appropriate assessment criteria.

If deemed appropriate the GE shall request additional and/or supplementary chemical testing, dependant on the nature of any materials encountered on site during the course of the remediation works.

The analytical testing will be undertaken on a five-day turnaround and shall be forwarded to the GE as they become available. The results shall be compared with the threshold guideline values given in Appendix B of this Strategy. Should any analyte exceed the concentrations shown, then the GE will advise upon further works required.

6.3. Asbestos

Although not identified to date, the possibility of asbestos sheeting, used as shuttering, and / or fragments of asbestos-containing materials within made ground or fill materials 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.

Any potentially contaminated materials requiring assessment shall be placed in temporary stockpiles on hardstanding or heavy-duty plastic sheeting, suitably covered and bunded with appropriate signage and identification. The GE should advise the contractor as to the testing requirements to adequately classify the materials for either potential re-use or removal from site.

6.4. Hazardous Ground Gas

The ground gas risk assessment for the site determined that precautions for ground gas risk Characteristic Situation CS4 should be adopted. Design and installation of appropriate gas protection measures should be undertaken in accordance with the requirements of BS8485:2015+A1:2019. Design of gas measures will be subject to regulatory approval.

Radon protection measures are not required for the site.

6.5. Control of Contaminated Water

During the progress of the works, if significant dewatering is required necessitating disposal to surface water drains or foul sewer, appropriate discharge consents must be obtained from the Environment Agency / appropriate water authority by the contractor. This is likely to require further chemical analysis of such groundwater. In the event that significantly contaminated groundwater is encountered, this should be treated and/or removed by tanker and disposed at a licensed disposal facility.

The contractor shall ensure that potentially contaminated waters and leachate from excavations or stockpiling areas do not reach watercourses, surface water drains, etc. All such waters will be

removed from site by tanker to a suitable disposal facility or alternatively treated on site for subsequent disposal to foul sewer.

The contractor will be responsible in obtaining all necessary permits and consents for disposal to foul sewer prior to the commencement of works.

Contaminated waters pumped from excavations should be stored in a holding tank and chemically tested prior to disposal. All 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.

7. SOFT LANDSCAPING SOILS

7.1. General

Where the site is underlain directly by natural ground a nominal 100mm depth of a suitable growing medium should be provided in soft landscaped areas. If any texturally unsuitable (but chemically acceptable) non-landfill waste type made ground is to be left in situ in proposed soft landscaped areas, it should be covered with 300mm depth of clean topsoil/subsoil to provide a suitable growing medium.

It is anticipated that the (locally chemically unsuitable) landfill waste type made ground will remain below hardstanding and / or building footprints following development. On this basis, there is no requirement for provision of a clean cover layer for this soil type.

7.2. 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 the table provided within Appendix C.

Any materials for use as topsoil / subsoils within landscaping, including site-won and imported material, shall be inspected to ensure that it meets the required specification. A visual / olfactory inspection of the material should be carried out by a suitably qualified GE to ensure that it is free from obvious contamination i.e., staining/free product, free of odours, and does not comprise any unsuitable materials (i.e., bricks, brick ties, timber and glass etc) or evidence of ACMs etc.

The re-use of site won soils should be agreed with the relevant regulators prior to placement.

Any imported materials used as topsoil / subsoil on the site shall be tested in accordance with the guidance given in the YALPAG document *Verification Requirements for Cover Systems,* Version 4.1 dated June 2021. These are summarised in Table 7.1 below.

Table 7.1 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 Table in Appendix C
Crushed Hardcore, Stone, Brick (excluding asphalt)	Minimum 1 per 500m³	Standard metals/metalloids (As above) PAH (16 USEPA speciation) Asbestos Total TPH	
Greenfield/ Manufactured Soils	Minimum 3 or dependent on source, between 1 per 50m³ and 1 per 250m³	Standard metals / metalloids (As above) PAH (16 USEPA speciation) Asbestos pH and SOM / TOC	
Brownfield/ Screened Soils	Minimum 6 or dependent on source and receptor, between 1 per 50m³ and 1 per 100m³	Standard metals / metalloids (As above) PAH (16 USEPA speciation) TPH (CWG banded) Asbestos pH and SOM / TOC 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.

7.3. Placement

It is recommended that topsoil / subsoils shall be placed within landscaping in the latter stages of development. This will act to minimise the potential for disturbance of the placed topsoil / subsoil and physical destruction of topsoil structure i.e., via plant trafficking, following placement.

8. GROUND GAS PROTECTION MEASURES

8.1. Introduction

The previous ground gas risk assessment for the site determined that precautions for ground gas risk Characteristic Situation CS4 should be adopted for the site.

Radon protection measures are not required for the site.

The proposed development is classified as Type C Buildings, as defined in Table 4 of British Standard BS8485:2015, '*Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings'.* Accordingly, a minimum of Gas Protection Score of 4.5 points is required, incorporating at least two of the three following protective features:

- The structural barrier of the floor slab;
- Sub-floor ventilation measures; and
- Gas resistant membrane.

Floor and Substructure Design

From Table 5 of BS8485, no gas protection points can be gained from the use of a suspended beam and block floor. A well-reinforced cast in situ monolithic ground bearing raft or suspended floor slab with minimal penetrations can achieve a score of 1.5.

Ventilation Protection Measures

Ventilation measures should include one of the five following types:

- Pressure relief pathway only (no effective dispersal layer);
- Passive dispersal layer;
- Active dispersal layer;
- Active positive pressurisation; and,
- Ventilated basement substructure present.

Within Table 6 of BS8485, the Gas Protection Score for a passive sub-floor dispersal layer comprising a clear void, polystyrene or geocomposite void former blanket or no-fines gravel layer is

2.5 for ‘very good performance’ and 1.5 for ‘good performance’, as defined in Annex B of BS8485. A clear void is the most effective gas dispersal method. Underfloor passive ventilation systems should be designed to provide sufficient air flow to dilute ground gases to acceptable concentrations within the dispersal layer beneath the floor slab for most or all of the time.

Gas Resistant Membrane

From Table 7 of BS8485, the Gas Protection Score for a Gas Resistant Membrane is 2 points, provided that the gas membrane fulfils the following requirements:

- Sufficiently impervious to the gases detected;
- Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions;
- Sufficiently strong to withstand in-service stresses (e.g. settlement if placed below a floor slab);
- Sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc);
- Capable, after installation, of providing a complete barrier to the entry of the relevant gas; and
- Verified in accordance with CIRIA C735.

These criteria should be communicated to prospective gas membrane suppliers, and their written confirmation that the product meets these requirements should be obtained.

Available Gas Protection Score

For design and installation of a sub-floor ventilation layer/void with ‘very good performance’ and a gas resistant membrane meeting the requirements given above and installed in full accordance with the manufacturer’s instructions, a Gas Protection Score of 4.5 can be achieved. This meets the requirements for ground gas protection measures at the site.

8.2. Ground Gas Protection Measures Design and Installation

The detailed design and installation of ground gas protection measures should be in full accordance with the requirements of BS8485 and the gas membrane manufacturer’s instructions.

Within BS8485, there is a requirement for a ground gas protection measures design report, including drawings and specifications.

Ground Gas Protection Verification Plan

In preparing recommendations for verification of gas protection installation, reference should be made to CIRIA Report C735 '*Good Practice on the Testing and Verification of Protection Systems for Buildings against Hazardous Ground Gases'* (2014) and YALPAG document '*Verification Requirements for Gas Protection Systems, Technical Guidance for Developers, Landowners and Consultants*' (Version 1.1, December 2016).

In summary, the salient gas risk assessment aspects for the site include:

- The risk from hazardous ground gas at the site is considered to be Intermediate (CS4).
- The primary risk driver has been identified as locally elevated concentrations of carbon dioxide and methane and associated gas flows.
- The source of potential elevated concentrations of ground gas has been identified as the underlying landfill-waste type made ground.

The verification plan should address how the gas protection measures will be installed and what verification information will be provided to demonstrate the installation has been carried out in accordance with appropriate guidance. Information pertaining to both the chosen installers and verifier's qualifications and experience should be included within the verification report, along with demonstration of the independence of the verifier.

The gas verification plan should be submitted to the local authority for their review and approval, prior to installation.

Protection of the Gas Resistant Membrane Following Installation

Immediately following satisfactory verification of installation of the gas resistant membrane, it should be fully protected from damage from follow-on trades, weather, etc., e.g., by installation of the floor insulation and concrete screed, or placement of suitable temporary protection, e.g., plywood boards, proprietary membrane protection boards, etc.

Ground Gas Protection Measures Verification Reporting

For each inspection, a report would be prepared, with a final report to be produced on completion of all validation visits. In accordance with CIRIA Report C735, ground gas protection measures verification reporting should include the following:

- Site details and reasons for carrying out remediation;
- Details of the various parties involved in the project, i.e., client, consultant, contractor;
- A summary of the original site conditions and ground gas risk assessment carried out;
- The conceptual site model (CSM) for remediation, identifying each pollutant linkage to be addressed by remedial activities, and the lines of evidence to test whether the linkages are broken;
- A description of the ground gas protection measures put in place, with reference to the installer's method statements, detailed design drawings, etc;
- A clear description of the verification plan, including the methods used for data collection and interpretation;
- A summary of progress data, such as completed pro formas and monitoring results;
- Details of all communications held with regulatory bodies during implementation;
- Reference to the health and safety file, assuming that the remedial activities were performed in accordance with the Construction Design and Management (CDM) Regulations;
- A clear statement, based on the presentation of 'lines of evidence' and review of the CSM, of the extent to which the remedial objectives and criteria have been achieved and the presence, extent and nature of any residual hazards (e.g., the continued presence of elevated concentrations of hazardous gases in the ground);
- Supporting information ('lines of evidence'), such as plans showing where a gas membrane was laid down, where air vents were installed, test results and monitoring data, completed site pro formas, photographs, the contractor's records, as-built engineering drawings, specifications etc.

9. GENERAL SITE REQUIREMENTS

9.1. Health and Safety

The remediation / 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;
- The Control of Substances Hazardous to Health Regulations, 2002; and
- The Control of Asbestos at Work Regulations, 2012.

Contaminated materials may be locally present on the site. 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 where potential for exposure to contaminated materials exists:

- All ground workers should be issued with safety glasses, protective footwear and impermeable heavy-duty gloves. Personnel should be instructed in their correct use;
- Hand washing and boot cleaning facilities shall be provided;
- No smoking on-site other than in designated areas if any are present on-site; and,
- Good practices relating to personal hygiene shall be adopted.

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

9.2. Offsite Disposal

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

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.

10. 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 Strategy 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 the remediation works, the GE will provide a verification report, comprising relevant site records and act as certification that the remedial works have been carried out in accordance with this specification.

The verification report shall include the following:

- A description of the works undertaken;
- Records of the works;
- Progress photographs;
- Waste transfer notes;
- Chemical validation test results; and,
- A statement that the works have been undertaken in accordance with the agreed specification.

11. POST REMEDIATION REQUIREMENTS

A verification report will be provided to the client by the contractor on satisfactory completion of the remedial and preparatory works.

Production of a verification report is a requirement for re-use of soils undertaken in accordance with a Materials Management Plan declared to CL:AIRE under *The Definition of Waste: Development Industry Code of Practice.*

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

- Compliance with environmental issues;
- Construction of foundations;
- 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 growth medium within soft landscaping and the installation of appropriate gas protection measures within proposed buildings. The correct installation of the required gas protection measures will require validation.

On completion of the drill and grout programme, the appointed contractor shall prepare a validation report containing copies of borehole records, a borehole location plan, procedures followed during the works, the results of validation boreholes and pressure tests, and a record of any deviation from the specification, a copy of which is included within Appendix D.

On completion of remedial and enabling works, a granular working platform / load distribution mat should be placed in preparation of the proposed ground improvement solution, placed in accordance with Vibro Meynard's design specification. Detailed design for ground improvement and foundations, taking into consideration the risk of ongoing settlement, has been addressed by Vibro Menard and Beam Consulting.

12. REGULATORY APPROVAL

A copy of this Strategy should 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 Contractor and any nominated subcontractors may also be required to be submitted and approved 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

NOTES

○ Site Location

REVISION	
0	For Information
A	>>
B	>>
C	>>
D	>>

SIRIUS GEOTECHNICAL LTD
4245 Park Approach, Thorpe Park, Leeds LS15 8GB
www.thesiriusgroup.com
TEL: 0113 264 9960
FAX: 0113 264 9962

CLIENT: Lidl GB Ltd	DRAWING NO.: C8781/RS/01	REVISION NO.: 0	
SITE: Centre 27, Bankwood Way, Birstall	DRAWN BY: MF	APPROVED BY: AW	
DRAWING TITLE: Site Location Plan	DATE: May 2022	SCALE: 1:25,000	A4

N

RH207
TP114
DS112(s)
RH208
DS111(s)
RH209
RT109
RH206
TT205
TP113
DS102(s)
TP112
DS108(s)
DS110(s)
RH210
TP103
RH205
RH208
RT108
TP111
TP104
DS109(s)
BH201
RH212
TP116
TT204C
TP110
RH211
RT104
RO302
DS103
TP109
DS107(s)
RT105
TP106
TT204B
RO305
CP301
BH203
RT107
TT204A
TP105
DS104(s)
RH204
DS106(s)
RO304
RO301
TP108
BH202
DS105(s)
TT203
TT202
CP302
RT106
TP102
RH201
TT201
RH202
TT201A
RH203
RT101
RT103
RT102
RO303

NOTES

Site Boundary

Delta-Simons Site Investigation, 2018

DS100 Dynamic Sampler Borehole

RT100 Rotary Borehole

TP100 Trial Pit

Curtins Site Investigation, 2020

RH200 Rotary Probe Borehole

BH200 Cable Percussive Borehole

RH210 Rotary Probe Borehole with Cored Follow On

TT200 Trial Trench

Sirius Borehole Locations, 2022

Cable Percussive Borehole with Gas / Groundwater Monitoring Well

Rotary Borehole with Gas / Groundwater Monitoring Well

Rotary probehole whereby solid coal was encountered

Rotary probehole whereby soft ground / no coal was encountered

Indicative Trial / Trench Location

REVISION		BY	DATE
0	For Information	MF	20/10/21
A	>>	>>	>>
B	>>	>>	>>
C	>>	>>	>>
D	>>	>>	>>

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CLIENT

Lidl GB Limited

SITE

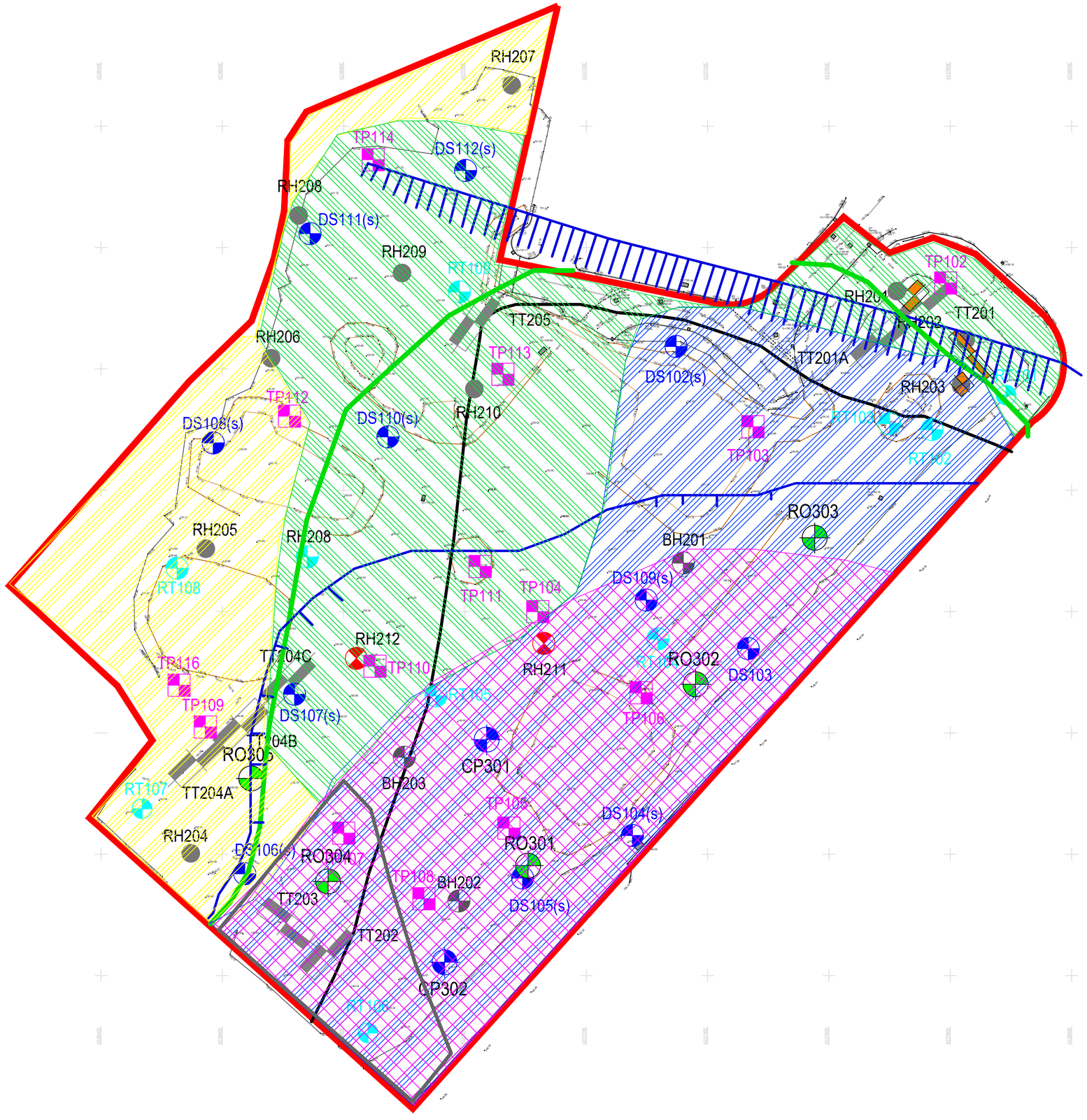
Centre 27
Bankwood Way
Birstall

DRAWING TITLE

Previous Exploratory Hole Location Plan

DRAWING NO.	REVISION NO.
C8781/RS/02	0
DRAWN BY	APPROVED BY
MF	GH
DATE	SCALE	PAPER SIZE
May 2022	1:500	A2

NTS



NOTES

Site Boundary

Delta-Simons Site Investigation, 2018

- DS100 — Dynamic Sampler Borehole
- RT100 — Rotary Borehole
- TP100 — Trial Pit

Curtins Site Investigation, 2020

- RH200 — Rotary Probe Borehole
- BH200 — Cable Percussive Borehole
- RH210 — Rotary Probe Borehole with Cored Follow On
- TT200 — Trial Trench

Sirius Borehole Locations, 2022

- Cable Percussive Borehole with Gas / Groundwater Monitoring Well
- Rotary Borehole with Gas / Groundwater Monitoring Well
- Rotary probehole whereby solid coal was encountered
- Rotary probehole whereby soft ground / no coal was encountered
- Indicative Trial / Trench Location

Indicative Extents of Made Ground

- Indicative extent of made ground where <2m in depth.
- Indicative extent of made ground where between 2-5m in depth.
- Indicative extent of made ground where >5m in depth.
- Approximate extent of landfill
- Approximate extent of landfill at less than 2m depth from existing ground level
- Conjectured coal outcrop and adit (taken from Curtins Coal Authority mining report)
- Approximate extent of former earthworks, as taken from 1893 and 1974 historic OS maps.
- Approximate line of conjectured high wall of former opencast and landfill operations.

REVISION		BY	DATE
0	For Information	MF	24/05/22
A	>>	>>	>>
B	>>	>>	>>
C	>>	>>	>>
D	>>	>>	>>

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CLIENT

Lidl GB Limited

SITE

Centre 27
Bankwood Way
Birstall

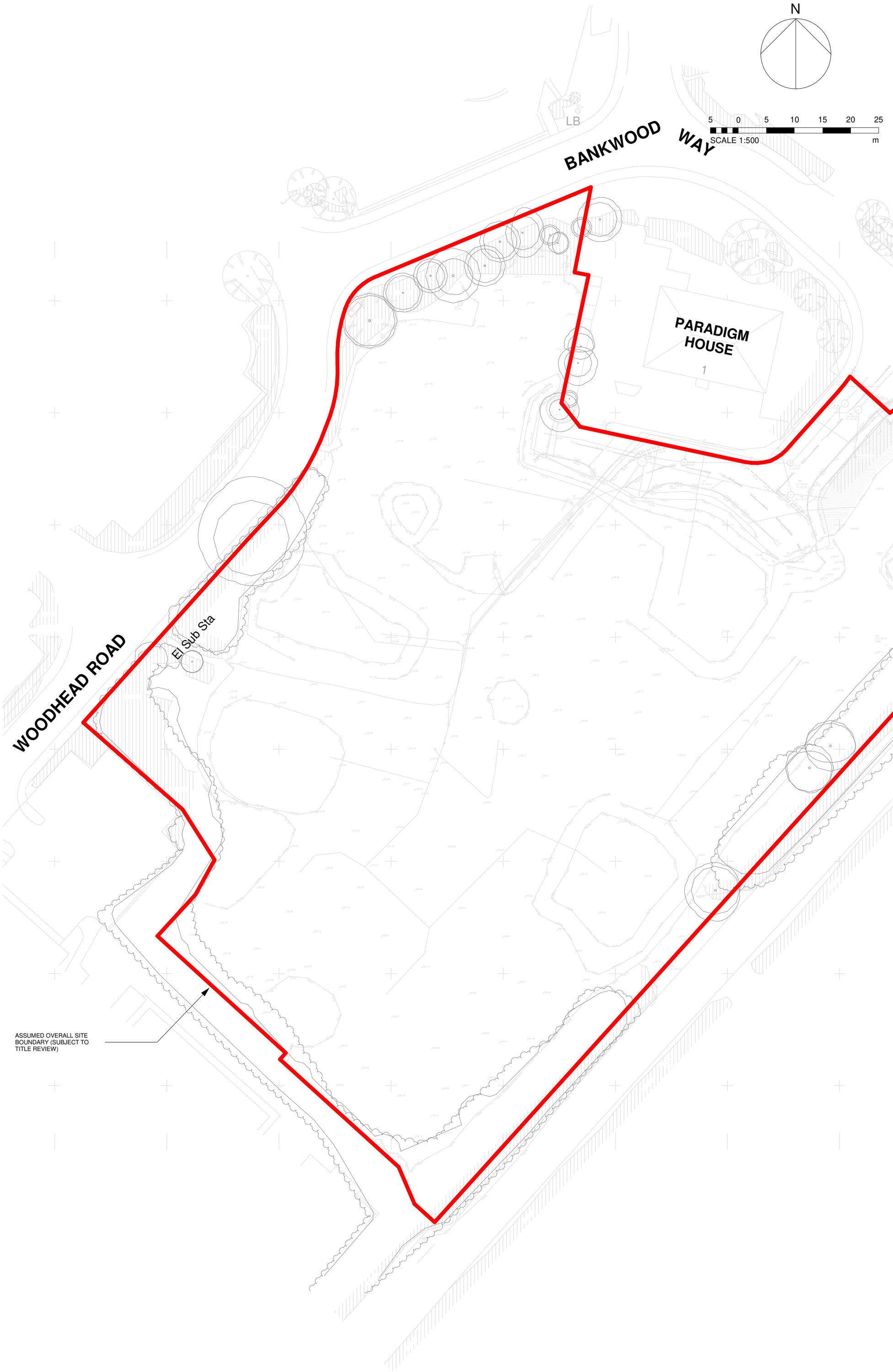
DRAWING TITLE

Site Constraints Summary Plan

DRAWING NO.	REVISION NO.
C8781/RS/03	0

DRAWN BY	APPROVED BY
MF	GH

DATE	SCALE	PAPER SIZE
May 2022	1:500	A2



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Architects are to be notified of any discrepancies.
Contractors must check all dimensions on site.
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To be read in conjunction with relevant design standards/protocols

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SITE AREA EXTG			
		ACRES	HECTARES
	OVERALL SITE BOUNDARY (ASSUMED)	3.78	1.53

Rev	Description	Date	Drn	Ckd
P2	DRAFT PLANNING ISSUE	16.04.21	MN	JM
P1	DRAFT PLANNING ISSUE	07.04.21	MN	JM

Status

PLANNING

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01423 707 757 admin@smrarchitects.co.uk

Project

LIDL BIRSTALL, BANKWOOD WAY

Client

Drawing Title

EXISTING SITE PLAN

Proj Ref	Origin	Zone	Level	Type	Role	Num	Status	Rev
- - - 7404	- SMR	- 00	- ZZ	- DR	- A	- 2002	- S3	- P2

SMR Job Ref	Sheet	Scale	Drawn
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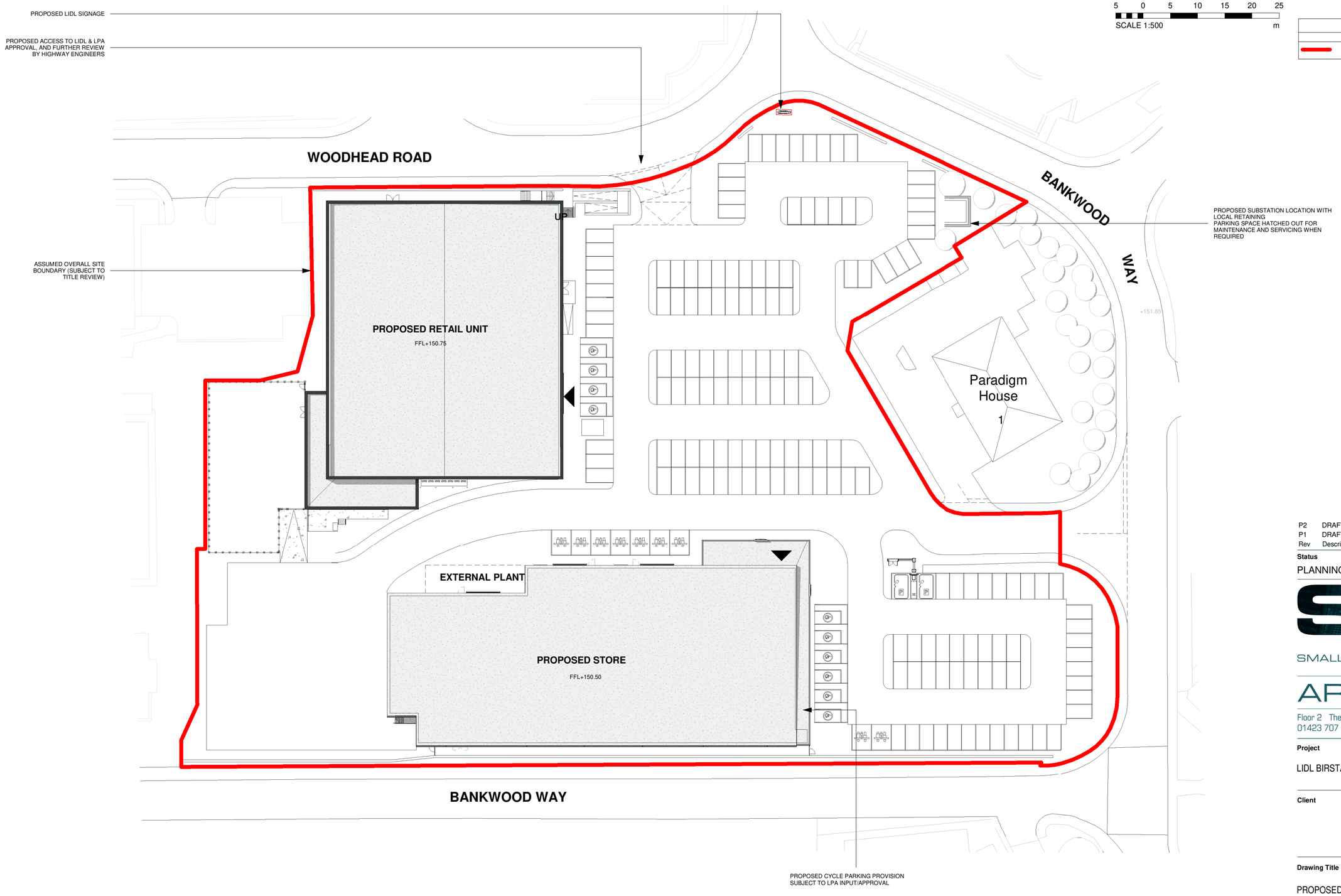

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5 0 5 10 15 20 25

SCALE 1:500 m

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For other information refer to the latest revision of any cross referenced drawings.
To be read in conjunction with relevant design standards/protocols

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SITE AREA EXTG			
		ACRES	HECTARES
	OVERALL SITE BOUNDARY (ASSUMED)	3.78	1.53

Rev	Description	Date	Drn	Ckd
P2	DRAFT PLANNING ISSUE	16.04.21	MN	JM
P1	DRAFT PLANNING ISSUE	18.12.20	GL	JM

Status

PLANNING

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Project

LIDL BIRSTALL, BANKWOOD WAY

Client

Drawing Title

PROPOSED SITE PLAN

Proj Ref	Origin	Zone	Level	Type	Role	Num	Status	Rev
- - - 7404	- SMR	- 00	- ZZ	- DR	- A	- 2003	- S3	- P2

SMR Job Ref	Sheet	Scale	Drawn
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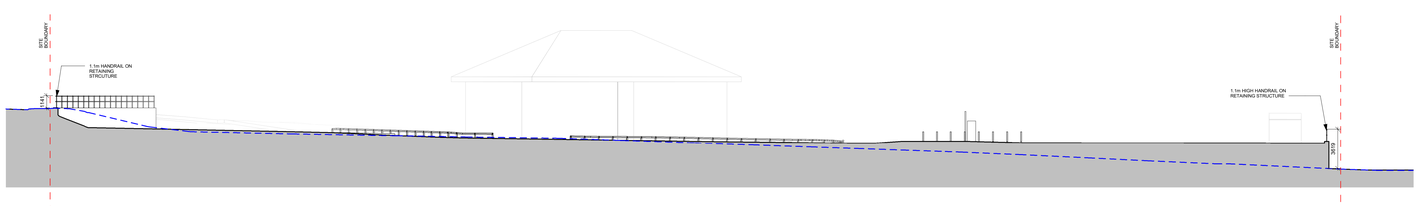

SECTION AA

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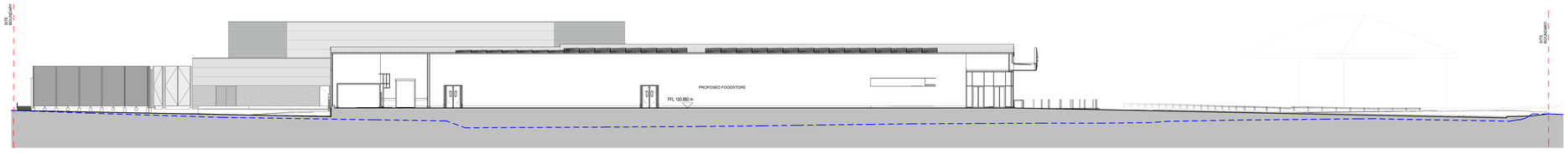

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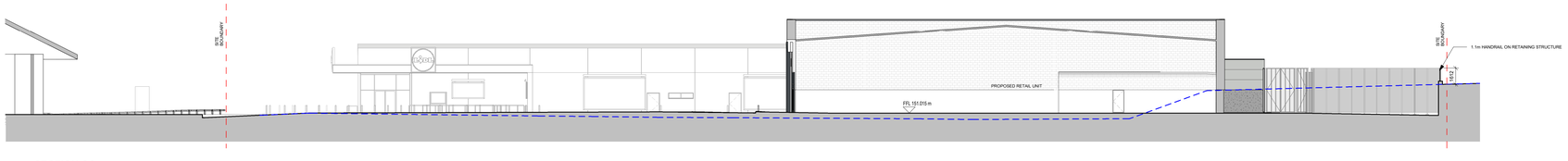

SECTION CC

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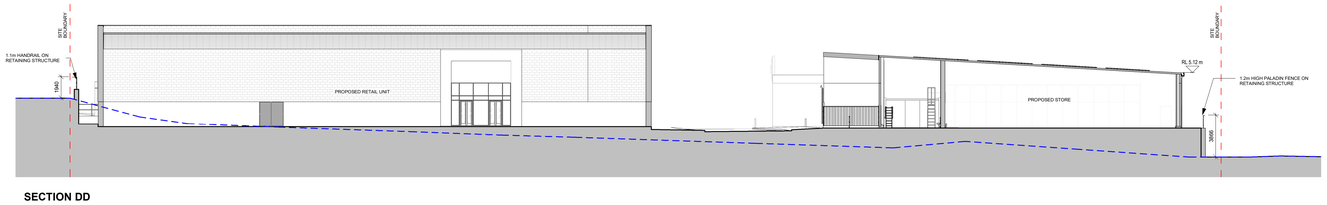

SECTION DD

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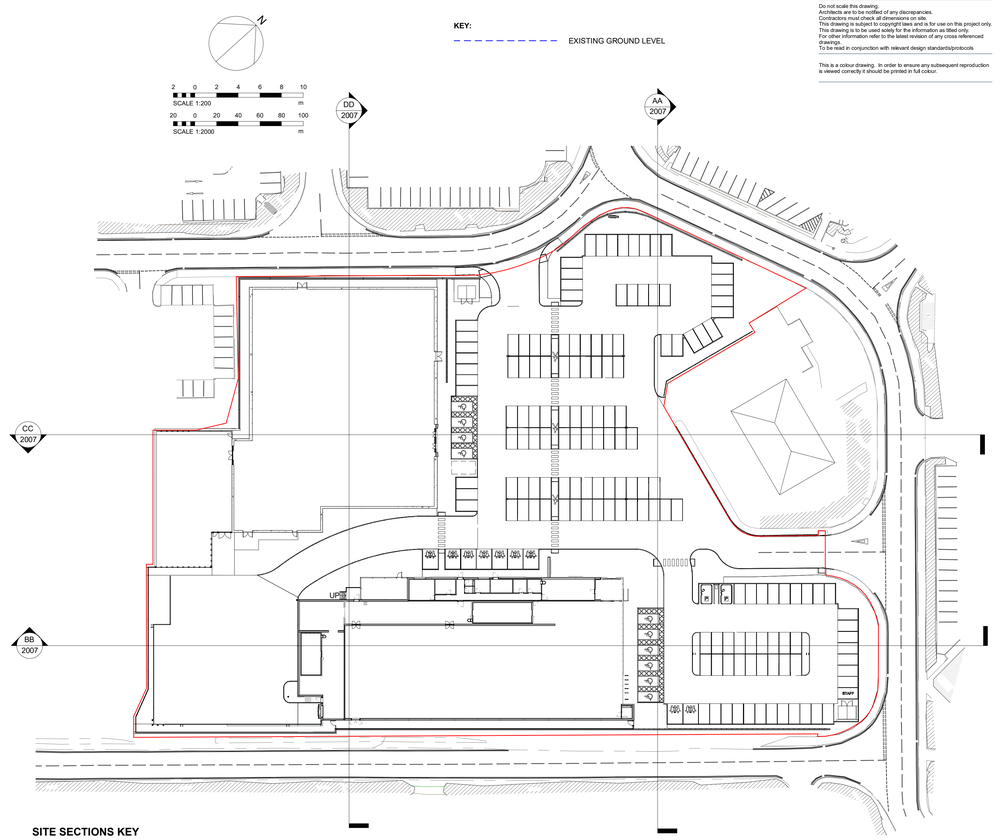

SITE SECTIONS KEY

1 : 500

Rev	Description	Date	Drn	Ckd
C4	LAYOUT/BOUNDARY TREATMENTS REVISED IN LINE WITH PLANNERS COMMENTS/LATEST LANDSCAPE PROPOSALS	11.11.21	MN	DM
C3	KNEE HIGH RAILING ADDED AS PER PLANNING COMMENTS	20.09.21	DM	JM
C2	SECTION HIGHLIGHTED TO SHOW HEIGHTS OF BOUNDARY TREATMENTS AND TYPES	15.09.21	DM	JM
C1	LAYOUT UPDATED, ISSUED FOR PLANNING	12.07.21	DM	PW
P2	DRAFT PLANNING ISSUE	16.04.21	MN	JM
P1	DRAFT PLANNING ISSUE	16.12.20	GL	JM

Status

PLANNING

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Project

LIDL BIRSTALL, BANKWOOD WAY

Client

Drawing Title

PROPOSED SITE SECTIONS

Proj Ref	Origin	Zone	Level	Type	Role	Num	Status	Rev
- - - 7404	- SMR	- 00	- ZZ	- DR	- A	- 2007	- A3	- C4

SMR Job Ref	Sheet	Scale	Drawn
7404-00-2007	A0	NOTED	GL

SEE DRAWINGS BY SMR ARCHITECTS FOR SURFACING AND BOUNDARY DETAILS

WOODHEAD ROAD

RETAIL UNIT
24535 SF

GARDEN CENTRE
5510 SF

EXTERNAL PLANT

PROPOSED FOOD STORE

BANKWOOD WAY

Paradigm House 1

53nr Euonymus fortunei 'Emerald n Gold'
83nr Hebe albicans 'Red Edge'
19nr Bergenia cordifolia 'Purpurea'
59nr Lavandula angustifolia 'Hidcote'
73nr Prunus laurocerasus 'Otto Luyken'
22nr Bergenia cordifolia 'Purpurea'
56nr Hebe pinguifolia 'Pagei'
29nr Hebe pinguifolia 'Pagei'
12nr Prunus laurocerasus 'Otto Luyken'
102nr Viburnum davidii
49nr Skimmia japonica 'Rubella'
90nr Lavandula angustifolia 'Hidcote'
67nr Hebe albicans 'Red Edge'
25nr Bergenia cordifolia 'Purpurea'
65nr Spiraea japonica 'Goldflame'
28nr Viburnum davidii
44nr Euonymus fortunei 'Emerald Gaiety'
46nr Santolina chamaecyparissus nana
75nr Cornus sanguinea 'Mid-Winter Fire'
72nr Skimmia japonica 'Rubella'
24nr Spiraea japonica 'Goldflame'
47nr Choisya ternata 'Sundance'
28nr Ceanothus thyrsiflorus repens
26nr Spiraea japonica 'Goldflame'
26nr Geranium endressii 'Wargrave Pink'
30nr Bergenia cordifolia 'Purpurea'
53nr Cistus 'Silver Pink'
76nr Euonymus fortunei 'Emerald n Gold'
76nr Hebe albicans 'Red Edge'
40nr Viburnum davidii
Native Hedge Mix (5/1m m double)
14nr Acer campestre
14nr Corylus avellana
139nr Crataegus monogyna
28nr Ilex aquifolium
42nr Ligustrum vulgare
14nr Rosa canina
28nr Sambucus nigra
39nr Euonymus fortunei 'Emerald Gaiety'
33nr Lavandula angustifolia 'Hidcote'
32nr Philadelphus 'Manteau d'Hermine'
27nr Ceanothus thyrsiflorus repens
30nr Choisya ternata 'Sundance'
41nr Skimmia japonica 'Rubella'
62nr Escallonia 'Apple Blossom'
30nr Hebe albicans 'Red Edge'
48nr Geranium endressii 'Wargrave Pink'
50nr Philadelphus 'Manteau d'Hermine'
57nr Cistus 'Silver Pink'
64nr Santolina chamaecyparissus nana
22nr Lavandula angustifolia 'Hidcote'
27nr Ceanothus thyrsiflorus repens
23nr Skimmia japonica 'Rubella'
39nr Viburnum davidii
35nr Euonymus fortunei 'Emerald Gaiety'
20nr Lavandula angustifolia 'Hidcote'
25nr Skimmia japonica 'Rubella'
Native Hedge Mix (5/lin m double)
46nr Acer campestre
46nr Corylus avellana
461nr Crataegus monogyna
92nr Ilex aquifolium
138nr Ligustrum vulgare
46nr Rosa canina
92nr Sambucus nigra

PLANTING NOTES

All trees to be planted and procured in accordance with BS 8545:2014. The providing nursery shall demonstrate Plant Healthy Certification and/or an adopted biosecurity policy.
Aftercare shall be in accordance with the approved Landscape Management Document.

PLANTING SCHEDULES

ORNAMENTAL PLANTING SCHEDULE

Herbaceous

Nr	Name	Ht in cm	Pot(L)	Density
96	Bergenia cordifolia 'Purpurea'		3L	5.00
74	Geranium endressii 'Wargrave Pink'		3L	5.00

Shrub

Nr	Name	Ht in cm	Pot(L)	Density
82	Ceanothus thyrsiflorus repens	30-40cm(D)	3L	5.00
77	Choisya ternata 'Sundance'	30-40cm	3L	5.00
110	Cistus 'Silver Pink'	30-40cm	3L	5.00
75	Cornus sanguinea 'Mid-Winter Fire'	40-60cm	3L	5.00
62	Escallonia 'Apple Blossom'	30-40cm	3L	5.00
118	Euonymus fortunei 'Emerald Gaiety'	20-30cm(D)	3L	5.00
129	Euonymus fortunei 'Emerald n Gold'	20-30cm(D)	3L	5.00
256	Hebe albicans 'Red Edge'	20-25cm	3L	5.00
85	Hebe pinguifolia 'Pagei'	20-30cm(D)	3L	5.00
224	Lavandula angustifolia 'Hidcote'	20-25cm	3L	5.00
82	Philadelphus 'Manteau d'Hermine'	30-40cm	3L	5.00
85	Prunus laurocerasus 'Otto Luyken'	30-40cm	3L	5.00
110	Santolina chamaecyparissus nana	20-25cm	3L	5.00
210	Skimmia japonica 'Rubella'	30-40cm	3L	5.00
115	Spiraea japonica 'Goldflame'	30-40cm	3L	5.00
209	Viburnum davidii	20-25cm	3L	5.00

All shrub material shall be first quality, sturdy, well rooted non-refridgerated stock with well branched heads and fibrous root systems. Shrubs shall be planted into 450mm good quality fibrous topsoil incorporating organic compost and slow release fertiliser in accordance with all good horticultural practice.
A proprietary geotextile membrane is to be installed between the soil and mulch of the planted areas (with 200mm minimum overlap) cut with T or X slits to fit around the plants as required. Sufficient pegs to be used to ensure that membrane does not lift. All plant material shall be a minimum of 3L pot size unless otherwise specified and conform to BS3936 Part 1 and BS 4428.
Finished beds shall be dressed with 50mm depth of purple slate chippings.

TREE SCHEDULE

SPECIES		NUMBERS REQUIRED
	Ht in m	4.5 min
	Girth in cm	16-18
Acer campestre 'Elstijk'		7
Betula utilis jaquemontii (Buj)		9
Carpinus betulus 'Frans Fontaine' (CbFF)		4
Pyrus calleryana 'Chanticleer' (PxC)		3
Sorbus aucuparia 'Sheerwater Seedling' (SaS)		5

All trees to have clear stems to 2.0m above ground level with well developed branching heads with a single, central leader and healthy, fibrous root systems.
Trees shall be planted into pits of an appropriate size to accommodate the root system without restriction, backfilled with a 3:1 topsoil:compost mix and shall be secured to a machine rounded stake using 1 no. tree tie with rubber spacer. Finished height of stake shall not exceed 1/3 height of staked tree above ground.
Extra heavy standard trees in hard landscape within tree grilles to be underground guyed and fitted with an irrigation system such as RootRain by GreenBlue Urban. Underneath hard surfacing a crate system such as StrataCell by GreenBlue Urban, is to be installed. The extent of the pit to be fitted with a tree pit crate system is shown by the blue dashed line. All pits are to be 1m deep.

NATIVE HEDGE

NATIVE HEDGE SCHEDULE

Nr	Name	Height/cm	Age	Root	Pol/L
60	Acer campestre	60-80cm	1u1	BR	
60	Corylus avellana	40-50cm	1/0	BR	
600	Crataegus monogyna	40-50cm	1u1	BR	
120	Ilex aquifolium	50-60cm		C	2L
180	Ligustrum vulgare	50-60cm	0/1	RB	
60	Rosa canina	50-60cm	1/1	BR	
120	Sambucus nigra	60-80cm	1/1	BR	

Hedge to be planted in a previously prepared trench, 500mm wide and 450mm deep backfilled with a 3:1 mix of multipurpose topsoil to BS3882:2007 and planting compost. Bareroot transplants to be dipped in a suitable mychorrizal dip before planting. Plants to be planted in a double staggered row, 300-350mm wide, at 5nr. plants per linear metre with species planted randomly throughout in groups of 7 to 30 of a single species.
The hedge lines shall be mulched after planting with forest mulch to a uniform depth of 50mm.

TURFING

The topsoiled area to be turfed, is to be grade and cross-graded to even running falls, to allow the finished levels of the turf to be 40mm above the adjoining paved areas. The surface should be lightly and uniformly firmed by rolling or treading and reduced to a fine tilth up to 25mm in depth. All rubbish, stones greater than 50mm in diameter etc, shall be removed from the surface.
Apply an even application of approved fertiliser at a rate of 70g/m² and rake in. No turves shall be laid in exceptionally frosty weather or in other unsuitable weather conditions.
The turves shall be laid in a stretcher bond pattern, closely butted and firmed into position, to the correct levels. The turves should be laid off planks, working over turves previously laid. A dressing of fine, sifted topsoil (complying with BS 3882) should be applied to the laid turf and brushed well into the joints.
Turves shall be watered regularly to prevent them drying out before they establish.

KEY

- Existing trees, hedges and vegetation to be retained
- Existing trees, hedges and vegetation to be removed
- Proposed Extra heavy standard (16-18cm girth) tree
- Proposed Beech hedging
- Proposed native hedge
- Proposed ornamental shrub planting
- Proposed amenity grass seed
- Proposed species rich grass seed
- Proposed wildflower grass seed
- Proposed wildflower grass seed for wet soils
- Proposed 2000mm high close boarded timber fencing (detailed by others)
- Proposed 2000mm high acoustic fence (detailed by others)
- Proposed 450mm high knee high fence (detailed by others)
- Proposed 2000mm high paladin fence (detailed by others)
- Proposed retaining wall to engineers details (detailed by others)
- Proposed 1100mm high brick wall with railing (detailed by others)
- Proposed bird boxes (from left to right) Swift box Sparrow box
- Proposed wildlife habitat boxes (from left to right) Schwegeler 2FE bat boxes or equivalent Insect refuge Underground bee shelter

Rev G: Updated to include additional native hedge to car park boundary and adjustment of species list (SF)	Nov 21
Rev F: Native hedge added behind the store (SF)	Oct 21
Rev E: Additional tree planting (SF)	Oct 21
Rev D: Entrance to Paradigm House updated and knee rail added (SF)	Sept 21
Rev C: Bollards and cycle hoops added in front of retail units (SF)	Sept 21
Rev B: Updated to latest sitelayout (SF)	July 21
Rev A: Amended in line with Proposed Site Plan Rev P3 (SEL)	Mar 21

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client: Lidl Great Britain Ltd

project: Proposed Store
BANKWOOD WAY, BIRSTALL

drawing title: LANDSCAPE DETAILS

scale	date	drawn by	drawing no
1:200 @A0	Mar 21	SEL	R/2459/1G

LEGEND

Indicative Strata Boundary

Anticipated former Flockton Thin Coal Seam

F'

F

RT107

RT108

RT105

RT104

RT103

RT102

RT101

GROUND LEVEL

ANTICIPATED FORMER FLOCKTON THIN COAL SEAM

MADE GROUND

PENNINE LOWER COAL MEASURES

'Possible workings encountered in RT107. RT108 and RT101'

RT107: 0.10, 1.00, 3.20, 4.60, 38.10, 38.30, 40.00

RT108: 0.10, 0.80, 2.20, 3.50, 5.00, 38.50, 38.75, 40.00

RT105: 0.08, 1.00, 2.00, 7.50, 8.25, 11.40, 12.90, 13.90, 15.10, 17.10, 18.00, 37.10, 37.30, 41.00

RT104: 0.10, 1.00, 8.70, 9.50

RT103: 0.10, 0.15, 1.00, 9.00, 11.80, 15.20, 19.50, 20.00

RT102: 0.10, 1.00, 2.50, 5.70, 20.50

RT101: 0.20, 1.00, 3.80

Legend Key

- MADE GROUND
- SANDSTONE
- TOPSOIL
- Void
- MUDSTONE
- SILTSTONE
- COAL

100.00

Chainage (m)	0.00	18.16	30.10	32.14	35.59	48.10	61.89	69.95	75.27	83.31	90.14	96.45	107.68	125.05	133.14	154.78	161.16	170.57	174.50	185.06
Offset (m)		24.59	7.01	14.88	11.48	13.19	13.58	21.44	21.64	3.30	13.27	25.77	26.82	21.53	5.10	1.19	4.25	18.11	2.51	
Elevation (mAOD)		150.62	151.11	150.76	150.75	150.70	150.31	149.47	150.87	150.16	150.14	151.00	149.90	150.51	150.03	148.50	148.50	149.37	148.92	

TITLE:
Indicative Geological Cross-Section F - F'

Centre 27

Birstall

deltasimons
Environment - Health & Safety - Sustainability

DRAWN BY:	ENGINEER:	VERTICAL SCALE:	PROJECT NO:
EN	TS	1:250	14-0672.03
CHECKED BY:	REVISION:	HORIZONTAL SCALE:	FIGURE NO:
RJS	0	1:650	7f
DATE: 20 July 2018	CLIENT: AEW UK		

LEGEND

Indicative Strata Boundary

C

C'

GROUND LEVEL

MADE GROUND

PENNINE LOWER COAL MEASURES

TP114: 0.10, 0.80, 1.90, 0.60, 3.70

DS112: 0.08, 0.60, 2.60, 3.80, 4.10, 5.70, 5.80, 6.17

DS102: 0.30, 1.10, 1.20, 6.45

TP103: 0.30, 0.70, 2.70, 2.90

RT103: 0.10, 0.15, 1.00, 9.00, 11.80, 15.20, 19.50, 20.00

RT102: 0.10, 1.00

Legend Key

- MADE GROUND
- TOPSOIL
- Clayey sandy GRAVEL
- SANDSTONE
- Clayey SAND
- Silty CLAY
- COAL
- MUDSTONE

122.00

Chainage (m)	0.00	9.61	22.84	67.79	85.66	104.14	110.53	119.09	
Offset (m)	5.93	1.08	3.89	7.91	4.99	8.03			
Elevation (mAOD)	151.91	151.62	150.51	150.03	148.50	148.50			

deltasimons
Environment - Health & Safety - Sustainability

TITLE:
Indicative Geological Cross-Section C - C'

Centre 27

Birstall

DRAWN BY: EN	ENGINEER: TS	VERTICAL SCALE: 1:150	PROJECT NO: 14-0672.03
CHECKED BY: RJS	REVISION: 0	HORIZONTAL SCALE: 1:450	FIGURE NO: 7c
DATE: 20 July 2018	CLIENT: AEW UK		

APPENDIX B

SIRIUS GENERIC ASSESSMENT CRITERIA

SIRIUS GENERIC ASSESSMENT CRITERIA

Context

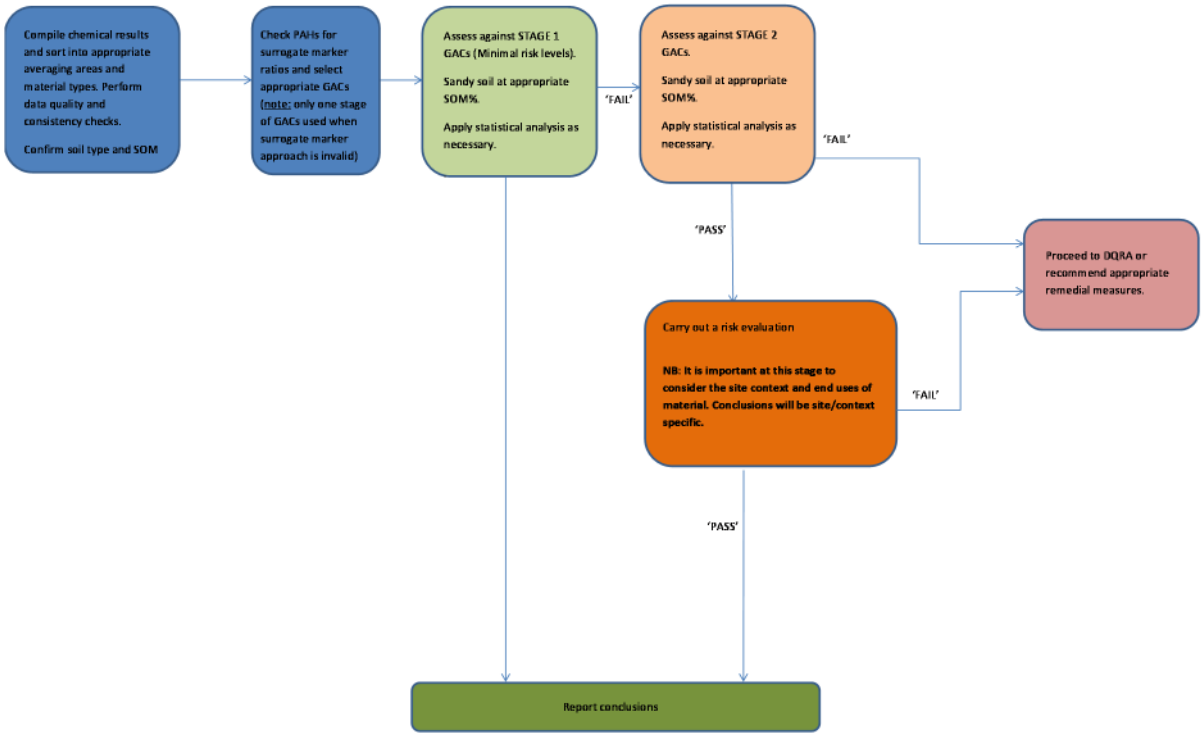
The framework for conducting site investigations, risk assessments and undertaking any necessary remedial works in the UK is provided by Environment Agency report CLR11 "Model Procedures for the Management of Contaminated Land". This presents a phased approach to risk assessment, involving: identification and qualitative assessment of potential pollutant linkages (source-pathway-receptor relationships) by means of a Conceptual Site Model; Generic Quantitative Risk Assessment (GQRA) of potentially significant pollutant links by comparing contaminant concentrations with appropriate Generic Assessment Criteria (GAC) values; and, if required, a Detailed Quantitative Risk Assessment (DQRA) based on site-specific conditions.

Assessment of Risk to Human Health

Introduction

A staged approach to GQRA has been adopted by Sirius for the evaluation of soil concentration data, as shown schematically in Figure 1.

Figure 1. GQRA Process.



The first stage of GQRA comprises assessment of the data against GAC values derived using toxicological parameter values based on "minimum risk". Any contaminants exceeding their GACs at this stage are further assessed against Stage 2 GACs, which have been derived using Low Level of Toxicological Concern (LLTC) criteria, where these are available.

With appropriate justification, a contaminant concentration that does not exceed the relevant Stage 2 GAC value may be considered to indicate that the land is "suitable for use". The appropriate use of LLTC-based criteria within the planning regime is considered reasonable by government agencies, as most recently highlighted in the letter (dated 3rd September 2014) to all local authorities from Lord de Mauley, Parliamentary Under Secretary at DEFRA.

A narrative "risk evaluation" must therefore accompany any Stage 2 assessment to justify the conclusions drawn. Where appropriate, this may provide a basis for eliminating from further consideration those contaminants whose concentrations do not exceed the applicable Stage 2 GAC value.

For the specific case of lead, the Category 4 Screening Level criteria given in CL:AIRE (2014)[1] have been adopted directly as GACs, as these are considered to be based on expert interpretation of current toxicological evidence.

In some areas, background concentrations of lead, other metals and metalloids, and/or individual PAHs may exceed their respective GACs and it may be appropriate to consider relative site and background concentration data as part of a more detailed assessment of the data.

Derivation of GACs

Except where otherwise stated, GACs have been derived by Sirius using CLEA version 1.071.

The GAC values have been derived for a sandy soil type, which will be conservative for the majority of soils (including made ground) encountered on historically contaminated sites. For organic contaminants of concern, criteria have been derived for a number of Soil Organic Matter (SOM) contents.

Genotoxic PAHs are assessed by the "Surrogate Method" using benzo(a)pyrene. Further information on this approach is given below.

Unless specifically stated, chemical properties and Health Criteria Values (HCVs) were obtained from:

- Environment Agency Science Report SC050021 series;
- Nathanail *et al*. (2009) "The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment", 2nd edition, Land Quality Press, Nottingham;
- CL:AIRE - AGS - EIC (2010) "Soil Generic Assessment Criteria for Human Health Risk Assessment". CL:AIRE, London.

GACs for arsenic, benzene, benzo(a)pyrene, cadmium and chromium (VI) have been derived using the

[1] CL:AIRE (2014) "Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination", Report SP1010, rev. 2.

Low Level of Toxicological Concern (LLTC) criteria given in CL:AIRE (2013). These criteria are considered a reasonable basis for assessment as they are still highly precautionary and definitely do not approach an intake level that could be defined as approaching Significant Possibility of Significant Harm to human health in the context of Part 2A of the Environmental Protection Act 1990. It must be further understood that the GACs derived will still incorporate a residual level of conservatism resulting from the exposure parameters used and the assumptions inherent in the model algorithms.

GACs for Genotoxic PAHs

Our approach to the assessment of genotoxic PAHs retains the use of benzo(a)pyrene as a surrogate marker. This approach for genotoxic PAHs is recommended by the HPA (2010)[2], which we consider to be the authoritative current guidance produced by a UK expert body and note that it was retained in the DEFRA Category 4 Screening Levels project (CL:AIRE, 2014).

The surrogate marker approach allows the assessment of the combined carcinogenic risk associated with all genotoxic PAHs[3] present as a mixture within soil, even though detailed toxicological information for many of the individual compounds may be lacking. The approach is based on determining the risk posed by the genotoxic PAH mixture using the concentration of benzo(a)pyrene present as an indicator.

To use the GAC for benzo(a)pyrene as a surrogate marker, a number of requirements must be met (HPA, 2010):

- Benzo(a)pyrene must be present in all soil samples containing genotoxic PAHs for which this method of assessment is being used;
- A similar profile of the genotoxic PAHs relative to benzo(a)pyrene should be present in all of the samples being assessed;
- The PAH profile of PAHs in the soil samples should be similar to that present in the pivotal toxicity study on which toxicological criterion for benzo(a)pyrene was based (Culp et al., 1998[4]). Table 1 provides the basis for defining the acceptable range.

Data indicate that contaminated soils in the UK generally meet these criteria[5] but the assessor must review their dataset before adopting this approach. If the above criteria are not met, then the surrogate marker approach must not be adopted and individual GAC or SSAC values are to be applied.

[2] HPA (2010) "Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)", version 5.

[3] The genotoxic PAHs included in the USEPA PAH 16 analysis reported by analytical labs are: benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, benzo(a)pyrene, chrysene, dibenz[a,h]anthracene and indeno[1,2,3-c,d]pyrene.

[4] Culp, S. *et al*. (1998) Carcinogenesis, 19, 117-124.

[5] Bull, S. & Collins, C. (2013) Environ. Geochem. Health, 31, 101-109.

Table 1. Profile of Genotoxic PAHs Relative to Benzo(a)pyrene that are Considered Acceptable for Application of Benzo(a)pyrene as a Surrogate Marker.

PAH	Acceptable Ratio of PAH Concentration to Benzo(a)pyrene for Application of Surrogate Marker Assessment	
	Lower Limit	Upper Limit
Benz[a]anthracene	0.12	12.43
Benzo[b]fluoranthene	0.11	10.85
Benzo[k]fluoranthene	0.04	3.72
Benzo[g,h,i]perylene	0.08	8.22
Chrysene	0.12	11.61
Dibenz[a,h]anthracene	0.01	1.38
Indeno[1,2,3-c,d]pyrene	0.07	7.27

For further information see: HPA (2010).

Soil Criteria Set for Purposes Other Than Human Health Protection

The Sirius GACs for sulphate, total organic carbon (TOC) and calorific value are set on basis of risks other than human health and their exceedance does not indicate a potential risk to future site users:

- The GAC for sulphate content is based on potential detrimental effects on buried concrete[6] and must be assessed with reference to the soil pH;
- The GAC for TOC content is provided for indicative assessment of disposal options if off-site landfill of soil were to be considered. This GAC is set at the 'Inert' waste threshold and should be considered as being applied for information purposes only;
- The GAC for calorific value is set to assist in an initial assessment of the potential fire risk posed by made ground or natural soils containing elevated concentrations of potentially combustible organic matter.

Assessment criteria more stringent than those for human health may be set for specific purposes, for example, elimination of nuisance odours or ensuring that potentially mobile free-phase organic products are not present.

Controlled Waters

The Environment Agency's "Remedial Targets Methodology" (2006) provides a framework for assessing the potential for pollution of controlled waters and for deriving remedial target concentrations in soil and groundwater.

There are no generic groundwater or surface water quality standards that are applicable to all sites. Drinking Water Standards and Environmental Quality Standards (EQS) are used by Sirius as assessment criteria where they are appropriate to the contaminant linkages under consideration. Given that these standards apply at the receptor point, this is a conservative approach for samples collected at a source or along a transport pathway.

[6] BRE (2005) "Concrete in Aggressive Ground", Special Digest No. 1; 3rd Edition.

Soil Leachability

Sirius specifies that the analytical laboratory undertakes leachate preparation by BS EN 12475-2:2002. Where specific circumstances require a different method to be used, then this will be explained and justified within the report body text.

The results of leachate analysis are compared to the relevant GAC values for controlled waters.

The Sirius Group
Stage 1 Generic Assessment Criteria for Soils

Revision: 24 January 2020

Parameter	Residential (mg/kg, unless otherwise stated)						Commercial / Industrial (mg/kg, unless otherwise stated)			Note
	With Homegrown Produce			Without Homegrown Produce						
	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	
Metals/Metalloids										
Arsenic (inorganic)	37			40			630			[1]
Cadmium	11			85			190			[2]
Chromium (III)	910			4000			8600			
Chromium (VI)	6.0			6.1			33			[3]
Copper	200			7100			68000			[4]
Lead	200			310			2300			[5]
Mercury (inorganic)	40			56			1100			[6]
Nickel	130			180			980			[7]
Selenium	250			430			12000			
Vanadium	410			1200			9000			
Zinc	450			40000			750000			[4]
Other Inorganics										
pH	<5 or >9			<5 or >9			<5 or >9			
Total Sulphate	2400			2400			2400			[8]
Water-Soluble Sulphate	0.5 g/l			0.5 g/l			0.5 g/l			[8]
Free Cyanide	34			34			1400			[9]
Organics										
PAHs										
Acenaphthene	200	490	920	2000	3600	4900	75000	92000	100000	
Acenaphthylene	170	400	760	2000	3600	4900	76000	93000	100000	
Anthracene	2300	5300	9400	30000	34000	36000	520000	540000	540000	[10]
Benzo(a)anthracene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Benzo(a)pyrene	2.1	2.1	2.2	2.3	2.3	2.3	27	27	27	[11]
Benzo(b)fluoranthene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Benzo(k)fluoranthene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Benzo(g,h,i)perylene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Chrysene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Dibenzo(a,h)anthracene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Fluoranthene	280	560	820	1500	1600	1600	23000	23000	23000	
Fluorene	170	390	730	2200	3400	4000	60000	67000	70000	
Indeno(1,2,3-c,d)pyrene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Naphthalene	1.0	2.3	4.6	1.0	2.4	4.7	110	260	510	
Phenanthrene	95	220	380	1300	1400	1500	22000	22000	23000	
Pyrene	620	1200	1900	3700	3800	3800	54000	54000	54000	
BTEX and related										
Benzene	0.063	0.13	0.24	0.16	0.30	0.38	15	28	49	
Toluene	100	240	460	370	830	1100	33000	68000	110000	
Ethylbenzene	26	62	120	34	81	110	3200	7400	14000	
Xylenes (total)	28	67	130	33	78	110	3200	7700	15000	[12]
1,2,4-trimethylbenzene	0.22	0.53	1.1	0.24	0.58	1.2	39	93	170	
Iso-propylbenzene	6.6	16	32	6.8	17	33	1300	3100	6100	
Propylbenzene	21	51	100	23	57	110	3800	9100	17000	
Styrene	6.9	16	32	21	49	93	3100	6100	9500	
TPH										
Aliphatic EC 5-6	24	41	68	24	41	68	2400	4100	6900	
Aliphatic EC >6-8	53	110	210	53	110	210	5300	11000	21000	
Aliphatic EC >8-10	13	31	61	13	31	61	1300	3100	6000	
Aliphatic EC >10-12	62	150	300	62	150	300	6100	15000	28000	
Aliphatic EC >12-16	510	1200	2300	510	1200	2300	43000	72000	85000	
Aliphatic EC >16-35	41000	70000	90000	42000	70000	90000	>1E6	>1E6	>1E6	[13]
Aromatic EC >5-7	53	110	200	150	300	538	15000	28000	48000	
Aromatic EC >7-8	100	240	460	370	820	1500	33000	68000	110000	
Aromatic EC >8-10	20	48	94	22	54	100	2200	5200	9800	
Aromatic EC >10-12	63	150	290	120	290	560	11000	22000	30000	
Aromatic EC >12-16	140	320	570	1100	1900	2200	35000	37000	37000	
Aromatic EC >16-21	260	540	840	1800	1900	1900	28000	28000	28000	
Aromatic EC >21-35	1100	1500	1700	1900	1900	1900	28000	28000	28000	
Chlorinated Organics										
Chlorobenzene	0.19	0.44	0.86	0.19	0.45	0.87	31	71	140	
Dichloromethane (DCM)	0.47	0.78	1.2	1.2	1.7	2.4	250	340	470	
1,1-dichloroethane (DCA)	1.4	2.4	4.0	1.4	2.4	4.1	260	420	690	
1,2-dichloroethane (DCA)	0.0031	0.0048	0.0076	0.0035	0.0053	0.0084	0.34	0.51	0.81	
1,1-dichloroethene (DCE)	0.15	0.26	0.45	0.15	0.26	0.46	24	43	74	
cis -1,2-dichloroethene (DCE)	0.066	0.12	0.20	0.069	0.12	0.21	14	23	38	
trans -1,2-dichloroethene (DCE)	0.11	0.21	0.38	0.12	0.22	0.39	21	37	65	
Pentachlorophenol	0.21	0.52	1.0	27	30	31	400	400	400	
1,1,1,2-tetrachloroethane	0.56	1.3	2.6	0.63	1.5	2.9	59	140	270	

Parameter	Residential (mg/kg, unless otherwise stated)						Commercial / Industrial (mg/kg, unless otherwise stated)			Note
	With Homegrown Produce			Without Homegrown Produce						
	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	
1,1,2,2-tetrachloroethane	0.98	2.1	4.0	1.6	3.4	6.3	150	310	570	
Tetrachloroethene (PCE)	0.074	0.17	0.32	0.07	0.17	0.33	10	23	45	
Tetrachloromethane (CT)	0.011	0.024	0.046	0.011	0.024	0.046	1.6	3.6	6.9	
1,1,1-trichloroethane (TCA)	3.7	7.8	15	3.8	7.9	15	370	770	1400	
1,1,2-trichloroethane (TCA)	0.39	0.85	1.6	0.51	1.1	2.0	89	180	320	
Trichloroethene (TCE)	0.0070	0.015	0.028	0.0071	0.015	0.028	1.5	2.8	44	
Trichloromethane (CF)	0.43	0.80	1.4	0.48	0.89	53	98	170	300	
Vinyl Chloride	0.00034	0.00045	0.00062	0.00037	0.00048	0.00066	0.038	0.049	0.068	
Miscellaneous Organics										
Carbon disulphide	0.066	0.13	0.25	0.066	0.13	0.25	6.7	14	25	
Di-(2-ethylhexyl)-phthalate	290	660	1100	3900	4000	4100	85000	85000	8600	
MTBE	31	55	94	39	68	120	7400	12000	19000	
Phenol	110	190	330	420	440	440	440			[14]
Methylphenols (cresols), total	78	170	330	5600	8200	9900	160000	170000	18000	[15]
2,4-dimethylphenol (m-xylenol)	18	43	82	200	430	720	15000	23000	28000	
Other Parameters										
TOC	3% w/w			3% w/w			3% w/w			[16]
Calorific Value	2 MJ/kg			2 MJ/kg			2 MJ/kg			[17]
Asbestos	Fibres present			Fibres present			Fibres present			

All concentration-based criteria are rounded to 2 significant figures.

The criteria assume a sandy soil type, which will be conservative for the great majority of soils (including made ground) encountered on historically contaminated sites.

Except where otherwise stated, criteria have been derived by Sirius using CLEA version 1.06. Parameters for the land use cases are consistent with those given in Environment Agency (2009) "Updated Technical Background to the CLEA Model", report SC050021/SR3 but updated (where relevant) for respiration rate, exposure frequency for dermal contact outdoors, soil adherence factors for children, and plant uptake concentration factors given in CL:AIRE (2014) and Nathanail et al., (2015). No correction has been made for the "Top Two" crop types in the Residential with Homegrown Produce land use and the criteria will therefore be conservative in this regard.

Health Criteria Values (HCVs) and (except where specifically noted) chemical property data were obtained from:
• Environment Agency Science Report SC050021 Series;
• Nathanail et al. (2015);
• CL:AIRE-AGS-EIC (2010).

Footnotes

[1] Based on oral GAC as this is the lower GAC and reflects a cancer risk many orders of magnitude greater than for inhalation.

[2] Determined for lifetime exposure. Plant uptake concentration factors applied were as given in CL:AIRE (2014). The GAC values are based on data for soils having a pH value in the range 6-8; caution should be applied in applying them at pH values outside this range, especially at pH values <5.

[3] Both oral and inhalation HCVs are based on local toxicological effects and therefore the lowest (oral) GAC value is adopted.

[4] For the Residential with Homegrown Produce land use, the GAC values for Cu and Zn are based on potential phytotoxic effects and have been set at the maximum allowable concentrations for sewage sludge-amended soils presented in the "Sludge (Use in Agriculture) Regulations" (SI 1263/1989); these criteria may also be applied in any land use where plants are to be grown. The equivalent GAC values for human health protection in the Residential with Homegrown Produce land use are around an order of magnitude greater.

[5] The Category 4 Screening Levels for lead defined in CL:AIRE (2013) have been adopted directly to provide an acceptable basis for initial assessment of data. Where background concentrations of lead exceed the GAC value, then site-specific evaluation will be required.

[6] The SGV for mercury is based on inorganic mercury which represents the most common form encountered within the environment. This is considered appropriate for most sites as: "…the SGV for inorganic mercury can normally be compared with chemical analysis for total mercury content because the equilibrium concentrations of elemental and methylmercury compounds are likely to be very low" (Environment Agency report SC050021/Mercury SGV). Analysis and specific assessment for elemental or methylated forms of mercury will need to be considered if historical land use or site-specific factors indicate that these forms of mercury are likely to be present.

[7] Toxicological effects by inhalation are localised, therefore the lower of the GAC values for oral and inhalation HCVs have been adopted.

[8] BRE (2005). Sulphate is not considered to pose a potential risk to human health under normal circumstances – this GAC applies to construction cases only and is set at the upper limit for DS-1 Design Sulphate Class concrete.

[9] GAC calculated for acute risk. Further information can be provided upon request.

[10] The genotoxic PAHs (benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene) are routinely assessed using benzo(a)pyrene as a surrogate (HPA (2010) "Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)", version 5). Separate information on this approach is provided.

[11] Calculated using a 'minimum risk' oral index dose derived from the application of a 10,000x safety factor to the BMD10 presented in CL:AIRE (2014) for benzo(a)pyrene as a surrogate marker and the inhalation index dose specified in CL:ARE (2014) and Nathanail *et al*. (2015). As a conservative measure, the GAC is based on combined exposure pathways to account for systemic carcinogenic effects. Further information on the derivation can be provided upon request.

[12] For screening purposes, a single GAC has been set for total xylene. This is the lowest of the values calculated for the three individual xylene isomers.

[13] "No GAC" indicates that no value has been specified for this land use as the TDSI cannot be exceeded at achievable soil concentrations.

[14] 440mg/kg is the minimum concentration that is protective for direct skin contact with phenol (See Environment Agency SR050021/Phenol SGV) and is adopted where GACs for chronic exposure are higher.

[15] For screening purposes, a single GAC has been set for total methylphenol. This is the lowest of the values calculated for the three individual methylphenol isomers.

[16] The Hazardous Waste (England and Wales) Regulations 2005. TOC content in itself does not represent a potential risk to human health. This GAC is provided for indicative assessment of disposal options, in the case that off-site landfill of soil is undertaken. This GAC is specified at the 'Inert' waste threshold and should be considered as for information purposes only.

[17] ICRCL (1986) Guidance Note 61/84, 2nd Edition, Notes on the Fire Hazards of Contaminated Land. Calorific value is not an indication of direct human health risk but may be useful in assessment of the potential fire risk posed by made ground or natural soils containing elevated concentrations of potentially combustible organic matter.

APPENDIX C

CLEAN COVER GUIDANCE VALUES

The Sirius Group
Stage 1 Threshold Concentrations for Clean Cover Soils for Use in Areas of Soft Landscaping

Parameter	Threshold Concentration (mg/kg, unless otherwise stated)			Comment
	1% SOM*	2.5% SOM	5% SOM	
Metals/Metalloids				
Arsenic (inorganic)	79			
Cadmium	120			Soil pH 6-9
Chromium (III)	1500			
Copper	200			Based on phytotoxic effect
Lead	630			
Mercury (inorganic)	120			
Nickel	230			
Selenium	1100			
Zinc	450			Based on phytotoxic effect
Other Inorganics				
pH	<5 or >9			pH to be in range 5-9
Water-Soluble Sulphate	0.5 g/l			
Organics				
PAHs**				
Total 16 PAHs	***100***	***100***	***100***	Professional judgement
Benzo(a)pyrene	4.2	4.2	4.2	Genotoxic surrogate
TPH†				
Sum of TPH fractions EC5-35	***500***	***500***	***500***	Professional judgement
Aliphatic EC 5-6	520000	550000	570000	
Aliphatic EC >6-8	560000	580000	600000	
Aliphatic EC >8-10	12000	12000	12000	
Aliphatic EC >10-12	13000	13000	13000	
Aliphatic EC >12-16	13000	13000	13000	
Aliphatic EC >16-35	250000	250000	250000	
Aromatic EC >5-7	55000	55000	55000	
Aromatic EC >7-8	55000	55000	55000	
Aromatic EC >8-10	5000	5000	5000	
Aromatic EC >10-12	5000	5000	5000	
Aromatic EC >12-16	5000	5000	5000	
Aromatic EC >16-21	3800	3800	3800	
Aromatic EC >21-35	3800	3800	3800	
TPH Hazard Index (no units)	<1	<1	<1	
BTEX‡				
Benzene	71	72	72	
Miscellaneous Organics				
Phenol	440	440	440	440mg/kg is the skin irritation threshold
Other Parameters				
Asbestos	Fibres present			

Based on sandy soil at a range of soil organic matter contents for areas of vegetated landscaping in residential or commercial land uses. Alternative criteria may be specified for other soil types and SOM contents, for soils placed at depth, or for other land uses.

Notes:

* Soil organic matter; %SOM = 1.724 * %TOC.

** Soils must meet the specified criteria for each component AND the sum of 16 PAHs. The total is specified to prevent unsuitable materials being placed as cover. Where an individual PAH is not shown, then its criterion is greater than that for the sum or it is a genotoxic PAH assessed by using benzo(a) pyrene as a surrogate marker.

† Soils must meet the specified criteria for each component and the Hazard Index for TPH must be <1.0. The sum of TPH fractions must also be met to prevent unsuitable materials being placed as cover. Where an individual TPH fraction has a criterion greater than that for the sum of TPH fractions, the value is solely provided for the calculation of the Hazard Index.

‡ Components other than benzene are not genotoxic carcinogens and therefore assessed as part of the TPH mixture.

Soils must have no visual or olfactory evidence of contamination.

Version date: 20 August 2015

APPENDIX D

D&G SPECIFICATION

REPORT SDL4050
MAY 2022

SPECIFICATION FOR THE DRILLING AND GROUTING OF SHALLOW MINE WORKINGS

for
CENTRE 27, BANKWOOD WAY
BIRSTALL

Prepared for
LIDL GB LIMITED

REPORT NUMBER:	SDL4050	**REPORT STATUS:**	FINAL
REPORT TYPE:	SPECIFICATION FOR THE DRILLING AND GROUTING OF SHALLOW MINE WORKINGS		
REPORT DATE:	MAY 2022		
SITE:	CENTRE 27 BANKWOOD WAY, BIRSTALL		
PREPARED FOR:	LIDL GB LIMITED		
PREPARED BY:	Sirius Drilling Ltd 4245 Park Approach Thorpe Park Leeds West Yorkshire LS15 8GB	Tel: 0113 2649960 Fax: 0113 2649962	

SPECIFICATION FOR THE DRILLING AND GROUTING OF SHALLOW MINE WORKINGS of land at CENTRE 27, BANKWOOD WAY, BIRSTALL Prepared for LIDL GB LIMITED

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APPENDICES

APPENDIX A FIGURES AND DRAWINGS

Drawing No.	Title	Scale
SDL4050/SP/01	Site Location Plan	1:25,000
SDL4050/SP/02	Proposed Shallow Mine Workings Treatment Plan	1:500

1. INTRODUCTION

Sirius Drilling Ltd (Sirius) have been commissioned by Lidl GB Limited (Lidl), the Client, to prepare a specification for the stabilisation of shallow mine workings below at proposed retail development at Centre 27, Birstall, West Yorkshire.

It is understood that Lidl intend to develop the site with two retail units, car parking areas and associated carriageways.

A combined Phase 1 and Phase 2 Ground Investigation Report was prepared for the site by Curtins Consulting Limited (Curtins) in 2020, which identified the presence of shallow coal and suspected shallow mineworkings below the site. The shallow seam is considered to be the Flockton Thin Coal, with evidence of workings within influencing distance encountered across the western and north-eastern site areas.

A Detailed Coal Mining Risk Assessment and Supplementary Coal Mining Investigation were prepared for the site by Sirius Geotechnical Limited (SGL) in 2021 and 2022 respectively.

A plan showing the required treatment areas, together with the development proposals, is enclosed in Appendix A.

Boreholes will be drilled on a nominal 3m x 3m grid across the building footprints and below retaining walls greater than 1.5m in height, with the nominal zone of consolidation extending up to 3m beyond the plot line.

Boreholes will also be drilled on a on a nominal 3m x 3m grid across the adoptable access road. Below the access road, should mine workings be encountered within 5m of the surface, the grid will be reduced further to form a 3m grid with central borehole.

Across the car parking areas boreholes will also be drilled on a nominal 6m x 6m grid.

The stabilisation works will be undertaken by injecting a PFA / cement grout into the workings via the boreholes with the aim of substantially filling any mining related voiding.

The Client will supply the contractor with details of all known underground and above ground services, equipment, property etc. prior to commencing operations.

All works shall be carried out in accordance with the Construction Design Management (CDM) Regulations and the Construction Phase Health and Safety Plan.

This specification is divided into two sections; the general site details including information on the site, previous investigations and their findings; the second part of this report is a general specification for the works to be undertaken.

On completion of the drill and grout programme, a validation report containing copies of borehole records, a borehole location plan, procedures followed during the works, the results of validation boreholes and pressure tests, and a record of any deviation from this specification will be produced and issued to the client and all other relevant parties.

This specification has been prepared for the sole use of Lidl and their appointed agents. No other third party may rely upon or reproduce the contents of this report without the written approval of Sirius. If any unauthorised third party comes into possession of this report, they rely on it entirely at their own risk and the authors do not owe them any Duty of Care or Skill.

2. SITE DETAILS AND DESCRIPTION

Table 2.1 Site Location

Location	The site is located to the south of Bankwood Way, within the wider Birstall Retail Park area, approximately 5km south-west of Leeds city centre.
National Grid Reference	NGR 423694, 427432
Current Site Description	The site occupies and area of approximately 1.5 hectares and comprises an irregular shaped parcel of land covered by demolition rumble stockpiles following clearance of the previous development.
Site Boundaries	**West** – Existing retail properties **East** – Bankwood Way and undeveloped area **South** – Bankwood Way, existing commercial buildings and undeveloped areas. **North** – Existing retail properties

3. GEOLOGICAL SETTING

A summary of available published geological information is provided in Table 3.1 below.

Table 3.1 Geological Summary

Sources of Information	BGS 1:10,000 scale geological maps (Sheet SE22NW).
Made Ground	Made ground is recorded across the site, associated with quarry or colliery spoil.
Drift Geology	No superficial soils recorded on the BGS map.
Solid Geology	Solid strata underlying the site comprise Pennine Lower Coal Measures strata, which typically consists of undifferentiated sandstones, siltstones, mudstones and coals with the Emley Rock sandstone formation is indicted to underlie the western and northern areas.

Mining and Quarrying	**Coal Seams:** The Flockton Thin Coal seam outcrops within the site, across the central area and close to the north eastern boundary, underlying the western and north eastern site areas. The First Brown Metal Coal seam underlies the Flockton Thin Coal with a parting of around 20m, outcropping beyond the south eastern boundary and underlying the entire site. **Coal Mining:** The site is noted to be in a Development High Risk Area due to the presence of probable unrecorded shallow mine workings in the Flockton Thin Coal and First Brown Metal Coal seams. **Mine Entries:** A recorded adit (CA Ref. 423427-054) is present within the site boundary, located in the north east of the site with a north-north easterly heading. **Opencast Coal & Quarries:** Former quarry highwalls are indicated to be present across the site associated with historic quarrying activity.

4. PREVIOUS INVESTIGATIONS

The site has been the subject of a Combined Phase 1 and Phase 2 Ground Investigation Report prepared by Curtins Consulting Limited in 2020. The report includes a desk study followed by an intrusive investigation and geoenvironmental assessment.

A Detailed Coal Mining Risk Assessment and subsequent Supplementary Coal Mining Investigation were prepared for the site by Sirius Geotechnical Limited (SGL) on behalf of Lidl GB Limited, in 2021 and 2022 respectively. The Detailed Coal Mining Risk Assessment comprised a desk based assessment of the published information and previous intrusive investigations. The Supplementary Coal Mining Investigation principally comprised of an intrusive investigation of the recorded adit as well as further confirmatory intrusive investigations.

Summary of Relevant Findings

Within their report, Curtins state that….

"The site is located within a Coal Mining Development High Risk Area.

The Flockton Thin and Top Fenton (also referred to as High Fenton or the First and Second Brown Metal coal seam) coal seams underlying the site were last worked in 1877 and 1911 respectively. The Flockton Thin coal seam (0.91m thick) is indicated to be present at a depth of 10mbgl and the Top Fenton (0.6m thick) is shown at a depth of 30mbgl.

The shallow coal encountered across the site is considered to be attributed to the Flockton Thin coal seam based on thickness and depths. It should be noted that recent changes to site levels resulting from demolition works may result in increased depth ranges when compared to previous site investigations. Given the thicknesses and depths of the Flockton Thin coal seam, this coal seam is considered to pose a risk to future developments based on CIRIA's SP32 10:1 criterion, which considers the potential collapse of historical mine workings propagating to the surface.

Exploratory holes (RH201 to RH203, TT201A and TT201e) completed in the northeast corner of the site did not identify any evidence of collapsed mine workings. The loss of flush identified at 4.6mbgl in RH202 is at a similar depth to the coal seam identified in RH201 and

therefore is considered to be broken ground attributed to the coal seam. Similarly, the thickness of loose coal tailings identified in TT201e, together with the identification of overlying reworked natural clay strata suggests disturbed ground and/or fill arisings rather than potential mine workings.

Intact coal (0.6m thick) was encountered within the PLCM in TT201A at 3.4mbgl which provides further evidence to suggest the lack of collapsed mine workings. The collapsed workings (described as loose fill) identified in the rotary probe borehole (RT101) completed by Delta-Simons in 2018 are confined to the extreme northeast boundary, trending offsite to the northeast. It should be noted the location of exploratory hole locations were restricted by the presence of the deep culverted watercourse (approximately 8mbgl) which runs parallel with the eastern boundary. Therefore, if present further to the east, the construction of the culvert may have disturbed the mine adit.

Rotary open-holed borehole RH204 drilled in the southwest of the site encountered a sequence of broken ground, potential backfilled arisings and soft ground and/or a void from 2.1mbgl to 3.5mbgl. This also coincided with a partial loss of flush followed by a complete loss of flush. These ground conditions are similar to those encountered in RT107 completed by Delta-Simons in 2018, which identified a loss of flush and no recovery which was deemed to be a potential void.

TT204B completed approximately 15m to the northeast of RH204 encountered a large void between 1.5mbgl and >3.0mbgl in the northern face of the pit. The base of the void was not proven due to collapse and rapid water ingress.

The nature, size and structure (i.e. overlying sandstone strata provides support as a roof) suggests potential bell pitting coal mining techniques within the west of the site. The depth at which the void was encountered is also similar to the depths recorded for the coal in TT204C (2.8mbgl to >3.2mbgl), located approximately 5m to the west.

The evidence of potential mine workings identified between 1.8mbgl and 4.5mbgl in RH205 affirms the findings encountered within RT108 completed by Delta-Simons in 2018. Similar mining techniques (i.e. bell pitting) identified in TT204B might have been employed in this area.

Mine legacy features comprising potential worked seam and bell pits will require treatment prior to development. The advice of a specialist contractor should be sought however consideration should be given to bulk excavation and filling of bell pit features in association with drilling and grouting of worked seams."

Within their reports, SGL state that….

"Based on the results of the ground investigation works, recorded mine workings within the Flockton Thin coal seam were recorded at depths of between 3.5m and 8.0m bgl. Where intact, the Flockton Thin coal seam was encountered at a thickness of up to 0.60m. Where encountered, suspected workings were identified due to/as 'loss of flush', 'loose fill: collapsed workings', 'possible voids', 'possible void / soft ground' and 'possible broken ground', at thicknesses of between 0.60m and 2.80m.

Evidence of seat earth was recorded underlying made ground soils within Curtins trial hole TT204A. It is unclear if the seatearth has been subject to extraction below the site, although a 0.3m thick band of 'spavin' is shown underlying the Flockton Thin seam on the relevant abandonment plan. The seam is recorded to have been worked in approximately 1877, indicating that a pillar and stall method is likely to have been used. Due to the age of the workings, the findings of the site investigation are consistent with collapsed workings. The presence of intact coal may represent areas of 'pillars', left in-situ as support for the workings.

The coal appears to have been locally extracted by opencast methods, as identified by areas of earthworks and highwalls on historic OS maps, with resultant excavations backfilled with made ground soils. These areas should be evident by associated deep made ground where the coal seam would be anticipated.

The CIRIA Abandoned Mine Workings Manual notes that instability in bedrock resulting from collapse of pillar and stall mine workings might, exceptionally, extend to 10 times the height of the original extraction. All boreholes where evidence of mine workings were encountered within the Flockton Thin seam were found with insufficient cover assuming 10 times the height of extraction (recorded as 0.91m in thickness by the CA).

Sufficient competent cover has been identified above the deeper Top Fenton / First Brown Metal seam (with a recorded extraction thickness of 0.60m), to mitigate any risk from

surface stability within any mine workings present below the site. In addition, no definitive evidence of mine workings within the seam are shown underlying the site on the relevant mine abandonment plan.

In view of this, it is recommended that areas of the site underlain by the Flockton Thin and / or associated coal / seatearth workings be stabilised by drilling and pressure grouting to mitigate the risk of surface instability. At this stage it is considered that remedial works are likely to comprise drill and grout stabilisation boreholes on a staggered preliminary 6m probing grid beneath the footprint of the proposed stores, reducing to a 3m grid where workings are encountered. Within adoptable highway and the service yard/car parking, consideration could be given to the treatment boreholes being drilled on a 3m and 6m grid, respectively. Confirmatory probe holes should be drilled within the areas of former opencast (to the north of the conjectured Flockton Thin outcrop) to prove the absence of the coal seam.

The stabilisation works are proposed to allow historic workings within the Flockton Thin coal seam (and any underlying seat earth) to be substantially filled, in addition to any voids or broken ground found within the overlying strata in order to prevent the development of crown holes at the surface / foundation level.

The possibility of encountering unrecorded mine entries on site cannot be discounted. It is therefore recommended that the areas beneath proposed buildings have overlying made ground removed (where feasible, and in particular where within the conjectured sub-crop of the underlying Flockton Thin coal seam), in order to expose the natural ground. This action, would enable the inspection for any disturbed ground, associated with possible historic bell pits/mine entries/ crop workings of the shallow coal. If any disturbed ground is suspected, advice regarding treatment should be sought from a suitably qualified engineer."

Based on the findings of this supplementary phase of investigation, no evidence of the adit has been identified to a maximum depth of 25m bgl, along its conjectured length (allowing for an up to 8m departure from its recorded location).

Abandonment plans obtained for the site indicate the conjectured adit to be present leading to off-site workings within the First Brown Metal coal, at a recorded depth of c.12m. On this basis, it is anticipated that the adit, if currently present, is anticipated to have been present at a depth of less than c.10m bgl within the site area, and likely to have been intersected by the rotary transects. The adit may have been removed as part of historical earthworks

within the northeastern site area and on this basis is considered to pose a low risk to surface stability.

Although considered an unlikely possibility, should the adit exist at a depth greater than 25m bgl within the site area, sufficient competent cover is considered to exist within the eastern part of the site to mitigate any risk from surface stability of the adit which has a conjectured height of 2m."

5. GENERAL SPECIFICATION

5.1. Constituent Materials for Grouting

Water shall be from the mains supply or other source approved by the Resident Engineer (RE) and supplied by the Client.

Cement shall be CEM II 32.5 conforming to BS EN 197-1:2011

Pulverised Fuel Ash (PFA) complying with BS EN 12715: 2000 shall be conditioned hopper ash, or dry powder ash, or a type suitable as a constituent for grout and obtained from an approved supplier.

Sand shall generally comply with BS882 and be of a grading suitable for use in the Contractor's plant and approved by the RE.

Pea gravel shall comply with BS882, and be of grading approved by the RE.

Thixotropic admixtures shall be bentonite or another admixture approved by the RE.

5.2. Storage and Use of Materials

Storage of materials shall be such as to prevent contamination and deterioration. Cement shall be kept in a dry location, and the sequence of deliveries recorded so that cement can be used in rotation.

PFA shall be stored within a pre-defined area and will be kept dampened to mitigate against fugitive dust.

5.3. Grouting Plant

The Contractor shall submit to the RE, for approval, details of the proposed method of mixing, and pumping of grout to the injection points, together with the means of monitoring grouting pressures and the quantities injected. The materials shall be introduced into the mixer via approved volumetric methods.

The grout mixer shall be capable of producing a homogenous mix, all particles being thoroughly wetted without segregation.

5.4. Grout Mixes

With consideration to the future use of the area, the filing material shall generally consist of a PFA: cement grout which should be generally mixed in the proportions of to 12:1.

The mixes shall produce cubes with crushing strengths of not less than 1.0 MN/m^2 at 28 days (Note: the 7 day test is performed to indicate that the 28 day strength is achievable i.e. a 7 day value of about 0.4MN/m^2 would probably be considered on target.

Where excessive lateral flow of grout is anticipated or when voids greater than 500mm are encountered, sand or pea gravel may be introduced in to the workings in accordance with CIRIA C758D. The specified grout mix shall have the minimum water content consistent with effective pumping.

The actual proportions to be used initially for the various grouts shall be agreed with the RE paying due regard of the conditions met in drilling and the results of any trial grouting carried out before work commences.

5.5. Grout Properties and Testing

With water / (cement and PFA) ratios generally in the range of 0.4 to 0.45, (including the moisture in the aggregates), the mixes proposed should produce pumpable grout with flowability readings of between 300 to 600mm, when measured in a meter of the “Colcrete” type.

The sample for the flowability test shall be obtained by the grouting Contractor at the point of injection i.e. from the end of the tremie pipe.

A minimum of two flowability tests per week shall be performed by the Contractor as directed by the RE.

High-bleed grouts shall be avoided. Bleed capacity should be limited to 5% maximum unless agreed otherwise with the RE.

A minimum of two bleed capacity tests shall be performed by the Contractor per shift or as directed the RE. The sample of grout for the test shall be taken from the point of injection i.e. the end of the tremie pipe.

Bleed capacity shall be measured in a clear plastic or glass graduated cylinder which has an internal diameter not less than 50mm and with a volume of approximately 1000ml. After placing the grout, a cover shall be placed over the cylinder to avoid evaporation. Bleed capacity shall be read at hourly intervals for neat cement grout, and readings should continue for not less than 3 hours. For PFA: cement grouts, readings should continue for not less than 6 hours.

The Contractor shall prepare two sets of test cubes of grout per week, or as directed by the RE. Each cube shall be of 100mm side, or as agreed with the RE, and shall be taken from the grout at the point of injection i.e. the end of the tremie pipe.

At the instruction of the RE, the Contractor shall arrange for them to be tested by crushing at 7 and 28 days in accordance with BS1881.

The testing shall be carried out by an independent laboratory or as agreed with the RE.

As stated previously mixes shall produce cubes with crushing strengths of not less than 1.0 MN/m^2 at 28 days

If the RE considers the results of the test indicate that a change of mix proportions is required, the Contractor shall make such modifications as the RE may direct.

5.6. Drilling Procedures for Treatment of Shallow Mine Workings

All boreholes to be used for the injection of grout, including those which strike coal pillars, shall be drilled by rotary or rotary percussive techniques down to a minimum of 0.5m beyond the base of the old workings in the seam or the floor of the seam itself whichever is greater.

The drilling system and flushing medium to be used shall be as instructed on the Coal Authority licence, and approved by the RE. The Contractor shall allow for the provision of appropriate dust suppression for those holes that are to be drilled near sensitive receptors (e.g. nearby houses, highways, active commercial properties, car parks and public footpaths).

Treatment of the access road will be undertaken utilising a nominal 3m x 3m grid across the highway footprint, where mine workings are encountered at a depth less than 5m from the surface the grid will be reduced to form a 3m grid with central borehole.

Treatment of the retail unit footprint and below retaining walls greater than 1.5m in height will be undertaken utilising a 3m x 3m grid, with the zone of consolidation extending up to 3m beyond the building footprint.

Treatment of the car park areas will be undertaken utilising a 6m x 6m grid.

The minimum diameter of the holes shall be 75mm unless otherwise specified by the RE. When it is impracticable to drill at the minimum diameter for the full depth, the diameter of the boreholes shall be increased in the upper lengths.

Boreholes shall be temporarily cased through superficial deposits down to the rockhead and if directed by the RE, down through the rock strata. The boreholes shall be kept open until grout injection into the workings and rock is complete.

Where a borehole proves abortive because it becomes obstructed, it shall be re-drilled in a suitable location as directed by the RE, at a large diameter and re-cased.

Boreholes shall be formed in general accordance with the locations shown on the plan in Appendix A. Any deviation from this proposed layout including the drilling of test holes shall be recorded by the contractor and a revised borehole location plan provided to the RE.

During the course of the works, the RE will review the borehole records generated, and will review the potential for the presence of workings at shallow depth below rockhead elsewhere on the site. If so required, the RE shall instruct the Contractor to undertake supplemental investigation boreholes in areas outwith the proposed drill and grout programme, to confirm the presence or otherwise of workings at shallow depth. If such

workings are suspected or identified, the drill and grout programme shall be extended to treat such areas.

5.7. Grouting Procedures for Shallow Mine Workings

The aim of the stabilisation work is to substantially fill any old workings within the identified seam as well as any voids or broken ground found within the overlying strata in order to mitigate the development of crown holes at the surface \ foundation level.

Perimeter grout walls, if required, shall be formed by filling boreholes with a viscous grout composed of appropriate proportions of cement, PFA, sand or pea gravel and water. The mix, proportions and method must be agreed with the RE.

Pressure need not be applied to the grout in affected boreholes unless required by the RE.

Unless specified otherwise, the section of the perimeter wall at the deepest part of the seam shall be constructed first.

Immediately prior to grouting each borehole, the Contractor shall check that it is unobstructed to the required depth to receive the tubing or tremie pipes for grout injection. Obstructions shall be dealt with as described in ‘drilling procedures’ above.

Grout shall be injected into each hole via an approved flexible tube with grout placed to the base of the hole.

Grouting shall proceed upwards from the base of each borehole to the base of the surface deposits. It is not intended that, as a general rule, significant quantities of grout shall be injected into the surface deposits unless specified otherwise. This requirement will be subject to RE review.

The grout shall be injected at the approved rates until grout appears near the point of injection, when the borehole shall be deemed complete. If the is criteria is reached quickly, the grout tubes shall be lifted to check that a local obstruction is not preventing flow of the grout into the strata.

Hydrostatic pressure shall be applied to the grout in every borehole. If grout has not appeared at the point of injection after 5 tonnes of grouting materials have been introduced

then sand and/or pea gravel (gravel which passes through a 6.33mm sieve and is retained on a 2.36mm sieve) may be added to the mix or placed down the borehole.

Should a borehole within the adoptable highway accept more than 6 tonnes of grout, treatment within the hole will be suspended for 12 hours. Thereafter further grout will be injected in 2 tonne batches. If pressure has not been achieved or grout appeared after a total of 10 tonnes of grout has been placed then a review of the borehole grid spacing, grout mix and materials used will be undertaken.

5.8. Stabilisation Procedures for the Treatment of Mine Shafts

Any former mine shafts encountered on site shall be stabilised in accordance with the recommendations given in the NCB handbook 'The Treatment of Disused Mine Shafts and Adits.' and CIRIA C758D.

All work on or about old mine shafts must be carried out from a safety platform of adequate dimensions that will span the potential collapse zone and support the crew and equipment should a catastrophic failure of the shaft occur.

Prior to work commencing the area will be inspected to ensure that the safe movement of heavy equipment can proceed. This will be carried out by a competent, experienced person who will be securely fastened to the surface by means of a full body harness anchored at an appropriate safe distance away from the potential shaft collapse zone.

If any shaft is found to be open from the surface, then it shall be backfilled with graded material. Any such material will be introduced directly into the shaft from the surface utilising equipment such as a 360 excavator or conveyor.

If the shaft is backfilled then reversed stage pressure grouting of the infill material will be undertaken. Such treatment is achieved by a combination of permeation grouting and low pressure compaction grouting of the infill material which forms a enhanced bond between the infill and the shaft lining \ country rock.

Treatment will therefore be undertaken in the following manner.

A rigid steel and wooden shaft frame will be then mounted over the shaft mouth to ensure that any slumping of the shaft infill will not jeopardise the stability of the drilling rig and the safety of the crew.

Once the safety frame is in place, the drill rig will be positioned over the shaft to allow the sinking of a centrally located borehole through fill material.

Treatment will involve the drilling of a single borehole to the base of the shaft and at least three metres in to natural strata, this is to ensure that no “staging” is present within the shaft and that the actual shaft base has been reached. Shaft staging would typically be encountered within the first 50m below ground within shafts although no hard or fast rules can be applied to this. Staging can be a problem if, over time, it deteriorates to such an extent that catastrophic failure of the infill material occurs

On completion of the first borehole temporary steel casing may then be inserted into the borehole. This casing forms the basis of the reversed stage pressure grouting technique.

The grouting operation will commence on completion of the borehole and will involve direct injection down the borehole under pressure through the drill rods or casing in ascending 1.5m stages.

The grout will possess water: solids ratio of no more than 0.4 giving an approximate compressive strength of 1.00 MN/m^2 @ 28 days.

Grout will be mixed by loading hopper conditioned PFA and bagged OPC directly into the mixer via a front loading shovel and by hand. Water supplied from the approved water source will be then be added to the mix to produce grout of the correct consistency.

The grout mixer will be capable of producing a homogenous mix, with all particles being thoroughly wetted without segregation occurring.

The grout will be mixed and injected using a 50mm diaphragm pump operating at around 100 psi and will be pumped via 50mm reinforced grout hoses into borehole. This will continue until either a maximum pressure is reached, or refusal of grout occurs. A length of casing will then be extracted, and the process repeated until the complete length of the shaft has been treated.

Should any significant thickness of permeable / granular fill be present on site, grouting may need to be terminated at the level of the base of such material.

If any significant voids are encountered during the operation, a grout \ pea gravel mix will be introduced into the borehole to restrict excessive movement of grout. However, should any major mining feature such as roadways running off the shaft are suspected these will require investigation and treating separately from the shaft.

Depending on the location of the shaft, a capping solution may be required such as a reinforced concrete cap.

Any cap will be designed by a competent structural engineer with its orientation founding depth and ultimate design agreed by the Coal Authority prior to construction. As a minimum any reinforced cap will be typically twice the shaft diameter,

5.9. Services and Roads

The grouting Contractor shall take all necessary precautions, including making all reasonable liaison with the Client, to ascertain the positions and depths of underground services and drains passing through the site, making full allowance for working around and protecting live services and drains.

The Contractor shall be responsible for maintaining close liaison with the Local Authority and the Public Utility Authorities so as to avoid any disruption of the existing services.

When introducing grout into any borehole the Contractor shall ensure by regular inspections throughout the day that the grout is not entering adjacent drains, services, culverts and ducts. In the event that any such leakage is detected the Contractor shall immediately suspend the grouting operations and commence to remove any accumulated grout.

5.10. *In Situ* Testing

When directed by the RE, the Contractor shall test the consolidated ground for permeability and strength.

Permeability by grout acceptance testing shall be checked by drilling test holes in positions to be selected by the RE and injecting grout at pressures appropriate to the depth, all in

accordance with the requirements for infilling grouting. If the RE considers that the quantities of grout accepted are excessive, further holes shall be drilled and grouted at the rates and prices agreed.

After testing, boreholes shall be completed in accordance with the requirements for grouting infill holes.

In general, test holes will be undertaken along the adoptable highways adjacent to boreholes exhibiting grout taken in excess of 6 tonnes.

5.11. Records

The Contractor shall prepare and keep available for inspection on site, plans showing the positions of all boreholes, daily drilling records (see below), together with the total amounts of grout injected. Levels shall be given with reference to a datum to be confirmed by the RE.

The plans shall be updated daily in conformity with the Records noted below. On completion of the works, the Contractor shall give fair copies of the plans and sections to the RE within one week of completion of the programme of grouting.

As works proceed, the Contractor shall maintain separate daily records for drilling, for grouting and for materials and plant received in a form to be approved by the RE. The daily records signed by the Contractor's agent shall be submitted each day to the RE for his agreement. The Contractor shall provide one copy of the agreed record for the RE's retention and keep a further copy available for inspection on site.

Daily drilling records shall be provided for each borehole and contain the following information:

1. Job title and location
2. Borehole reference number
3. Date
4. Contractor's name

5. Plant in use, crew members and hours worked
6. Method of boring or drilling
7. Type, diameter and depth of casing used
8. Diameter and depth of hole at the beginning and end of each working day or shift
9. Loss of any flushing medium during drilling
10. Standing time, with reason, or time lost overcoming obstructions
11. Details of underground services located
12. Details of any settlement or ground heave
13. Daily and cumulative length drilled
14. Depth to each major change of stratum
15. Description , with identification, of the stratum and whether it is intact or broken
16. Each depth at which groundwater is encountered (if apparent), the depth to which it rose and any steps taken to stop the flow
17. Depths at which any samples are taken
18. Details and results of any permeability tests instructed by the RE
19. Details of any voids or suspected workings
20. Details of any emissions of gas, water, etc.
21. Depth of completed borehole

Daily grouting records shall be provided for each borehole and contain the following information:

1. Job title and location
2. Borehole reference number
3. Date
4. Contractor's name
5. Plant in use, crew members and hours worked
6. Details of type of injection grout-line dimensions and length of standpipes inserted
7. Type of grout mix and volumetric quantity injected including total quantity by weight by each type of grouting material introduced
8. Grout pressures recorded, with the corresponding depths
9. The results of all flow and bleed tests
10. Details of casing abandoned
11. Details of grouting materials delivered to the site and a running total of each of the materials delivered
12. The nature, frequency and results of all inspections of services to check for grout penetration
13. Details of all stoppages or delays and any other relevant information

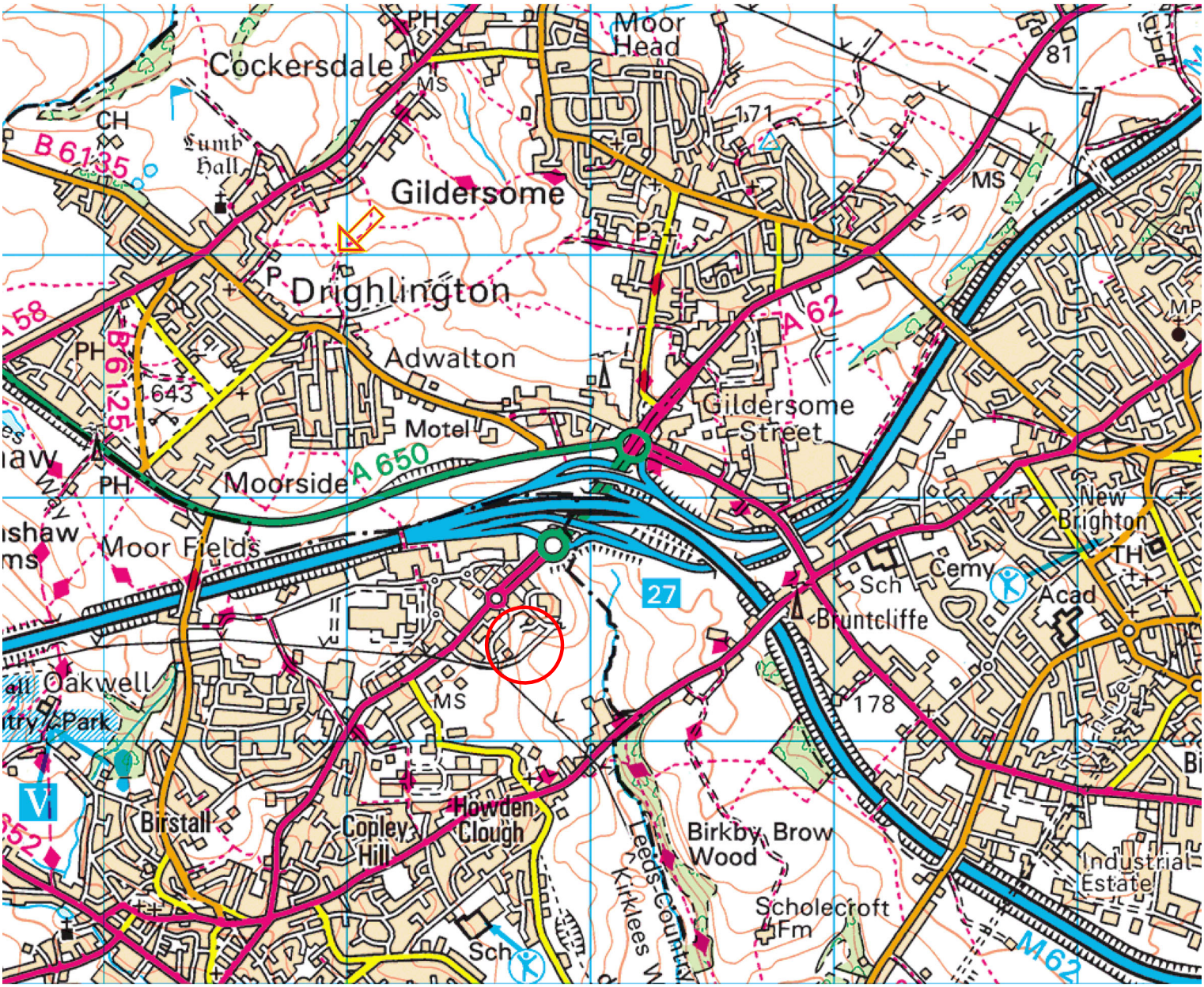
The daily records of materials and plant received shall show in particular that day's quantities by weight of each type of material and cumulative quantities. With the daily records, the Contractor shall submit to the RE copies of receipts or invoices for all materials delivered and he shall keep them on site until the Works are complete.

Notwithstanding the information listed above, the Contractor shall provide any other information required by the RE.

On completion of the drill and grout programme, the RE shall prepare a validation report containing copies of borehole records, a borehole location plan, procedures followed during the works, the results of validation boreholes and pressure tests, and a record of any deviation from this specification.

APPENDIX A

FIGURES, DRAWINGS AND PLATES



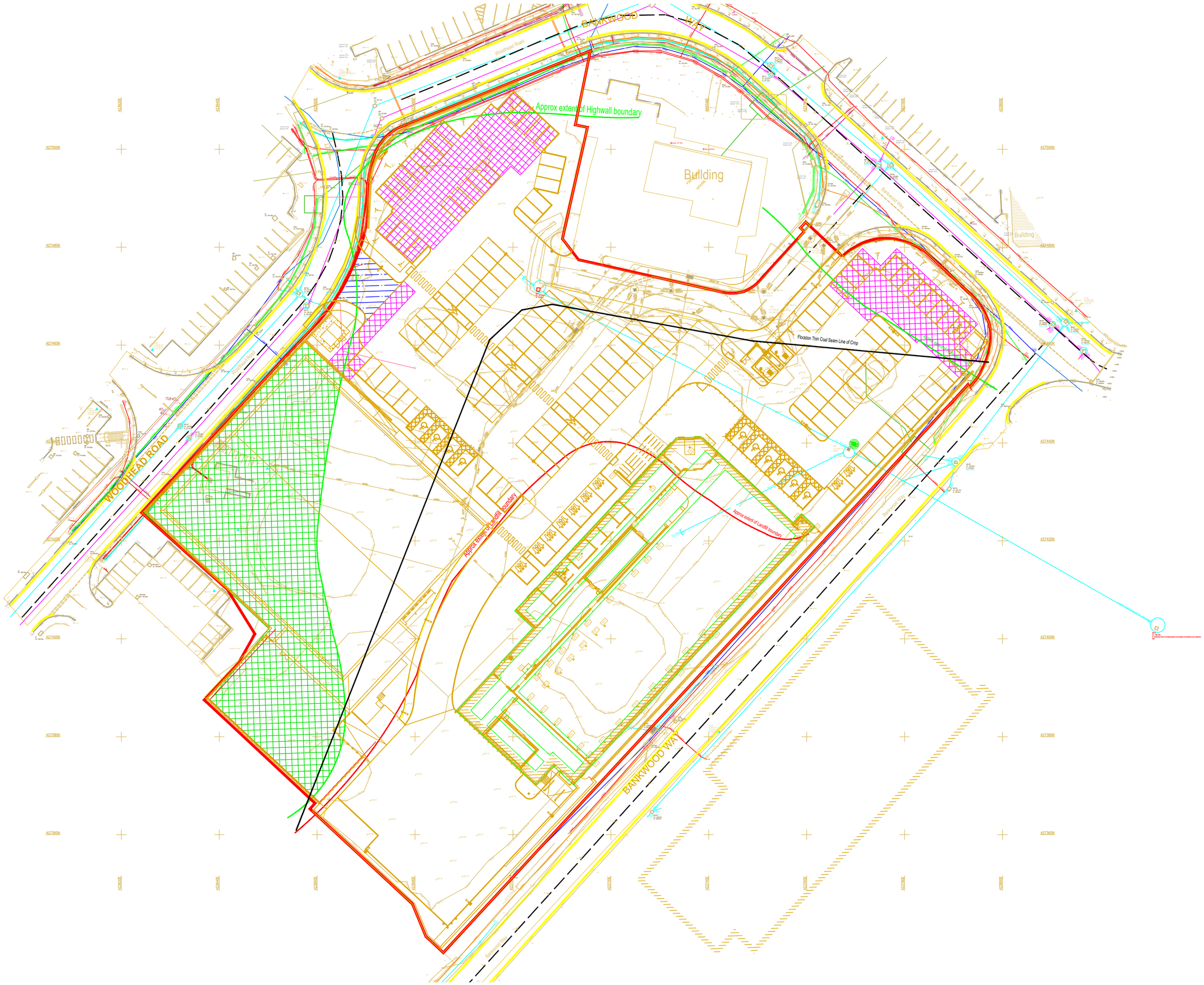
NOTES

Site Location

REVISION	
0	For Information
A	>>
B	>>
C	>>
D	>>

SIRIUS DRILLING LTD
4245 Park Approach
Thorpe Park
Leeds
LS15 8GB
www.theslrlusgroup.com
TEL: 0113 2649960
FAX: 0113 2649962

CLIENT	DRAWING NO.	REVISION NO.
LIDL GB LIMITED	SDL4050/CS/01	0
SITE: CENTRE 27 BANKWOOD WAY BIRSTALL	DRAWN BY: NJI	APPROVED BY: JCC
DRAWING TITLE: SITE LOCATION PLAN	DATE: MAY 2022	SCALE: 1:25,000 — A4



NOTES

- Buildings & Retaining Walls Over 1.5m - CMC Ground Improvement + Drilling & grouting of shallow mine workings at 3.0m c/c
- Car Park - BMC Ground Improvement + Drilling & grouting of shallow mine workings at 6.0m c/c
- Car Park - BMC Ground Improvement + Drilling & grouting of shallow mine workings at 1.5m c/c

REVISION		BY	DATE
0	>>	>>	>>
A	>>	>>	>>
B	>>	>>	>>
C	>>	>>	>>
D	>>	>>	>>

SIRIUS
REMEDIATION LTD
4245 Park Approach,
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Leeds
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CLIENT

LIDL GB LIMITED

SITE

CENTRE 27
BANKWOOD WAY
BIRSTALL

DRAWING TITLE

PROPOSED SHALLOW MINE WORKINGS TREATMENT AREAS

DRAWING NO.	REVISION NO.
SDL4050/SP/02	0
DRAWN BY	APPROVED BY
NJI	JCC
DATE	SCALE	PAPER SIZE
MAY 2022	1:500	A2