



**REPORT C6534
JUNE 2015**

PRELIMINARY INVESTIGATION REPORT (DESK STUDY)

**of land off
PEEL STREET, BARNSELY, SOUTH YORKSHIRE**

**prepared for
LIDL UK GMBH**



REPORT NUMBER:	C6534	REPORT STATUS:	FINAL
REPORT TYPE:	PRELIMINARY INVESTIGATION REPORT (DESK STUDY)		
REPORT DATE:	JUNE 2015		
SITE:	LAND OFF PEEL STREET BARNSELY SOUTH YORKSHIRE		
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PRELIMINARY INVESTIGATION REPORT (DESK STUDY)**Of land off****PEEL STREET****BARNSELY****SOUTH YORKSHIRE****Prepared for****LIDL UK GMBH****CONTENTS****EXECUTIVE SUMMARY**

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Drawing No.	Title	Scale
C6534/01	Site Location Plan	1:25,000
306/A	Proposed Site Plan	1:500 at A3
C6534/02	Site Layout Plan	NTS
C6534/03	Preliminary Conceptual Site Model	NTS
3100/A	Foundation Plan – Part 1	1:100
3101/A	Foundation Plan – Part 2	1:100
3102/A	Foundations Sections and Details	1:50 and 1:20

NTS: Not to Scale

APPENDIX B GROUNDSURE REPORT

APPENDIX C BGS BOREHOLE RECORDS

APPENDIX D PREVIOUS GROUND INVESTIGATION INFORMATION

EXECUTIVE SUMMARY

Introduction	Sirius Geotechnical & Environmental Ltd (Sirius) were commissioned by Lidl UK GmbH (Lidl) to undertake a preliminary investigation (desk study) of land off Peel Street, Barnsley (the “site”). It is understood that consideration is being given to the development of an extension to the western elevation of the existing retail unit.
Site Details	The site occupies an area of approximately 0.95 hectare and comprises an existing Lidl supermarket store and adjoining retail unit to the north, with an area of paved car parking with limited areas of soft landscaping to the west of the store, and concrete surfaced delivery service area to the east. A single storey electricity substation is present in landscaping to the north-west of the car park. The majority of the site is level, with a 1.0m high north facing slope along the south-west boundary, and a loading bay access ramp to the southern elevation of the Lidl store sloping down to the west where levels adjacent to the loading dock are approximately 1m below adjacent land. A retaining wall, approximately 5m high, is present along the south-eastern boundary, retaining soils to the south-east of the site. The retaining wall extends north along the eastern boundary, gradually reducing in height to the north.
Site History	The site appears to have been developed prior to 1889. The first recorded buildings on site included textile Mill, two reservoirs, various small buildings and Sough Dike. These were present until 1948, after which the buildings on site were replaced with various small buildings along with a builder's yard and a cinema. In the late 1970s, all of the buildings on site were cleared and the site was developed with a single large building in the east, connected to a two storey carpark in the west of the site. That building was demolished in around 2010, and has subsequently been developed with two retail stores and ground level car parking. Activities around the site have included residential buildings and various commercial and industrial land uses.
Anticipated Ground Conditions	Based on geological information and records from previous site investigations conducted on the land currently owned by Lidl were reviewed to determine the expected ground conditions. Made ground is expected to be present on site to depths ranging between 0.5m and >3.4m bgl. Made ground is expected to be underlain by alluvial deposits extending to depths extending to in excess of 5.45m bgl, and comprising very soft, locally firm, organic clay/silt. Within the west of the site, slightly sandy, slightly clayey gravel of sandstone, siltstone and mudstone is likely at the base of the cohesive alluvium. Bedrock is expected to comprise Coal Measures strata including mudstone, siltstone and sandstone. A coal seam was encountered at depths of between 6.7m and 15.6 bgl, and recorded to be between 1.2m and 2.3m thick.
Mining & Quarrying	Based on information reviewed as part of the desk study including previous ground investigation conducted by Sirius, the risk of historical coal mining or quarrying within/beneath the site affecting surface stability is considered to be low.
Foundations	Foundation solutions for new construction will be dependent on finished levels, loadings, and the detailed site geology, including: • Thickness of made ground; • Depth to rockhead; • Nature, thickness and method of placement of materials used to raise ground levels; • Presence/extent of any substructures/infilled basements/other obstructions; • Bearing capacity of the natural strata; • Groundwater levels;

	• Contamination status of the shallow soils/groundwater; and, • Proximity to trees where potentially shrinkable soils are present. At this stage, based on the information available it is anticipated that pad foundations, founded onto rockhead may be required to support structural loads associated with the proposed extension. This conclusion is dependant upon the foundation design of the current supermarket also bearing onto rockhead, to enable a compatible foundation solution to be developed and in doing so reduce the risk of differential settlement.
Contamination	The preliminary conceptual site model indicates that for a low sensitivity, commercial type development, concentrations of organic contaminants may pose a low to moderate risk to construction workers and end users.
Gas Risk	On the basis of a previous ground gas assessment completed for the site it is considered that no specific gas protection measures will be required within the proposed extension. According to the BGS, radon protective measures are not required for the site.
Further Works	The following ground investigation works should be undertaken to confirm foundation design and infiltration rates, and to allow determination of contamination constraints: • One day window sampling, to obtain shallow soil samples for chemical and geotechnical testing. • Geotechnical and contamination testing at UKAS and MCERTS accredited testing laboratories to adequately characterise the made ground, shallow soils and groundwater. • Reporting. Intrusive exploratory investigation works should be carried out by a suitably qualified geoenvironmental consultant. An invasive plant survey should be undertaken to confirm the absence of such species, and, if proven present, their implication.

The executive summary is an overview of the key findings and conclusions of the report. There may be other information contained in the body of the report which puts into context the findings of the executive summary. No reliance should be placed on the executive summary in isolation, particularly when deriving design detail/abnormal costs.

1. INTRODUCTION

Sirius Geotechnical and Environmental Ltd (Sirius) were commissioned by Lidl UK GmbH (Lidl) to undertake a preliminary investigation (desk study) of land off Peel Street, Barnsley, South Yorkshire (the “site”). The site currently comprises retail units, including an existing Lidl supermarket, with associated car parking, loading bay and limited soft landscaping.

It is understood that consideration is being given to the development of an extension along the western elevation of the current Lidl retail unit. A proposed master plan for the development has been provided to Sirius by Lidl and is shown as HTC Architects’ Drawing No. 306/A (“Proposed Site Plan”), dated February 2015 and presented in Appendix A.

The objectives of the preliminary investigation were to:

- Establish the historical development of the site and immediate surrounding area from a review of historical Ordnance Survey (“OS”) plans;
- Establish the environmental setting of the site;
- Evaluate whether past mining or other extractive industries could have an influence on the proposed end use;
- Determine if historical or current activities could give rise to significant ground contamination;
- Determine the potential risk to the proposed development from hazardous ground gas sources, including radon;
- Provide outline foundation recommendations and;
- Provide recommendations for intrusive works to determine the shallow ground/contamination profile, from which foundations and measures to deal with proven contamination could be confirmed.

This desk study includes an assessment of information provided within a Groundsure EnviroInsight Report (“Groundsure Report”) and Coal Authority (CA) mining report, in addition to the assessment of information from the British Geological Survey (BGS), Coal Authority Gazetteer and the Environment Agency (EA). In addition, the findings of a Preliminary Appraisal report dated October

2009, a Phase 1 Geotechnical Appraisal report dated February 2011, a Phase 2 Letter Report June 2011 and a Gas Risk Assessment dated March 2011, all of which were written by Sirius, have been considered.

A site inspection (walkover survey) was carried out on 19th June 2015.

It has been assumed in the production of this report that the site is to be developed with a retail (commercial) extension adjacent to the western elevation of the current Lidl retail building. This development is shown on HTC Architects' Drawing 306/A ("Proposed Site Plan"), dated February 2015, presented in Appendix A. If this is not the case, then amendments to the recommendations made in this report may be required.

Details of proposed extension loadings have not been made available at this time.

Where the report refers to the potential presence of invasive plants (such as Japanese Knotweed) or asbestos-containing materials, such observations are for information only and should be verified by a suitably qualified expert.

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2. SITE DETAILS AND DESCRIPTION

Table 2.1 Current Site Overview

Location	The site is located south of Peel Street, north-east of Westway and north-west of Pitt Street, within Barnsley town centre. A site location plan is included as Drawing No. C6534/01, in Appendix A.
National Grid Reference	The site is centred at approximate NGR E 434204 N 406263
Topography and Features	The majority of the site is relatively level and flat and is predominantly occupied by an existing Lidl supermarket store and adjoining “Quality Save” retail unit, located in the east of the site. Paved car parking with limited areas of soft landscaping are present across the site to the west of the two stores, with a concrete paved service area to the south-east and east of the stores. A small, single storey brick enclosed electricity substation is present in the north-west corner of the site. The carriageway of West Way to the south-west of the site is elevated approximately 1.0m above site levels, with the southern verge of the site comprising a soft landscaped slope approximately 1.5m high, sloping down to the north at approximately 1 Vertical :2 to 3 Horizontal. Pitt Street, to the south-east of the site, is elevated approximately 5m above the site, on an approach to an overbridge across West Way. The southern boundary of the site comprises a 5m high retaining wall, retaining soil to the south-east. The upper c.50% of the wall appears to comprise masonry. The lower c. 50% of the wall is stepped out approximately 0.5m and comprises concrete. In places, concrete extends to the full retained height, but does not appear to be in contact with masonry nor to be acting as a retaining structure to the full height. The retaining wall turns at the south-east corner of the site and also forms the eastern site boundary, gradually reducing in height northward. The northern 30% of the eastern boundary is approximately commensurate with adjacent ground levels.
Site Area	Approximately 0.95 hectares.
Site Boundaries	Bound to the north by Peel Street, to the south-west by West Way, to the south-east by Pitt Street (elevated approximately 5m above the site), and to the east by commercial/ retail properties on Peel Street and Pitt Street.

Current Land Use	Retail stores, including an existing Lidl supermarket store and associated carpark and landscaping.
Invasive Plant Species	No invasive plant species were observed during the site walkover.
Adjacent Land Uses	North: Peel Street, beyond which are retail and commercial properties. South-west: West Way, beyond which are areas of landscaping, religious and administrative properties. South-east: Pitt Street, elevated approximately 5m above the site, beyond which are commercial and retail properties. East: Commercial and retail properties on Pitt Street and Peel Street.

The main site features are shown on Drawing No. C6533/02, within Appendix A.

3. ENVIRONMENTAL SETTING

3.1. Introduction

Published environmental, geological and historical data relating to the site has been reviewed. A summary of relevant information is provided below and a copy of the Groundsure report is included in Appendix B.

3.2. Site History

Table 3.1 presents a summary of the site history from 1890 to 2008, as illustrated on historic OS mapping. It is not the intention of this report to describe in detail all of the changes that have occurred on or adjacent to the site, only those pertinent to the proposed development.

Table 3.1 Site History

Map Dates	On-Site Features	Off-Site Features (only features within 500m that may affect the site are listed)
1889 to 1904	Bore Spring Mill (linen) occupies the southern half of the site and extends south of the site. A reservoir is located in the north-east corner of the site extending offsite to the east and a second reservoir is located along the western boundary of the site, extending offsite to the west. Four buildings are recorded along the northern boundary of the site adjacent to Peel Street. Sough Dike is recorded centrally on site running approximately east to west.	The surrounding area is built up by residential, commercial and industrial buildings. Numerous reservoirs are recorded within 500m of the site. The closest five are located c.35m east, c.40m east, c.170m north-west, c.180m west and c.180m south-west of the site. Taylor's Mill (linen) is recorded c.30m north of the site. Union Mill (and two associated reservoirs) is recorded c.100m north-west of the site. A corn mill is recorded c.50m east of the site. A circus is recorded immediately adjacent to the western boundary of the site. St. George's Burial Grounds are recorded c.100m south-west of the site. Hope works (calender) works are recorded c.120m north-west of the site. Two foundries are recorded c.210m south-east of the site. Five timber yards are recorded c.100m north-west, c.160m south-east, c.170m north-west, c.200m south and c.200m south-east of the site. Carriage works are recorded c.230m south-west of the site. The Barnsley Rail Line is recorded c. 480m north-east and c.490m north-west of the site.
1904 to 1948	Two additional buildings are recorded centrally on site and one building is recorded north of the westernmost reservoir. Alterations have been made to the buildings along the northern boundary and the mill on site. 1938: The reservoir in the north-east corner of the site is no longer recorded and has been replaced by a building extending offsite. 1948: The Mill has been reduced in size.	Many of the reservoirs are no longer recorded, including the reservoirs c.35m and c.40m east of the site are no longer recorded. Union Mill and associated reservoirs are no longer recorded.

Map Dates	On-Site Features	Off-Site Features (only features within 500m that may affect the site are listed)
1948 to 1972	The buildings that previously occupied the site are no longer recorded and numerous small buildings are recorded covering the majority of the site. A Ritz Cinema is recorded centrally on site. A builder's yard is recorded centrally in the north of the site. A car park is recorded in the north-west corner of the site, extending to the west. Sough Dike appears to have potentially been culverted in locations. The site is sloped centrally along the western boundary of the site with the slope dipping approximately north to south. 1967: A substation is recorded in the north-west corner of the site and a depot is recorded in the west of the site.	A garage is recorded adjacent to the eastern boundary of the site. Numerous works are recorded within the area, with the closest located c.10m north of the site.
1972 to 1992	All of the previous buildings on site are no longer recorded and have been replaced by one large building (described as a building with a rooftop carpark in the east and as a two storey carpark in the west) that covers the majority of the site. Sough Dike is no longer recorded on site but is noted east of the site.	Two substations are recorded c.10m south and c.30m south-west of the site. The works immediately north of the site are no longer recorded. A garage is recorded c.15m north of the site.
1992 - 2008	No significant changes evident.	A roundabout is recorded immediately north-west of the site. A dual carriageway is recorded along the western boundary of the site. An overpass for Pitt Street is recorded adjacent to the south-west corner of the site.

The site has subsequently been developed with the current retail units and associated ground level carpark.

In summary, the site appears to have been developed prior to 1890. The first recorded uses on site included a textile Mill, two reservoirs and various small buildings. Sough Dike was recorded as an open watercourse crossing the site until redevelopment in the 1980s and it is assumed that this watercourse was culverted. After 1948, the buildings on site were replaced with various small buildings along with a builder's yard and a cinema. In 1972, all of the buildings on site were replaced by a single large building.

The site is currently developed with two retail units one of which is occupied by a Lidl supermarket, with car parking to the west.

Activities around the site have included residential buildings and various commercial and industrial land uses.

3.3. Published Geological Information

A summary of available published geological information is provided in Table 3.2 below.

Table 3.2 Geological Summary

Sources of Information	BGS 1:50,000 scale geological map (Sheet 87 – Barnsley, 1993). BGS 1:10,566 scale geological map (Sheet SE30NW, 1980) BGS on-line Geology of Britain viewer. Groundsure EnviroInsight Reports, Order Numbers HMD-283-599239 and HMD-283-599240, 22nd October 2009. BGS Lexicon of Named Rock Units. Coal Authority Coal and Brine Report, Reference Number 00048155-09, 22nd October 2009. BGS Borehole Records SE30NW280 and SE30NW284.
Made Ground	None on-site on the published map. However, made ground is anticipated throughout the site, associated with former and current development of the site.
Drift Geology	No drift geology is recorded on published maps. However, alluvial soils are anticipated in and around the former course of Sough Dike.

Solid Geology	The BGS 1:10,566 scale map shows the site as underlain by the Pennine Middle Coal Measures Formation. Two coal seams are conjectured to subcrop on the site. Both seams are recorded running approximately north-east to south west, dipping to the south-east. The Kent's Thin coal seam conjectured to subcrop c.30m north-west of the south-east boundary and is recorded as being 0.29m to 0.76m thick. The Kent's Thick coal seam is conjectured to subcrop c.70m north-west of the south-east boundary and is recorded as being 0.91m to 1.22m thick.
Mining and Quarrying	Recorded Workings: According to the CA report, the site is within a zone of likely physical influence from workings in 1 seam of coal at 100m depth, last worked in 1875. The Coal Authority note that the property is in an area where coal is believed to be present at or close to the surface which may have been worked at some time in the past. Potential Unrecorded Workings: The Kent's Thin and Kent's Thick coal seams are conjectured on published maps to subcrop within the site, each of which is recorded to be potentially sufficiently thick as to have been worked at some time in the past. However, previous investigation of the site undertaken by Sirius on behalf of Lidl, has included drilling rotary openhole boreholes on a 6m grid beneath the footprint of the current store. No evidence of former workings was identified during that investigation. Mine Entries: None recorded within the site boundaries or within 20m of the site. Quarries: None recorded within the site boundary or within the near vicinity of the site.

BGS Borehole Records	A borehole located within the south east of the site (SW30NW280) indicates made ground of medium dense clay, ash, brick and rubble fill present to a depth of 3.5m bgl, underlain by mudstone fragments in a matrix of clay. Hard mudstone was encountered at 7.0m bgl. A borehole located in the south-west of the site (SW30NW284) records soil fill to 0.4m bgl, underlain by very soft/soft organic silt to a depth of 4.0m bgl. Mudstone fragments in a firm/stiff clay matrix to a depth of 6.5m bgl, was recorded underlying the organic silt, which in turn was underlain by hard mudstone.
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3.4. Hydrology and Hydrogeology

A summary of available information pertaining to hydrology and hydrogeology is present in Tables 3.3 to 3.5 below.

Table 3.3 Surface Water Features

	Presence/location	Comments
EA GQA Classified Watercourses (within 500m)	None recorded within 500m of the site.	
Unclassified Watercourses (within 500m)	Sough Dike is believed to be present within a culvert beneath the site.	Culverted beneath the site, flow from east to west. Open watercourse still present immediately to the north east.
Surface Water Features (Canals, Ponds, Lakes, etc.) (within 250m)	None	
Licensed Surface Water Abstractions (within 1km)	None	
Flood Risk Status	The site does not lie within an indicative flood plain (Zone 2 or 3) at risk of flooding from rivers or the sea without defences.	

Table 3.4 Groundwater Occurrence and Abstraction

	Presence/location	Comments
Licensed Abstractions (within 1km)	Two recorded within 1km of the site.	The closest is located 474m south-west of the site, licenced to for 'water bottling/ potable water'. The licence expiry date is given as 2017. A second licence is located 5003m from the site, and also pertains to 'water bottling', although this licence appears to have expired.
Source Protection Zones (within 500m)	None recorded within 500m of the site.	

Table 3.5 Groundwater Vulnerability Status

	Environment Agency Classification
Groundwater Classification	There is no EA aquifer classification for superficial deposits on the site. Solid strata comprising Coal Measures Formation strata, are classified by the EA as a Secondary (A) Aquifer. Secondary A Aquifers are described as "permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers". The Groundwater Vulnerability soil classification is 'Intermediate leaching potential'.

3.5. Landfilling and Waste Management

Table 3.6 Waste Management Activities

	Presence/location	Comments
Historical Landfill Sites (within 500m)	One recorded within 500m of the site.	Located 291m south. No other additional information is provided.
BGS / EA Recorded Landfills (within 500m)	None recorded within 500m.	
Licensed Waste Management Facilities (within 500m)	None recorded within 500m.	
Local Authority Recorded Landfill Sites (within 500m)	One recorded within 500m of the site.	Located 389m south. No other additional information is provided.
Other Registered Waste Management Sites (within 500m)	Two Non-operational Waste Treatment Transfer or Disposal Sites are recorded within 500m.	The closest is located 388m south-east of the site and registered as a waste transfer site. The waste type is classified as difficult. The second is located 395m north-west and is classified as a storage site. The waste type is classified as difficult.
Walkover Evidence of Fly-Tipping on Site	None noted.	
Ground Gas and Vapour Risk Assessment Required?	A ground gas risk assessment is not considered necessary on the basis that extensive gas monitoring was conducted on the site during previous ground investigations conducted by Sirius.	

3.6. Radon Risk

To determine whether the site is at risk from radon gas, the BRE Document “BRE 211 - Radon: Guidance on the protective measures for new dwellings” together with the National Radiological Protection Board (NRPB) “Radon Atlas of England and Wales” have been referenced.

These documents, together with a geological assessment contained within the Groundsure Report report, which includes information obtained from the Health Protection Agency and British Geological Survey, state that the site lies within an area in which **no radon protective measures are required**.

3.7. Other

Other potentially contaminative activities or environmental constraints are listed below. The entries relate to activities within approximately 250m of the site, with the exception of COMAH and NIHHS facilities where the assessment is extended to a distance of approximately 1km from the site.

- 16 no. IPPC Authorisations within 250m of the site. All are associated with Monckton Coke and Chemical Company, and are located 84m east of the site.
- Two Local Authority Pollution Prevention and Controls are recorded within 250m of the site. The closest is located 92m east of the site and is registered to Johnson Dry Cleaner Ltd. The other is located 112m south-east of the site and is registered to Westway Filling Station, on Westway, and is noted to be revoked.
- 31 no. Current Industrial Sites are recorded within 250m of the site. The closest is located 7m north-west of the site.
- One Petrol and Fuel Site is located 166m north-west of the site.

4. PREVIOUS INVESTIGATION FINDINGS

Preliminary Appraisal (desk top study)

A Preliminary Appraisal (desk top study) of the site was carried out in 2009 by Sirius (Report Ref: C3547) on behalf of Opus Land (North) Ltd. At the time of the investigation, the site comprised a single building which included disused retail premises in the eastern half of the site and a two storey car park in the western half.

The conceptual site model indicated potential risks to humans associated with ingestion, inhalation of dust and dermal contact with soils impacted with heavy metals and hydrocarbons associated with former site uses. A potential risk was also identified associated with inhalation of vapours from possible hydrocarbon spillages,

Potential risks to the environment from leachate migration to adjacent properties, the underlying aquifer, and surface water contamination of the Sough Dike were also identified.

In addition, a potential risk of ground gas generation associated with made ground, natural organic rich soils and potentially shallow mine workings was also identified.

The investigation also concluded that there may be a potential risk of surface subsidence from the possible unrecorded shallow coal workings associated with the Kent's Thick and Kent's Thin coal seams.

It was considered likely that spread foundations would be suitable for the majority of the site. However, it was suggested that deeper foundations such as piled foundations may be required in areas of deeper made ground. In addition, it was noted that any foundation design would need to take into account the possible presence of a culverted watercourse and shallow mining.

Geoenvironmental Appraisal

A Phase 1 Geoenvironmental Appraisal of the site was carried out in 2011 by Sirius (Report Ref: C4013), on behalf of Lidl UK GmbH. That appraisal was based on the findings of the desk study and included an intrusive investigation.

The investigation comprised the excavation of 5 No trial pits, the boring of 11 No window sample boreholes and 4 No rotary openhole boreholes. Gas and groundwater monitoring installations were installed at six locations.

Ground Conditions

The investigation revealed the presence of made ground of variable composition to depths ranging from 0.5m to in excess of 3.40m below ground level (bgl).

The made ground was found to be underlain in the north-east and west of the site by alluvial deposits comprising soft to very soft, locally firm, organic clay/silt. Where present the alluvial deposits extended to depths of between 3.6m and 5.15m below ground level.

The made ground and alluvial deposits (where present) were found to be underlain by natural cohesive material to depths of between 1.9m and >5.45m bgl. The natural cohesive material was described as firm to very stiff sandy clay with occasional gravel fragments. Within the western area of the site, slightly sandy, slightly clayey gravel of sandstone, siltstone and mudstone was encountered below the natural cohesive deposits to a depth of 4.55m bgl. The natural cohesive deposits and granular deposits were considered to be representative of completely weathered (residual) Middle Coal Measures strata.

The residual Middle Coal Measures strata was not encountered in the south-eastern area of the site and it was assumed that the level of that area of the site may have been reduced and regraded as part of a previous development on the site.

Bedrock comprising mudstone, siltstone and sandstone was encountered at depths of between 0.5m and 6.5m bgl.

A single seam of coal was encountered at depths of between 6.7m and 14.5m bgl, and recorded to be between 2.0m and 2.3m thick. This was considered to be representative of the Kent's Thick coal seam, with the Kent's Thin coal seam not present beneath the site.

Seepages of groundwater were encountered at depths of between 1.4m and 4.0m bgl, within made ground, alluvial soils and residual coal measures strata. Groundwater was also struck at depths of between 9.5m and 12.5m bgl within bedrock, in some rotary boreholes.

Contamination

Evidence of a slight hydrocarbon odour was recorded in the groundwater within TP4 at 2.7m bgl.

Marginally elevated levels benzo(a)pyrene were detected in two samples of made ground containing ash, clinker and coal. Elevated concentrations of water soluble sulphate were identified within the organic alluvial deposits.

Locally elevated concentrations of sulphate and ammonium were observed in groundwater. In addition, elevated total TPH concentrations were recorded within perched groundwater and natural ground water. However, it was concluded that risks to controlled waters were low and further remedial action was not required within the context of the proposed development.

Geotechnical Conclusions

It was recorded that Lidl provided Sirius with records of a redundant culvert located beneath the site. It was recommended that clarification regarding the status of the culvert be confirmed (i.e. whether live or disused) and the location of the culvert be confirmed to determine any implication it may have on the development of the site.

Further recommendations were made regarding foundations for two proposed buildings on site. The foundation recommendations for the proposed for the Lidl retail store (Commercial Unit 1) included that the structural loads are supported upon a competent and consistent stratum, which was determined to be the bedrock on site.

It was suggested that the rockhead is sufficiently shallow in the east and central part of the site that structural loads could be supported on shallow spread foundations such as strips or pads. However, it was recognised that the depth to the competent strata beneath the west of the structure may be in excess of 2.45m bgl and it was suggested that it may be possible to consider a trench fill/mass concrete pier solution. As the exact depth to rockhead in that area of the site had not been identified owing to site constraints at the time of investigation, it was also suggested that a piled foundation may be prudent.

Based on a visual examination of the ground, alluvial deposits, and Atterberg Limit determinations undertaken on site on the cohesive alluvial deposits, a preliminary CBR value of <2.5% was recommended for the materials on site. As that value is considered unsuitable support for a pavement foundation, it was recommended that in-situ CBR testing be carried out on site following the completion of the demolition of buildings on site, when final site levels will be known.

Contamination Conclusions

It was recommended that any made ground of a similar type to that identified to contain elevated concentrations of benzo(a)pyrene be placed beneath the areas of proposed hardstanding to remove any need for remedial action. If such material could not be fully accommodated beneath

hard surfaced areas, then a 450mm thick subsoil/topsoil “cap” was recommended in areas of soft landscaping.

A Gas Risk Assessment of the site was conducted by Sirius in 2011 (Letter Ref: C4013/JW/4320) as a continuation of the investigation conducted in February 2011. The findings of all four ground gas monitoring visits indicated non-detectable or very low concentrations of methane, carbon dioxide, hydrogen sulphide and carbon monoxide, with no detectable initial and steady state positive flows. Subsequently, the overall ground gas regime for the site was assessed as Characteristic Situation 1, based on Situation A presented in CIRIA 665; necessitating no special precautions.

Additional Geoenvironmental Appraisal

A Phase 2 “Infill” Ground Investigation / Mining Risk Assessment of the site was carried out in 2011 by Sirius on behalf of Lidl UK GmbH (Lidl) (Letter Ref: C4013/JW/4449). The investigation comprised a brief the review of previous Sirius reports and further ground investigation conducted on site in the location of the footprint of the recently demolish structures on site. The investigation also included a programme of rotary openhole ‘proof drilling’ on a nominal 6m grid across the proposed building footprint to further determine the potential risk from unrecorded mineworkings at shallow depth in the Kent’s Thick coal seam.

The mining investigation found the depth to rockhead to vary between 0.3m and 6.0m bgl beneath the footprint of the buildings. The top of the coal seam was recorded between 8.6m and 15.6m bgl, with the seam dipping to the south-east at approximately 7° with a thickness of between 1.2m and 2.2m. Broken ground was encountered in one rotary borehole between 10.0m and 15.2m bgl. Additional boreholes sunk locally encountered intact coal. It was therefore considered that the broken ground recorded in I9 may be the result of a natural fracture/fault zone within the bedrock.

Boreholes were injected with grout comprising a 1:15 ratio mixture of Ordinary Portland Cement (OPC) and Pulverised Fuel Ash (PFA), respectively, with 40 to 45% water. Grout uptake in each borehole was minimal, further indicating the absence of unrecorded workings.

As part of the Phase 2 (Infill) Ground Investigation, a further eight trial pits were excavated. Granular made ground was encountered to depths of between 1.5m and 2.6m bgl and was generally described as of sandy gravel with occasional cobbles. The gravel and cobbles were of limestone, concrete, ash, clinker, brick and wood.

Numerous relic foundations and structures were encountered during the excavation of the trial pits. Concrete obstructions were encountered locally. At one location, an obstruction was encountered at 1.8m bgl and bituminous material was recovered. A tarry material with a hydrocarbon odour was encountered between 1.2 and 2.0m bgl at one location.

Alluvial soils were encountered in the majority of the trial pits and the soils generally comprised soft, slightly sandy, slightly organic clay. In the northern part of the Phase 2 investigation area, very soft, silty/clay was encountered underlying the soft clay deposits.

Residual Middle Coal Measures (MCM) soils, comprising firm and stiff, slightly sandy, slightly gravelly clay and slightly clayey, sandy gravel were encountered locally.

Following the ground investigation, it was determined that the risk to surface stability from shallow mining is considered to be low.

5. PRELIMINARY CONCEPTUAL SITE MODEL

Based on the desk study (including information from the previous investigations at and around the site), a combined preliminary conceptual site model and conceptual exposure model (PCSM) has been developed for the proposed future use of the site (commercial).

This summarises the understanding of surface and sub-surface features, potential contaminant sources, transport pathways and receptors in order to assess potential pollutant linkages.

A qualitative risk assessment has also been made of the likelihood of any complete pollutant linkage and its potential significance.

The preliminary conceptual model for the site is presented in schematic form as Drawing No. C6534/03, in Appendix A.

In summary, the PCSM has identified the following potential pollutant linkages which may be present and could result in an unacceptable risk to end-users, construction workers and/or controlled waters:

- Ingestion, inhalation and dermal contact with benzo(a)pyrene in made ground soils presenting a low to moderate risk to construction workers.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1. General

It is understood that consideration is being given to the extension of an existing along the western elevation of a current Lidl retail unit. A proposed master plan for the development has been provided to Sirius by Lidl and is shown as HTC Architects' Drawing No. 747-01 306/A ("Proposed Site Plan"), dated February 2015 and presented in Appendix A.

6.2. Flood Risk

The site is not recorded by the Environment Agency to be at risk of flooding from rivers or the sea.

6.3. Geotechnical Constraints

Mining and Quarrying

Based on information reviewed as part of the desk study including previous ground investigation conducted by Sirius, the risk of historical coal mining or quarrying within/beneath the site affecting surface stability is considered to be low.

Foundations

No further information with regard to the culverted watercourse has been made available to Sirius. However, it is assumed that the status of the culvert beneath the site was established and that it was confirmed that it was diverted away from the subject site prior to the construction of the current development.

Drawings produced by Structural Design Solutions Ltd (SDS) in July 2011, showing the foundation construction for the existing store, have been provided to Sirius by Lidl. These indicate the store has been constructed on pad foundations (Drawing No. 3102/A, 3101/A and 3100/A). Based on available ground investigation information, pads to the western elevation of the existing building appear to have been constructed at shallow depth within made ground.

Based on the ground conditions previously identified beneath the area of the proposed extension, which are anticipated to comprise made ground up to 2.1m bgl, potentially overlying soft and very soft alluvial clays to depths of up to 4.5m bgl (TP106A), it would be expected that a foundation

solution bearing onto competent rock would be appropriate as recommended in Sirius' previous reports in order to mitigate potential total and differential settlements.

At this stage, based on the information available from TP106A, a piled foundation solution bearing onto rockhead would be recommended for the development of the proposed extension.

However, if the western elevation of the existing store is confirmed to be constructed on shallow pads bearing onto compressible made ground and/ or natural superficial soils, then construction of the extension on foundations bearing onto rockhead could result in significant differential settlements between the two areas of the structure.

It is recommended that confirmation is obtained regarding the precise nature of the 'as built' foundations to the western store elevation. If it is confirmed that the store is, as appears to be indicated, constructed on shallow spread foundations bearing onto made ground or natural superficial soils, then further consideration of foundation design and likely settlement characteristics will be required in order to determine an appropriate design taking into consideration proposed total and differential settlements. Additional ground investigation and laboratory analysis will be required in order to provide sufficient geotechnical information for foundation design for the proposed extension.

The existing foundation/floor slab design should be confirmed so that the design of the extension can be appropriately tied in to the existing construction. At this stage, due to the thickness of made ground and compressible superficial deposits anticipated beneath the area of the extension, it is considered likely that a suspended floor slab will be required. However, further consideration may be required subject to confirmation of the construction of the existing slab.

6.4. Contamination Constraints

Risk Evaluation for the Proposed Land Use (commercial)

The conceptual site model and available analytical data indicate that significant pollutant linkages are likely to be limited with respect to the proposed extension development. Potential elevated levels of benzo(a)pyrene and hydrocarbons in made ground soils may pose a short term to construction workers during the redevelopment. Subject to appropriate management of any made ground arising from construction works and, risks to end users from these materials are likely to be negligible. The precise nature of the risks in the immediate vicinity of the proposed extension should be investigated further through site investigation.

6.5. Ground Gas/Vapours

On the basis of the previous ground gas assessment completed for the site it is considered that no specific gas protection measures will be required within the proposed development.

According to the BGS, radon protective measures are not required for the site.

6.6. Invasive Plants

Invasive plants were not identified during the walkover survey, although their presence or absence and the absence of other invasive plants should be confirmed by an appropriately qualified specialist.

7. FURTHER INVESTIGATION

The following ground investigation works is suggested to confirm foundation design and to allow determination of contamination constraints:

- One day window sampling, to obtain shallow soil samples for chemical and geotechnical testing.
- Geotechnical and contamination testing at UKAS and MCERTS accredited testing laboratories to adequately characterise the made ground, shallow soils and groundwater.
- Reporting.

In advance of any supplemental ground investigation works, it is recommended that the 'as built' existing foundation construction to the western elevation of the store is further reviewed and confirmed, to allow an appropriate scope of investigation to be specified.

Intrusive exploratory investigation works should be carried out by a suitably qualified geoenvironmental consultant.

An invasive plant survey should be undertaken to confirm the absence of such species, and, if proven present, their implication.

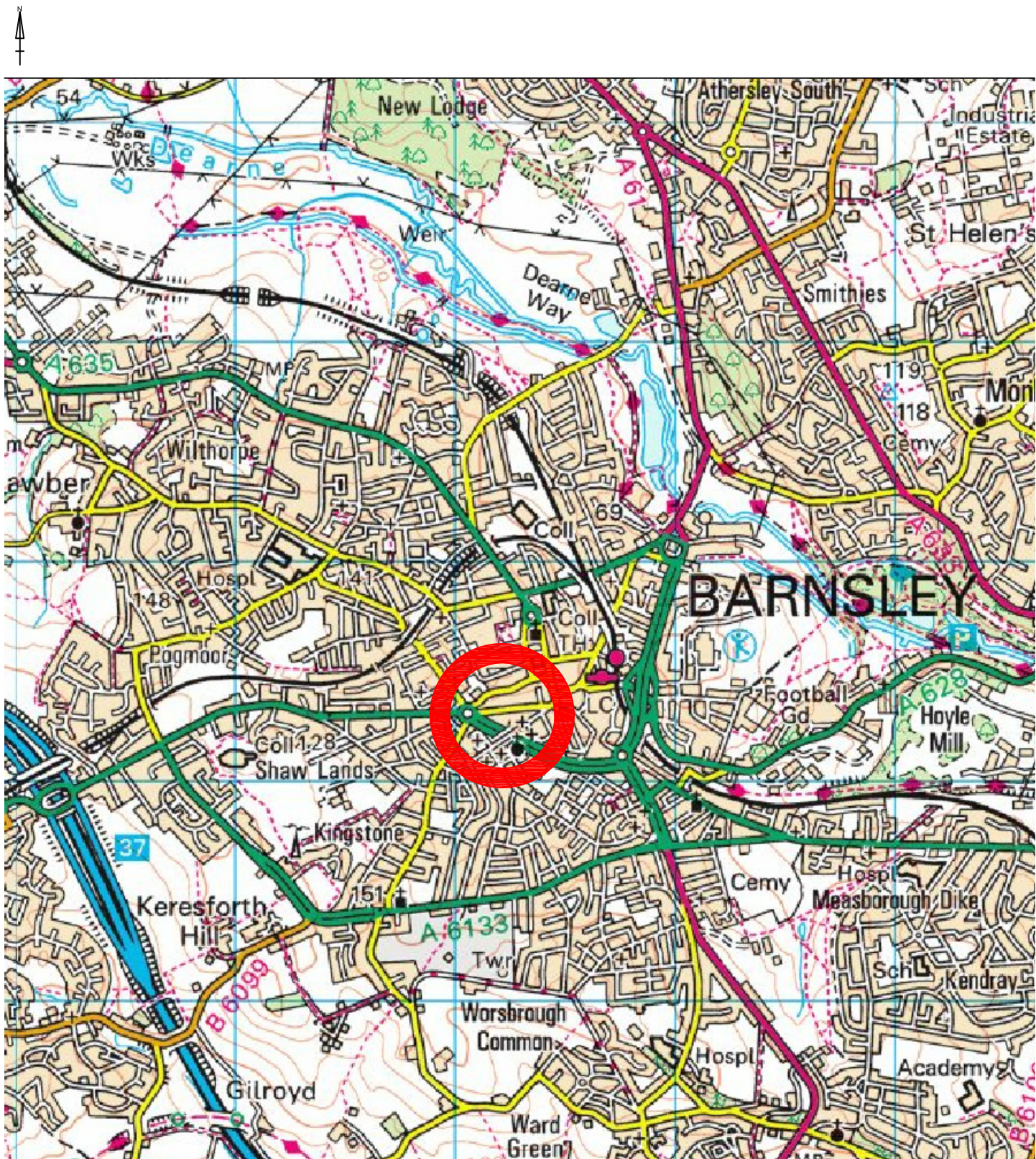
REGULATORY APPROVALS

The conclusions and recommendations presented above are considered reasonable based on the findings of the Preliminary Investigation. However, these cannot be guaranteed to gain regulatory approval and, therefore, the report should be passed to the appropriate regulatory authorities and/or other organisations for their comment and approval prior to undertaking any works on site.



APPENDIX A

FIGURES AND DRAWINGS



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NOTES

 Site Location

REVISION

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

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CLIENT

Lidl UK GmbH

SITE
Peel Street
Barnsley
South Yorkshire

DRAWING TITLE

Site Location Plan

DRAWING NO.

C6534/01

DRAWN BY

APC

DATE

June 2015

REVISION NO.

0

APPROVED BY

NJ

SCALE

1:25,000

A4