



Copeland Borough Council

**Leconfield Industrial Estate,
Cleator Moor**

Geo-Environmental Desk Top Study

December 2019

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Document Control

Project: Leconfield Industrial Estate
Client: Copeland Borough Council
Job Number: A114312
File Origin: A114312/Reports/Draft

Document Checking:

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Issue	Date	Status
1	December 2019	First Issue



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Drawings

Drawing No. A114312-MAN-N-01 - Site Location Plan.

Figure 2 – Walkover Photo Plates

Figure 3 – Walkover Photo Plan

Appendices

Appendix A – Report Conditions

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Appendix D – Coal Mining Reports



1.0 EXECUTIVE SUMMARY

Current Site Status and Future Development	The site is currently occupied by Leconfield Industrial Estate in Cleator Moor, Cumbria. No proposed development plans are currently available however the site is to remain as commercial usage.
Site and Surrounding History	Earliest historical mapping shows a number of water features which were subsequently infilled. From 1863, the site was developed with an iron and steel works with associated infrastructure including a railway and slag heaps. From 1962, the site was developed as Leconfield Industrial Estate which remains to the present day. Surrounding the site, was railway land with a series of ponds and pits to the south and east, which were later infilled. A Goods Station was present in the south-east which later became allotment gardens.
Environmental Setting	There are several former water features recorded as being infilled on-site and a Licenced Waste Management Facility (Whitehaven Skips). A historical landfill is located 105m to the west.
Geology	Published maps provide evidence that Made Ground is present on site associated with historical development at the site. Superficial deposits are reported below the Made Ground which is Glacial Till (Clay). There are four faults at the site, three of which define the bedrock beneath the site. The Henry Pit fault located two thirds up the site is orientated east-west, two other faults are truncated by the Henry Pit fault on the eastern part of the site and a further smaller fault impinges in the far west. To the north of the Henry Pit fault is the Whitehaven Sandstone Group. To the south of the fault is the Eskett Limestone, overlying this is the Yoredale Parent Group and above this is the Middle Coal Measures. The geology has been confirmed (primarily to the east of the access road) through historical investigations at the site.
Mining	The site is in an area which may be affected by coal mining with the west of the site recorded as being within a High-Risk area for development. There are three coal seams which have been worked beneath the site and eight mine entries on or within 20m of the site. No information relating to shaft depth or treatment details were available. Extraction of an iron ore band within the Sandstone in the east and south of the site may have also occurred on site. Two shafts off-site were sunk for the extraction of the band.
Hydrogeology	Superficial Deposits are classified as Secondary (Undifferentiated) Aquifer with the bedrock classified as a Secondary A Aquifer. The site is not located within a source protection zone.
Hydrology	There are no surface watercourses present on site, Nor Beck (culverted) is present adjacent to the western boundary of the site. There are no active surface water abstractions at or within 250m of the site. There is potential for flooding to occur on the western site boundary from Nor Beck.
Preliminary Contamination Risk Assessment (PRA)	The contamination risks posed by the on-site sources to the majority of receptors is considered to be low with the exception of the risks posed to future site users (low to moderate), the risk to surface waters and buildings and services (moderate) and the risk from gas (high). There is a moderate risk from off-site sources to all receptors on site.
Geotechnical Considerations	Potential land stability issues may arise in the western portion of the site from the possible presence of shallow coal mine workings and from potentially untreated mine shafts in this area. The distance to an off-site shaft to the west of the site should also be considered. The presence of slag material and general backfill from the sites historical past will need to be considered for future foundation options. Investigation within the western part of the site needs to be carried out to determine if slag deposits/fill are present in this area. There is also the potential for shallow workings within the iron band



	in the east which may pose a land stability issue. Four faults transect the site which may pose a risk in relation to differential settlement across foundations.
Conclusions	The site lies within a complex geological setting. The western part of the site lies within a Development High Risk Area with eight known mine shafts on or within 20m of the site. In order to refine the current risk to the future development from historical coal mining activities, further investigation is required. The eastern part of the site lies in an area where between 10% to 30% of homes are estimated to be above the radon action level. The remainder of the site lies within a lower probability radon area whereby <1% of homes are estimated to be above the action level. Historical investigations show several exploratory locations were terminated at a shallow depth which is likely a result from the presence of slag gravel and dense Sand and Gravels.
Recommendations	As part of development proposals, if new buildings are proposed in the eastern part of the site, radon protection measures will be required. In order to further refine the risk from coal mining at the site, it is recommended that a visit to the Coal Authority to obtain abandonment plans is carried out with completion of a Preliminary Coal Mining Risk Assessment. Further work to determine if there are iron workings beneath the eastern part of the site is also required. A full ground investigation to determine the contamination risk posed to on-site receptors and the nature and type of slag deposits is also recommended.



2.0 INTRODUCTION

2.1 Instruction

WYG Environment Planning Transport Ltd (WYG) was commissioned by Energy Coast West Cumbria (Properties) Ltd ('BEC') on behalf of Copeland Borough Council to undertake a Geo-Environmental Desk Top Study for a site known as Leconfield Industrial Estate in Cleator Moor, Cumbria. The site's location is shown on Drawing No. A114312-MAN-N-01.

2.2 Objectives

Principal objectives of the commission are to provide an initial assessment of ground conditions, environmental setting, potential ground related constraints, develop a Conceptual Site Model (CSM) and undertake a Preliminary Risk Assessment (PRA) for the site.

2.3 Scope of Services

In order to achieve the above objectives, the following scope of works has been determined:

- A discussion of the site's current status and undertaking of a site walkover on 21st November 2019;
- Review and discussion of environmental database information (EnvirocheckTM report);
- An historical site and area review, referring to past editions of Ordnance Survey maps;
- A discussion of the expected ground and groundwater conditions by reference to geological and hydro-geological mapping;
- Procurement and review of bespoke Coal Authority coal mining reports (Consultants Coal Mining Report, basic Coal Mining Report and 7 no. Mine Entry Data Sheets);
- Review of WYGE Ground Investigation Factual Report, ref: E11683-GI-FAC, issue 1, June 2007 (written on behalf of West Lakes Renaissance) – for information only;
- Review of WYGE Ground Investigation interpretative Report, ref: E11126, issue 1, April 2007 (written on behalf of West Lakes Renaissance) – for information only;
- A qualitative Preliminary Land Contamination risk assessment (PRA);
- An assessment of in-ground constraints; and,



- Production of a report capturing the above information.

2.4 Proposed Development

Proposed development plans are yet to be confirmed. It is anticipated that the development will remain similar to that presently i.e. commercial purposes only.

2.5 Report Conditions

Attention is drawn to the report conditions included in Appendix A. This report includes a review of a historical WYGE reports (ref: E11126/R001/V1, April 2007 and E11683-GI-FAC, issue 1, June 2007). Whilst this information has been presented in good faith, it was written on behalf of others and so has been presented as 'information only'.

3.0 SITE SETTING

3.1 Location & Size

Key details for the site are provided in Table 3.1 below.

Table 3.1 Site Address and Size

Address	Leconfield Industrial Estate, Cleator Moor, CA25 5QQ
Grid Reference	301380, 515510
Site Area	15.46 hectares (ha)

3.2 Site Description & Walkover

General

The assessment of the site and its surrounds has been obtained from a site walkover undertaken on 21st November 2019. At the time of the walkover, the site units were not accessible and therefore the walkover was undertaken on the publicly accessible areas. Photographs together with a photograph location plan are presented as Figure 2 and 3, respectively.

Access to the site is via a gate (open during business hours) off Leconfield Street. The site is bisected centrally by a road orientated north east to south west, called Little Croft / an extension of Leconfield Street, with many of the site's businesses concentrated around it. Much of the site was covered in hardstanding comprising of asphalt and concrete. Unkempt grassland was present along the site boundary with a larger boggy area to the east. Whilst the majority of the site is level there is a fall in gradient to the western site boundary.

East

The east of the site is defined as land located to the east of Little Croft / Leconfield Street.

'BOC Ltd - Cleator Moor' is located in the north-east of the eastern part of the site which comprises the storage of various gas canisters/holders located on a large concrete slab and a single-story portable office unit. The area is secured with palisade fencing around its perimeter. Whitehaven Skips and Service Ltd is located just beyond with a gated compound comprising a large waste stockpile and a caravan. Outside of the fence line are several skips, stored on a concrete slab.

To the south of Whitehaven Skips is unkempt boggy grassland which was strewn with litter. There are several smaller units to the west of BOC Ltd, one of which was being used as a parcel sorting depot. To the north of the parcel depot, located on soft landscaping is a Northern Gas Networks service marker.

To the west of the parcel depot is an active children's nursery with adjacent unoccupied units. To the south of the nursery, immediately adjacent to the east of Leconfield Street / Little Croft is Forth UK, an engineering manufacturer with two large concrete slabs occupying the footprint of historically demolished buildings beyond. Several small areas of fly tipped material were noted on the concrete slabs mainly consisting of bricks.

Immediately adjacent to Leconfield Street / Little Croft in the south-east is Capalex, an Aluminium manufacturing and distribution centre.

West

The west of the site is defined as land located to the west of Little Croft / Leconfield Street.

In the far north-west of the site is a vehicle repair garage with a tyre recycling centre and vehicle storage (access not available at the time of the visit). To the south of this is a further Forth UK unit. Beyond which are disused works/warehouses with external above ground storage tanks located within fenced enclosures (historical content was not identifiable). Adjacent to the west is Romar Innovate (PPE and workwear suppliers).

In the far west, a large concrete footing/slab from a recently demolished building is found, with evidence of sporadic fly tipping. Adjacent are two slabs (one circular and one rectangular) which likely held tanks/water holders. Beyond was unkempt grassland to the far west, north and east of the concrete slab.

Mineshafts were historically recorded in the west (discussed further in Section 7.1.7 below), however at the time of the walkover no surface evidence was observed as the area was overgrown and inaccessible.

The surrounding land uses are summarised in Table 3.2 below.

Table 3.2 Site Surrounds

Boundary	Description
North	Dismantled railway with residential properties and fields beyond.
East	Woodland with Football Club and residential properties beyond.
South	Leconfield Street with commercial and residential properties beyond.
West	Woodland with residential properties beyond.

4.0 ENVIRONMENTAL SETTING

Regulatory authority information relevant to the site and its surroundings has been obtained from the undertaking of an environmental database search. The information is summarised below, and the environmental database records are enclosed in Appendix B. Distances stated are approximate and are taken from the boundary of the site to the database recorded entries.

4.1 Infilled Features

The absence or presence of infilled features at or within 250m of the site boundary have been summarised in Table 4.1 below. Further detail is given in Table 4.2.

Table 4.1 Summary of Infilled Features

Feature Type	On Site	Off Site (within 250m)
Potentially Infilled Land (former non-water feature e.g. pit, quarry etc.)	No	Yes
Potentially Infilled Land (former water feature e.g. pond, marsh, river, stream, dock etc.)	Yes	Yes

Table 4.2 Detail of Infilled Features

Feature Type - On Site	Location On Site	Detail
Former water feature	East	Ordnance Survey map 1925 shows pond infilled by 1962
	North	Ordnance Survey map 1863 shows reservoir infilled by pre 1956
	South	Ordnance Survey map 1863 shows reservoir infilled by 1899
	North-west	Ordnance Survey map 1863 shows ditch/stream infilled by 1899

Feature Type - Off Site	Distance (Direction)	Detail
Former non-water feature	30m (south-east)	Ordnance Survey map 1925 shows potential infilled Iron Ore pit by 1962
	35m (south-east)	Ordnance Survey map 1867 shows 'Crowgarth Pit' infilled by 1899
	75m (south-east)	Ordnance Survey map 1926 shows extraction feature infilled by 1971

Feature Type - Off Site	Distance (Direction)	Detail
Former non-water feature	80m (south-east)	Ordnance Survey map 1867 shows shaft feature, no longer recorded on mapping from 1899.
	80m (south-east)	Ordnance Survey map 1899 shows shaft feature no longer recorded. on mapping from 1962
	215m (west)	Ordnance Survey map 1900 shows pit infilled by 1971.
Former water feature	10m (west)	Ordnance Survey map 1900 shows feature infilled by 1899 likely associated with Culverting of Nor Beck.
	25m (east)	Ordnance Survey map 1863 shows pond infilled by 1970
	30m (east)	Ordnance Survey map 1863 shows pond infilled by 1970

4.2 Waste

The absence or presence of waste facilities at or within 250m of the site boundary have been summarised in Table 4.3 below. Further detail is given in Table 4.4.

Table 4.3 Summary of Waste Facilities

Facility Type	On Site	Off Site (within 250m)
BGS Recorded Landfill	No	No
Historical Landfill	No	Yes
Registered Landfill	No	No
Licensed Waste Management Facility	Yes	No
Registered Waste Treatment or Disposal Sites	No	No
Local Authority Recorded Landfill	No	No
Active Registered Waste Transfer Stations	No	No

Table 4.4 Detail of Waste Facilities

Facility Type - On Site	Site Name and Location	Detail
Licensed Waste Management Facility	Whitehaven Skips and Services Ltd (east)	Operated as HCI Waste Transfer Station. Issued July 2017.

Facility Type - Off Site	Site Name and Location	Distance (Direction)	Detail
Historical Landfill	Whitehaven Road, Cleator Moor	105m (west)	Licence holder not supplied. Inert waste landfill, reference EAHLD35312. Last input is dated 13 th April 1979.

4.3 Industrial Processes

The absence or presence of industrial processes at or within 250m of the site boundary have been summarised in Table 4.5 below. Further detail is given in Table 4.6.

Table 4.5 Summary of Industrial Processes

Process Type	On Site	Off Site (within 250m)
Contaminated Land Entry and Notices	No	No
Active Local Authority Pollution Prevention Controls	No	Yes
Active Integrated Pollution Controls	No	No
Active Integrated Pollution Prevention Controls	No	No
Active Local Authority Pollution Prevention or Control Enforcements	No	No

Table 4.6 Detail of Industrial Processes

Facility Type – Off Site	Site Name and Location	Distance (Direction)	Detail
Active Local Authority Pollution Prevention Controls	Crossfield Garage Ltd, Leconfield Street, Cleator Moor	30m (south)	Enforced by Copeland Borough Council relating to petrol filling station. Permit Number CBC/LAPPC/B 22.

4.4 Health & Safety

The absence or presence of sites subject to restrictions in relation to Health & Safety at or within 1km of the site boundary have been summarised in Table 4.7 below.

Table 4.7 Summary of Facilities subject to Health & Safety Consents

Health & Safety Permits	On Site	Off Site (within 1km)
Explosive Sites	No	No
Notification of Installations Handling Hazardous Substances	No	No
Planning Hazardous Substance Consents	No	No

Health & Safety Permits	On Site	Off Site (within 1km)
Registered Radioactive Substances Consents	No	No
Control of Major Accident Hazard sites	No	No

4.5 Environmentally Sensitive Areas

The absence or presence of Environmentally Sensitive Areas at or within 250m of the site boundary have been summarised in Table 4.8 below.

Table 4.8 Summary of Environmentally Sensitive Areas

	On Site	Off Site (within 250m)
Environmentally Sensitive Areas	No	No

4.6 Flooding

The absence or presence of flooding potential at the site is summarised in Table 4.9 below.

Table 4.9 Summary of Flooding Potential

Designation	On Site	Detail
Flooding at Surface (from Groundwater)	Yes	Potential for groundwater flooding to occur at surface.
Flooding below Ground Level (from Groundwater)	Yes	Potential for groundwater flooding of property situated below ground level in north, west and south.
Flooding from Surface Waters	Yes	Extreme Flooding from Rivers without defences (Zone 2) on western site boundary relating to culverted watercourse off-site.

4.7 Trade Directory Entries

The absence or presence of Active Trade Entries Directory at or within 250m of the site boundary have been summarised in Table 4.10 below. Further detail is given in Table 4.11.

Table 4.10 Summary of Active Trade Directory Entries

	On Site	Off Site (within 250m)
Trade Directory Entries	Yes	Yes

Table 4.11 Detail of Trade Directory Entries

Name – On Site	Detail
Delkia	Electrical Engineers
Travis Perkins Plc (no longer present – not identified during site walkover)	Builders Merchants
Brannan	Thermometer Makers
Bespoke Backdrops	Photographic Equipment Supplier and Manufacturer

Name – Off Site	Distance (Direction)	Detail
Crossfield Garage	30m (south)	Petrol Filling Station
Station Yard Garage	95m (south-east)	Car Body Repairs
S A Miller	95m (south-east)	Car Body Repairs
Millers Garage	100m (south-east)	Car Body Repairs
Mossop Construction Services	250m (south)	Road Haulage Services

4.8 Points of Interest

The absence or presence of points of interest which may impact upon the proposed development (ones previously not identified) at or within 250m of the site boundary have been summarised in Table 4.12 below.

Table 4.12 Summary of Points of Interest

	On Site	Off Site (within 250m)
Points of Interest	No	No

4.9 Unexploded Ordnance

Zetica Ltd Online Unexploded Ordnance (UXO) Risk Mapping indicates the site to be located within an area at Low Risk from unexploded ordnance.

5.0 SITE HISTORY

Available extracts of historical Ordnance Survey (OS) maps were used to research the history of the site and the surrounding area. Copies of all historical Ordnance Survey maps reviewed are included in Appendix C.

5.1 Review of Site History

5.1.1 On Site History

The history of the site is summarised in Table 5.1 below.

Table 5.1 On Site History

Feature	Map Years	Notes
Pond (east)	1925 - 1962	Potentially Infilled.
Reservoir (north-west)	1863 - pre 1956	Potentially Infilled.
Reservoir (south)	1863 - 1899	Potentially Infilled.
Infilled watercourse (north)	1863	Potentially infilled
Railway sidings associated with the iron and steel works	1863 - 1957	No longer identified from 1957.
Hematite Iron and Steel Works with associated material mounds and infrastructure	1863 - 1962	Infrastructure includes travelling cranes, limekilns and tanks.
Slag heaps	1962 – pre 1971	No longer identified from 1971.
Leconfield Industrial Estate	1962 – present	Initially developed around 1967 with further expansion in 1970 and 1982. Leather, thermometer and various other factories present including a tank in the far west.
Electricity Sub-stations	1982 – present	Four electricity sub-stations were developed in the west associated with on-site factories.

5.1.2 Surrounding History

There are number of potentially contaminative land uses near to the site; the main ones (not listed previously) within 100m of the site boundary are listed in Table 5.2 below.

Table 5.2 Historical Potentially Contaminative Land Uses with 100m of the site

Distance and Direction	Feature	Map Years	Notes
Adjacent to north, east and west.	Railway lines	1863 - 1962	Noted dismantled c.1962.



Distance and Direction	Feature	Map Years	Notes
Adjacent to south	St Johns Pit	1925 – 1962	Recorded as slag heap from 1962.
10m south-east	Goods Station	1863 – 1970	Later allotment gardens.
20m north and east	Tank	1899 – 1962	-



6.0 HISTORICAL REPORT REVIEW

6.1 Overview

A historical ground investigation report written by WYGE in 2007 (ref: E11683-GI-FAC, issue 1, dated June 2007 and E11126, dated April 2007) has been reviewed as part of this study. The information contained within the reports has been referred to for 'information only' as it was written on behalf of others.

6.2 Ground Investigation Factual and Interpretative Reports, WYGE, June 2007 & April 2007, for West Lakes Renaissance

WYGE was commissioned by West Lakes Renaissance to undertake ground investigation works at Leconfield Industrial Estate to identify existing ground conditions.

6.2.1 Ground Investigation

The fieldwork was undertaken between 5th and 30th March 2007 whereby 4 no. cable percussive boreholes, 6. no rotary open hole boreholes, 5. no rotary open hole boreholes followed by cable percussive boring, 8. no window sample boreholes and 15. no machine dug trial pits were excavated. The location of the boreholes was mainly restricted to the east of the internal access road of the industrial estate.

6.2.2 Ground Conditions

Cable Percussive Boreholes – Made Ground was encountered within all cable percussive boreholes at depth of between 0.60 metres (m) below ground level (bgl) in CP5 to a maximum depth of 4.50m bgl in CP7. It generally comprised fine to coarse slag Gravel with ash and brick. Natural deposits were encountered at depths of between 0.60m and 2.90m bgl comprising stiff brown slightly gravelly sandy Clay with gravel of sandstone, siltstone and coal. Grey limestone bedrock was encountered within CP1 at 8.20m bgl which was chiselled to 9.10m bgl. Groundwater was encountered within CP5 at 6.50m bgl.

Cable Percussive and Rotary Boreholes – Made Ground was encountered within all rotary locations with thicknesses varying from between 1.30m to 8.70m bgl and generally comprising slag Gravel with ash and brick. Superficial deposits consisted of firm to stiff Clay (glacial till) with occasional sand and gravel bands at depths from between 1.30m and 8.70m. Limestone bedrock was encountered at a depth of

8.60m to 8.80m bgl in BH1 and BH2. Mudstone was encountered in BH1 from 10.0m bgl and Sandstone was also encountered between 16.50m and 25.50m bgl.

Locations BH3, BH3A, BH5A, BH7, BH8, BH9 and R1 were terminated at shallow depths before encountering bedrock. BH3, BH8 and R1 were terminated early due to slow progress through slag gravel.

Trial Pits – Made Ground was encountered in all locations with exception to TP13 and generally comprised slag, brick, coal, ash and concrete Gravel. The depth of which was not proven with exception to that reported in TP15 whereby sandy gravelly Clay was encountered between 1.90m and 2.80m bgl. Natural Ground was also encountered in TP13 and generally comprised Topsoil (up to 0.10m bgl) overlying sandy gravelly Clay up to 2.80m bgl. Trial Pits were terminated between 0.60m and 4.10m bgl. Shallower terminations were probably associated with collapse or below ground obstructions.

Window Sample Boreholes – Made Ground was encountered in all locations and generally comprised of slag and mixed lithology Gravel. The depth of Made Ground was not proven with exception to WS2 (0.40m bgl) which was underlain by gravelly Clay containing ash and slag gravel up to 1.65m bgl. Six locations (WS1 to WS6) were terminated at depths <2.0m bgl to investigate road construction.

6.2.3 Contamination

As the data is >10 years old, it has not been screened against current guidance due to reliance issues. A strong sulphurous odour, however, was recorded in three locations located in the central and north-eastern parts of the site in WS3 between 0.55m and 0.65m bgl, WS7 between 2.3m and 2.4m bgl and CP7 between 2.0m and 4.5m bgl. No other visual or olfactory evidence of contamination was recorded.

Six ground gas monitoring visits carried out between 14th April and 7th June 2007 within two exploratory positions (BH1 and CP7) recorded <0.1% for both CH₄ and CO₂ with no flow rate recorded for either borehole. Oxygen readings ranged from 16.1% to 21.1% and both boreholes were recorded as dry on each visit.

6.2.4 Conclusions

Ground conditions generally consisted of varying depths of Made Ground from 0.10m up to 8.70m bgl overlying firm to stiff Glacial Till deposits. Bedrock was encountered at depths of between 8.20m to 8.80m bgl.



Several boreholes and trial pits were terminated at shallow depths, this is likely due to below ground obstructions relating to Made Ground deposits from historical usage.

The borehole logs (cable percussive and rotary) listed above have noted particularly difficult drilling conditions on site relating to below ground obstructions of slag deposits and dense Sand and Gravels.

7.0 GEOLOGY, HYDROGEOLOGY AND HYDROLOGY

7.1 Geology

Details of the geology underlying the site have been obtained from the following sources:

- British Geological Survey (BGS) Sheet No. 28 (Whitehaven) Solid and Drift Edition, 1:50 000 scale;
- BGS National Grid Sheet NY01NW, Frizington, 1:10 000 scale;
- BGS website (Geology of Britain Map Viewer and Borehole Records);
- BR211 Indicative Radon Map Number 18 North Cumbria and British Geological Survey (2000);
- Coal Authority Interactive Mapper;
- MAGIC Map;
- Consultants Coal Mining Report (Reference 51002189488002), Coal Mining Report (Reference 51002189488001) and Shaft Plan and Data Sheets (Reference 51002189626001) enclosed as Appendix D; and,
- Environmental database.

7.1.1 Made Ground

Published maps provide evidence that Made Ground deposits are present on site. The detailed geological map indicates the site to be in an area where the ground is known to have been deposited by man: colliery spoil, shale bings and furnace slag.

7.1.2 Superficial Geology

The geological map indicates that Glacial Till – Clay deposits underlie the site.

7.1.3 Solid Geology

The site lies within a complex geological setting. There are four faults at the site, three of which define the main geology types present:



- The Henry Pit Fault orientated generally east-west is located two thirds up the site with the downthrow to the north.
- There are two faults truncated by the Henry Pit Fault on the eastern end of the site one orientated north-south and the other northeast-southwest down throwing to the east and southwest, respectively.
- A further smaller fault impinges on to the most westerly point of the site orientated east west with a downthrow to the south.

To the north of the Henry Pit Fault the Whitehaven Sandstone Group is present.

To the south of the Henry Pit Fault (oldest first from the west):

- The Eskett Limestone (formerly the Chief Limestone Group) including the following sub groups; Fourth and Third Limestone, Orebank Sandstone and Second and First Limestone. The limestone dips 20 degrees towards the south west.
- The Yoredale Parent Group (formally the undivided Hensingham Group).
- The Middle Coal Measures which includes the following coal seams which sub crop on the site (oldest first); the Ten Quarters (Cleator Moor 5ft), the Slaty (Cleator Moor 4ft) and the White Metal (Cleator Moor 6ft). The Coal Measures dip to the west. It is likely that the impact by the White Metal on the site is minimal depending on where it sub crops.

Several shafts are recorded on the 1:10,000 National Grid Sheet (NY01NW) in the west of the site, one of which is labelled 'Wyndham'.

A plan showing the location of the faults is included within Appendix B.

7.1.4 BGS Soil Chemistry

The environmental database also provides Urban Soil Chemistry Averages for the site (source: Urban Soil and Soil Chemistry data provided by the British Geological Survey). The information is summarised in Table 7.1 below.

Table 7.1 Urban Soil Chemistry Averages

Determinand	Soil Concentration Range	
	Min (mg/kg)	Max (mg/kg)
Arsenic	<15	35
Cadmium	<1.8	<1.8
Chromium*	60	90
Lead	<100	<100
Nickel	<15	<15

*Assumed to be Total Chromium

All the metal concentrations not at levels that may be considered to pose a potential risk to human health for a commercial end use (published Defra C4SLs and LQM S4ULs).

7.1.5 British Geological Survey Borehole Logs

British Geological Survey (BGS) logs have been referred to for information only. The absence or presence of BGS logs at or within 50m of the site boundary have been summarised in Table 7.2 below. Further detail is given in Table 7.3.

Table 7.2 Summary of BGS Borehole Logs

Presence	On Site	Off Site (within 100m)
BGS Borehole Logs	Yes	Yes

Table 7.3 Detail of BGS Logs

Reference Number (Hole Type and Depth) – On Site	Detail (m bgl)
NY01NW281 – No Log	Associated with Wyndham Pit (old) – Also recorded on 1:10,000 BGS Sheet NY01NW.

Reference Number (Hole Type and Depth) – On Site	Detail (m bgl)
NY01NW277 – Rotary Hole – 169.49m bgl) – associated with historical iron works – Crowgarth Mine 11	0.00 – 0.18: Soil 0.18 – 0.80: Clay 0.80 – 1.82: Gravel and sand 1.82 – 20.77: Sandstone cobbles and Sand 20.77 – 22.40: Dark blue shale 22.40 – 26.70: Grey Sandstone 26.70 – 28.86: Grey sandy shale 28.86 – 32.33: Grey sandstone 32.33 – 32.85 Blue sandy shale 32.85 – 42.52: Grey sandstone 42.52 – 48.04: Reddish grey sandstone 48.04 – 52.12: Reddish grey limestone. 52.12 – 59.20: Grey limestone. 59.20 – 61.51: Grey sandy shale. 61.51 – 68.64: Dark grey and blue grey limestone. 68.64 – 82.05: Dark grey blue grey shale. 82.05 – 162.49: Grey dark grey limestone. 162.99 – 163.07: Grey shale 163.07 – 164.50: Grey limestone 165.50 – 167.33: Reddish grey sandstone. 167.33 – 169.49: Red shale.
NY01NW278 (Rotary Hole – 75.79m bgl) – associated with historical iron works – Crowgarth Mine 12	0.00 – 0.18: Soil 0.18 – 1.22: Yellow clay and cobbles 1.22 – 17.98: Sand, cobbles and boulders 17.98 – 19.78: Dark blue shale 19.78 – 21.30: Reddish grey mudstone 21.30 – 23.44: Dark grey shale 23.44 – 27.70: Blue shale 27.70 – 28.74: Reddish grey shaley sandstone
NY01NW278 (Rotary Hole – 75.79m bgl) – Associated with historical iron works	28.74 – 32.10: Grey shale sandstone 32.10 – 33.31: Blue shaley limestone 33.31 – 36.05: Dark grey sandstone 36.05 – 38.74: Dark grey shale with sandstone 38.74 – 41.42: Grey mudstone with shale joints 41.42 – 49.65: Dark grey/blue grey shale 49.65 – 51.69: Grey sandstone 51.59 – 54.13: Grey shale sandstone 54.13 – 55.80: Dark blue sandy shale 55.80 – 75.79: Grey limestone

Reference Number (Hole Type and Depth) – On Site		Detail (m bgl)
Drilled in car parking area, north of current Brannan & Sons Ltd building	NY01NW485 (Borehole 4.87m)	0.00 – 0.79: Made Ground: Red stoney clay 0.79 – 4.87: Made Ground: Ash and slag
	NY01NW486 (Borehole – 5.48m)	0.00 – 0.91: Made Ground: Red stoney clay 0.91 – 5.48: Made Ground: Ash with large pieces of slag
	NY01NW487 (Borehole - 6.10m)	0.00 – 0.30: Made Ground: Red stoney clay 0.30 – 6.10: Made Ground with ash sandstone boulders and slag.
	NY01NW488 (Borehole – 8.53m)	0.00 – 0.30: Made Ground: red stoney clay 0.30 – 8.53: Made Ground: ash and slag
	NY01NW489 (Borehole - 5.79m)	0.00 – 0.30: Made Ground: red stoney clay 0.30 – 5.79: Made Ground: Ash, sandstone, slag with large slag boulders
Drilled concurrently in far western part of site	NY01NW490 (Borehole – 6.10m)	0.00 – 3.96: Red clay and slag 3.96 – 6.10: Ash and small stones
	NY01NW491 (Borehole – 6.10m)	0.00 - 3.05: Red clay and slag 3.05 – 6.10: Ash and small stones
	NY01NW492 (Borehole – 6.58m)	0.00 – 2.44: Slag (fill) 2.44 – 6.58: Ash small stones (fill)
	NY01NW493 (Borehole – 6.10m)	0.00 – 2.74: Slag (fill) 2.74 – 6.10: Ash and small stones
	NY01NW494 (Borehole – 6.10m)	0.00 – 2.13: Slag (fill) 2.13 – 6.10: Ash & small stones
Drilled beneath existing Alan Dick Engineering Ltd building	NY01NW495 – 499 inclusive	Information not available for review
Drilled beneath existing main Forth Engineering Ltd building	NY01NW500 - 501	Information not available for review
	NY01NW502 (Borehole – 7.22m)	0.00 – 1.10: Compact grey foundry waste 1.10 – 1.31: Hard grey foundry waste (boulder) 1.31 – 1.83: Very dense grey foundry waste 1.83 – 2.32: Moderately loose dark grey foundry waste 2.32 – 5.46: Moderately loose dark grey foundry waste with occasional ash and cinders with large pieces of waste material 5.46 – 7.22: Hard grey foundry waste
	NY01NW503	Information not available for review
Drilled beneath existing smaller Forth Engineering Ltd building in far north of site	NY01NW504 (Hand Pit 0.22m)	0.0 – 0.075: Topsoil 0.075 – 0.22: Very hard grey foundry waste
	NY01NW505 (Hand Pit 0.90m)	0.00-0.10: Topsoil 0.10-0.90: Very hard grey foundry waste
	NY01NW506 (Hand Pit 1.76m)	0.00-0.10: Topsoil 0.10-0.40: Very hard grey foundry waste 0.30-1.08: Soft organic soil 1.08-1.76: Very hard grey foundry waste
	NY01NW506 (Hand Pit 0.70m)	0.00-0.10: Topsoil 0.10-0.70: Very hard grey foundry waste

Reference Number (Hole Type and Depth) – Off Site	Distance and Direction	Detail (m bgl)
NY01NW479 (Cable Percussion – 9.00m)	5m (east)	0.00 – 1.20: MG: Medium dense black clayey ash, clinker and stone fill. 1.20 – 3.40: Soft dark grey organic silty sandy clay. 3.40 – 6.20: Firm reddish brown silty very sandy clay with gravel. 6.20 – 7.60: Stiff reddish brown sandy silty clay with sandstone. 7.60 – 9.00: Stiff reddish brown sandy silty clay.
NY01NW13905/10 (Cable Percussion 5.00m)	25m (east)	0.0 – 0.30: Topsoil 0.30 – 4.00: Stiff brown sandy CLAY with gravel and clayey sand. 4.00 – 4.30: Grey shaley mudstone. 4.30 – 5.00: Grey brown siltstone with sandstone bands.
NY01NW13905/8 (Cable Percussion 5.10m)	25m (east)	0.00 – 0.40: Topsoil 0.40 – 4.10: Stiff red-brown silty sandy gravelly CLAY with cobbles. 4.10 – 5.10: Red brown silty sandstone.
NY01NW13905/TP5 (Trial Pit – 1.00m)	35m (east)	0.00 – 0.25: Friable dark grey sandy clay TOPSOIL 0.25 – 0.50: Firm to stiff yellowish brown sandy silty clay. 0.50 – 0.80: Stiff reddish-brown sandy clay. 0.80 – 1.00: Dark blue grey fine to medium grained Limestone.
NY01NW13905/TP1 (Trial Pit – 2.20m)	35m (east)	0.00 – 0.50: Topsoil 0.50 – 1.40: Firm to stiff pinkish brown sandy silty clay. 1.40 – 1.60: Light reddish-brown SANDSTONE. 1.60 – 2.20: Dark brown silty sandstone.
NY01NW473 (Cable Percussion – 9.00m)	35m (east)	0.00 – 1.30: MG: Medium dense black clayey ash filter. 1.30 – 3.80: Soft reddish brown sandy silty clay. 3.80 – 4.70: Soft brown grey organic silty sandy clay. 4.70 – 5.90: Medium dense dark brown coarse sandy fine to coarse gravel. 5.90 – 6.80: Firm reddish brown very silty clay. 6.80 – 9.00: Firm reddish brown silty sandy clay.
NY01NW13905/TP6 (Trial Pit – 0.6m)	45m (south east)	0.00 – 0.20: Topsoil (loose dark grey friable sandy silty Clay) 0.20 - 0.40: Firm reddish brown slightly gravelly sandy silty Clay 0.40 – 0.60: Dark bluish grey fine to medium crystalline Limestone

7.1.6 Radon

The site is shown to be in higher probability radon area in the eastern part of the site whereby between 10 – 30% of homes are estimated to be above the action level. The indicative radon map indicates that the eastern part of the site is in an area where full radon protection measures are required for the construction of new dwellings or extensions. The remainder of the site is within a lower probability radon area where between <1% of homes are estimated to be above the action level. No radon protection measures are required for this area.

7.1.7 Mining

The site is in an area which may have been affected by coal mining. Reference to the Coal Authority interactive mapper indicates that the western portion of the site is located within a Development High Risk Area. The eastern portion of the site has subject to iron ore mining. The different types of mining are discussed in detail below:

Coal Mining

The site is in an area which may be affected by coal mining. A Coal Mining Report (Reference 51002189488001) obtained, describes that the property is an area that is in a surface area that could be affected by underground mining in three seams from shallow to 150m depth, last worked in 1890. The Consultants Coal Authority Report (Reference 51002189488002) describes that there are three Seams worked beneath the site; The Main seam at depths of between 9 and 22m bgl worked in a southerly direction, the Upper Ten Quarters at a depth of 33m worked in a south westerly direction and the Six Quarters at depths of between 117 and 140m worked in a southerly direction.

The seam workings names within the Consultants Report do not tie together with seams identified to be at site at shallow depth on the geological maps.

The Consultants Coal Mining Report shows that there are eight recorded mine entries on or within 20m of the site these have been summarised in Table 7.4 below. Further detail as given in Table 7.5. All coal mining reports pertaining to the site are enclosed in Appendix D.

Table 7.4 Summary of Mine Shafts

Feature	On Site	Off Site (within 20m)
Mine Shafts	Yes	Yes

Table 7.5 Detail of Coal related Mine Shafts

Reference Number - On Site	Detail
301515-007	Entry name not recorded. No information relating to shaft depth or treatment details. Assumed diameter 2m.
301515-008	Entry name not recorded. No information relating to shaft depth or treatment details. Assumed diameter 2m.
301515-010	Name: Barkers or Wyndham Pit. No information relating to shaft depth or treatment details. Assumed diameter 2m. Ties in with BGS log outlined above (NY01NW281).
301515-009	Entry name not recorded. No information relating to shaft depth or treatment details. Assumed diameter 2m.
301515-005	Entry name not recorded. No information relating to shaft depth or treatment details. Assumed diameter 2m.
301515-006	Entry name not recorded. No information relating to shaft depth or treatment details. Assumed diameter 2m.
301515-004	Entry name not recorded. No information relating to shaft depth or treatment details. Assumed diameter 2m.

Reference Number - Off Site	Detail
301515-003	Entry name not recorded. Assumed depth 33m. No information relating to treatment details. Assumed diameter 2m.

Iron Ore

The site as a whole has historically been used as a steel / iron works. Extraction of an iron ore band within the Sandstone may have occurred on the east of the site. Two shafts off site to the south east - Crowgarth Mine 11 and 12 (discussed above in Table 7.3) were sunk for the extraction of the band. There is no information relating to the potential treatment of these shafts. The extraction of the band is likely to be limited by the presence of faults.

Other

The absence or presence of BGS registered sites and cavities at or within 250m of the site boundary have been summarised in Table 7.6 below. Further detail is given in Table 7.7.

Table 7.6 Summary of BGS Features / Cavities

Feature	On Site	Off Site (within 250m)
BGS Mineral Sites	No	Yes
Recorded Man-Made Cavities	No	Yes
Recorded Natural Cavities	No	No

Table 7.7 Detail of BGS Features / Cavities

Feature – Off Site	Distance and Direction	Detail
BGS Mineral Sites	245m (west)	Whinny Hill Colliery No. 2 Pit, Keekle, Whitehaven, Cumbria. Underground mining for coal. Operation has since ceased.
Recorded Man-Made Cavities	80m (south-east)	Commodity: Hematite. No further details given.
	90m (south-east)	

7.1.8 Ground Stability

Table 7.8 indicates the potential ground stability hazards on site, as obtained from the environmental database.

Table 7.8 Ground Stability Hazards

Ground Stability Hazard	Risk
Collapsible Ground	Very Low
Compressible Ground	No Hazard to Very Low
Ground Dissolution	No Hazard to Very Low
Landslide	Very Low
Running Sand	Very Low
Shrinking or Swelling Clay	Very Low

7.2 Hydrogeology

Details of the hydrogeology underlying the site have been obtained from the following:

- MAGIC interactive mapping website; and,
- Environmental database.

7.2.1 Groundwater Classification

The bedrock is designated as a Secondary A Aquifer. These are 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. These are generally aquifers formerly classified as Minor Aquifers.

The Glacial Till (superficial) is classified as a Secondary Undifferentiated Aquifer. This has been assigned in cases where it has not been possible to attribute either a Secondary A or B aquifer to the soil type due to the variable characteristics.

In most cases, this means that the layer in question has previously been designated as both Minor and Non-Aquifer in different locations due to the variable characteristics of the rock type.

7.2.2 Groundwater Abstractions

The absence or presence of groundwater abstraction wells at or within 1km of the site boundary have been summarised in Table 7.9 below.

Table 7.9 Summary of Groundwater Abstraction Wells

Feature	On Site	Off Site (within 1km)
Groundwater Abstraction Well	No	No

7.2.3 Groundwater Quality

The site is not located within a Source Protection Zone.

7.2.4 Hydrology

Details of the hydrology of the area have been obtained from the following sources:

- MAGIC interactive mapping website; and,
- Environmental database.

7.2.5 Watercourses

The absence or presence of watercourses at or within 250m of the site boundary have been summarised in Table 7.10 below. Further detail is given in Table 7.11.

Table 7.10 Summary of Watercourses

Feature	On Site	Off Site (within 250m)
Watercourses	No	Yes

Table 7.11 Details of Watercourses

Name - Off Site	Distance and Direction	Detail
Nor Beck (culverted)	10m (west)	Culverted watercourse to the west of the site. Watercourse flows southwards into the River Keekle
Nor Beck	20m (north-east)	Watercourse flows southwards into the River Keekle
Unnamed drain	135m (west)	Drain from disused mine

7.2.6 Surface Water Abstractions

The absence or presence of surface water abstractions at or within 250m of the site boundary have been summarised in Table 7.12 below.

Table 7.12 Summary of Surface Water Abstractions

Feature	On Site	Off Site (within 250m)
Surface Water Abstractions	No	No

7.2.7 Discharge Consents

The absence or presence of discharge consents at or within 250m of the site boundary have been summarised in Table 7.13 below. Further detail is given in Table 7.14.

Table 7.13 Summary of Active Discharge Consents

Feature	On Site	Off Site (within 250m)
Discharge Consents	No	Yes

Table 7.14 Details of Active Discharge Consents

Location - Off Site	Distance and Direction	Detail
Nor Beck Park, Cleator Moor	195m (south-west)	Operated by United Utilities Water Ltd relating to the discharge of public sewage into Nor Beck from a storm tank.
Rear garden of 16 Crossing Close, Cleator Moor	205m (south-west)	Operated by United Utilities Water Ltd relating to the discharge of public sewage into Nor Beck from a storm tank.

7.2.8 Pollution Incidents, Prosecutions and Substantiated Pollution Incidents

The absence or presence of pollution incidents at or within 250m of the site boundary have been summarised in Table 7.15 below. Further detail is given in Table 7.16.

Table 7.15 Summary of Incidents

Feature	On Site	Off Site (within 250m)
Pollution Incidents	Yes	Yes
Prosecutions	No	No
Substantiated Pollution Incidents	No	No

Table 7.16 Details of Incidents

Location - On Site	Detail	
Pollution Incidents	Category 3, Minor Incident, Oils/petrol polluting freshwater river/stream dated 16/07/91.	

Location - Off Site	Distance and Direction	Detail
Pollution Incidents	40m (north-west)	Category 3, Minor Incident, Rubble/Litter/Soils polluting freshwater river and stream dated 22/03/2019.

8.0 PRELIMINARY CONTAMINATION RISK ASSESSMENT

The site is being considered for future development and has been assessed in line with current UK guidance including the National Planning Policy Framework (NPPF), February 2019.

For a risk of pollution or environmental harm to occur as a result of ground contamination, all of the following elements must be present:

- A source, i.e. a substance that is capable of causing pollution or harm;
- A receptor (or target), i.e. something which could be adversely affected by the contaminant; and
- A pathway, i.e. a route by which the contaminant can reach the receptor.

If one of these elements is absent there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

8.1 Potential Hazard Sources

8.1.1 On-site Sources

Potential on site sources of contamination include the following:

- General presence of Made Ground across the site, including asbestos;
- Historical uses of the site which may give/have given rise to in-ground contamination and/or impacted groundwater such as coal mining, iron mining, the iron and steel works with associated reservoirs, railways and slag heaps;
- Current uses include the waste management facility & infrastructure associated with Leconfield Industrial Estate;
- Ground gases and vapours from Made Ground, mine gas and radon.

8.1.2 Off-Site Sources

Based on historical uses identified surrounding the site, it is considered that potential off-site contamination sources would generally be in line with those identified onsite (outlined above) excluding the below:



- Petrol Filling Station 30m to the south; and,
- Landfill located 105m to the west.

8.2 Contamination Pathways

Potential contamination pathways are listed below:

- Dermal contact;
- Inhalation of vapours or dusts;
- Ingestion of soil and dusts;
- Leaching to surface run-off/drainage;
- Leaching to groundwater;
- Lateral and vertical migration of groundwater;
- Ground gas generation/accumulation; and,
- Migration along/into service conduits and pipe work.

8.3 Contamination Receptors

Receptors that may be affected by potential contamination and ground gas for the future development are considered to be:

- Future Site Users (commercial);
- Construction and Maintenance workers;
- Secondary Undifferentiated Aquifer (superficial);
- Secondary A Aquifer (bedrock);
- Surface Waters;
- Flora and Fauna; and,
- Buildings / Services.

8.4 Ground Contamination Risk Assessment

By considering the sources, pathways and receptors, a preliminary assessment of the environmental risk has been made with reference to the significance and degree of the risk. This assessment is based on consideration of whether the source contamination can reach a receptor and hence whether it is of significance (CIRIA C552).

The risk assessment has been carried out by assessing the severity of the potential consequence, the sensitivity of the target and the likelihood of occurrence, based on the categories given below (Tables 8.1 to 8.3).

A summary of the preliminary risk assessment for on and offsite sources is given in Table 8.4.

Table 8.1 Potential Hazard Severity Definition

Category	Definition
Severe	Acute risks to human health, catastrophic damage to buildings/property, major pollution of controlled waters
Medium	Chronic risk to human health, pollution of sensitive controlled waters, significant effects on sensitive ecosystems or species.
Mild	Pollution of non-sensitive waters, significant damage to buildings or structures
Minor	Requirement for protective equipment during site works to mitigate health effects, damage to non-sensitive ecosystems or species, minor damage to buildings or structures

The likelihood of an event (probability) takes into account both the presence of the hazard and target and the integrity of the pathway and has been assessed based on the categories given below.

Table 8.2 Probability of Risk Definition

Category	Definition
High likelihood	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term
Low likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable

The potential severity of the risk and the probability of the risk occurring have been combined in accordance with the following matrix in order to give a level of risk for each potential hazard.



Table 8.3 Level of Risk for Potential Hazard Definition

		Potential Severity			
		Severe	Medium	Mild	Minor
Probability of Risk	High Likelihood	High	High	Moderate	Low/ Moderate
	Likely	High	Moderate	Low/Moderate	Low
	Low Likelihood	Moderate	Low/Moderate	Low	Low
	Unlikely	Low/Moderate	Low	Low	Low



Table 8.4 Preliminary Contamination Risk Assessment

ON SITE SOURCES						
Source	Pathway	Receptor	Justification	Severity	Probability	Risk
Ground Conditions – Made Ground and contaminants from historical & current site usage.	Dermal contact, ingestion and/or inhalation of vapours or dusts	Human Health – Future site users (commercial)	The historical usage of the site could potentially have given rise to numerous contaminants and previous ground investigations record significant Made Ground deposits onsite. The probability of future site users coming into contact with contaminated materials is Low given its commercial setting.	Medium	Low	Low/Moderate
		Human Health – Construction & Maintenance Workers	The risk rating is based on the above with mitigation measures in place such as good working practices, risk assessments and PPE.	Minor	Likely	Low
	Leaching to groundwater, drainage and lateral / vertical migration.	Secondary Undifferentiated Aquifer	The Secondary Undifferentiated Aquifer is likely to comprise low permeability Clay therefore any movement of contaminants will be restricted both laterally and vertically so they will be confined.	Mild	Unlikely	Low
		Secondary A Aquifer	The Secondary A Aquifer is overlain by clay which will offer some protection and limit migration of potential contaminants. The site is not located within a Source Protection Zone and there are no groundwater abstractions within 1km of the site.	Medium	Unlikely	Low
		Surface Waters	Made Ground associated with historical site activities may be generating leachate which has the potential to migrate to nearby surface waters. Nor Beck is culverted off site to the west, the construction of which is unknown.	Medium	Likely	Moderate
		Flora & Fauna	There is potential for soft landscaping to be incorporated within the proposed commercial development. It is assumed that new planting will have appropriate growing medium.	Medium	Unlikely	Low
	Migration along / into service	Buildings & Services	The risk is based on the potential for mobile contaminants to be present associated with historical	Medium	Likely	Moderate



ON SITE SOURCES						
Source	Pathway	Receptor	Justification	Severity	Probability	Risk
	ducts and pipework		use.			
Ground gas – Associated with Made Ground, gas associated with mining activities and mine/shafts and Radon.	Generation and migration / accumulation of ground gases	Human Health – Current and Future site users (commercial)	The design of the proposed buildings needs to be considered. The commercial development is likely to be located on top of areas previously backfilled. Radon is a known issue with full measures required for new builds in the east. The risk rating is based on no mitigation. Consideration needs to be given to the construction of new builds in respect to radon protection measures.	Severe (Asphyxiation and Explosion)	Likely	High
		Buildings and Services		Severe (Explosion)	Likely	High



OFF SITE SOURCES						
Source	Pathway	Receptor	Justification	Severity	Probability	Risk
Made Ground – contaminants associated with Petrol Filling Station 30m south and Landfill 105m to the west.	Leaching to groundwater, drainage and lateral / vertical migration.	Groundwater beneath the site	Potential for the migration of impacted groundwater to site. The distance of the Landfill from the site will offer some protection of the site. T	Medium	Likely	Moderate
Ground gas – Associated with Made Ground from Petrol Filling Station 30m south and Landfill 105m to the west of the site.	Generation and migration / accumulation of ground gases	Human Health – Current and Future site users (commercial)	The risk is based on the probability of ground gas/vapours being present onsite from offsite sources. Mine shafts and unrecorded workings may offer a preferential pathway for gas/vapour.	Severe (Asphyxiation and Explosion)	Low	Moderate
		Buildings and Services		Severe (Explosion)	Low	Moderate



9.0 IN-GROUND GEOTECHNICAL CONSTRAINTS

There are a number of constraints which may impact the future development type / developability of the site including;

- The potential exists for shallow Coal Mine workings to be present beneath the western portion of the site, these pose a land stability issue;
- There are 7 no. mine shafts within the site boundary with no treatment records beneath the western portion of the site, these pose a land stability risk;
- The site is underlain in the east by a layer of slag material associated with its former land uses. The slag maybe expansive which potentially poses an issue with future foundation options;
- There is no ground investigation data on the west of site therefore it is unclear if the slag extends beneath this area;
- The potential exists for shallow workings within the iron band beneath the east of the site (in particular the south eastern corner), these pose a land stability issue;
- The distance to the off-site shaft (301515-003) should be considered to determine if they pose a land stability risk to the site;
- The backfill is of a substantial thickness in areas and is unlikely to have been placed as engineered fill, this may pose a stability risk to future foundations (this includes the former reservoirs); and,
- Four faults are present on the site these may pose a potential risk in relation to differential settlement across foundations.



10.0 CONCLUSIONS & RECOMMENDATIONS

10.1 Conclusions

The site is underlain by Made Ground deposits as a result of previous industrial activities. Due to the site's industrial past, there is also potential for land stability issues.

The contamination risks posed by on-site sources to receptors are considered to be as follows:

- To future construction/maintenance workers, Secondary Undifferentiated Aquifer, Secondary A Aquifer, Flora and Fauna: Low
- To future commercial site users: Low/Moderate
- To surface waters and buildings and services: Moderate
- The gas risk posed to all identified receptors: High

The contamination risks posed by off-site sources to receptors are considered to be as follows:

- Groundwater beneath the site: Moderate
- The gassing risk to future site users and buildings and service: Moderate.

The site lies in a complex geological setting with faulting present in the north of the site and two further faults extending from it perpendicular to the south.

The site lies within a Development High Risk Area and there are eight known mine shafts on or within 20m of the boundary of the site. On the basis of the information reviewed, the current risk to the future development of the site from historical coal mining activities needs to be investigated further due to the potential presence of shallow mine workings and untreated mine entries.

The eastern part of the site lies in an area where between 10%-30% of homes are estimated to be above the radon action level. The remainder of the site lies within a lower probability radon area where between <1% of homes are estimated to be above the action level.



During the previous ground investigation dated April 2007, several boreholes and trial pits terminated at shallow depths, this is likely as a result from the presence of slag gravel (from historical use of the site) or dense Sands and Gravels.

There is potential for flooding to occur on the western site boundary from the possible presence of a culverted watercourse (Nor Beck) adjacent to the western boundary of the site.

10.2 Recommendations

As part of development proposals, if new buildings (excluding any existing properties) are proposed in the eastern part of the site, full radon protection measures will be required to be installed.

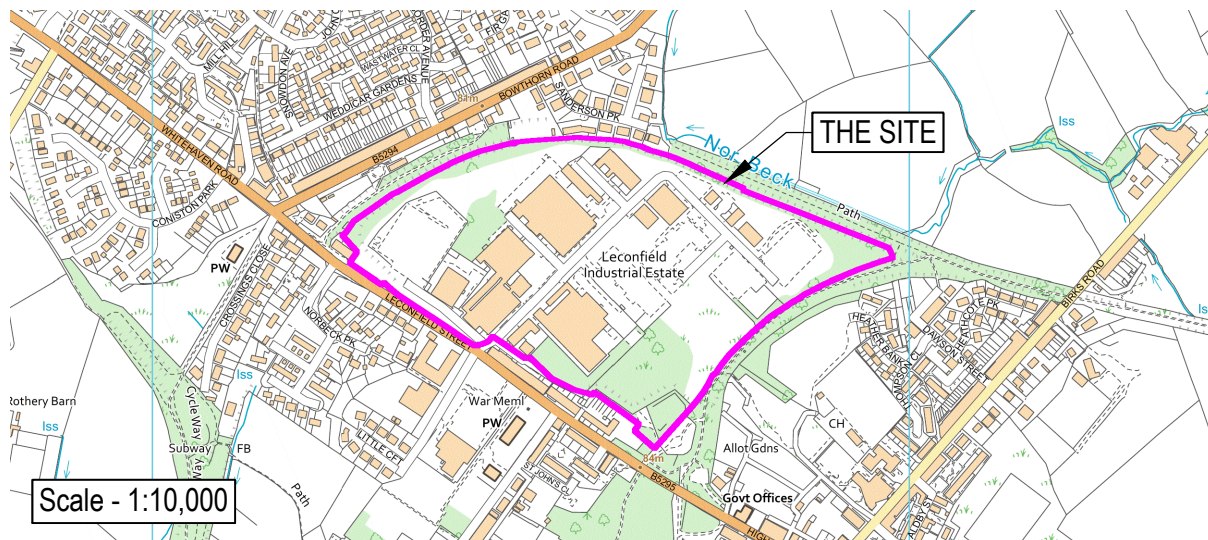
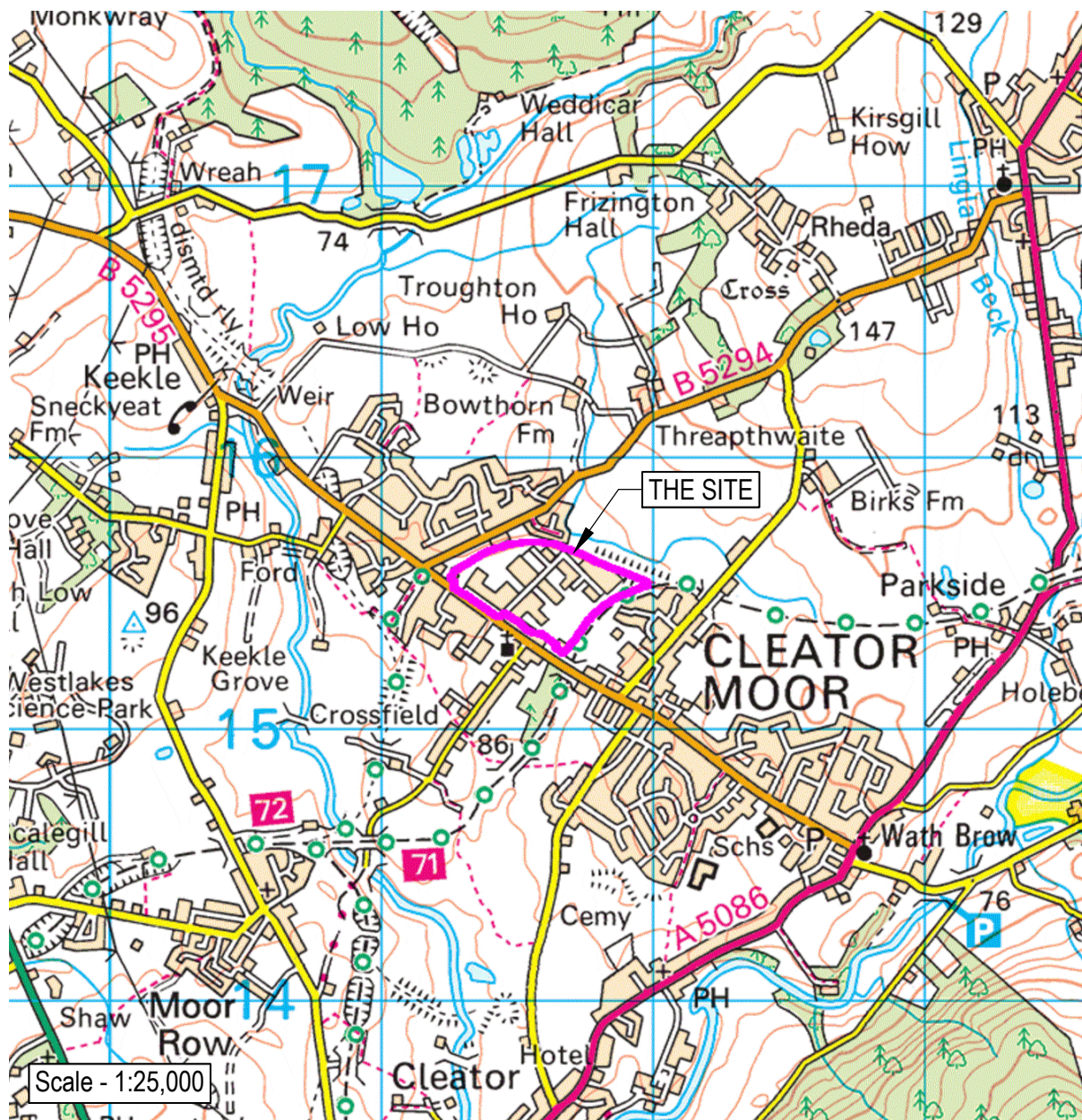
The following further works are recommended to support acquisition and/or re-development of the site:

- A visit to the Coal Authority to obtain abandonment plans (17356, OM6981, OM3324, NW1348, OM13116, 17413, NC176, NW1390 AND OM15072);
- Completion of a Preliminary Coal Mining Risk Assessment to inform the ground investigation which is likely to include;
 - Geophysics to help locate the mineshafts prior to proof drilling;
 - Ground investigation on the west and centre of the site by rotary drilling methods to identify if coal seams have been worked at shallow depth;
 - Following on from the above completion of a Refined Coal Mining Risk Assessment with recommendations for stabilisation (if required).
- Further work to determine if there are iron workings beneath the site and if present an assessment to identify if they pose a land stability risk;
- Investigation into the nature and type of the slag deposits at the site; and,
- Design and implementation of a ground investigation to determine the contamination risk posed by the site to the identified receptors.

Geo-Environmental Desk Top Study
Leconfield Industrial Estate, Cleator Moor
Copeland Borough Council



Drawings



REV		DESCRIPTION				BY	CHK	APP	DATE																
QUAY WEST at MediaCityUK TRAFFORD WHARF ROAD TRAFFORD PARK MANCHESTER M17 1HH TEL: +44 (0)161 872 3223 e-mail: manchester@wyg.com				Client: COPELAND BOROUGH COUNCIL		Project: A114312 LECONFIELD INDUSTRIAL ESTATE		Drawing Title: SITE LOCATION PLAN		<table><tr><td>Scale @ A4 AS SHOWN</td><td>Drawn CM</td><td>Date 14.11.19</td><td>Checked SB</td><td>Date 14.11.19</td><td>Approved SB</td><td>Date 14.11.19</td></tr><tr><td>Project No. A114312</td><td>Office MAN</td><td>Type N</td><td colspan="2">Drawing No. 01</td><td colspan="2">Revision</td></tr></table>		Scale @ A4 AS SHOWN	Drawn CM	Date 14.11.19	Checked SB	Date 14.11.19	Approved SB	Date 14.11.19	Project No. A114312	Office MAN	Type N	Drawing No. 01		Revision	
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										WYG Group Ltd															



Photo Plate No. 01: Skip hire company in east of site.



Photo Plate No. 02: BOC gas supplies in east.

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**Environmental Consultancy
Ground Technologies & Investigation**



Project: Leconfield Industrial Estate, Cleator Moor

Client: Copeland Borough Council

Figure 2 - Site Walkover Photo Plates

Project No.: A114312

Date: December 2019



Photo Plate No. 03: Public skips for waste/recycling in east adjacent to skip hire company (looking southwards).



Photo Plate No. 04: Grassland in north-east of site adjacent to BOC Ltd.

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Photo Plate No. 05: Gas service marker in east behind parcel depot.



Photo Plate No. 06: Large concrete footing of demolished building behind Forth UK in east.

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