BWB
A CAF GROUP COMPANY

ENVIRONMENT

Hargreaves Land Limited
Planning Application 1 at Lincolnshire Lakes (North) Scunthorpe
Phase 1 Geo-Environmental Assessment

ENVIRONMENT

Hargreaves Land Limited
Planning Application 1 at Lincolnshire Lakes (North) Scunthorpe
Phase 1 Geo-Environmental Assessment

Birmingham
Livery Place, 35 Livery Street, Colmore Business District, Birmingham, B3 2PB
T: 0121 233 3322

Leeds
Whitehall Waterfront, 2 Riverside Way, Leeds, LS1 4EH
T: 0113 233 8000

London
11 Borough High Street, London, SE1 9SE
T: 0207 407 3879

Manchester
11, Portland Street, Manchester M1 3HU
T: 0161 233 4260

Nottingham
Waterfront House, Station Street, Nottingham NG2 3DQ
T: 0115 924 1100

January 2025

DOCUMENT ISSUE RECORD

Document Number:	LLP1-BWB-XX-XX-T-G-0001_Ph1		
BWB Reference:	221423		
Author:	Paolo Moniz BSc (Hons)	Graduate Geotechnical Engineer	[redacted]
Reviewer:	Mike Harper BSc(Hons MSc CEnv	Principal Consultant	[redacted]
Approver:	Julian Owen BSc(Hons) ARSM FGS MSc(Eng) CGeol	Commercial Manager	[redacted]

REVISION CONTROL

Revision	Date of Issue	Status	Update Notes:	Updated:	Approved:
P1	July 2023	S0	Draft Issue	-	-
P2	December 2024	S2	Updated red line boundary	ZT	CRi
P3	January 2025	S2	Updated with Client Comments	ZT	LC

EXECUTIVE SUMMARY

Executive Summary	
Site Location	The Site is located immediately east of the M181/A1077(M), to the west of Scunthorpe, Lincolnshire.
Proposed Development	The hybrid planning application consists of the following: Full planning application for the construction of a new vehicular access off the M181/A1077(M) roundabout, a pedestrian and cycle link to Scotter Road, a foul pumping station, earthworks and 'off-plot' drainage, ecological and associated landscaping and infrastructure works. Outline planning application, with all matters reserved, for the development of up to 550 residential dwellings (Use Class C3), a local centre (Use Class E) and associated 'on-plot' landscaping, drainage and other infrastructure works.
Current Site Use	The Site currently comprises agricultural land with a farm in the south-east of the northern land parcel. The Site is predominantly surrounded by the M181/A1077(M) road to the west with agricultural fields and woodland and residential properties to the east. Brumby Common Lane splits the Site into northern and southern areas.
Site History	The Site has remained undeveloped and existed as open fields for the majority of its mapped history. A historical landfill was located immediately south-east of the southern Site boundary. Various ponds off-site in the north are no longer present and have been potentially infilled.
Ground Conditions	Information published by the British Geological Survey (BGS) indicates that the majority of the Site is directly underlain by Warp superficial deposits. The Sutton Sand Formation superficial deposits are located in the eastern section of the northern parcel of land, as well as a small portion of the southern parcel of land. A small outcrop of Alluvium is noted in the southernmost part of the southern parcel of land. Superficial deposits on both the northern and southern parcels overlie the Mercia Mudstone Group bedrock. Artificial ground is not recorded to be present. Made Ground may be present along road and paths. It may also be present offsite to the north, with a historical collection of ponds being potentially infilled.
Geotechnical Review	In consideration of the indicative ground conditions and the Proposed Development (high-density residential housing and a commercial development), shallow strip foundations are unlikely to be viable. Deeper (piled) foundation solutions or surcharging are likely to be required, as the Alluvium / Warp and possible Peat soils are likely to be low strength / compressible. It is understood that Site levels are likely to be required to be raised for flood reasons, and any local excavations may give rise to unsuitable soils, in engineering terms. Soft, compressible soils and potential high groundwater levels may impact on road construction and services installation.
Environmental Review	When considered in the context of the conceptual site model (CSM) and the historical activities that have taken place (farming activities, potentially infilled ponds, local landfill), the Proposed Development is considered to pose a potential moderate risk to human health. It is considered that the main driver for the risk rating for human health is the potential for hazardous ground gases to arise from possible localised Made Ground deposits on-site, the localised Alluvium and Peat deposits expected on-site, a collection of possibly infilled ponds to the north of the Site, and the potential migration of ground gas from the off-site historical landfill to the south east. The risk posed to controlled waters is considered to be low due to a lack of a significant contaminant source on-site.

Recommendations	A ground investigation should be undertaken with in-situ and laboratory testing of the encountered soils in order to confirm the ground conditions at the Site, as well as post investigation gas and groundwater monitoring. Interpretation of the ground investigation will be required to assess the nature and extent of soil and groundwater contamination to allow a quantitative risk assessment and updated CSM and to assess the ground gas regime. Deeper boreholes will be required to determine the level of competent strata to found upon and provide initial information on any proposed surcharging strategy. Limited geotechnical information may be gained from trial pitting and dynamic sampling.
This summary should be read in conjunction with BWB's full report (ref. LLP1-BWB-XX-XX-T-G-0001_Ph1) and reflects an assessment of the site based on information received by BWB at the time of production.	

CONTENTS

FIGURES

TABLES

APPENDICES

1. INTRODUCTION

Instruction

1.1 BWB Consulting Limited (BWB) was instructed by Hargreaves Land Limited (the Client) to carry out a Phase 1 Geo-Environmental Assessment for the Planning Application 1 at Lincolnshire Lakes (North), Scunthorpe ('the Site').

1.2 The Proposed Development is anticipated to comprise a hybrid planning application as detailed below:

- Outline planning application, with all matters reserved, for the development of up to 550 residential dwellings (Use Class C3), a local centre (Use Class E) and associated 'on-plot' landscaping, drainage and other infrastructure works; and
- Full planning application for the construction of a new vehicular access off the M181/A1077(M) roundabout, a pedestrian and cycle link to Scotter Road, a foul pumping station, earthworks and 'off-plot' drainage, ecological and associated landscaping and infrastructure works.

1.3 A site boundary plan is presented as **Appendix 1**.

Objectives

1.4 This report has been completed to present pertinent information into the environmental risks and liabilities associated with the Site. It has been completed to fulfil the requirements of a preliminary risk assessment in accordance with BS 10175:2011+A2:2017 *'Investigation of potentially contaminated sites, code of practice'* and EA Guidance on Risk Management of Land Contamination https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm.

1.5 The report has also been prepared with reference to land contamination technical guidance available through https://www.gov.uk/government/collections/land-contamination-technical-guidance.

1.6 The objectives of this report are to:

- Assess historical activities at the Site with respect to their potential impact on the Site environment;
- Characterise the environmental setting of the Site, identify migration pathways and vulnerable receptors for contamination originating at the Site, focusing on potential soil and groundwater liabilities;
- Assess historical and current surrounding land use in relation to known or potential off-site contamination issues that may impact the Site;
- Review existing site investigation and remediation information for the Site, where available;
- Develop a preliminary Conceptual Site Model (CSM); and
- Assess potential environmental liabilities associated with the Site.

Scope of Work

1.7 The scope of work included:

- A site visit to inspect the current site and immediate surroundings, identify potential hazards associated with ground conditions or contamination and to determine potential constraints with regards to ground investigation (photographs presented as **Appendix 2**);
- A review of the following information:
    - Groundsure report, reference HMD-214-IUA-Q4M-M9J-E4E (**Appendix 3**);
    - Historical Ordnance Survey Mapping (**Appendix 4**);
    - Historical aerial photographs (Google Earth) and other imagery (Groundsure);
    - British Geological Survey (BGS) 1:50 000 Scale, 'Brigg', Sheet 89, Solid and Drift, (1982);
    - BGS online geological maps and exploratory hole records (www.bgs.ac.uk);
    - MAGIC website (www.natureonthemap.naturalengland.org.uk/magicmap);
    - Coal Authority Interactive Map Viewer (http://mapapps2.bgs.ac.uk/coalauthority/home.html); and
    - Regional unexploded bomb risk maps.
- A summary of the key hazards or uncertainties that require additional investigation in order to further characterise the associated risks; and
- Production of a Geo-Environmental Assessment (this report), concluding in a qualitative assessment of the risks from contamination and ground-related constraints which may impact on the Site.

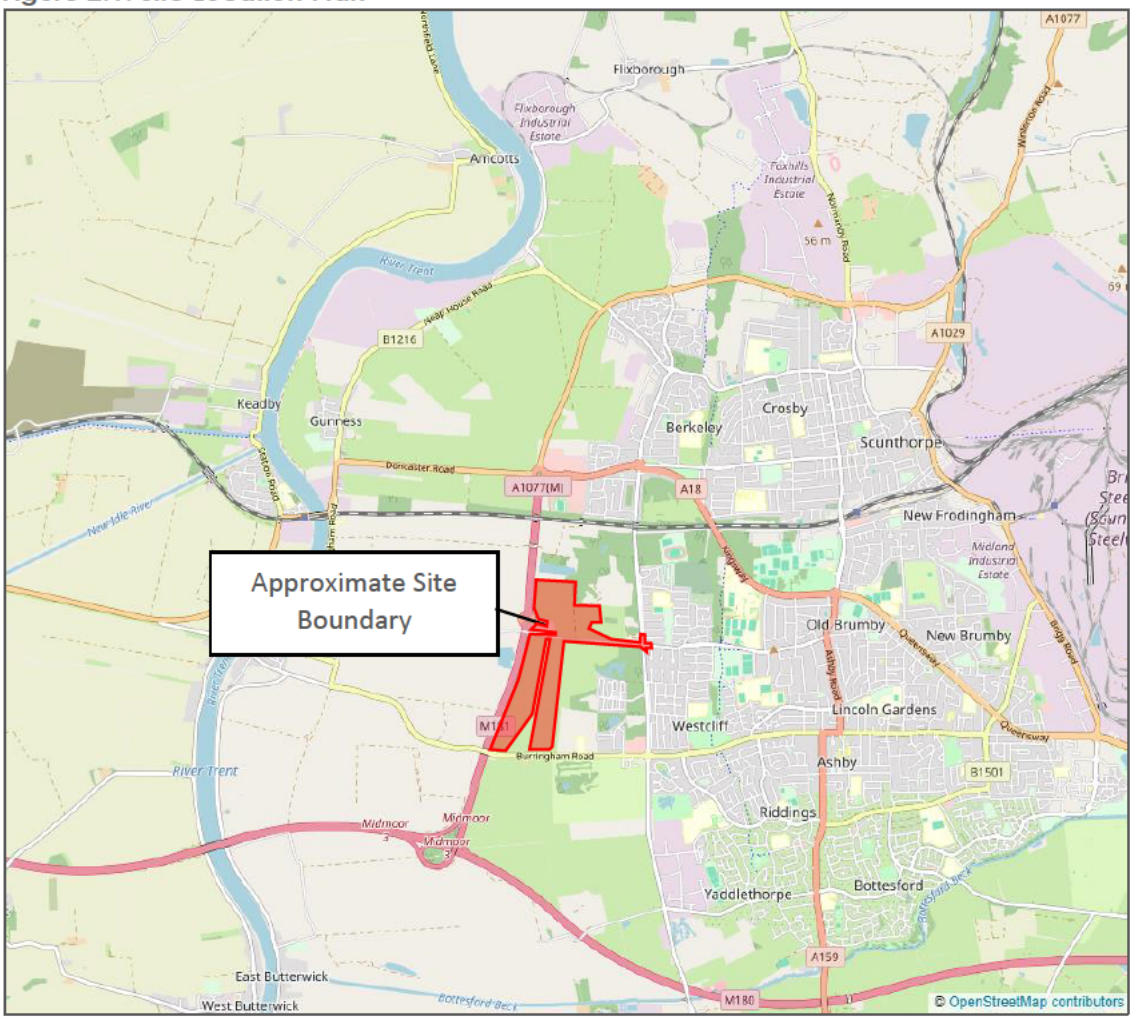
1.8 It should be noted that the Groundsure included within this report, covers the Proposed Development area and the surrounding area to the east. BWB consider the Groundsure Report still to provide relevant baseline information for this assessment.

2. THE SITE

Site Location

2.1 The Site is located immediately east of the M181/A1077(M), to the west of Scunthorpe, Lincolnshire, centred at National Grid reference 486593, 409493. The approximate location of the site is shown below in **Figure 2:1.**

Figure 2:1: Site Location Plan



Site Description

2.2 The Site comprises an irregular shaped parcel of land immediately east of the M181/A1077(M) with Brumby Common Lane dissecting the Site into a northern and southern parcel.

2.3 The Site covers an area of approximately 56.51 hectares (ha). The elevation across the Site is relatively flat and consistent at around 3-5m Above Ordnance Datum (AOD).

2.4 The Site, at present, is predominantly utilised for agricultural purposes, comprising several fields.

Site Walkover

2.5 A site walkover of the site areas was completed on 17/07/2023 by a representative of BWB. Photographs from the walkover are presented in **Appendix 2**.

Northern Section

2.6 At the time of the site walkover, the northern section of the Site was largely uniform, consisting of areas of historical agricultural use but disused and containing overgrown vegetation. In this section, areas closer to Brumby Common Lane were less densely vegetated and have seen activity more recently, with density of overgrown vegetation increasing to the north.

2.7 A fenced area was located immediately off Brumby Common Lane in the western field parcel of this section, with evidence of previous fly tipping being present on the ground nearby.

2.8 A large drainage ditch (Earl Beauchamp's Warping Drain) is located in the west of this area, partially infilled with a large amount of overgrown vegetation.

2.9 Access to Site was available via Brumby Common Lane, from which a lane runs to two field parcels in the north-east. This track can be reached by a gate off the Brumby Common Lane; however, this was locked by a chain and pin, or it can be accessed via the field to the west. Sporadic drainage ditches or drainage infrastructure connected to the lane make up the southern boundary of these field parcels.

2.10 The north-east field parcels were divided by hedgerows and drainage ditches, however, the track leads to vehicular access points for these fields. A rectangular area of mature trees was recorded in one of these north-east parcels. An area to the north of the track contains mature trees with some slight overhang over the track.

2.11 Surface ground conditions in the northern fields were largely dry at the time of the site walkover, with only the track retaining water following rainfall. Areas of soil not covered by vegetation became soft, but not boggy, though saturated ground conditions were recorded. Topography is flat across this area of the Site.

Southern Section

2.12 The southern Site area, south of Brumby Common Lane, is made up by two large fields which, at the time of the walkover, was covered by overgrown vegetation, divided by a drainage ditch running north to south. The area was accessible from Brumby Common Lane, with vehicular access achievable into both fields via gaps in the hedgerow. It was bounded along the north by a drainage ditch which follows Brumby Common Lane, before becoming a divider between the fields. It was also bounded by a rise in elevation associated with the bridge crossing the M181 in the north-west. To the immediate west is the M181 that was divided from the Site by a small wooden fence and a mix of hedgerows and trees. It was bounded by a smaller drainage ditch along the southern boundary, with working agricultural fields immediately to the south of this ditch and to the east, a second area of fields with a wooded area in the south-east.

2.13 This area consists of overgrown vegetation, which ranges in density and height, sporadically through the fields. Old track marks were noticeable throughout the field indicating soft ground.

2.14 Ground conditions in both areas were largely dry, with the less vegetated areas noticeably softer following recent heavy rain showers, however, this did not appear to create especially boggy conditions.

Potential Constraints to Ground Investigation

2.15 Access will need to be agreed in advance with the landowner of the agricultural land.

2.16 Local existing buried services are also anticipated in close proximity to and within the Brumby Farm.

2.17 Soft ground may be present in places especially after intense rainfall events.

2.18 For potential ecology reason, crossing ditches and encroaching on ditches during any ground investigation will be avoided, and a buffer zone will be observed.

Site Surroundings

2.19 The surrounding land uses at the time of the walkover survey are summarised in **Table 2:1**.

Table 2:1: Surrounding Land Use

Surrounding Land Use	
North	Agricultural land, a lake and a woodland area is located immediately north.
East	High density residential housing is located immediately east within the village of Westcliff.
South	Agricultural land and a section of medium density residential housing is located south of the southeastern parcel of land and a roughly restored landfill.
West	To the west of the Site is agricultural land. The M181/A1077(M) is located directly west of the south-eastern parcel of land.

2.20 An aerial photograph representative of the Site and surroundings, dated 04/04/2021 is included within the Groundsure report, presented as **Appendix 3**.

3. ANTICIPATED GROUND CONDITIONS

3.1 The anticipated ground conditions for the Site, and controlled waters vulnerability, is discussed within **Table 3:1**.

Table 3:1: Summary of Anticipated Ground Conditions

Anticipated Ground Conditions	
Geology	Information published by the BGS indicates that the majority of the Site is directly underlain by Warp (clay and silt) superficial deposits. The Sutton Sand Formation superficial deposits are located in the eastern section of the northern parcel of land, as well as a small portion of the southern parcel of land. A small outcrop of Alluvium is noted in the southernmost part of the southern parcel of land. The superficial deposits on both the north and south parcels overlie the Mercia Mudstone Group bedrock. Artificial ground and Made Ground are not mapped on-site. However, Made Ground deposits may be present along the M181/A1077(M), Brumby Common Lane and paths across the Site. The BGS Lexicon database describes the Warp as 'artificially induced alluvium'. Alluvium is described as 'the unconsolidated detrital material deposited by a river, stream or other body of water as a sorted or semi-sorted sediment in the bed of the stream or on its floodplain or delta, or as a cone or fan at the base of a mountain slope'. The Sutton Sand Formation is described as a 'fine-grained silt sand with thicknesses of around 7m). The Mercia Mudstone Group is described as a 'dominantly red, less commonly green-grey, mudstones and subordinate siltstones with thick halite-bearing units in some basinal areas with thin beds of gypsum / anhydrite are widespread, with thin sandstones also present'. There are three accessible BGS borehole logs within the Site boundary (all in in the north-eastern parcel of land), with another approximately 50m from the northern Site boundary. Borehole SE80NE70 recorded 0.2m of Topsoil overlying, 8.9m of fine sand, over 1.8m of silty clay, over 0.8m of Mercia Mudstone before terminating at 14.80m below ground level (bgl). Borehole SE80NE26 displays Warp deposits to 1.40m, overlying Peat to 2.5m, over sand (with intermittent clay and with gravel from 13.45m) to 14.3m. Mercia Mudstone was recorded from 14.30m bgl until termination of the borehole at 25m bgl. Thin bands of Gypsum were recorded within the mudstone from 18.28m to 24.08m bgl Borehole SE81SE31/A recorded topsoil to 0.5m, overlying intermittent medium dense sand and firm to stiff, becoming soft to firm with depth, clay strata to 12.8m, over Mercia Mudstone from 12.80m to 13.73m bgl. Borehole SE81SE31/B, north of the Site boundary, recorded topsoil to 0.4m, overlying sand until termination at 5.45m bgl.
Hydrogeology	The Environment Agency (EA) classifies al superficia strata s a Second ry A Aquifer and the ercia Mu stone Gr u as a Sec n ary B Aquifer. Bo ehole SE 0NE70 recorded a gro ndwate s rike at 2 0m bgl, E80NE26 t 3.00m, SE 1NE31/A at 1.80m, and E8 NE31/AB at 1 00m. A high roundwater vu ne ability s ecorded n site. he nearest historical roundwater bstra ti n po nt is 69 m south of the S te bou dary (spray irrigation). he Site is no indic te t be ithin, o i lose proximi y to, an EA gro ndwater Source Protection Zone.

Anticipated Ground Conditions	
	A high risk of groundwater flooding is recorded on-site. One Water Framework Directive (WFD) Groundwater body is recorded on-site, the Lower Trent Erewash with a good overall rating, good chemical rating and a good quantitative rating.
Surface Waters	Several unnamed surface water features are recorded on-site, as well as one named feature (Earl Beauchamp's Warping Drain). All are narrower than 5m and are land drainage features. Four historical surface water features are recorded on-site, all involving Earl Beauchamp's Warping Drain. One WFD surface water body catchment is recorded on site (The Bottesford Beck Catchment – Tributary of the River Trent). The EA classes the majority of the Site as being at a low risk of surface water flooding. This risk increases to medium along the far western boundary. Two historical flood events were recorded on site in 1947 with the entire Site indicated to have been affected by historical flood events. The majority of the Site is within Flood Zone 2, with a thin section being classed as Flood Zone 3, associated with the Earl Beauchamp's Warping Drain, located in the northern site area as well as a small area also classed as Flood Zone 3 in the far south west of the Site. The highest risk of surface water flooding on-site is recorded as a 1 in a 30 year return period (0.3-1.0m).
Ground Gas and Radon	The Site is in an area with a radon risk of less than 1% for which no radon gas protection is required. Alluvium, Warp and Peat (in borehole logs) superficial deposits could contain organic materials, acting as a potential source of ground gas. Any areas of deep Made Ground could present a potential source of ground gas risk. A historical landfill located immediately south-east of the southern Site boundary and a historical collection of ponds in the north of the Site also have potential to produce ground gas if they have been infilled.
Mining and Mineral Extraction	Brumby Common to the north of the Site, is a recorded historical Brit Pits surface mineral working. Three other records are recorded on site (unspecified heaps). A historical mineral planning area is recorded approximately 40m north of the site.
Environmental Sensitivity	Two nitrate vulnerability zones are recorded on-site (The Bottleford Beck Catchment and The Burton Stather Drain). The Site is located within a Site of Special Scientific Interest (SSSI) impact risk zone relating to; • Infrastructure - Pipelines and underground cables, pylons and overhead cables; • Any transport proposal including road, rail and by water (excluding routine maintenance). Airports, helipads and other aviation proposals; • Rural non-residential - Large non-residential developments outside existing settlements / urban areas where footprint exceeds 1ha; • Rural residential - Any residential development of 50 or more houses outside existing settlements / urban areas; and • Discharges - Any discharge of water or liquid waste of more than 20m³/day to ground (i.e. to seep away) or to surface water, such as a beck or stream.

4. SITE HISTORY

4.1 Historical Ordnance Survey (OS) mapping for the Site and the wider area to the east has been reviewed. These maps and plans date from 1886 to 2023. The historical plans reviewed are provided in **Appendix 3**. The key points of the historical development of the Site and surrounding area are summarised in **Table 4:1**. All distances quoted are approximate.

Table 4:1: Key Points of Development History

Dates	On Site	Off-Site
1885 - 1886	The Site formed part of open agricultural fields with sporadic pathways within. Several woodland areas were also mapped. A main road was noted running east / west between the north and southern areas. A large ***drain*** in a cutting ran north / south in the western section of the northern parcel of land, and the northern section of the southern parcel.	The surrounding area was similarly used as open agricultural land, with sporadic farms and residences. **Brumby Grove Farm** was mapped to the east of the site, consisting of a farm, and several outbuildings.
1905-1956	No significant changes.	The Viaduct Plantation was located approximately 500m north-east. An infectious diseases hospital was located approximately 400m northeast.
1963-1975	Many drainage ditches / channels were located on-site. The main drainage channel in the western section of the northern area is now identified as ***Earl Beauchamp's Warping Drain***.	In 1980, various ***ponds*** were mapped to the north and south-east of the Site. The surrounding area to the east became increasingly residentially built up (Westcliffe village). A caravan site was located approximately 300m southeast. **Brumby Grove** gained a few more outbuildings and a trough.
1980-1990	No significant changes.	The A1077/M181(M) was now mapped, located north / south immediately west of the Site.
2001-2023	No significant changes.	The ponds mapped in the woodland to the north are no longer mapped from 2001 onwards.

Historical Aerial Photography and Imagery

4.2 Aerial photographs / imagery available through Google Earth and included within the Groundsure report are summarised in **Table 4:2**.

Table 4:2: Summary of Aerial Photography

Date (Source)	Description
28/04/1999-01/05/2021 - (Groundsure and Google Earth)	The Site forms part of open agricultural fields with sporadic pathways and drainage runs within. The A1077/M181(M) was located to the west. A main road was noted running east / west between both parcels of land. Brumby Grove Farm was located to the east of the Site.

Operational / Company Records

4.3 No operational records have been made available for review as part of this assessment.

Planning History

4.4 The North Lincolnshire Council (NLC) Planning Portal was accessed on 11/07/2023 and indicated that no current or relevant planning applications have been submitted for the Site.

Summary of Site History

4.5 The Site has remained undeveloped comprising open fields.

4.6 The Site surroundings were similarly used as predominantly agricultural land throughout the mapped history. From 1968, the surrounding area (immediately east) became increasingly residentially built up. From 1980 the A1077/M181(M) ran north / south to the immediate west of the Site.

5. REGULATORY SETTING

Permits Consents and Authorisations

5.1 A full listing of permits, consents and authorisations including discharge consents, pollution incidences and other environmental information, is included in the Groundsure report, presented in **Appendix 2**.

5.2 No significant features have been identified which are considered likely to have had a detrimental impact on the Site.

Landfilling and Waste Management

5.3 A full listing of EA, BGS and Local Authority recorded landfills are provided in the Groundsure report presented in **Appendix 2**. The following facilities have been identified which have the potential to have a detrimental impact on-site:

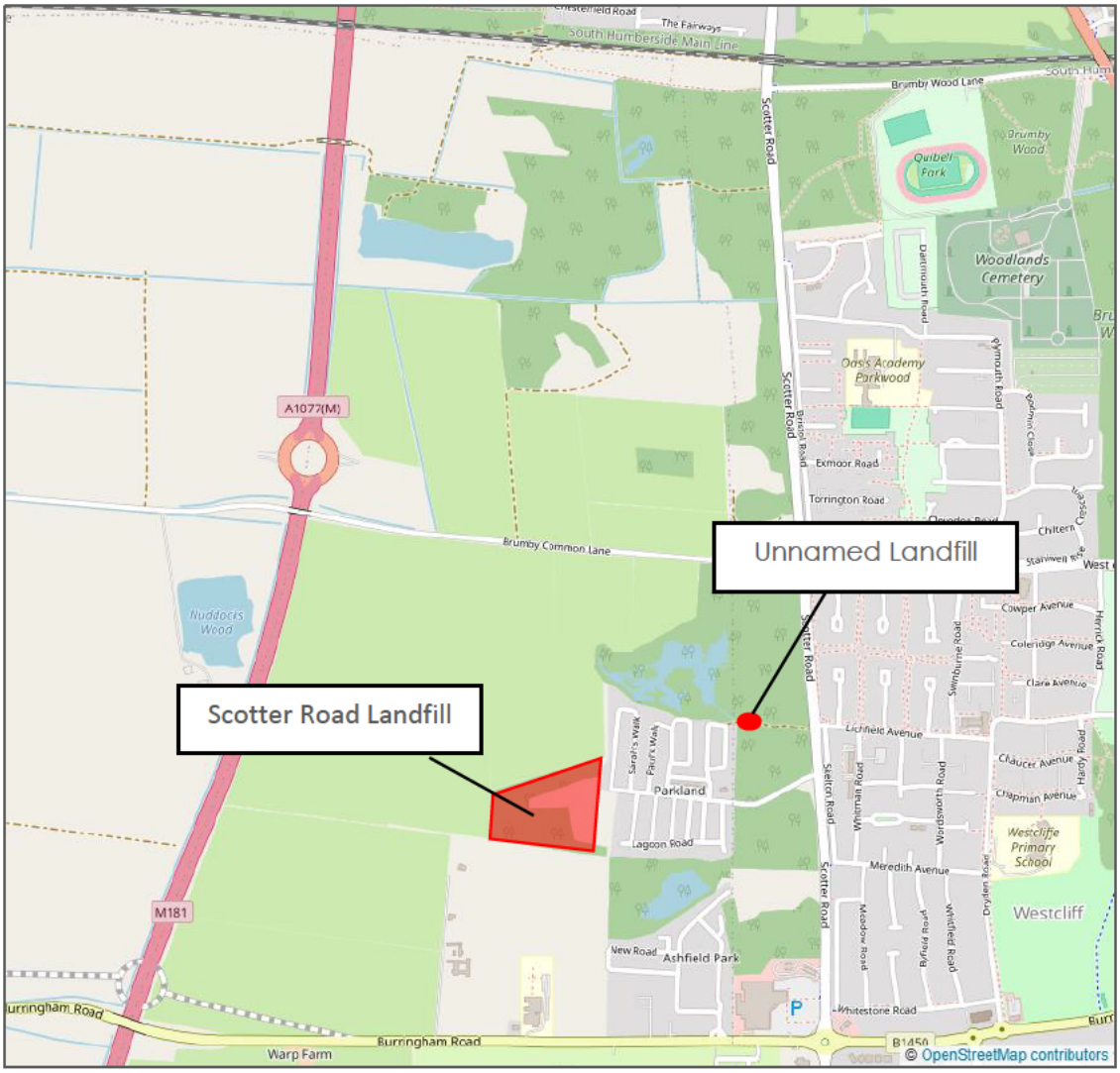
- Multiple waste exemptions are recorded on-site for disposing of waste, relating to (but not limited to) Burning of waste as a fuel in a small appliance, spreading of waste on agricultural and non-agricultural land to confer benefit, incorporation of ash into soil, pig and poultry ash and burning of waste in the open.

5.4 Two historical landfill sites were identified within 500m of the Site, as detailed in **Table 5:1**.

Table 5:1: Historical Landfill Sites

Name	Distance from Site	Details
Scotter Road / Parklands, Parklands, Scunthorpe	Immediately southeast	Accepted inert and industrial waste from 1977 to 1993, as detailed in the hashed section within **Figure 5:1**.
Unnamed Landfill	400m southeast	Refuse Tip

Figure 5:1: Historical Landfill Map



6. GEOTECHNICAL APPRAISAL

6.1 The Groundsure report, Site history, current Site setting and geological setting have all been considered in order to provide an indication of the potential ground related constraints and opportunities in the context of the Proposed Development as set out in **Table 6:1**.

Table 6:1: Ground Related Constraints & Opportunities

Potential Constraint / Opportunity	Explanation	Potential Mitigation Options
Topsoil / Made Ground	Topsoil is present across the majority of the Site. Limited Made Ground may be present along the M181/A1077(M), Brumby Common Lane and paths across the Site. Made Ground may be present within possible infilled ponds off-site.	Topsoil and Made Ground may be suitable for reuse on-site, subject to confirmation of chemical status and engineering properties via ground investigation, and confirmation of potential restrictions on reuse associated with waste management licencing. Unlikely to be suitable as engineered fill but may be placed in non-structural bunds.
Preliminary Foundation Solution	A review of the indicative ground conditions and the Proposed Development (high-density residential housing) suggests shallow strip foundations are unlikely to be viable. Deep (piled) foundation solutions or possibly ground improvement by surcharging, if feasible, are likely to be required as the Alluvium / Warp and possible Peat soils are likely to be of low strength / compressible.	Ground investigation should be undertaken to confirm ground conditions at the Site and allow for in-situ and laboratory testing to inform foundation design to competent ground.
Buried Obstructions	Given the historical uses of the Site there is limited potential for buried obstructions such as services and former foundations.	Buried obstructions may require removal locally from Site within areas of Proposed Development.
Trees	Mature trees were noted on-site, in woodland areas, the farm and sporadically around the Site.	Foundations in close proximity to new or existing trees may need to be locally deepened beyond the zone of influence of tree roots and / or heave precautions adopted.
Pyritic Geology	Ground conditions are expected to be pyritic within the bedrock strata only.	As part of ground investigation works, appropriate testing should be undertaken in relation to aggressive ground conditions.
Ground Subsidence Risks	The Groundsure Report indicates a low to negligible risk on-site associated with	Ground investigation should seek to assess the plasticity of cohesive soils, nature and

Potential Constraint / Opportunity	Explanation	Potential Mitigation Options
	shrink / swell clays, negligible to low risk of running sands, a negligible risk of collapsible deposits, a very low risk of landslides, and a negligible risk of dissolution of soluble rocks. A moderate compressibility risk is reported across site, where Alluvium and Warp deposits are mapped. Peat is not mapped but found on local borehole records which is of high risk. The Sutton Sand Formation superficial deposits have a negligible risk of compressibility.	sequence of soils, including layer thicknesses, and depth to bedrock.
Mineral Extraction	Potential minor historical mineral abstraction has been noted immediately off-site to the north.	Ground investigation should be undertaken to confirm the ground conditions in identified areas.
Earthworks	The Proposed Development is likely to include changes (raising) to site levels to mitigate flood risk.	Ground investigation should be undertaken to confirm the ground conditions at the Site and assess the compressibility of soils on-site. Settlement will impact required fill volumes.
Retaining Walls	No retaining walls were noted during the walkover.	No further assessment required.
Drainage and Soakaways	Soakaways are unlikely to be a viable option at the Site, due to the anticipated fine-grained deposits and shallow groundwater.	Should soakaways be considered as part of the drainage strategy, it is recommended that infiltration testing in accordance with current guidance is undertaken.
Roads and Pavements	California Bearing Ratio (CBR) values should be sought for road, car park and pavement design.	In-situ testing should be undertaken to derive CBR values, initially during investigation (either site or laboratory) and ultimately confirmed at construction stage
UXO	Review of the unexploded ordnance risk maps available online indicates the Site to be in an area of low risk from UXO.	No further assessment required.

7. PRELIMINARY ENVIRONMENTAL RISK ASSESSMENT

Introduction

7.1 The risk posed by any contaminants in soil or groundwater will depend on the nature of the hazard, the probability of exposure, the pathway by which exposure occurs, and the likely effects on the receptors. A contaminant is defined as a substance that has the potential to cause harm, while a risk is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.

7.2 Three impact potentials exist for any given site, all of which need to be considered in a risk assessment, which are:

- The site impacting upon itself;
- The site impacting on its surroundings; and
- The surroundings impacting on the site.

7.3 The following sections discuss all the identified potential on and off-site sources, pathways and receptors in the context of the proposed development and plausible pollutant linkages which may represent a risk to identified receptors such as human health and/or controlled waters from the data gained from the desk study.

7.4 The assessment is qualitative and aimed to determine all likely pollutant linkages, with consideration of significance and allowing for uncertainties.

7.5 **Sources (S):** These are potential or known sources of contamination that may relate to a former land use or present site feature or process (e.g., fuel storage tanks).

7.6 **Pathways (P):** A pathway is defined as a mechanism or route by which a contaminant comes into contact with, or otherwise affects a receptor. Pathways by which the identified receptors may be impacted upon in the context of the proposed development.

7.7 **Receptors (R):** Receptors are defined as people, living organisms, ecological systems, controlled waters, atmosphere, structures and utilities that could be adversely affected by contaminant(s).

Conceptual Site Model

7.8 Consideration has been given to the likely sources, pathways and receptors which may be present, based on the information in the previous sections. These are presented in **Table 7:1** and **Table 7:2** and further information about the risk classification scheme is included within **Appendix 4**, with reference to CIRIA C552 '*Contaminated land risk assessment - a guide to good practice*'.

7.9 A tabulated version of the Preliminary CSM based on the desk study and Site observations is presented in **Table 7:3.**

Table 7:1: Potential Sources of Contamination

Location	Potential Source	Contaminants of Potential Concern (CoPC)
On-site	Localised **MADE GROUND** associated with the M181/A1077(M), Brumby Common Lane and paths across the Site.	• Heavy metals; • Inorganics, such as cyanides, sulphates, and nitrates; • Ph; • Asbestos Containing Materials (ACMs); • Petroleum hydrocarbons; and • Methane, carbon dioxide.
	AGRICULTURAL WORKS and works including practices covered under **WASTE EXEMPTIONS.**	• Inorganics, such as cyanides, sulphates, and nitrates; • pH; • Pesticides and herbicides; and • Petroleum hydrocarbons.
	ALLUVIUM and PEAT deposits	• Methane, carbon dioxide.
Off-site	Contamination associated with **HISTORICAL LANDFILLED AREA.**	• Heavy metals; • Inorganics, such as cyanides, sulphates, and nitrates; • pH; • VOCs; • SVOCs; • PAHs; • Petroleum hydrocarbons; and • Methane, carbon dioxide.
	MADE GROUND and **CONTAMINATION** associated with the historical potentially **INFILLED PONDS**	• Heavy metals; • Inorganics, such as cyanides, sulphates, and nitrates; • VOCs; • SVOCs; • PAHs; • Petroleum hydrocarbons; and • Methane, carbon dioxide.

Table 7:2: Relevant Potential Pathways and Receptors

Receptors	Pathways
Human Health: • Future site users (residential); • Neighbouring public (residential); and • Intrusive maintenance workers.	• Dermal contact with soil or dust; • Incidental ingestion of soil and / or dust; • Inhalation of dust and / or fibres; • Ingestion of contaminated vegetables and/or soil attached to vegetables; • Inhalation of vapours; and • Migration and accumulation of ground gas in enclosed spaces leading to inhalation or explosion.
Controlled Waters: • Groundwater (Secondary A, B and Undifferentiated Aquifers); and • Surface water (several unnamed watercourses and	• Leaching of soil contaminants; • Vertical and lateral migration; and • Surface run-off.

Receptors	Pathways
Earl Beauchamp's Warping Drain).	
Ecology: • Flora and Fauna; and • SSSI/LNR (Two nitrate vulnerability zones and SSSI impact risk zone).	• Lateral migration; and • Uptake and accumulation.
Property: • Underground utilities; and • Building structures.	• Direct Contact; and • Accumulation and explosion of gas.

Table 7:3: Preliminary Conceptual Site Model

Source	Pathway	Receptor	Con	Prob	Risk	Potential Mitigation / Investigation Requirements
On-site sources as detailed in **Table 7:1**.	Dermal contact with, and incidental ingestion of soil and / or dust Inhalation of dust and/or fibres	Future site users (residential / commercial / recreational)	Md	Ul	L	As part of the Proposed Development, it is anticipated that hardstanding will be present across the majority of the Site. This will limit the potential for direct contact with, and minimise dust generation from, potentially contaminated soils at the Site post construction. In public open space / landscaped and residential areas the provision of a clean capping layer would restrict direct access to potentially contaminated soils should they be present. It is recommended that an intrusive ground investigation be completed in order to assess the extent of any potential contamination at the Site.
	Ingestion of contaminated vegetables and / or soil attached to vegetables	Future site users (residential / commercial / recreational)	Md	Ul	L	In landscaped areas / garden areas where there is the potential for allotments, the provision of a clean capping layer would with appropriate demarcation at depth would limit the potential for vegetables to be grown in potentially contaminated soils should they be present.
	Inhalation of vapours	Future site users (residential / commercial / recreational)	Md	Ul	L	In the event that elevated concentrations of volatile contaminants are identified during ground investigation works, potential sources of vapours such as Made Ground and contaminated soils / groundwater could potentially be mitigated through removal or treatment prior to construction, or the installation of protection measures may be required during construction to mitigate the potential risk to future site users from vapours.
		Neighbouring public	Md	Ul	L	
	Migration and accumulation of ground gases in enclosed spaces leading to asphyxiation (carbon dioxide) or explosion (methane)	Future site users (residential / commercial / recreational)	Sv	L	M	Limited Made Ground is expected across the Site. Alluvium, Warp and possibly Peat are expected throughout Site. Potentially infilled ponds could be apparent in the north of the Site. The presence of the above indicates a potential risk from ground gases. Ground investigation should include the installation of ground gas monitoring wells in order to determine the risk posed from ground gases.

Source	Pathway	Receptor	Con	Prob	Risk	Potential Mitigation / Investigation Requirements
	Leaching and permeation through soil profile	Groundwater: Underlying Secondary A, B and Undifferentiated Aquifers	Md	UI	L	Groundwater has been recorded between 1.4m and 3m depth but may increase at times as shown by a high risk of groundwater flooding present. A significant source of contamination has not been identified at the Site. The risk should be quantified through appropriate ground investigation and risk assessment.
	Vertical and lateral migration of contaminants		Md	UI	L	
	Surface run-off	Many Unnamed watercourses / features on-site	Md	UI	L	
	Direct contact	Water utility pipes	Md	UI	L	Organic compounds in the shallow soils could taint the water supply. A ground investigation and subsequent laboratory analysis should be undertaken to inform the design of new services.
		Buried structures / foundations	Mi	Li	M/L	Sulphates and low pH in the ground could accelerate the degradation of buried concrete structures (e.g., foundations). Ground investigation should include an assessment of the concrete design class. The Mercia Mudstone underlying the superficial deposits on-site is known to accelerate the degradation of buried concrete structures.
On-site sources as detailed in **Table 7:1**.	Migration and accumulation of ground gases in enclosed spaces leading to asphyxiation (carbon dioxide) or explosion (methane)	Future site users (residential / commercial / recreational)	Sv	L	M	Ground gas monitoring should be completed as part of an intrusive ground investigation in order to characterise the ground gas regime at the site. Where possible, monitoring wells should be located along the south-eastern Site boundary in order to delineate any potential gas migration.
	Lateral migration of contaminated groundwater.	Groundwater: Underlying Secondary A, B and Undifferentiated Aquifers	Md	UI	L	Several localised sources of potential contamination were identified adjacent to the Site, which could possibly migrate towards Site. Intrusive ground investigation should be undertaken to quantify the risk. Where possible, groundwater monitoring wells should be located along the site boundaries in order to delineate any potential contamination.
VH = Very High, H = High, M = Moderate, M/L = Moderate/Low, L = Low, VL = Very Low						

Source	Pathway	Receptor	Con	Prob	Risk	Potential Mitigation / Investigation Requirements
KEY: Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor, Hi = High, Li = Likely, Lw = Low Likelihood, Ul = Unlikely						
Pollutant Linkage Assessment Summary When considered in the context of the conceptual site model and the historical activities that have taken place (Farming activities), the Proposed Development is considered to pose a MODERATE risk to human health. It is considered that the main driver for the risk rating for human health is potential for hazardous ground gases to arise from organic rich natural deposits on-site, localised Made Ground and the off-site historical landfill site. The risk posed to controlled waters is predominantly considered to be LOW due to the lack of a significant contamination source identified on-site. It is recommended that a ground investigation be undertaken to quantify the identified pollutant linkages and assess any likely mitigation measures.						

8. ENVIRONMENTAL LIABILITY ASSESSMENT AND DEVELOPMENT IMPLICATIONS

Statutory Liability

8.1 The contaminated land regime has implications for those who cause or knowingly permit land to be contaminated, or who own or occupy land that is contaminated. Contaminated land is defined in Section 78A(2) of Part IIA of the Environmental Protection Act 1990 as:

"Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that:

i. Significant harm is being caused or there is a significant possibility of such harm being caused; or

ii. Significant pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused."

8.2 Harm is defined in Section 78A(4) of the Environmental Protection Act 1990 as:

"Harm to the health of living organisms or other interference with ecological systems of which they form part and, in the case of man, includes harm to his property."

8.3 Once an area of land has been identified as contaminated land, appropriate persons will be identified as being responsible for the cost of cleaning up the land by the enforcing authority. The appropriate person will be liable for all or part of the remediation of the land. Two classes of appropriate person have been identified:

- Class A appropriate persons are those who cause or knowingly permit the pollutants to be in, on or under the land; and
- Class B appropriate persons are the owners(s) or occupier(s) of the land.

8.4 Where no Class A appropriate persons can be identified, then Class B appropriate persons may become liable.

8.5 Based on the information available regarding the site, the potential for Statutory Authority action based on "pollution of controlled water" or "significant harm" as defined by Part IIA of the Environmental Protection Act 1990 is considered to be LOW.

Third Party Liability

8.6 Based on the information contained in this report, it is the opinion of BWB that the potential for legal action by surrounding landowners, based on the potential for contamination to migrate off-site, is considered to be LOW when considering the agricultural history of the local area.

Public Relations

8.7 The likelihood of public relations being tarnished due to contamination issues at the site are considered to be LOW.

Development Implications

8.8 The historical landfilled area is noted on the Groundsure but is not recorded on historical maps.

8.9 It is recommended that the requirement for earthworks and potential for re-use of or disposal of waste is established at an early stage in the project.

9. CONCLUSION AND RECOMMENDATIONS

Conclusions

9.1 The Site is located immediately east of the A1077/M181(M), and to the west of Scunthorpe, Lincolnshire.

9.2 The Proposed Development is anticipated to comprise a residential-led mixed use development. The Site has remained undeveloped comprising open fields throughout its mapped history.

9.3 The Site surroundings were similarly used as predominantly agricultural land throughout the mapped history. From 1968, the surrounding area (to the east) became increasingly residentially built up. A historical Landfill was located immediately south-east of the southern Site boundary and operated from 1977 to 1993. From 1980 the A1077/M181(M) ran north / south to the immediate west of the Site.

9.4 Information published by the BGS indicates that the majority of the Site is directly underlain by Warp (clay and silt) superficial deposits with a small outcrop of The Sutton Sand Formation superficial deposits are located in the eastern section of the northern parcel of land, as well as a small portion of the southern parcel of land. Alluvium is noted in the southernmost part of the southern parcel of land. The superficial deposits on both the northern and southern parcels overlie the Mercia Mudstone Group bedrock.

9.5 Artificial ground is not indicated to be present on-site. Made Ground may be present along the M181/A1077(m) to the west. It could also be present in large quantities, off-site to the north with a collection of historical ponds displaying the potential to have been infilled.

9.6 In consideration of the indicative ground conditions and the Proposed Development (high-density residential housing and a commercial development) shallow strip foundations are unlikely to be viable. Deeper (piled) foundation solutions or possibly ground improvement by means of surcharging, if feasible, are likely to be required as the Alluvium / Warp and possible Peat soils are likely to be of low strength / compressible.

9.7 When considered in the context of the CSM and the historical activities that have taken place (farming activities, off-site potentially infilled ponds, local off-site landfill), the proposed development is considered to pose a potential MODERATE risk to human health. It is considered that the main driver for the risk rating for human health is the potential for hazardous ground gases to arise from localised Made Ground deposits on-site, the Alluvium and Peat deposits expected on-site, a collection of potentially infilled ponds offsite to the north, and the potential migration from the off-site historical landfill to the south-east.

9.8 The risk posed to controlled waters is predominantly considered to be LOW due to a lack of a significant contaminant source.

Recommendations

9.9 A ground investigation should be undertaken at the Site with in-situ testing, laboratory testing of the encountered soils and gas and groundwater monitoring in order to confirm the ground conditions at the Site. The ground investigation will need to extend through the weak superficial soils to prove competent material if foundation solutions are to be determined.

9.10 Interpretation of the ground investigation will be required to assess the nature and extent of soil and groundwater contamination to allow a quantitative risk assessment and updated CSM and to assess the ground gas regime.

10. REFERENCES

1. BS 10175:2011+A2:2017 Investigation of potentially contaminated sites. Code of practice. British Standards Institute, 2017.

2. CIRIA C552 *Contaminated land risk assessment. A guide to good practice*. Rudland, D J, Lancefield, R M, Mayell, P N, 2001.

3. Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance. Department for Environment Food and Rural Affairs (DEFRA), 2012.

4. Land Contamination Risk Management. Environment Agency, 2020.

5. https://www.gov.uk/government/collections/land-contamination-technical-guidance.

6. The Control of Asbestos Regulations. Health and Safety Executive, 2012.

APPENDICES

Appendix 1: Redline Boundary Plan

N

50 0 50 100 150 200 250

SCALE 1:5000 m

KEY

RED LINE BOUNDARY

OTHER LAND UNDER CLIENT OWNERSHIP

Rev	Description	Date	Drn	Ckd
P1	FIRST ISSUE	15.01.24	TD	CG

Status

SKETCH - NOT FOR CONSTRUCTION

SMR
SMALLEY MARSEY RISPIN
ARCHITECTS
Floor 2 The Exchange Station Parade Harrogate HG1 1TS
01423 707 757 admin@smrarchitects.co.uk

Project

LINCOLNSHIRE LAKES

Client

Hargreaves Land

Drawing Title

LOCATION PLAN

Proj Ref	Origin	Zone	Level	Type	Role	Num	Status	Rev
7730	SMR	00	ZZ	DR	A	2001	S3	P1

SMR Job Ref	Sheet	Scale	Drawn
7730-00-2001	A1	NOTED	TD

Appendix 2: Site Photographs

Project Number: 221423
Project Name: Lincolnshire Lakes
Site Photographs

Photo 1 – View facing east of Brumby Common Lane towards Scunthorpe.

Photo 2 – View facing west of Brumby Common Lane, towards motorway bridge.

Project Number: 221423
Project Name: Lincolnshire Lakes
Site Photographs

Photo 3 – View of the southern section's first area, with road access and motorway in background.

Photo 4 – View south of drainage ditch that divides the first area, overgrown with vegetation.

Project Number: 221423
Project Name: Lincolnshire Lakes
Site Photographs

Photo 5 – View facing south within the first area, field consists largely of overgrown vegetation and even terrain.

Photo 6 – View south along western boundary with overgrown vegetation and a natural boundary of mature trees between the field and the M181.

Project Number: 221423
Project Name: Lincolnshire Lakes
Site Photographs

Photo 7 – View to the southwest along the southern boundary, vegetation thins towards a drainage ditch forming border. Pylons on neighbouring field.

Photo 8 – View southeast towards the wooded area over historical landfill site.

Project Number: 221423
Project Name: Lincolnshire Lakes
Site Photographs

Photo 9 – View south along eastern boundary with the second area, divided by drainage ditch marked by overgrown plants.

Photo 10 – View to west of metal fenced area in layby. View of M181 in background.

Project Number: 221423
Project Name: Lincolnshire Lakes
Site Photographs

Photo 11 – Small areas of fly tipped material around the layby area.

Photo 12 – View to northeast of warping drain ditch that divides this area, overgrown vegetation throughout.

Project Number: 221423
Project Name: Lincolnshire Lakes
Site Photographs

Photo 13 – View west towards M181, northwest field parcel contains overgrown vegetation becoming denser to the north.

Photo 14 – View to east of neighbouring field, evidence of vehicle usage connecting layby to central track.

Project Number: 221423
Project Name: Lincolnshire Lakes
Site Photographs

Photo 15 – View north along central track, dividing two western field parcels from remainder of northern section. Leads to northeast parcels.

Photo 16 – View to south from central track. Access obtainable by gate locked by chain and pin at time of visit. Hedgerow divides track and small ditch.

Project Number: 221423
Project Name: Lincolnshire Lakes
Site Photographs

Photo 17 – View east along track northern bend. Ditch divides track from bordering field parcel. Hanging branches over track.

Photo 18 – View to south from track, unmarked entry path into field parcel with rectangular patch of trees.