Castledine Environmental

LAND CONTAMINATION SURVEYS

Phase 1 Land Contamination Risk Assessment

for

Proposed Industrial Usage

on the site of

Site 4B, Great Yarmouth Energy Park, Between Salmon & Suffling Road, Great Yarmouth NR30 3QP

Date: November 2022

Status:	Final Report
Reference:	3423D P1 Trent Energy – Gt. Yarmouth
Date:	30/11/2022

[redacted]399 [redacted]@castledineenvironmental.co.uk

4 Wymeswold Road, Hoton, Loughborough, Leicestershire, LE12 5SN

EXECUTIVE SUMMARY

The site currently comprises an open expanse of tarmac and concreted areas which was formerly a lorry park. Historically, the site has been located in a heavily industrialised area since at least circa.1905 and as occupied by unknown industrial usages since at least circa.1927 to recent times.

The industrial development and usage of the site and surrounding areas, various developments and demolitions on site, and the storage of a large number of tanks (both on site and adjacent) and lorries and tankers are considered potentially significant sources of contamination.

Based on the information contained in this report, it is the opinion of Castledine Environmental that the site represents a **MODERATE** level of risk with respect to the proposed development.

It is recommended that further investigation inline with Section 11.0 is planned and carried out on site.

This report should be submitted to your Local Planning Authority for agreement to allow the Phase 2 intrusive testing to be undertaken.

CONTENTS

LIST OF APPENDICES

LIST OF TABLES

1.0 QUALITY ASSURANCE

Castledine Environmental confirm that all reasonable efforts have been made to ensure that the information outlined within this report is accurate.

Castledine Environmental would further confirm that due care, attention and technical skill were used in the creation of this report.

For and on behalf of Castledine Environmental

(Director)

2.0 LIMITATIONS

The conclusions and recommendations made in this report are limited to those based on the findings of the investigation. Where comments are made based on information obtained from third parties, Castledine Environmental assumes that all third-party information is true and correct. No independent action has been undertaken to validate the findings of third parties. The assessments and interpretation have been made in line with legislation and guidelines in force at the time of writing, representing best practice at the time.

This survey has not included asbestos within existing structures, invasive plant species, geotechnical considerations or any elements unconnected with potential ground contamination at the site. If required, such surveys should be undertaken by suitably accredited organisations.

There may be other conditions prevailing at the site which have not been disclosed by this investigation and which have not been taken into account by this report. Responsibility cannot be accepted for conditions not revealed by the investigation.

3.0 INTRODUCTION

Castledine Environmental have been appointed by Trent Energy Limited to undertake a Phase 1 Desk study on Site 4B, located between Salmon and Suffling Road, Great Yarmouth Energy Park, Great Yarmouth NR30 3QP.

4.0 SCOPE

Castledine Environmental have prepared this report for the sole use and reliance of Trent Energy Limited and their appointees for the purpose of ensuring compliance with:

- Paragraph(s) 174, 179, 183 & 184 of the National Planning Policy Framework 2021
- Part C1 of the building regulations
- Support of a Planning Application

This report may not be used or relied upon by any unauthorised third party, or for any other proposed use than that specified above, without the explicit written agreement of Castledine Environmental

The report consists of a preliminary risk assessment in accordance with BS10175:2011+A2:2017, CLR11 “Model Procedures for the Management of Land Contamination” and LCRM “Land Contamination Risk Management”.

The objectives of the report are:-

- To assess historical activities at the site with respect to their potential impact on the site environment.
- To 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.
- To assess historical and current surrounding land use in relation to known or potential off-site contamination issues that may impact on the subject site and
- To develop a preliminary conceptual site model (CSM).

5.0 SITE DESCRIPTION

The site is located in Great Yarmouth at National Grid Reference: 652859,305573 and is approximately 0.22ha in area.

The site is rectangular in shape and is orientated slightly north east to south west. The site is located in a predominantly urban and industrialised area and is directly bounded by a sewage works and a liquid-fertiliser industry to the north and north west of site, respectively. Admiralty Road to the east, Salmon Road to the south and a former lorry park to the west of site. The River Yare is located approximately 122m west of site and the North Sea is located approximately 378m east of site.

The site interior comprises an open, largely unoccupied former lorry-park. The entirety of site is occupied by tarmacked and concreted areas and large, lorry parking bays. A motorhome was noted parked in a small, concreted bay on the northern boundary of site, with a low brick-wall located around this. Some vegetation was noted growing through cracks and joins in concrete along the easternmost boundary of site and along the northern. Standing water a manhole were noted in the remaining open areas of site.

The adjacent sewage works, the surrounding industrial area and the sites former usage as a lorry park are considered potential sources of contamination. Topographically, the site is level.

Photos of the site are present in Appendix D

6.0 REGULATORY AUTHORITY AND OTHER ENVIRONMENTAL DATA

An environmental search listing historical and environmental factors likely to affect the property has been reviewed. Additional geological and hydrological data was obtained from the British Geological Survey.

The most pertinent information is summarised in the following sections.

A copy is presented in Appendix A.

6.1 HYDROLOGICAL

6.1.1 AQUIFER

6.1.1.1 SUPERFICIAL GEOLOGY

ID	Distance (m)	Direction	Designation	Description
1	0	On Site	Secondary A	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
2	121	W	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow

6.1.1.2 BEDROCK GEOLOGY

ID	Distance (m)	Direction	Designation	Description
1	0	On Site	Principal	Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers

6.1.2 ABSTRACTIONS AND PRIVATE WATER SUPPLIES

None recorded within 250m of site.

6.1.3 SOURCE PROTECTION ZONE

The site is not located in a Source Protection Zone (SPZ).

6.1.4 GROUNDWATER VULNERABILITY AND SOIL LEACHING POTENTIAL

An assessment of the vulnerability of groundwater to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties within a one-kilometre square grid. Groundwater vulnerability is described as High, Medium or Low as follows:

- High - Areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits.
- Medium - Intermediate between high and low vulnerability.
- Low - Areas that provide the greatest protection from pollution. They are likely to be characterised by low leaching soils and/or the presence of superficial deposits characterised by a low permeability.

ID	Location	Summary	Soil / Surface	Superficial geology	Bedrock geology
1	On site	Summary Classification: Secondary superficial aquifer - High Vulnerability Combined classification: Productive Bedrock Aquifer, Productive Superficial Aquifer	Leaching class: High Infiltration value: >70% Dilution value: <300mm/year	Vulnerability: High Aquifer type: Secondary Thickness: >10m Patchiness value: >90% Recharge potential: No Data	Vulnerability: Low Aquifer type: Principal Flow mechanism: Intergranular

6.1.5 POTENTIAL SURFACE WATER

The Groundsure report records the tidal River Yare located 158m west of site and satellite imagery shows the North Sea coastline to be located approximately 378m east of site.

6.1.6 DISCHARGE CONSENTS

The Groundsure report records 4 No. licenced discharge consents held 119m west of site and an additional record located 248m north west of site.

The records located 119m west of site relate to sewage discharges on behalf of the water company and discharging into the River Yare. Of the 4 No. records, only a single is active and is recorded as in effect from 23/02/2002. The remaining record relates to final/treated effluent discharges not on behalf of the local water company, also discharging into the River Yare and is recorded as in effect from 24/03/1986.

No further licenced discharge consents are recorded within 250m of site.

6.2 PERMITTED PROCESSES

The Groundsure report records a current Part B Permit located 139m north east of site and relating to the respraying of road vehicles; a historical permit at the same location and relating to the same processes

The Groundsure report records 4 No. Part B Permits located within 250m of site. Of these, 2 No. are located 139m north east of site and relate to the respraying or road vehicles with a single active permit and a historical permit here; an active permit relating to hot dip galvanising processes is located 235m north and a historical permit relating to a waste oil burner is then located 243m north east of site.

No further permitted processes are located within 250m of site.

6.3 COMAH SITES

The Groundsure report records a current, Lower Tier COMAH Operator located 153m north west of site at ASCO UK. No further COMAH sites are located within 250m of site with the nearest beyond this being a historical NIHHS site located 232m north west of site.

6.4 POLLUTION INCIDENTS

The Groundsure report records an incident located 34m north of site and dated 03/11/2002. The incident related to storm sewage releases with a minor impact to water quality and no impact to land or air quality.

No further pollution incidents are located within 250m of site and no significant impact incidents are recorded within 500m of site.

6.5 RADIOACTIVE SUBSTANCES REGISTRATIONS

None recorded within 250m of site.

6.6 WASTE

6.6.1 LICENSED WASTE MANAGEMENT FACILITIES (LOCATIONS)

None recorded within 250m of site; the nearest record beyond this is an asbestos waste transfer station located 251m north of site and dated 10/11/2006.

6.6.2 HISTORICAL WASTE SITES

The Groundsure report records a historical waste transfer station located 206m north west of site and dated 01/05/1999. The site is described as:

"Construction of a waste transfer station. The work will involve the construction of a waste transfer station which will include a recycling centre.

Also included is a main storage building with roller shutters, laboratory, changing rooms, mess and power wash bays, portable buildings, toilets, offices and storage tanks. An application (ref: 06/98/0582/F) for Detailed Planning permission was granted by Great Yarmouth B.C. on 4th September 1998."

6.6.3 LANDFILL SITES

None recorded within 500m of site.

6.7 HAZARDOUS SUBSTANCES

None recorded within 250m of site; the nearest record beyond this is a historical record located 464m south of site, however no details are held relating to the site.

6.8 LIST 2 DANGEROUS SUBSTANCE SITES

The Groundsure report records List 2 Dangerous Substance Sites located 7m south west and 180m south east of site with both authorised substances recorded as ‘pH’.

No further List 2 sites are located within 250m of site with the nearest beyond this being a site located 253m south and also relating to pH authorised substances.

6.9 ECOLOGICAL RECEPTORS

The Groundsure report records the site as being located within the Norwich Crag and Gravels groundwater Nitrate Vulnerable Zone (NVZ) and with an additional record of the NVZ being located 382m north of site. The Groundsure report also records a Special Protection Area (SPA) located 118m west of site and relate to tidal rivers and a Special Area of Conservation (SAC) located 382m east of site and relating to the Southern North Sea.

6.10 SOILS AND GEOLOGY

"Contains British Geological Survey materials © NERC 2022" obtained from http://www.bgs.ac.uk/data/mapViewers/home.html under the Open Government Licence

6.10.1 SUPERFICIAL DEPOSITS

Both BGS geological mapping and the Groundsure report record superficial geological deposits of the North Denes Formation on the western half of site and comprising sands with subordinate gravels and thin layers of silty clay; and Blown Sand Deposits on the eastern half of site, comprising sand transported by aeolian (airborne) processes.

Records of the Breydon Formation, comprising an unconsolidated silt and clay with a shelly marine fauna and peat, of freshwater and brackish origins and is a major component and the formation underlies much of the marshland in the Great Yarmouth District, are located 121m west of site.

Tidal River or Creed Deposits, comprising mainly silts and clays with possible lenses of peat, sands and gravels are then mapped 148m west; and the Happisburgh Glaciogenic Formation, comprising a range of diamictons, sands and gravels, sands and laminated silts and clays is then mapped 213m south west of site.

6.10.2 SUPERFICIAL DEPOSITS PERMEABILTY

The Groundsure report records the site as being within an area where the maximum permeability of superficial deposits is recorded as 'very high to high' and the minimum permeability as 'high' and facilitated by intragranular flow mechanisms.

6.10.3 BEDROCK DEPOSITS

Both BGS geological mapping Groundsure report record bedrock geology of the Crag Group underlying site, comprising sands, gravels, silts and clays.

6.10.4 BEDROCK PERMEABILITY

The Groundsure report records the site as being within an area where the maximum permeability of bedrock geology is recorded as 'very high' and the minimum permeability as 'high' and facilitated by intergranular flow mechanisms.

This is a qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of any superficial deposits (the zone between the land surface and the water table).

6.10.5 ARTIFICIAL GROUND

BGS geological mapping records extensive areas of artificial deposits described as ‘made ground (undivided) located 81m and 212m west of site (and being orientated north to south here along the banks of the River Yare) and 213m east of site (also being orientated north to south and forming what appears to be sea defences along the coastline).

6.10.6 BGS ESTIMATED BACKGROUND SOIL CHEMISTRY

The Groundsure report records BGS background soil chemistry for the site. This is estimated values providing the likely background concentration of the potentially harmful elements Arsenic, Cadmium, Chromium, Lead and Nickel in topsoil. The values are estimated primarily from rural topsoil data collected at a sample density of approximately 1 per 2 km2. In areas where rural soil samples are not available, estimation is based on stream sediment data collected from small streams at a sampling density of 1 per 2.5 km2; this is the case for most of Scotland, Wales and southern England. The stream sediment data are converted to soil-equivalent concentrations prior to the estimation.

The Groundsure report records arsenic, lead & bioaccessible lead, cadmium, chromium and nickel at background concentrations of 15mg/kg, 100mg/kg & 60mg/kg, 1.8mg/kg, 20-40mg/kg and 15mg/kg, respectively.

Assuming a worst-case generic acceptance threshold (GAC) of 1% soil organic matter (SOM), none of the recordings are above the generic acceptance thresholds of 37mg/kg, 200mg/kg (both lead and bioaccessible lead), 11mg/kg, 910mg/kg and 180mg/kg, respectively.

6.10.7 COAL MINING

The site is not located in a coal mining reporting area.

6.10.8 NON-COAL MINING

The Groundsure report records a ceased operations former sand pit located 244m south east of site.

6.10.9 SURFACE WORKINGS

ID	Distance [m]	Direction	Land Usage	Year of Mapping
A	76	W	Quay	1949
B	90	W	Unspecified wharf	1949
B	90	W	Unspecified wharf	1904
A	99	W	Quay	1952
1	103	E	Refuse heap	1884
2	107	W	Quay	1978
A	119	SW	Quay	1988
B	122	W	Unspecified wharf	1978
3	144	NE	Sand pit	1884
C	205	SE	Sand pit	1901
D	206	W	Quay	1988
E	206	W	Quay	1978
C	208	SE	Sand pit	1884
E	209	W	Quay	1938
E	209	W	Quay	1938
F	209	W	Quay	1978
F	209	W	Quay	1988
F	211	W	Quay	1946
F	211	W	Quay	1904
D	212	W	Quay	1946
D	212	W	Quay	1904
F	226	SW	Quay	1938
F	226	SW	Quay	1938

6.10.10 RADON

The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level. No radon protective measures are necessary as described in publication BR211:2015 by the Building Research Establishment.

6.11 AERIAL PHOTOGRAPHY

Aerial photography shows the following:

6.11.1 GOOGLE MAPS

The site is shown as occupied by a lorry park with a number of trailers, tractor units and at least 8 No. tankers parked in the far east of site. The small parking bay noted on the walkover in the north of site is at this time shown adjacent to a large tank and is likely an interceptor bay; however, some staining appears to be located adjacent to the tank and outside the bay.

6.11.2 GOOGLE EARTH

9 No. images are held in the historic imagery dataset, as follows:

Date	Description
December 1999	The site is shown as located within a wider industrialised area and as directly bounded by the sewage works to the north of stie. The site is occupied by a large lorry-park. The large tank seen in the north of site in the present-day is not present and the far eastern extent of stie appears occupied by a building, located on, inside and parallel with the eastern boundary of site. The site is occupied by a number of parked lorries at this time.
September 2006	The building located along the eastern boundary of site has now been demolished and removed. The area is now occupied by a number of parked lorries and trailers and 2 No. small tanks in the NE corner of site. The brick-walled bay / interceptor is now present and a red-tank appears located atop the feature.
December 2006	No major change on site.
May 2015	No major change on site.
April 2017	The red tank located in the interceptor bay has now been removed and replaced with a larger, blue tank located adj. to the east of the bay. The number of tankers in the NE / east of site has increased to 8 No.
May 2017	The number of vehicles stored on site has decreased.
April 2019	The site is now unoccupied and the tank has been removed.
August 2019	No major change on site; the industrial unit to the NW of site has now been demolished and removed, leaving an open expanse of concrete.
June 2021	The site remains unoccupied and areas of site are shown as slightly vegetated, indicating disuse. The area north and NW of site (previously cleared of structures) is now in use once again, with stacks of containers, 2 No. weigh bridges and at least 3 No. large tanks located here (tanks directly north of site).

6.12 GOOGLE STREET VIEW

Google Street View imagery is dated August of 2022 with the site viewed off Salmon Road and Suffling Road. The site is shown as unoccupied with areas of vegetation growing though cracks in concrete and tarmac noted. The main, gated entrance to site is blocked off by sacking on the inside of the gate.

6.13 HISTORIC MAPPING

The following historic maps have been reviewed as part of this assessment, found in the appendices.

Map	Onsite	Offsite
OS County Series: 1883, 1:2,500	The site is shown as unoccupied field in the south western half of site and marshland in the north eastern half of site. The site is traversed from NW to SE by an access track.	The immediate surroundings to site comprise marshland to the north and NE and fielded areas to the south, SW and SE. A large pit is located approx.110m east of site and a second, smaller sand pit is located approx.240m SE of site. Nelsons Memorial is located approx.105m SE of site (remains persistent until the present-day). The east coast and the River Yare are located east and west of site, as in the present-day.
OS County Series: 1885, 1:500	No discernible change on site.	Surrounding areas see little site relevant change.
OS County Series: 1883-1886, 1:10,560	No discernible change on site.	Surrounding areas see little site relevant change.
OS County Series: 1887, 1:2,500	No discernible change on site.	Surrounding areas see little site relevant change.
OS County Series: 1901-1904, 1:10,560	No discernible change on site.	Surrounding areas see little site relevant change.
OS County Series: 1905, 1:10,560	The eastern extent of site is now occupied by a road, which has replaced the access path traversing site.	The areas to the north and NE of site have been developed into what appears to be an industrial area and the marshland is no longer marked nor is the large pit to the NE of site. An electricity works is located approx.135m NW of site and gas works are located approx.351m NW of site and approx.500m N of site.

Map	Onsite	Offsite
OS County Series: 1906, 1:2,500 & 1:10,560	No discernible change on site.	Newly installed railway sidings are now located approx.80m W/NW of site.
OS County Series: 1927, 1:2,500	The site has now been developed with an unknown usage building – the structures are located inside and parallel with the eastern and southern boundaries of site.	The immediate surroundings to site to the N, E, S & W have all been developed into an industrial area. The areas W & SW of site have replaced a former horse-racing ground. An ice factory and net works are marked approx.200m S of site.
OS County Series: 1926-1928,1:10,560	No discernible change on site.	Surrounding areas have seen further erection and extension to developed industrial areas. Gas works to the NW and N of site have been extended.
OS County Series: 1938, 1:10,560	No discernible change on site.	Surrounding areas see little site relevant change.
OS County Series: 1946, 1:10,560	No discernible change on site.	New structures of unknown usage are now located south of site (approx.10-50m).
National Grid: 1949, 1:1,250	A tank is now marked on site in the SW extent.	Large tanks are now located immediately adjacent to the west of site. Drying racks are marked south of site on the opposite side of Salmon Road. The Trafalgar electrical components works is now located approx.120m east of site. The former ice works and net works to the south of site are now simply marked as 'works' and an electrical components works.
National Grid: 1950-1951, 1:2,500	No discernible change on site.	Works unit NE of site is now marked as a 'canning works'.
National Grid: 1957-1958, 1:1,250	A new structure is located inside and parallel with the northern boundary of site.	Areas to the north ,east and south of site are now marked with multiple unspecified works and a number of depots to the south.
Provisional: 1958, 1:10,560	No discernible change on site.	Gas works to the NW and N of site are no longer marked as such; however, the large tanks / gasometers remain.
National Grid: 1960, 1:2,500	No discernible change on site.	Areas to the south have been developed with large industrial units marked as 'depots'. A garage is now marked approx.150m N of site.

Map	Onsite	Offsite
National Grid: 1964-1968, 1:1,250	Site is now marked as 'warehouses'.	Surrounding areas have seen further industrial infill in unoccupied areas with addition of several new industrial units. Area immediately south marked as frozen food factory and cold store. Areas east are marked the same and areas immediately north marked as 3 No. warehouses with depots to either side of this. The former garage to the N of site is now an engineering works.
National Grid: 1969, 1:2,500	No discernible change on site.	Surrounding areas see little site relevant change.
National Grid: 1981, 1:1,250	No discernible change on site.	Further change of use of industrial units in surrounding areas – areas now predominantly occupied by unspecified depots.
National Grid: 1987-1981, 1:10,000	No discernible change on site.	Gas works to the NW of site and to the N of site are now gasholder stations.
National Grid: 1984, 1:1,250	No discernible change on site.	2 No. large tanks are now marked approx.200m NW of site.
National Grid: 1988, 1:10,000	The site now appears to have been cleared of buildings and is now marked as a depot.	Industrial unit north of site now enlarged into a single, large unspecified depot. Areas E, S and SW of site marked with multiple unspecified works and depots. Gas holder station to the N of site is now a 'depot'.
National Grid: 1990, 1:1,250	Site is shown as unoccupied at this time.	A large number of unspecified tanks are now marked approx.100m W of site (at least 14 No. here).
National Grid: 1994, 1:1,250	A new building has been erected inside and parallel with the eastern boundary of site.	Surrounding areas remain industrial.
National Grid: 2001, 1:10,000	No discernible change on site.	The large depot located north of site and across Suffling Road has been demolished and removed, leaving the area unoccupied. Areas to the south of site have also been cleared of previous industrial structures.

Map	Onsite	Offsite
Landline: 2003, 1:1,250	Tanks are now marked in the NW extent of site.	The sewage pumping station seen north of site in the present-day is now present along with a substation bounding the northern boundary of site. Further tanks have been added to the tank area 100m west of site (at least 29 No. tanks here).
National Grid: 2010, 1:10,000	The building located in the east of site has been demolished and removed.	Surrounding areas see little site relevant change.
National Grid: 2022, 1:10,000	No discernible change on site.	Area south of site beyond Salmon Road has now been once again developed with an industrial unit.

6.14 CURRENT LAND USE DATA

ID	Distance [m]	Direction	Company	Activity	Category
A	0	On site	Tank	Tanks (generic)	Industrial features
A	10	N	Pumping station	Water pumping stations	Industrial features
A	19	SW	Electricity substation	Electrical features	Infrastructure and facilities
A	25	S	Selwood Ltd	Industrial repairs and servicing	Repair and servicing
A	33	N	Electricity substation	Electrical features	Infrastructure and facilities
B	35	E	Certex UK Ltd	Lifting and handling equipment	Industrial products
B	36	E	Corday Sheet Metal Fabrication	Metalworkers including blacksmiths	Construction services
A	44	NW	Gall Thomson Environmental Ltd	Special purpose machinery and equipment	Industrial products
1	66	SE	Strachans Ltd	Catering and non-specific foodstuffs	Foodstuffs
B	67	E	Electricity substation	Electrical features	Infrastructure and facilities

ID	Distance [m]	Direction	Company	Activity	Category
B	67	E	Factory	Unspecified works or factories	Industrial features
2	71	S	Savoy Catering Supplies	Catering and non-specific foodstuffs	Foodstuffs
B	91	NE	Breydon Enterprise Ltd	Luggage, bags, umbrellas and travel accessories	Consumer products
B	91	E	Great Yarmouth Ceiling Ltd	Building and component suppliers	Construction services
C	93	W	Factory	Unspecified works or factories	Industrial features
D	98	SW	Radio mast	Telecommunications features	Infrastructure and facilities
D	103	SW	Pylon	Electrical features	Infrastructure and facilities
B	105	E	D J Oakley Scaffolding Ltd	Construction and tool hire	Hire services
B	109	E	A C P Foods Ltd	Container and storage	Transport, storage and delivery
B	111	E	Tank	Tanks (generic)	Industrial features
C	112	W	Tank	Tanks (generic)	Industrial features
E	114	SW	Quay	Moorings and unloading facilities	Water
F	115	NE	C & C Sheds	Garden goods	Consumer products
C	115	W	Tank	Tanks (generic)	Industrial features
F	119	N	Kirkland's Ltd	Workwear	Industrial products
G	119	N	Electricity substation	Electrical features	Infrastructure and facilities
C	129	NW	Ebrex UK Ltd	Distribution and haulage	Transport, storage and delivery

ID	Distance [m]	Direction	Company	Activity	Category
C	129	NW	D P Services & Supplies Ltd	Container and storage	Transport, storage and delivery
C	129	NW	Ikon Ambulance Services	Ambulance and medical transportation services	Health support service
C	129	NW	Brineflow Ltd	Fertilizers	Industrial products
C	129	NW	Top Line Trucks Ltd	New vehicles	Motoring
C	137	W	Electricity substation	Electrical features	Infrastructure and facilities
H	143	NE	East Bilney Coachworks	Vehicle repair, testing and servicing	Repair and servicing
B	144	E	Chimney	Chimneys	Industrial features
I	149	SE	Works	Unspecified works or factories	Industrial features
3	160	SW	Dudgeon Offshore Wind Ltd	Electrical motors and generators	Industrial products
G	161	N	Hy-Tek Engineering Services Ltd	Precision Engineers	Engineering services
G	161	N	Toucam Engineers Ltd	Fuel distributors and suppliers	Household, office, leisure and garden
G	162	N	Works	Unspecified works or factories	Industrial features
I	162	SE	Works	Unspecified works or factories	Industrial features
F	164	N	Equpiment Supply Co GY Ltd	General construction supplies	Industrial products
F	167	N	Jump Warehouse	Hobby, sports and pastime process	Consumer products
C	173	NW	Mooring posts	Moorings and unloading facilities	Water
C	175	NW	Tank	Tanks (generic)	Industrial features

ID	Distance [m]	Direction	Company	Activity	Category
C	176	NW	Tank	Tanks (generic)	Industrial features
C	181	NW	Tank	Tanks (generic)	Industrial features
F	181	N	Harbour	Moorings and unloading facilities	Water
C	183	NW	Tank	Tanks (generic)	Industrial features
I	184	SE	Electricity substation	Electrical features	Infrastructure and facilities
I	188	SE	Creative Solutions	Signs	Industrial products
C	189	NW	Tank	Tanks (generic)	Industrial features
J	190	SE	Electricity substation	Electrical features	Infrastructure and facilities
4	192	NW	Regional Scaffolding	Construction and tool hire	Hire services
K	199	S	Premier Recycling	Recycling, reclamation and disposal	Recycling services
L	203	E	Mirra Coat	Vehicle repair, testing and servicing	Repair and servicing
L	204	E	C K Precision Engineering	Precision Engineers	Engineering services
L	205	NE	Stevie's Sheds	Garden goods	Consumer products
L	205	NE	Albies Workshops	Vehicle repair, testing and servicing	Repair and servicing
C	205	NW	Tank	Tanks (generic)	Industrial features
M	205	W	Crane	Travelling cranes and gantries	Industrial features
J	217	SE	Electricity substation	Electrical features	Infrastructure and facilities
C	221	NW	Tank	Tanks (generic)	Industrial features
M	222	W	Landing stage	Moorings and unloading facilities	Water

ID	Distance [m]	Direction	Company	Activity	Category
K	223	S	Tank	Tanks (generic)	Industrial features
K	224	S	Tank	Tanks (generic)	Industrial features
K	224	S	Tank	Tanks (generic)	Industrial features
K	224	S	Tank	Tanks (generic)	Industrial features
K	225	S	Tank	Tanks (generic)	Industrial features
K	227	S	Tank	Tanks (generic)	Industrial features
F	228	N	Micro Engineering Ltd	Precision Engineers	Engineering services
K	229	S	Tank	Tanks (generic)	Industrial features
6	229	SW	Fisherman's Wharf	Moorings and unloading facilities	Water
C	230	NE	Effective Imaging	Signs	Industrial products
C	230	NE	Works	Unspecified works or factories	Industrial features
C	232	NE	Tank	Tanks (generic)	Industrial features
F	233	NW	Lacons	Alcoholic drinks	Foodstuffs
C	233	NW	Tank	Tanks (generic)	Industrial features
C	235	NW	Tank	Tanks (generic)	Industrial features
C	236	NW	Tank	Tanks (generic)	Industrial features
C	237	NW	Tank	Tanks (generic)	Industrial features
N	238	N	Works	Unspecified works or factories	Industrial features
C	241	NW	Tank	Tanks (generic)	Industrial features

ID	Distance [m]	Direction	Company	Activity	Category
F	244	NE	Kingsway Tyres	Vehicle parts, accessories	Motoring
C	244	NW	Tank	Tanks (generic)	Industrial features

6.15 PETROL AND FUEL SITES

The Groundsure report records an obsolete fuel station formerly located 244m north east of site.

6.16 HISTORICAL PETROL AND FUEL SITE DATABASE

None recorded within 250m of site.

6.17 POTENTIAL CONTAMINATIVE LAND USES IDENTIFIED ON MAPPING

ID	Distance [m]	Direction	Use	Date
A	0	On site	Unspecified depot	1988
B	12	NE	Unspecified factory	1952
1	13	SW	Unspecified factory	1978-1988
C	57	NW	Unspecified factory	1978
C	57	NW	Unspecified depot	1988
D	65	W	Railway sidings	1938
E	76	W	Quay	1946
D	79	W	Railway sidings	1904
D	85	W	Railway sidings	1946
D	90	W	Unspecified wharf	1946
D	90	W	Unspecified wharf	1904
2	95	SE	Unspecified works	1978-1988
E	99	W	Quay	1952
G	103	E	Refuse heap	1884
F	105	W	Unspecified commercial / industrial	1988
H	106	SW	Paddock	1901
E	107	W	Quay	1978-1988
F	112	W	Unspecified tanks	1988
D	122	W	Unspecified wharf	1884-9178
D	126	NW	Railway sidings	1946
G	132	E	Unspecified works	1987-1988
G	132	E	Unspecified works	1952
I	135	NW	Electric works	1904

ID	Distance [m]	Direction	Use	Date
J	138	W	Unspecified commercial / industrial	1988
4	144	NE	Sand pit	1884
M	177	S	Unspecified factory	1952
M	178	S	Ice factory	1938-1946
J	184	NW	Unspecified tanks	1988
M	194	SE	Net works	1938-1946
M	196	SE	Unspecified works	1952
D	203	NW	Fish wharf	1938
M	205	SE	Sand pit	1901
N	206	W	Quay	1988
O	206	W	Unspecified works	1988
O	206	W	Quay	1978
M	208	SE	Sand pit	1884
O	209	W	Quay	1938
P	209	W	Quay	1978-1988
P	211	W	Quay	1904
P	211	W	Quay	1946
N	212	W	Quay	1904
N	212	W	Quay	1946
P	212	W	Unspecified Quay	1901
O	214	W	Malthouses	1884
O	218	W	Malthouses	1901
J	219	NW	Railway sidings	1884
I	223	N	Unspecified commercial / industrial	1938-1946
J	224	NW	Fish wharf	1952
I	224	NW	Unspecified works	1952
P	226	SW	Quay	1938
P	226	SW	Quay	1938
I	226	N	Unspecified depot	1978
7	230	SE	Unspecified factory	1978-1988
J	241	NW	Unspecified tank	1988
O	245	W	Malthouse	1904
O	247	W	Malthouse	1946
D	250	NW	Unspecified works	1978-1988

6.18 HISTORICAL TANK DATABASE

ID	Distance(m)	Direction	Use	Date
A	0	On site	Unspecified works	1949-1958
A	0	On site	Unspecified works	1949-1957
A	16	SW	Tanks	1949-1984

ID	Distance(m)	Direction	Use	Date
A	34	S	Unspecified works	1981-1984
A	42	S	Unspecified works	1981-1984
A	58	S	Tanks	1967-1968
F	103	W	Tanks	1990
B	103	E	Unspecified works	1981-1990
F	103	W	Unspecified works	1990
3	128	S	Unspecified works	1990
L	161	NE	Unspecified works	1957
L	161	NE	Unspecified works	1949
L	162	NE	Unspecified works	1949
L	162	NE	Unspecified works	1958
L	164	NE	Tanks	1968
J	179	NW	Tanks	1990
L	189	NE	Unspecified works	1968
I	190	NW	Unspecified works	1968-1984
E	196	S	Unspecified works	1927-1967
J	198	NW	Tanks	1984-1990
6	206	N	Tanks	1949-1968
M	216	S	Tanks	1968
L	219	NE	Unspecified Tanks	1967-1968
L	220	NE	Unspecified Tanks	1971
M	222	S	Tanks	1949-1967
M	223	S	Tanks	1949
M	223	S	Tanks	1968
M	225	S	Tanks	1967
I	228	NW	Unspecified Tanks	1924
E	231	S	Tanks	1976
J	232	NW	Tanks	1990
M	243	S	Tanks	1990

6.19 HISTORICAL ENERGY FACILITIES

ID	Distance(m)	Direction	Use	Date
A	57	S	Electricity substation	1976
B	62	E	Electricity substation	1968-1990
C	118	N	Electricity substation	1990
H	119	SW	Electricity substation	1967-1976
H	120	SW	Electricity substation	1990
5	194	SE	Electricity works	1990
M	207	SE	Electricity substation	1976-1990
I	222	N	Electricity works	1949
D	247	NW	Electricity works	1968-1990
I	247	N	Electricity works	1968-1984
D	247	NW	Electricity works	1968

6.20 HISTORICAL GARAGE DATABASE

ID	Distance(m)	Direction	Use	Date
K	141	N	Garage	1958
K	143	N	Garage	1949-1957
L	154	NE	Garage	1971-1990
K	175	N	Boat repair yard	1968
L	197	NE	Garage	1964-198

7.0 POLLUTANT LINKAGE ASSESSMENT

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.

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 from the data gained from the desk study. At this stage the assessment is qualitative and aimed to determine all pollutant linkages, irrespective of significance or allowing for uncertainty.

Three impact potentials exist for any given site, these are:

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

All three impacts need to be considered in a risk assessment.

7.1 SOURCES

The following potential sources of contamination have been identified.

7.1.1 ONSITE

- Historical marshland (circa.1883-1905)
- Development of site with unknown usage buildings (circa.1927)
- Historical tank on site (circa.1949 SW extent of site)

- Additional erection of structure on site (circa.1957/58 northern extent)
- Demolition of structures on site (circa.1988)
- Erection of new building / depot (circa.1994, eastern boundary)
- Historical tanks (circa.2003 in NW extent of site)
- Removal of building (circa.1994-2010, eastern boundary)
- Contemporary, small tanks (circa.2006, NE extent of site)
- Tank adj. to interceptor bay (red, small, circa.2006-2017)
- Contemporary, large tank (adj. to bay, circa.2017-2019)
- Usage of site as depot & parking of multiple tankers (circa.1999-2017)

7.1.2 OFFSITE

- Multiple records of potentially contaminative industries (circa.1905 to present including unspecified works, factories, depots, engineering works, net & canning works, electricity works, ice factory – all compass directions)
- Multiple records of tanks (<150m N, NW, W, E, S & SE)
- Railway sidings (approx.80m W/NW of site, circa.1906-1949)

7.2 PATHWAYS

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 are identified as follows:

- Ingestion;
- Skin contact;
- Inhalation;
- Plant uptake,
- Direct contact by buried structures;
- Leaching of soluble contamination into groundwater

7.3 RECEPTORS

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

- Human Health
    - Current users of the site;
    - Future users of the site;
    - Users of neighbouring sites;

  - Construction workers; and
  - Services personnel working in trenches.
  - Construction Materials
- Buried concrete, which may be affected by high concentrations of sulphate and/or low pH, in the soils and groundwater underlying the site; and
- Buried water pipes.
- Controlled Waters
- Ecological Receptors
- Flora and fauna using the proposed development

8.0 CONCEPTUAL SITE MODEL

The Conceptual Site Model (CSM) is a hypothesis of the nature and sources of contamination, potential receptors that may be the recipient of contamination arising from those sources and any pathways that may exist. It creates a plausible source-pathway-receptor pollutant linkage (hazard), set within the context of the ground and proposed end use of the site.

8.1 PRELIMINARY CONCEPTUAL SITE MODEL

8.1.1 SOIL CONTAMINATION

The site currently comprises an open expanse of tarmac and concreted areas which was formerly a lorry park. Historically, the site was occupied by marshland and field traversed by a footpath in circa.1883 and remained as such until circa.1905 when a road was constructed on the eastern boundary of site. By circa.1927 had been developed with unknown usage buildings located along and inside the eastern and southern boundaries of site. The site then sees little change until circa.1949 when a tank is marked in the south western extent of site. A new structure was then located along and inside the northern boundary by circa.1957/58 and was subsequently marked as ‘warehouses’ by circa.1964/68. By circa.1988 the site was cleared of all structures and a new building was erected along and inside the eastern boundary by circa.1994, further tanks were then

located in the north western extent of site by circa.2003 and by circa.2010 the building in the east of site was demolished. Contemporary satellite imagery then shows the as occupied by a large number of lorries and a large tank in circa.1999, with further tanks added to the north east of site by circa.2006 (the easternmost, youngest building on site also being removed prior to this date). Also at this time, the brick- and concrete-built interceptor bay was present on site, along with a red tank located adjacent to this. By circa.2017 this tank had been removed and replaced with a larger tank and the number of tankers located on site had increased. Finally, by circa.2019, the site had been cleared of all vehicles and tanks and has remained unoccupied since this date. The surrounding areas over time have remained industrialised since at least circa.1905 with a number of potentially contaminative industries noted nearby to site, including unspecified works, factories, depots, engineering works, net & canning works, electricity works, and ice factory, with these features located all compass directions. More contemporarily, the site has been located immediately adjacent to and south of a liquid fertiliser company and a sewage works (with associated electrical substations).

The historical industrial development and usage of the site and immediate surrounding areas are considered potentially significant sources of contamination, capable of impacting site and the surrounding areas with various substances including:

- Made ground deposits (various developments and demolitions)
- Metals and metalloids (industrial usages on and offsite / made ground)
- Polycyclic aromatic hydrocarbons (PAH's) (tanks, fuels & oils, unknown industrial usage)
- Petroleum hydrocarbons (tanks, fuels & oils, industrial vehicles)
- Asbestos (age of various developments and demolitions)
- PCB's (adjacent electricity substation, industrial usage)

8.1.2 HAZARDOUS GROUND GAS AND VAPOURS

The site has been identified being located on and nearby to significant peat deposits and there is a potential for a significant depth of made ground on site, associated with the long, historical industrialised usage of the site and surrounding areas. Furthermore, the site is located in an area where both superficial and bedrock geologies are predominantly high in permeability and thus provide credible pathways both laterally to site from offsite sources and vertically into proposed structures. Additionally, a significant number of (largely unspecified) tanks have been identified on site, in close proximity to site and in the wider surrounding areas. The tanks, the unknown historical usage of the site, subsequent warehousing and depot usage and the storage of multiple industrial vehicles and tankers on site over time are considered potentially significant sources of hazardous vapours, again with credible pathways provided by both superficial and bedrock geologies.

TABLE 1. SUMMARY OF SIGNIFICANT POLLUTION LINKAGES

Contaminant	Pathway	Receptor	Probability of Pollutant Linkage	Consequence	Risk	Possible Mitigation
Contaminated Soils *(historical & recent industrial usage of site, development & demolitions on site, multiple tanks, vehicle storage, made ground)*	Direct Ingestion & Direct Contact	Site Workers *(during site works, excavations, eating and drinking)*	Li	Md	M	Site workers likely to come into contact with contaminated made ground materials during site works. Site workers to wear appropriate PPE for health and safety reasons, considered usage would mitigate this risk to LOW – following confirmation via a Phase 2 Site Investigation.
Contaminated Soils *(historical & recent industrial usage of site, development & demolitions on site, multiple tanks, vehicle storage, made ground)*	Inhalation of Dust, Adsorption	Site Workers *(during site works, excavations, eating and drinking)*	Li	Md	M	
Contaminated Soils *(historical & recent industrial usage of site, development & demolitions on site, multiple tanks, vehicle storage, made ground)*	Direct Ingestion & Direct Contact	End Users *(site workers, visitors)*	Lw	Md	M/L	The historical industrial development and usage of the site and surrounding areas, various developments and demolitions on site and a large number of tanks both on and adj. to site with onsite stored vehicles and tankers are considered potentially significant sources of contamination. It is recommended that this is investigated further as part of a Phase 2 Site Investigation with integrated gas monitoring with provision for usage of a photon-ionisation detector (PID) during site works. Both trial pits and boreholes should be advanced, to allow an assessment of the ground conditions (i.e. made ground, natural or reworked natural deposits, their nature, extent and depth) and to facilitate the taking of environmental samples for laboratory analysis.
Contaminated Soils *(historical & recent industrial usage of site, development & demolitions on site, multiple tanks, vehicle storage, made ground)*	Inhalation, Adsorption	End Users *(site workers, visitors)*	Lw	Md	M/L	
Contaminated Soils *(historical & recent industrial usage of site, development & demolitions on site, multiple tanks, vehicle storage, made ground)*	Ingestion, inhalation, plant uptake, surface run-off	Flora and Fauna *(limited in industrial area)*	Lw	Md	M/L	
Contaminated Soils *(historical & recent industrial usage of site, development & demolitions on site, multiple tanks, vehicle storage, made ground)*	Vertical and lateral migration *(credible pathways provided by both superficial and bedrock geologies)*	Controlled Waters *(Principal Aquifer, River Yare, South North Sea)*	Li	Md	M	
Contaminated Soils *(historical & recent industrial usage of site, development & demolitions on site, multiple tanks, vehicle storage, made ground)*	Direct contact *(pipe degradation and leaching)*	Services *(impacted potable piping)*	Li	Md	M	
Ground Gases (Methane and CO_2) *(historical marshland, potentially significant made ground)*	Vertical and lateral migration *(credible pathways provided by both superficial and bedrock geologies)*	End Users & Building Envelope	Lw	Sv	M/L	Potential sources of ground gas identified in form of historical and nearby peat deposits & potentially significant depth of made ground. Risk assessment is based in severity of outcome rather than likelihood – recommend further investigation as part of Phase 2 SI with integrated gas monitoring.
Volatile and Semi-volatile Organic Compounds *(multiple tanks on and adj. to site, vehicle storage, industrial usage)*	Vertical and lateral migration	End Users & Building Envelope	Li	Md	M	Large number of tanks & vehicle storages and industrial usages on & adj. to site – recommend further investigation as part of Phase 2 SI. Provision for usage of a PID during site works.
Radon	Vertical and lateral migration	End Users & Building Envelope	Ul	Md	L	The site is not located in a Radon Affected Area.

KEY: Probability of pollutant linkage Hi = Highly likely, Li = Likely, Lw = Low Likelihood, Ul = Unlikely
Consequence Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor,
Overall Risk VH = Very High, H = High, M = Moderate, M/L = Moderate/Low, L = Low, VL = Very Low

Based on the preliminary CSM for the site, an environmental risk assessment has been undertaken. A simple matrix can provide a consistent basis for decision making. It should be used with caution, recognising the over-simplification that it will normally represent. The probability and consequences are defined according to parameters relevant to the situation; the boundaries of risk acceptability (and tolerability, where relevant) indicated on the matrix provided in Table 2, can be tailored to the factors influencing the significance of the risk. Individual situations are mapped onto the matrix to provide a ready and consistent indication of their acceptability or tolerability.

TABLE 2. RISK CLASSIFICATION MATRIX

		Consequence			
		Severe (Sv)	**Medium (Md)**	**Mild (Mi)**	**Minor (Mr)**
Probability	**High (Hi)**	Very high risk	High risk	Moderate Risk	Moderate/ Low Risk
	Likely (Li)	High risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood (Lw)	Moderate Risk	Moderate/ Low Risk	Low Risk	Very Low Risk
	Unlikely (Ul)	Moderate/ Low Risk	Low Risk	Very Low Risk	Very Low Risk

Source: CIRIA Report C552, Contaminated Land Risk Assessment. A Guide to Good Practice, 2001

These attributes are evaluated qualitatively against individual hazard assessments to determine the likelihood of a given hazard occurring. The risk evaluations for each plausible pollutant linkage are given in the last three columns of Table 1.

TABLE 3. CLASSIFICATION OF RISK

Very high risk (Vh)	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High risk (Hi)	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short-term and are likely over the longer term.
Moderate risk (Md)	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer-term.
Low risk (Lw)	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very low risk (Vl)	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

Source: CIRIA Report C552, Contaminated Land Risk Assessment. A Guide to Good Practice, 2001

9.0 ENVIRONMENTAL RISK ASSESSMENT

Based on the information contained in this report, it is the opinion of Castledine Environmental that the site represents a **MODERATE** level of risk with respect to the proposed development.

It is recommended that further investigation inline with Section 11.0 is planned and carried out on site.

This report should be submitted to your Local Planning Authority for agreement to allow the Phase 2 intrusive testing to be undertaken.

10.0 SUMMARY OF RISKS

10.1.1 SOIL CONTAMINATION

The site currently comprises an open expanse of tarmac and concreted areas which was formerly a lorry park. Historically, the site was occupied by marshland and field traversed by a footpath in circa.1883 and remained as such until circa.1905 when a road was constructed on the eastern boundary of site. By circa.1927 had been developed with unknown usage buildings located along and inside the eastern and southern boundaries of site. The site then sees little change until circa.1949 when a tank is marked in the south western extent of site. A new structure was then located along and inside the northern boundary by circa.1957/58 and was subsequently marked as 'warehouses' by circa.1964/68. By circa.1988 the site was cleared of all structures and a new building was erected along and inside the eastern boundary by circa.1994, further tanks were then located in the north western extent of site by circa.2003 and by circa.2010 the building in the east of site was demolished. Contemporary satellite imagery then shows the as occupied by a large number of lorries and a large tank in circa.1999, with further tanks added to the north east of site by circa.2006 (the easternmost, youngest building on site also being removed prior to this date). Also at this time, the brick- and concrete-built interceptor bay was present on site, along with a red tank located adjacent to this. By circa.2017 this tank had been removed and replaced with a larger tank and the number of tankers located on site had increased. Finally, by circa.2019, the site had been cleared of all vehicles and tanks and has remained unoccupied since this date. The surrounding areas over time have remained industrialised since at least circa.1905 with a number of potentially contaminative industries noted nearby to site, including unspecified works, factories, depots, engineering works, net & canning works, electricity works, and ice factory, with these features located all compass directions. More contemporarily, the site has been located immediately adjacent to and south of a liquid fertiliser company and a sewage works (with associated electrical substations).

10.1.2 GROUND GASSES AND VAPOURS

The site has been identified being located on and nearby to significant peat deposits and there is a potential for a significant depth of made ground on site, associated with the long, historical industrialised usage of the site and surrounding areas. Furthermore, the site is located in an area where both superficial and bedrock geologies are predominantly high in permeability and thus provide credible pathways both laterally to site from offsite sources and vertically into proposed structures. Additionally, a significant number of (largely unspecified) tanks have been identified on site, in close proximity to site and in the wider surrounding areas. The tanks, the unknown historical usage of the site, subsequent warehousing and depot usage and the storage of multiple industrial vehicles and tankers on site overtime are considered potentially significant sources of hazardous vapours, again with credible pathways provided by both superficial and bedrock geologies.

11.0 RECOMMENDATIONS

It is recommended that an intrusive Phase 2 Site Investigation is planned and carried out on site. This should comprise both trial pit and borehole formation across the site, to facilitate an assessment of the ground conditions (i.e. made ground, natural or reworked natural deposits, their nature, extent and depth), the taking of environmental samples for laboratory analysis and integrated ground gas and vapour monitoring, respectively.

12.0 REFERENCES

12.1 LEGISLATION AND REGULATIONS

12.1.1 ACTS

[1] Environmental Protection Act 1990, Part IIA: inserted by Environment Act 1995, Section 57. See Environment Act 1995 for text of Part IIA.

12.1.2 PLANNING REGULATIONS

[2] The Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 SI1999/No.293

[3] The Town and Country Planning (Environmental Impact Assessment) (England and Wales) (Amendment) Regulations 2000 SI2000/No.2867

12.1.3 CONTAMINATED LAND REGULATIONS

[4] The Contaminated Land (England) Regulations 2000. SI2000/No.227

[5] The Contaminated Land (England) (Amendment) Regulations 2001 SI2001/No.663

[6] The Contaminated Land (England) Regulations 2006 SI2006/No.1380

12.2 STATUTORY GUIDANCE

[7] Department of Environment, Food and Rural Affairs. 2012. *Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance.* Department of Environment, Food and Rural Affairs

[8] Communities and local Government, 2018: National Planning Policy Framework.

12.3 BRITISH STANDARDS

[9] BS 5930:2015 Code of practice for site investigations

[10] BS 10175:2011+A2:2017 Investigation of potentially contaminated sites - Code of practice

[11] BS 8485:2015+A1:2019 BS 8485 - 2015 - Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings

[12] BS 8576:2013 Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs)

12.4 NON STATUTORY TECHNICAL GUIDANCE

12.4.1 ENVIRONMENT AGENCY

[13] [redacted], 2002. Model Procedures for the Management of Contaminated Land, Contaminated Land Report (CLR) 11, Department for Environment, Food, and Rural Affairs.

12.4.2 CIRIA PUBLICATIONS

[14] [redacted] 2007, *C 665 Assessing risks posed by hazardous ground gases to buildings* London: Construction Industry Research and Information Association

[15] [redacted]2014, *C 735 Good practice on the testing and verification of protection systems for buildings against hazardous ground gases* London: Construction Industry Research and Information Association

12.4.3 CL:AIRE

[16] [redacted] [redacted]. 2012. *A Pragmatic Approach to Ground Gas Risk Assessment. CL:AIRE Research Bulletin RB17*. CL:AIRE, London, UK. ISSN 2047- 6450 (Online)

13.0 APPENDICES

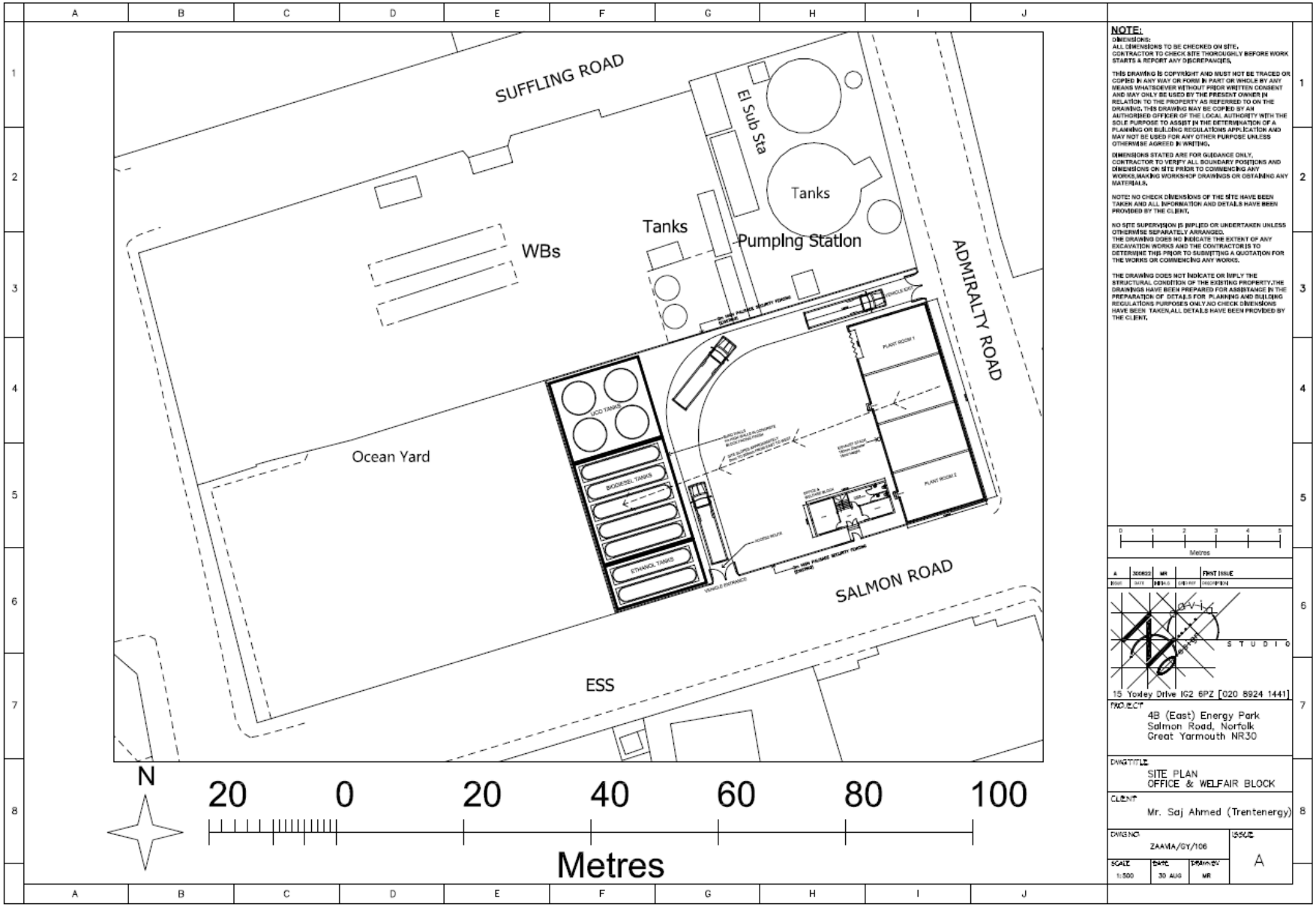
APPENDIX A **ENVIRONMENTAL SEARCH**

Separate Groundsure Report

APPENDIX B **HISTORICAL MAPPING**

Separate Map Packs (2 No. files)

APPENDIX C PROPOSED AND CURRENT SITE PLANS



NOTE:

DIMENSIONS:
ALL DIMENSIONS TO BE CHECKED ON SITE.
CONTRACTOR TO CHECK SITE THOROUGHLY BEFORE WORK STARTS & REPORT ANY DISCREPANCIES.

DIMENSIONS STATED ARE FOR GUIDANCE ONLY, CONTRACTOR TO VERIFY ALL BOUNDARY POSITIONS AND DIMENSIONS ON SITE PRIOR TO COMMENCING ANY WORKS,MAKING WORKSHOP DRAWINGS OR OBTAINING ANY MATERIALS.

NOTE! NO CHECK DIMENSIONS OF THE SITE HAVE BEEN TAKEN AND ALL INFORMATION AND DETAILS HAVE BEEN PROVIDED BY THE CLIENT.

NO SITE SUPERVISION IS IMPLIED OR UNDERTAKEN UNLESS OTHERWISE SEPARATELY ARRANGED.
THE DRAWING DOES NO INDICATE THE EXTENT OF ANY EXCAVATION WORKS AND THE CONTRACTOR IS TO DETERMINE THIS PRIOR TO SUBMITTING A QUOTATION FOR THE WORKS OR COMMENCING ANY WORKS.

THE DRAWING DOES NOT INDICATE OR IMPLY THE STRUCTURAL CONDITION OF THE EXISTING PROPERTY,THE DRAWINGS HAVE BEEN PREPARED FOR ASSISTANCE IN THE PREPARATION OF DETAILS FOR PLANNING AND BUILDING REGULATIONS PURPOSES ONLY,NO CHECK DIMENSIONS HAVE BEEN TAKEN,ALL DETAILS HAVE BEEN PROVIDED BY THE CLIENT.

0 1 2 3 4 5
Metres

A	30/08/23	MR		FIRST ISSUE
ISSUE	DATE	DRAWN	CHECKED	DESCRIPTION

15 Yoxley Drive IG2 6PZ [020 8924 1441]

PROJECT
4B (East) Energy Park
Salmon Road, Norfolk
Great Yarmouth NR30

DWG TITLE
SITE PLAN

CLIENT
Mr. Saj Ahmed (Trentenergy)

DWG NO	ISSUE
ZAAMA/GY/105	A

SCALE	DATE	DRAWN BY
1:500	30 AUG	MR

APPENDIX D SITE PHOTOS AND LOCATIONS

Castledine Environmental
LAND CONTAMINATION SURVEYS

Site Walkover Photos

Address: Site 4B, Great Yarmouth Energy Park

Client: Trent Energy Limited

Photo No.1: Facing slightly NE from the western extent of site

Photo No.2: Facing slightly SW from the eastern extent of site

Castledine Environmental
LAND CONTAMINATION SURVEYS

Site Walkover Photos

Address: Site 4B, Great Yarmouth Energy Park

Client: Trent Energy Limited

Photo No.3: Facing east in the western extent of site showing ground conditions and manhole covering

Photo No.4: Facing north along the eastern site boundary (right of photo) to the adjacent former sewage works

Castledine Environmental
LAND CONTAMINATION SURVEYS

Site Walkover Photos

Address: Site 4B, Great Yarmouth Energy Park

Client: Trent Energy Limited

Photo No.5: facing north from the central area of site showing camper van stored in small brick-built bay

Photo No.6: Facing slightly NE from adj. to the brick-built bay showing possible substation located adj. to northern boundary

Castledine Environmental, 4 Wymeswold Road, Hoton, Loughborough, Leicestershire. LE12 5SN
[redacted] kevin@castledineenvironmental.co.uk

APPENDIX E WATCHING BRIEF

It remains possible that previously unexpected soil conditions may be encountered during the construction process. Examples may include oily pockets within the soil, potential for asbestos containing materials, black ashy materials, soils exhibiting strong odours, brightly coloured materials, and former demolition materials.

Should previously undiscovered contamination be encountered during the demolition/construction of the new buildings the following course of action should be adhered to:

1. The ground workers should report any suspected contamination immediately to the Client's site supervisor. The supervisor should contact the Client or their appointed agent who will in turn contact Castledine Environmental to request an engineer to visit the site to assess the extent of the 'contamination'.
2. Castledine Environmental shall make records of their inspection, and pass details of these to the Local Authority.
3. Where the conditions revealed differ from those previously anticipated, the Castledine Environmental shall take samples as deemed appropriate to be dispatched for appropriate chemical testing.
4. Depending on the results of the testing either:
    a. no further work will be required;
    b. a further detailed risk assessment will be required; and/or
    c. Localised specific remedial measures will be necessary. Appraisal criteria will vary depending on the nature of the assessment.
5. The results of any such testing will be sent to the Local Authority Pollution Control Section, Local Authority development control section, and the appointed building inspector. If remediation is required, the LA/Building inspector will be informed of the date and time of the proposed works.

6. Remediation will be undertaken in accordance with a method statement submitted for approval. The works shall be supervised where necessary by Castledine Environmental who shall provide a Verification Report for the Local Authorities.
7. A copy of the discovery strategy should be lodged on site and provisions made to ensure that all workers are made aware of their responsibility to observe, report and act on any potentially suspicious or contaminated materials they may encounter.

APPENDIX F DISCOVERY STRATEGY