

IMMINGHAM EASTERN RO-RO TERMINAL



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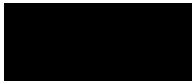



Outline Remediation Strategy

Associated British Ports

Project number: 60664611

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Quality information

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The exploratory holes carried out during the fieldwork, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. The comments made and recommendations given in this Report are based on the ground conditions apparent at the site of the exploratory holes. There may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this Report.

The comments made on groundwater conditions are based on observations made during site work and the limited monitoring programme. It should be noted that groundwater levels might vary owing to seasonal or other effects.

Any risks identified in this Report are perceived risks, based on the information reviewed during the desk study and therefore partially based on conjecture from available information.

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Reference to historical Ordnance Survey (OS) maps and/or data provides invaluable information regarding the land use history of a site. However, it should be noted that historical evidence will be incomplete for the period pre-dating the first edition and between the release of successive maps and/or data.

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B2429400-JAC-00-ZZ-DR-ZZ-0110	Overall Scheme General Arrangement
B2429400-JAC-00-ZZ-DR-ZZ-0202	General Arrangement Plans Sheet 1 of 6
B2429400-JAC-00-ZZ-DR-ZZ-0203	General Arrangement Plans Sheet 2 of 6
B2429400-JAC-00-ZZ-DR-ZZ-0204	General Arrangement Plans Sheet 3 of 6
B2429400-JAC-00-ZZ-DR-ZZ-0205	General Arrangement Plans Sheet 4 of 6
B2429400-JAC-00-ZZ-DR-ZZ-0206	General Arrangement Plans Sheet 5 of 6
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1. Introduction

1.1 Overview

- 1.1.1 AECOM Ltd has been commissioned by Associated British Ports (ABP) (hereafter referred to as 'The Client') to prepare an Outline Remediation Strategy for the proposed development. This Outline Remediation Strategy will identify potential impacts to sensitive receptors from the proposed development and outline mitigation measures to limit those impacts where appropriate.
- 1.1.2 The proposed development comprises of a roll-on / roll-off facility at the Port of Immingham (herein referred to as the 'site'), which will be known as the Immingham Eastern Ro-Ro Terminal (herein referred to as the 'scheme'). This development is designated as a Nationally Significant Infrastructure Project (NSIP) which will service the embarkation and disembarkation of principally commercial and automotive traffic with the potential for passenger use during quiet periods.
- 1.1.3 The site is located at the Port of Immingham. The centre of the site can be located at approximate National Grid Reference TA 20558 15316.
- 1.1.4 The site comprises of three Sub Plots (Sub Plot 1, Sub Plot 3 and Sub Plot 4). Sub Plot 2 was previously included within the proposed development for the site; however, this has now been removed from the Development Consent Order (DCO) application.
- 1.1.5 A site location plan is presented as Drawing B2429400-JAC-00-ZZ-DR-ZZ-0101.
- 1.1.6 The proposed development plan is presented as Drawings B2429400-JAC-00-ZZ-DR-ZZ-0110, B2429400-JAC-00-ZZ-DR-ZZ-0202, B2429400-JAC-00-ZZ-DR-ZZ-0203, B2429400-JAC-00-ZZ-DR-ZZ-0204, B2429400-JAC-00-ZZ-DR-ZZ-0205, B2429400-JAC-00-ZZ-DR-ZZ-0206 and B2429400-JAC-00-ZZ-DR-ZZ-0207.

1.2 Purpose of report

- 1.2.1 The purpose of this Outline Remediation Strategy document is to set out the mitigation measures required during the works to reduce identified impacts to controlled waters and human health, including potential impacts associated with ground gases, and to mitigate future impacts related to the construction and operation of the scheme.
- 1.2.2 A list of commitments in the Construction Environmental Management Plan (CEMP) relating to the Outline Remediation Strategy is summarised in Table 1.1.

Table 1.1 List of main commitments from the CEMP

Reference	Action / Commitment	Objective
Remediation Strategy	The Remediation Strategy will set out the measures required to mitigate any significant / unacceptable contamination risks and how the earthworks stage of construction would be undertaken during the landside works.	To mitigate the presence of potentially contaminated materials and of unexpected, contaminated land (if any) encountered during construction.

Reference	Action / Commitment	Objective
Materials Management Plan	A Materials Management Plan following the guidance in CL:AIRE (2011) Definition of Waste: Development Industry Code of Practice, will be prepared and implemented to provide suitable controls to facilitate the re-use of materials such as soils and crushed concrete.	To provide suitable controls for the re-use of materials and detail the procedures and measures that would be taken to classify, track, store, dispose of and potentially re-use all excavated materials that are expected to be encountered.
Asbestos Management Plan	An Asbestos Management Plan will be prepared and implemented should asbestos or asbestos containing materials be encountered during the ground investigation.	To provide identification and quantification of asbestos encountered through chemical testing and provide details of who is responsible for managing asbestos found at the site.
Hazardous Waste Classification	Surplus soil materials will be classified under the Waste Framework Directive (WFD) (2009/98/EC) as either hazardous (17-05-03) or non-hazardous (17-05-04) soils. Classification would be undertaken using a proprietary assessment tool such as "HazWasteOnline™". Waste deemed to be hazardous, will require testing using the Waste Acceptance Criteria (WAC) prior to disposal to landfill.	To classify surplus materials appropriately and ensure the surplus materials are disposed of in appropriate waste management facilities.
Stockpile Materials	Stockpile materials will be located away from watercourses and will be reseeded or temporarily covered if they are not to be used within 3 months and following the reinstatement of the proposed development. Erosion protection matting may be used to minimise sediment in water flow or wind.	To minimise run-off of stockpile materials in watercourses and becoming entrained in the air.
Vehicle / Equipment Washing	Vehicle and equipment washing will only take place in controlled areas.	To minimise the environmental impacts associated with vehicle and equipment washing.
Re-use of Excavated Materials	All earthworks operations will need to be undertaken in	To ensure that best practice guidance is followed and

Reference	Action / Commitment	Objective
	<p>accordance with BS1997:2004 Eurocode 7 (BSI, 2014), BS16907-1 to 7:2018 Earthworks (BSI, 2018); BS6031:2009 Code of Practice for earthworks (BSI, 2009) and National Highways (NH) guidelines including DMRB Series 600 'Earthworks' (Highways England, 2016). Best practice will be adopted during construction to prevent or minimise spillage risk and spillage impacts by adhering to the CEMP.</p>	<p>any excavated materials that could be re-used are suitable.</p>
<p>Potential Concrete Contamination</p>	<p>The CEMP addressed the management of concrete batching, usage, and accidental spillage to prevent potential contamination associated with concrete use.</p>	<p>To prevent concrete contamination and manage the use of concrete on site.</p>
<p>Potential Made Ground and Aquifer Contamination</p>	<p>The construction methodology will be assessed to reduce the potential risk associated with preferential pathways for piling, deep foundations or ground improvement works.</p>	<p>To reduce the risk of preferential pathways associated with foundations and ground improvement works.</p>

Source: Construction Environmental Management Plan

- 1.2.3 This Outline Remediation Strategy relates to potential contamination across the entirety of the scheme.

1.3 Proposed works

- 1.3.1 The details of the anticipated activities during works at the site will be presented in the CEMP. Construction works are anticipated to start in early 2024. The construction works at the site may be completed as a single activity, continuous construction, largely completed by mid-2025 or it may be sequenced construction with operation of the northern most pier and landside elements, excluding the Western Storage Area. The northern finder pier with two berth would be complete along with the approach jetty and become operational around mid-2025. Following this, and at the same time as the operation of the northern finger pier, the innermost southern finger pier and third berth would be constructed alongside the Western Storage Area. The southern finger would be completed in late 2026, when the third berth would become operational.

1.4 Sources of information

- 1.4.1 This Outline Remediation Strategy is based on AECOMs accumulated knowledge of the site, in particular the work undertaken in the preparation of the following documents. These documents were also used by AECOM to form the basis of subsequent geo-environmental assessments:
- AECOM. (2022a). Immingham Eastern Ro-Ro Terminal. Phase 1 Geo-environmental and Geotechnical Desk Study. Associated British Ports. 60664611;
 - AECOM. (2022b). Immingham Eastern Ro-Ro Terminal. Phase 2 Ground Investigation Report. Associated British Ports. 60664611;
 - British Transport Docks Board. (1965). Proposed Oil Jetties at Immingham, Lincolnshire. Report on Site Investigation;
 - Exploration Associates. (1980). British Transport Docks Board Immingham Dock – Eastern Jetty Final Report on Site Investigation 22552;
 - GD Pickles Ltd. (2020). Geoenvironmental Investigation Report; and
 - Ground Explorations Ltd. (1967). Report No. 3722/SJB. Report on Exploration of Ground Conditions for Proposed Oil Terminal, Immingham.

2. Site setting

- 2.1.1 The site is located at the Port of Immingham which serves the main deep-water shipping channel of the Humber Estuary. The following bulk commodities and discrete operational areas are located within the wider Port area: liquid fuels, solid fuels, ores, Ro-Ro freight, the Eastern and Western Jetties, the Immingham Oil Terminal (IOT), the Immingham Gas Terminal, Immingham Outer Harbour (IOH) and the Humber International Terminal (HIT).
- 2.1.2 The surrounding land use of the site comprises of marine works and a jetty to the north. In the east, the land use comprises of petroleum terminals, agricultural fields and Stallingborough village located 600 m east to southeast. Disused railway tracks and industrial sites are located immediately south of the site with agricultural fields located further south. Residential properties are located within 150 m south of the site. Towards the west, the land use comprises of Immingham Dock and the associated industrial land use, and the town of Immingham approximately 500 m west to southwest.
- 2.1.3 The proposed development site comprises of three Sub Plots known as Sub Plot 1, Sub Plot 3 and Sub Plot 4 as presented in Figure 2.1 in Volume 2 of ES

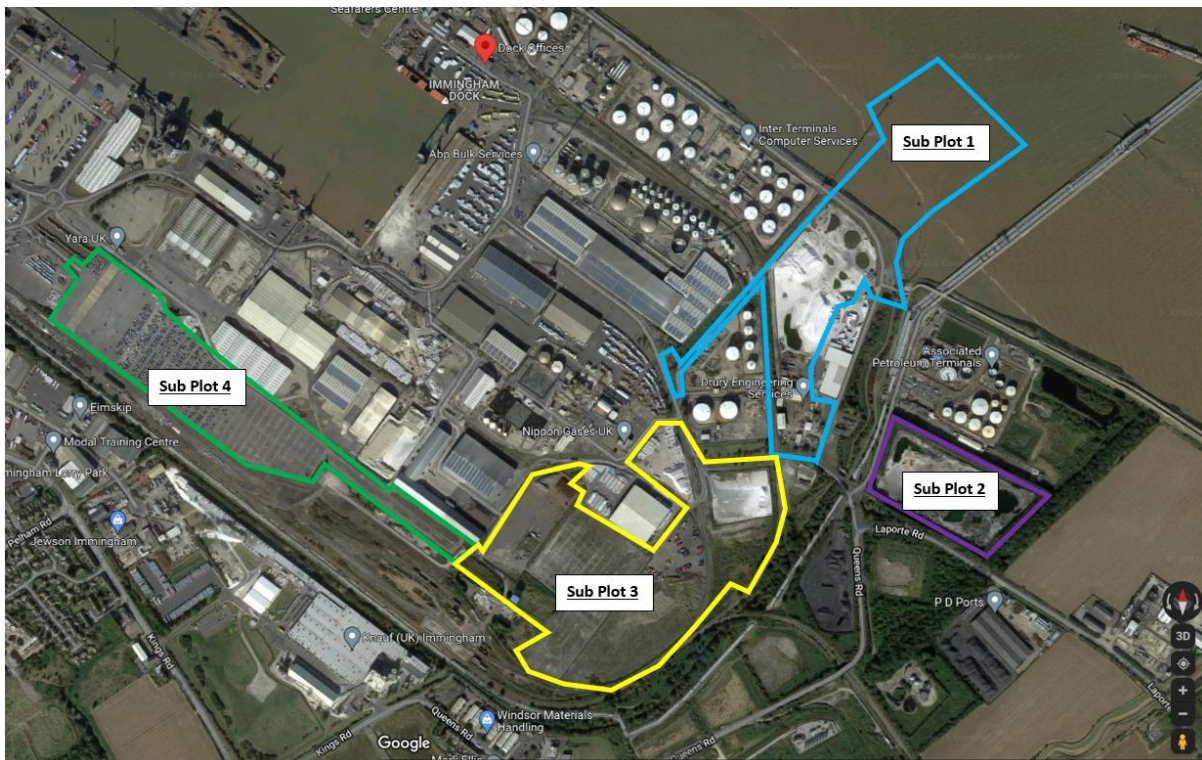


Figure 2-1 Sub Plots of the Site

*Sub Plot 2 is no longer part of the development and is therefore not included in this remediation strategy

(Application Document Reference number 8.3). Additional areas of the site are located on a section of the A1173 Queens Road and the land associated with Long Strip.

- 2.1.4 Sub Plot 1 is located towards the north of the proposed development site and comprises of the area for the proposed jetty in the Humber Estuary and the landside area. The current land use of Sub Plot 1 comprises of a storage yard in the centre for imported materials, a car park and overground oil terminal pipelines. The area to the south comprises of a maintenance shed / yard with intermediate bulk containers (IBCs), drums and gas cannisters with two electric sub stations located on the boundary of the plot. During the site walkover, it was noted that the ground comprised of Made Ground, bituminous macadam and gravel.
- 2.1.5 Sub Plot 3 is located in the southeast area of the proposed development, immediately south of Sub Plot 1. Railway sidings are located within the eastern area of the plot, and storage yards / areas are located in the northeast, northwest and west of the plot. An area of grassland is located within the western area of the site. A trailer yard is located to the south of the railway sidings and 1 no. 5,200L diesel tank, 1 no. gas oil tank, 3 no. IBCs and 2 no. old empty fuel tanks were observed in this area during the site walkover. The southeast area of the plot comprises of vacant land with Made Ground and vegetation.
- 2.1.6 Sub Plot 4 is located in the southern area of the port immediately adjacent to Sub Plot 3. The plot is currently used as a storage area / car park for newly imported vehicles. The ground surface comprises of hardstanding and gravel chippings. During the site walkover, temporary structures were observed on the site (a welfare cain, toilet block, security hut and smoking shelter) and service infrastructure (water, drains, electricity, CCTV, and communications).
- 2.1.7 The section of the site along the A1173 Queens Road comprises of the existing road and port east gate. A small section of vegetated land is located within the site boundary to the east of the existing port gate.
- 2.1.8 The land associated with Long Strip comprises of dense vegetation and a drain along the western site border.

3. Published geology and environmental setting

3.1 Published geology

- 3.1.1 For the geological assessment of the site, the British Geological Survey (BGS) 1:50,000 Sheet 81 (and including parts of sheet 82 and 90) (Partington) (BGS, 1991), the BGS GeoIndex Onshore Map Application (BGS, 2022a), BGS Geological Memoir (BGS, 1994) and BGS Geology 1:10,000 maps included in the Groundsure® Report (GS-8247702) (Groundsure, 2021) were reviewed. Table 3.1 outlines the published geology beneath the site.

Table 3.1 Published geology

Stratum	Expected Location	British Geological Survey (BGS) lithological description (BGS, 2022b)
Made Ground	Most of the site apart from a small area to the north of Sub Plot 1, the southeast corner of Sub Plot 3 and the Long Strip site. The area of land in Sub Plot 1, Sub Plot 3 and around Queens Road is not mapped as Artificial Ground on the BGS 1:50,000 map, however, it is anticipated that Made Ground will underlie this area of the site.	Variable composition.
Tidal Flat Deposits - Clay and Silt	The majority of the site, apart from the bank of the Humber estuary.	Tidal flat deposits consist of unconsolidated sediment, mainly mud and/or sand. They may form the top surface of a deltaic deposit, which is normally a consolidated soft silty clay, with layers of sand, gravel and peat.
Beach and Tidal Flat Deposits (Undifferentiated) - Clay, Silt and Sand	Along the bank of the Humber estuary.	Composite of 'Beach deposits' and 'Tidal Flat Deposits'. Beach deposits comprise shingle, sand, silt and clay, which may be bedded or chaotic. Beach deposits may be in the form of dunes, sheets or banks.
Devensian Glacial Till	Entire site, underlying the Beach and Tidal Flat deposits.	No description given. Likely comprising a mixture of clay, sand, gravel, and boulders.
<u>Bedrock:</u> Burnham Chalk Formation	The northwest trending arm of the site.	White, thinly bedded chalk with common tabular and discontinuous flint bands; sporadic marl seams.
<u>Bedrock:</u> Flamborough Chalk Formation – Chalk	The majority of the site, apart from the northwest trending arm of the site, underlying the Devensian Glacial Till.	White, well-bedded, flint-free chalk with common marl seams (typically one per meter). Common stylolitic surfaces and pyrite nodules.

3.2 Hydrogeology

- 3.2.1 The Tidal Flat Deposits and Devensian Glacial Till deposits underlying the site are classified as an Unproductive Aquifer. Unproductive Aquifers are defined by the Environment Agency as “... *rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow*” (Groundsure, 2021).
- 3.2.2 The Beach and Tidal Flat Deposits which underlie the bank of the Humber Estuary are classified as a Secondary Undifferentiated Aquifer. The Environment Agency define Secondary Undifferentiated Aquifers as “*in general, these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type*” (Groundsure, 2021).
- 3.2.3 The bedrock geology comprising of the Burnham Chalk Formation and the Flamborough Chalk Formation are both designated as Principal Aquifers. The Environment Agency define Principal Aquifers as “*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*” (Groundsure, 2021).
- 3.2.4 The Beach and Tidal Flat Deposits are considered to have a *High* groundwater vulnerability due to the combination of Secondary Undifferentiated superficial aquifer and a Principal bedrock aquifer. The remainder of the site has a *Low* vulnerability due to the combination of an Unproductive superficial aquifer and a Principal bedrock aquifer.
- 3.2.5 Whilst there are no groundwater abstractions within the site boundary, there are eight abstractions within a 1 km radius.
- 3.2.6 The southeast corner of the site is designated as a Source Protection Zone (SPZ) 1 (Inner Catchment). The Environment Agency define SPZ 1 as being “*50-day travel time of pollutant to source with a 50 m default radius*” (Environment Agency, 2019). A radius that encompasses the SPZ1 within the site boundary is designated as an SPZ 2 (Outer Catchment). An SPZ 2 is defined as “*400-day travel time of pollutant to source. This has a 250 or 500 metres minimum radius around the source depending on the amount of water taken*” (Environment Agency, 2019). The remainder of the site is designated as a SPZ 3 (Total Catchment). The Environment Agency define an SPZ 3 as an “*area around a supply source within which all groundwater ends up at the abstraction point. This is the point from where the water is taken. This could extend some distance from the source point*” (Environment Agency, 2019). This is likely to be associated with an abstraction within the Flamborough Chalk Formation, although this has not been confirmed.
- 3.2.7 The site is located in an area that may be susceptible to artesian aquifers, as stated in the BGS Research Report RR/06/03 (Whitehead and Lawrence, 2006).
- 3.2.8 The groundwater flood risk is classified as *Negligible* to *Low* risk in the north and north-east areas of the site, along the A1173 Queens Road and Long Strip land. In the south of the site, the groundwater flood risk is mostly classified as a *Moderate* risk, although there are areas that are classified as *Negligible*, *Low* risk and *Moderate* to *High* risk.

- 3.2.9 The ground investigation undertaken by GD Pickles Ltd in 2020 of Sub Plot 1 and Sub Plot 3 recorded the presence of two groundwater bodies: perched groundwater within Made Ground and a second groundwater body at the boundary of Made Ground and Tidal Flat Deposits (GD Pickles, 2020). True groundwater levels were recorded at 3.6 m bgl in BH04. Sub artesian groundwater pressure was also observed beneath the Tidal Flat Deposits and Boulder Clay at 18 m bgl. Groundwater ingress within trial pits were recorded between 0.8 m bgl and 1.5 m bgl.

3.3 Hydrology

- 3.3.1 The majority of the site has a *Very Low* to *Low* flood risk associated with river and coastal flooding. In the north of the site near the River Humber, the Long Strip land and the Queens Road land, the river and coastal flood risk is classified as *Medium* risk.
- 3.3.2 The site is partially located within the Humber Estuary. The Environment Agency Catchment Data Explorer indicates the Humber Lower Transitional section of the Humber Estuary has an overall '*Moderate*' status, with a '*Moderate*' ecological status and a '*Fail*' chemical status in 2019 (Environment Agency, 2022). The '*Fail*' chemical status is associated with priority hazardous substances Polybrominated diphenyl ethers (PBDE), Perfluorooctanesulfonic acid (PFOS), Polycyclic aromatic hydrocarbons (PAHs) and, mercury and its compounds.
- 3.3.3 There are three unnamed surface water courses within Sub Plot 2 of the site that are described as '*Inland river not influenced by normal tidal action*'.
- 3.3.4 Within the surrounding area to the site, there are 47 unnamed watercourses within 250 m and the North Beck Drain river body catchment is located within 409 m south of the site. The 2019 status of the North Beck Drain was classified as a '*Moderate*' overall status, a '*Moderate*' ecological status and a '*Fail*' for the chemical status (Environment Agency, 2022).
- 3.3.5 The nearest surface water abstraction is located approximately 1.24 km west from the site; a historical abstraction that was operated by Immingham Town Council.

4. Summary of previous ground investigations

4.1.1 The following previous ground investigations (GI) have been undertaken across the site:

4.2 Associated British Ports 2022: ground investigation

4.2.1 A ground investigation was undertaken by ABP between 23rd May and 24th May 2022 to collect soil samples for chemical testing to support the risk and environmental impact assessment within the Ground Conditions including Land Quality chapter of the Environmental Statement for the landside development of the Immingham Eastern Ro-Ro Terminal (IERRT) project within the Port of Immingham. AECOM undertook sampling and logging of soil.

4.2.2 The scope of the investigation consisted of:

- 7 machine excavated trial pits;
- Soil logging to British Standards Institution Publication BS5930:2015+A1:2020 “Code of practice for ground investigations”;
- Soil sampling; and
- Geo-environmental laboratory testing.

4.3 GD Pickles Ltd 2020: ground investigation

4.3.1 An intrusive investigation was undertaken of areas of the site within Sub Plot 1 and Sub Plot 3 by GD Pickles Ltd, on behalf of HBPW LLP between 24th February 2020 and 29th February 2020. Groundwater monitoring wells were installed in BH03 and BH05.

4.3.2 The scope of investigation consisted of:

- 6 boreholes excavated using cable percussion boring techniques to depths between 10 m bgl and 13.5 m bgl;
- 1 borehole excavated using rotary percussion boring techniques to a depth of 28.5 m bgl;
- 15 trial pits excavated using a 9-tonne backhoe machine excavator to depths between 1 m bgl and 2.5 m bgl;
- Geotechnical in-situ and laboratory testing; and
- Geo-environmental laboratory testing comprised:
 - 15 asbestos screen tests;
 - 8 soil organic matter tests;
 - 15 heavy metal tests;
 - 15 phenol tests;
 - 15 total cyanide tests;
 - 15 water soluble boron tests;
 - 15 speciated polyaromatic hydrocarbon tests;
 - 11 TPH tests and 8 BRE Special Digest 1 (for buried concrete) tests.

4.4 Exploration Associates 1980: ground investigation

4.4.1 An intrusive investigation was undertaken of the area to the northwest of the site by Exploration Associates on behalf of British Transport Docks Board, outside of the site boundary, between 21st April 1980 and 23rd May 1980 (Exploration Associates, 1980).

4.4.2 The scope of the investigation consisted of:

- 4 boreholes excavated using cable tool boring (shell and auger) techniques to depths between 34.5 m bgl and 40 m bgl; and
- Geotechnical in-situ and laboratory testing.

4.5 Ground Explorations Ltd 1967: ground investigation

4.5.1 An intrusive investigation was undertaken by Ground Explorations Ltd on behalf of The British Transport Docks Board between 4th June 1966 and 14th June 1966 (onshore investigation) and 15th August 1966 and 10th September 1966 (offshore investigation) (Groundsure Explorations, 1967). The onshore borehole was drilled near to, or within, Sub Plot 1, whilst the remaining boreholes were drilled within the Humber Estuary.

4.5.2 The scope of the investigation consisted of:

- 4 boreholes excavated using shell and auger techniques to depths between approximately 21.3 m bgl and 33 m bgl;
- Geotechnical in-situ and laboratory testing; and
- A chemical analysis test for sulphate of a clay sample from the onshore borehole.

4.6 The British Transport Docks Board 1965: ground investigation

4.6.1 An intrusive investigation was undertaken by The British Transport Docks Board within the Humber Estuary in close proximity to the area of Sub Plot 1 between 6th August 1965 and 11th September 1965 (British Transport Docks Board, 1965).

4.6.2 The scope of the investigation consisted of:

- 17 boreholes were excavated using shell and auger techniques to depths between 9.1 m BOD (Below Ordnance Datum) and 32.3 m BOD; and
- Geotechnical in-situ testing.

5. Review and collation of information on encountered ground conditions

5.1 Encountered ground

5.1.1 The ground conditions encountered during the previous investigations, including the GI undertaken in 2022, within the site boundary is summarised in Table 5.1.

Table 5.1 Summary of encountered ground conditions

Deposit	Min Depth (m bgl)	Max Depth (m bgl)	Summary Description	Approximate Distribution
Topsoil	Ground level	0.76	Thin and poor quality of layer of clayey organic topsoil. Topsoil was only encountered in two trial pits during the 2020 GI and in the 2022 initial GI. The 1967 GI noted that the topsoil contained chalk stones.	Small areas within northern sector of Sub Plot 3 and the northeast corner of Sub Plot 1. Topsoil was encountered within the onshore borehole within Sub Plot 1 in the 1967 GI.
Made Ground	Ground level	5.0	Made Ground is mostly gravel and sandy gravelly clay with pottery, bricks, wire, clay tiles and concrete. In the 2020 GI, inert landfill / industrial waste was observed within the Made Ground. A wood obstruction and railway sleeper were recorded in Made Ground in the south-east of the site during the 2020 GI. A chalk fill material was encountered in two trial pits. The 2022 initial GI recorded sand within Made Ground and additional anthropogenic material such as clinker, crushed stone, rebar, cables, pipes, plastic sheeting and plastic-coated fibre glass sheets.	Made Ground was encountered in all exploratory hole locations within Sub Plot 1, Sub Plot 3 and Sub Plot 4 during the 2022 GD Pickles GI and the 2022 GI.
Reworked Natural Deposits	0.3	3*	<p>The reworked natural deposits comprise of soft to stiff, slightly silty or mottled clay. Lenses of sand were recorded within the clay, as well as fine to medium angular black mudstone and well-rounded white chalk.</p> <p>Soft to firm slightly gravelly sandy silt is also described as reworked natural deposits. The gravel comprises of white chalk and black fissile mudstone.</p>	Reworked natural deposits were encountered in five exploratory hole locations across all Sub Plots in the GI undertaken in 2022.

Deposit	Min Depth (m bgl)	Max Depth (m bgl)	Summary Description	Approximate Distribution
Tidal Flat Deposits	0.55	10.9	Tidal Flat Deposits are described as a firm orange, brown sandy clay underlain by soft grey clays and silts with organic material. Bands of sand were encountered within the sandy clay.	Although not encountered in all trial pits during the GD Pickles Ltd 2020 GI, the Tidal Flat Deposits are likely to be present underneath the entire area of Sub Plot 1 and 3.
Peat	1	3.3*	Dark brown, black, slightly fibrous to fibrous peat.	Encountered within the northeast area of Sub Plot 3 and the southwest area of Sub Plot 4.
Beach and Tidal Flat Deposits	0.76	10.06	The 1976 GI encountered soft to stiff silty clay with patches of peat and peaty clay. Clayey sand with silt and gravel was also encountered. Offshore boreholes encountered soft silty with peat.	Beach and Tidal Flat Deposits were encountered within the northern area of Sub Plot 1 and in close proximity to the offshore area of Sub Plot 1.
Devensian Till	8.7 (Sub Plot 3 in 2020 GI) 1.22 (Offshore area near Sub Plot 1 in 1967 GI)	22.5 (Sub Plot 3 in 2020 GI) 28.65 (Offshore area near Sub Plot 1 in 1967 GI)	The Devensian Till is a stiff brown mottled grey gravelly sandy clay. Sand and gravel filled channels were also encountered with occasional peat. The 1967 GI encountered stiff boulder clay with chalk gravel, silty sand and sand inclusions. Offshore boreholes encountered stiff brown boulder clay and laminated clay with chalky gravel.	Encountered in all boreholes within Sub Plot 3 during the 2020 GI. Two boreholes drilled in Sub Plot 1 in the 2020 GI did not encounter till, however, the boreholes were only drilled to 10 m and 10.5 m depth.
Bedrock: Flamborough Chalk Formation	22.5 (Sub Plot 3 in 2020 GI) 18.29 (near the offshore area of Sub Plot 1 in 1967 GI)	28.5* (Sub Plot 3 in 2020 GI) 33.07* (Sub Plot 1 in 1967 GI)	Weathered chalk gravel is present in the upper section which increases in hardness with depth. The 1967 GI encountered medium to hard chalk in onshore and offshore boreholes.	Chalk was only encountered within one borehole within the northern area of Sub Plot 3 in the 2020 GI. However, chalk is anticipated to be present underlying the superficial deposits across the entire site.

Deposit	Min Depth (m bgl)	Max Depth (m bgl)	Summary Description	Approximate Distribution
				Chalk was encountered within the northern area of Sub Plot 1 and in the offshore area close to the area of Sub Plot 1 in the 1967 GI.

* Depth to base not proven

Source: Ground Explorations (1967); GD Pickles (2020); AECOM (2022b)

5.2 Groundwater conditions from 2022 GI

5.2.1 Shallow groundwater conditions were encountered during the 2022 GI (AECOM, 2022b). Water strikes were recorded between 0.8 m bgl and 3.3 m bgl. TP4 was terminated at 1.8 m bgl due to water ingress. A summary of the encountered groundwater conditions is provided in Table 5.2.

Table 5.2 Summary of groundwater conditions encountered in the trial pits during the 2022 GI

Location	Termination Depth (m bgl)	Water Strike (m bgl)	Depth water rose to time period (m bgl)	Strata	Comments
TP4	1.8	1.8	1.6 (10 minutes)	Made Ground	Trial pit terminated at 1.8 m due to water ingress.
TP5	3.3	3.3	3.2 (20 minutes)	Peat	Water ingress observed from the base of the pit.
TP6	3	0.8	-	Made Ground (terram)	Water ingress observed along terram within Made Ground. This did not fill the base of the trial pit.
TP7	3	1.8		Clay	Water encountered at 1.8 m bgl which flowed to the base of the trial pit at 3 m bgl.
		2.1		Clay	Water encountered at 2.1 m which flowed to the base of the trial pit at 3 m bgl.

The groundwater at the base of the pit rose to 2.8 m bgl after 20 minutes.

5.3 Assessment of potential contamination

5.3.1 Indication of potential soil contamination has been recorded during the ground investigations at the site. The following observations were made:

- The majority of Made Ground encountered within the 2020 GI comprised of industrial waste / inert landfill waste with an industrial odour (GD Pickles, 2020). The factual report notes that the contamination of Made Ground by anthropogenic content was greater within the area of Sub Plot 1.
- A slight organic / industrial odour was observed within Made Ground in TP20 in the 2020 GI, however, this was not a hydrocarbon odour (GD Pickles, 2020).
- A slight industrial odour was observed within Made Ground in TP24 in the 2020 GI (GD Pickles, 2020).
- A slight hydrocarbon odour was reported within Made Ground between 0.2 m bgl and 0.5 m bgl in TP1 during the initial GI undertaken in 2022 (AECOM, 2022b).

5.3.2 These findings are subject to a confirmatory ground investigation which is being undertaken. The findings of the confirmatory GI will be assessed and detailed in an interpretative report. In the event that geo-environmental risks are identified following that assessment, then in accordance with guidance in LC:RM (Environment Agency, 2021), appropriate mitigation measures as necessary will be incorporated in the final remediation strategy for the project.

5.4 Human health risk assessment

5.4.1 A tier 2 human health risk assessment was undertaken using geo-environmental data from the GI undertaken in 2022 and the GD Pickles GI undertaken in 2020. Soil samples from Made Ground and reworked natural deposits were screened against the Generic Assessment Criteria (GAC) for a Commercial / Industrial land-use with a Total Organic Carbon (TOC) of 1.45 – 3.48%. Fourteen samples of Made Ground from the GD Pickles GI (GD Pickles, 2020) and eleven samples of Made Ground from the 2022 GI (AECOM, 2022b) were screened against the GAC criteria. The exceedances are summarised in Table 5.3.

Table 5.3 Summary of determinands identifying exceedances above GAC in made ground

Determinand	No. of samples Exceeding GAC / No. of samples Analysed	GAC (mg/kg)	Recorded Concentration Range (mg/kg)	Order of Magnitude above GAC criteria
Benzo(a)anthracene	2 / 25	170	<0.05 – 190	Same order of magnitude
Benzo(a)pyrene	3 / 25	35	<0.05 - 150	1 order of magnitude
Benzo(b)fluoranthene	3 / 25	44	<0.05 – 150	1 order of magnitude
Dibenzo(a,h)anthracene	2 / 25	3.6	<0.05 – 22	1 order of magnitude

Determinand	No. of samples Exceeding GAC / No. of samples Analysed	GAC (mg/kg)	Recorded Concentration Range (mg/kg)	Order of Magnitude above GAC criteria
4-Chloroaniline	1 / 11	11	<0.6 – 15.1	Same order of magnitude

5.4.2 Most of the exceedances were recorded in two exploratory hole locations; TP6 of the 2022 GI and TP24 of the GD Pickles GI. All exceedances were within the same, or one order of magnitude above the GAC criteria, therefore, this presents a low risk. No exceedances were identified in soil samples from reworked natural deposits.

5.4.3 Twenty-eight samples from the initial GI and fifteen samples from the GD Pickles GI were tested for asbestos. A concentration of 0.002% w/w of chrysotile was recorded in TP4 at 1.2 m bgl in the 2022 GI.

5.4.4 These findings are subject to a confirmatory ground investigation which is currently being undertaken. The findings of the confirmatory GI will be assessed and detailed in an interpretative report.

5.5 Controlled waters risk assessment

5.5.1 A tier 2 controlled waters risk assessment was undertaken using geo-environmental data from the GI undertaken in 2022 (AECOM, 2022b) and the GD Pickles GI undertaken in 2020. The leachate samples from Made Ground and reworked natural deposits were screened against the Drinking Water Standards (DWS) and Environmental Quality Standards (EQS) for Freshwater. The soil leachate exceedances are summarised in Table 5.4.

Table 5.4 Summary of the Tier 2 exceedances in soil leachate

Determinand	Units	DWS	EQS	No of Exceedances / Results DWS	No of Exceedances / Results EQS	Range	Order of Mag above DWS	Order of Mag above EQS Freshwater
Made Ground								
Arsenic*	mg/l	0.01	0.05	3 / 12	0 / 12	<0.001 – 0.0434	Same order of magnitude	-
Copper*	mg/l	2	0.001	0 / 12	4 / 12	<0.001 – 0.053	-	1 order of magnitude
Lead*	mg/l	0.01	0.0012	0 / 12	4 / 12	<0.001 – 0.008	-	Same order of magnitude
Nickel*	mg/l	0.02	0.004	0 / 12	5 / 12	<0.0003 – 0.0092	-	Same order of

Determinand	Units	DWS	EQS	No of Exceedances / Results DWS	No of Exceedances / Results EQS	Range	Order of Mag above DWS	Order of Mag above EQS Freshwater
								magnitude
Chromium* (Total)	mg/l	0.05	-	1 / 12	-	<0.001 – 0.138	1 order of magnitude	-
Zinc*	mg/l	6	0.0109	0 / 12	3 / 12	<0.002 – 0.019	-	Same order of magnitude
Ammoniacal Nitrogen	mg/l	-	0.3	-	4 / 7	<0.01 – 17.4	-	2 orders of magnitude
Chromium VI	mg/l	0.05	0.0034	1 / 12	3 / 12	<0.003 – 0.104	1 order of magnitude	2 orders of magnitude
Antimony*	mg/l	0.005	-	2 / 5	-	<0.0017 – 0.017	1 order of magnitude	-
Fluoride*	mg/l	1.5	1	4 / 5	5 / 5	1.3 – 7.6	Same order of magnitude	Same order of magnitude
Sulphate*	mg/l	250	400	3 / 5	3 / 5	180 – 1400	1 order of magnitude	1 order of magnitude
Reworked Natural Deposits (Clay, Clay with Peat and Silt)								
Arsenic	mg/l	0.01	0.05	4 / 9	1 / 9	<0.001 – 0.052	Same order of magnitude	Same order of magnitude
Copper	mg/l	2	0.001	0 / 9	3 / 9	<0.001 – 0.002	-	Same order of magnitude
Lead	mg/l	0.01	0.0012	0 / 9	1 / 9	<0.001 – 0.002	-	Same order of magnitude
Nickel	mg/l	0.02	0.004	0 / 9	2 / 9	<0.001 – 0.007	-	Same order of magnitude

Determinand	Units	DWS	EQS	No of Exceedances / Results DWS	No of Exceedances / Results EQS	Range	Order of Mag above DWS	Order of Mag above EQS Freshwater
Zinc	mg/l	6	0.0109	0 / 9	1 / 9	0.002 – 0.013	-	Same order of magnitude
Boron	mg/l	1	2	2 / 9	0 / 9	0.05 – 1.24	Same order of magnitude	-
Iron	mg/l	0.2	1	2 / 9	1 / 9	<0.01 – 4.14	1 order of magnitude	Same order of magnitude
Ammoniacal Nitrogen	mg/l	-	0.3	0 / 9	5 / 9	0.2 – 9.9	-	1 order of magnitude
Chloride	mg/l	250	250	1 / 9	1 / 9	3 - 313	Same order of magnitude	Same order of magnitude
Chromium VI	mg/l	0.05	0.0034	0 / 9	1 / 9	<0.003 – 0.01	-	1 order of magnitude
Thiocyanate	mg/l	0.004	-	1 / 9	-	<0.2 – 0.82	2 orders of magnitude	-
Total Cyanide	mg/l	0.05	0.001	0 / 9	2 / 9	<0.02 – 0.02	-	1 order of magnitude

**Exceedances include a combination of results from the 2022 GI data (AECOM, 2022b) and the 2020 GD Pickles GI data (GD Pickles, 2020) which have difference in leachate ratios.*

- 5.5.2 Some of the exceedances of ammoniacal nitrogen, copper and nickel in the 2022 GI soil leachate samples were recorded in Made Ground and reworked natural deposits within the same exploratory hole location. This suggests there is a potential source of contamination within Made Ground, and a pathway to the reworked natural deposits or that the reworked natural deposits also includes Made Ground material.
- 5.5.3 Most of the exceedances were within the same, or one order of magnitude above the DWS and EQS Freshwater criteria. However, ammoniacal nitrogen, thiocyanate and chromium (VI) recorded exceedances within 2 orders of magnitude of the DWS and EQS Freshwater criteria at the maximum concentration.
- 5.5.4 These findings are subject to a confirmatory ground investigation which is being undertaken. The findings of the confirmatory GI will be assessed and detailed in an interpretative report.

5.6 Ground gas risk assessment

- 5.6.1 A ground gas risk assessment was undertaken using the method outlined in RB17 (CL:AIRE, 2012). The soil organic matter (SOM) and TOC content of Made Ground in soil samples from the 2022 GI and the GD Pickles GI were reviewed against the criteria in Table 1 of RB17. The maximum TOC content was recorded as 4.34% in TP4 of the 2022 GI, which classifies the site as Characteristic Situation CS3. This is defined as a *moderate* risk. However, it should be noted that a conservative approach to the assessment was adopted, and a reduction factor to account for degradable portion of TOC has not been calculated. Five samples also recorded a SOM content of >43% which have been excluded from the analysis as they are, following confirmation from the chemical laboratory, indicative results only.
- 5.6.2 These findings are subject to a confirmatory ground investigation which is being undertaken. The findings of the confirmatory GI will be assessed and detailed in an interpretative report.

5.7 Waste acceptance criteria assessment

- 5.7.1 Waste Acceptance Criteria testing of five Made Ground samples from the 2020 GD Pickles Ltd GI was undertaken. These samples were classified as Stable Non-reactive HAZARDOUS Waste in a non-hazardous landfill. The samples of Made Ground were obtained from TP01 at 0.1 – 0.5m bgl; TP05 at 0.3 – 1 m bgl; TP06 at 0.2 – 1 m bgl; TP13 at 0.5 – 0.8 m bgl and TP24 at 0.3 – 0.6 m bgl. Note these results are relevant only in the event that material are disposed as waste off site.
- 5.7.2 A sample of the sulphates within a clay sample from BH1 (potentially within the area of Sub Plot 1) in the Ground Explorations Ltd 1967 GI was designated as Classification 3 of the Code of Practice C.P.3. Chapter IX.
- 5.7.3 These findings are subject to a confirmatory ground investigation which is being undertaken. The findings of the confirmatory GI will be assessed and detailed in an interpretative report.

6. Conceptual site model

- 6.1.1 The Conceptual Site Model (CSM) for the site presented here has been refined by successive phases of desk-based, intrusive and interpretative investigation.
- 6.1.2 Table 6.1 presents the latest version of the CSM compiled from all available information reviewed for this area of the site.
- 6.1.3 Table 6.1 highlights all of the relevant pollutant linkages (RPLs) and attaches a Risk Rating to each of the RPLs based on the Severity of the risk and the Probability of that risk occurring in accordance with the methodology proposed in CIRIA document Construction Industry Research and Information Association publication Research & Development (R&D) Publication 66, National House Building Council (NHBC)/Environment Agency/Chartered Institute of Environmental Health (CIEH) 2008 (NHBC, Environment Agency and CIEH, 2008).

Table 6.1 Risk evaluation of potential pollutant linkages

Source	Pathway	Receptor	Level of Risk		
Contaminants of potential concern within soil in Made Ground and natural strata	Direct Contact / Ingestion / Inhalation of vapours & dust	Future Site Visitors (users of the Ro-Ro facility)	Low		
		On-Site Human Health	On-site Workers (Within future constructed buildings)	Low	
			On-site workers (Outdoors)	Low	
		Inhalation of Vapours / Dusts	Construction / Maintenance Workers	Construction / Maintenance Workers	Moderate / Low
	Workers in the commercial/ industrial buildings located adjacent to the west site boundary			Very Low	
	Surface run-off / Migration via site drainage		Controlled Waters	Surface Water: (Humber Estuary/ Drains on site)	Moderate / Low
				Groundwater: (Superficial Secondary Undifferentiated (Beach and Tidal Flat Deposits and Glacial Till))	Moderate / Low
	Infiltration / Vertical Migration		Controlled Waters	Groundwater: (Principal bedrock aquifers (Flamborough Chalk Formation and Burnham Chalk Formation))	Low
				Direct Contact	Development

Source	Pathway	Receptor	Level of Risk
		Infrastructure	associated foundations and infrastructure
	Direct Contact / Uptake	Flora & Fauna	On site flora and fauna
Leachate and Groundwater contaminants from Made Ground and Natural Strata	Direct Contact / Ingestion / Inhalation of vapours	On-Site Human Health	Future Site Users / Visitors
			On-site Workers (Within future constructed buildings)
			On-site workers (Outdoors)
			Construction / Maintenance Workers
	Lateral Migration		Surface Water: (Humber Estuary/ Drains on site)
	Preferential migration Through Surface Water Drainage		Groundwater: (Superficial Secondary Undifferentiated (Beach and Tidal Flat Deposits and Glacial Till))
	Vertical Migration	Controlled Waters	Groundwater: (Principal bedrock aquifers (Flamborough Chalk Formation and Burnham Chalk Formation))
	Direct Contact	Development Infrastructure	Buildings to be constructed on site and associated foundations and infrastructure
	Infiltration / Off-site Migration	Off-Site Human Health	Workers in the commercial/ industrial buildings located adjacent to the west site boundary
		Direct Contact / Uptake	Flora & Fauna
Ground Gas potentially produced by Made Ground, historical	Inhalation	On-Site Human Health	Future Site Visitors (users of the Ro-Ro facility)

Source	Pathway	Receptor	Level of Risk	
landfills, and naturally from organic content within the underlying deposits		On-site workers (Outdoors)	Very Low	
	Inhalation / Migration & Explosion	On-site Workers (Within future constructed buildings)	Moderate	
		Construction / Maintenance Workers	Moderate	
	Migration & Explosion	Development Infrastructure	Buildings to be constructed on site and associated foundations and infrastructure	Moderate
	Inhalation / Migration & Explosion	Off-Site Human Health	Off-site Receptors: Workers in the commercial/ industrial buildings located adjacent to the west site boundary	Very Low

6.1.4 The level of risk identified in Table 6.1 is based on the site being developed for the proposed end use. The conclusions are also subject to a confirmatory ground investigation which is currently being undertaken. The findings of the confirmatory GI will be assessed and detailed in an interpretative report. The risk levels also take into consideration that whilst construction / site workers (and maintenance workers during the operation period) might be expected to come into contact with soils and leachate/groundwater, the use of personal protective equipment will be a pre-requisite to them being on site. Before commencing work, a site-specific health and safety risk assessment should be carried out in accordance with current health and safety regulations. This assessment should cover potential risks to both construction staff and the local population. It is also assumed that dust generation would be kept to a minimum, in accordance with general best practice, as outlined in, for example, “Environmental Good Practice on Site”, 3rd Edition, CIRIA Publication C692 (CIRIA, 2010). Based on the findings of the risk assessment, appropriate mitigation measures should be implemented during the course of the earthworks.

6.1.5 The risk levels also take into consideration that maintenance workers accessing underground utilities are at a higher risk from ground gas, although this will be mitigated through wearing appropriate PPE and monitoring the atmospheric conditions. Entry into underground structures should comply with confined space legislation and assessed prior to entry.

7. Outline remediation strategy

7.1 Objectives of the outline remediation strategy

7.1.1 The objectives of the Outline Remediation Strategy leading to an industrial/commercial end use at the site are as follows:

- That the site is geo-environmentally suitable for the proposed end use;
- That the re-use criteria for earthworks materials are protective of human health and the environment;
- That on-site ground gas hazard, where confirmed, and its associated risks to development is mitigated such that potential risks to human health and development infrastructure are minimised and the site is suitable for an industrial/commercial end-use;
- To promote the use of site-won materials at the site, minimising offsite disposal and the import of virgin materials; and
- That any remediation activities are undertaken in such a way as to avoid potential pollution to the environment during the works.

7.1.2 The objective for any identified remediation that may be required is to ensure that hazards and related risks from earthworks arisings and related controlled waters pollution hazards are treated and managed. To achieve this objective the works will aim to:

- Capture and test any incidental groundwater encountered in the excavations, where necessary treat the incidental groundwater, and discharge a to the foul sewer or to a neighbouring watercourse, upon approval of permit from the Environment Agency, or to foul sewer upon approval of a discharge consent from the sewerage undertaker; and
- Ensure that soil re-used from the scheme at the site meets the re-use criteria.

7.2 Unanticipated issues

7.2.1 If contamination is encountered, at any time when carrying out the earthworks and / or remediation works, that was not previously identified, an investigation and a risk assessment will be undertaken and where remediation is considered necessary a remediation scheme will be prepared and agreed with the relevant authorities.

7.2.2 Where unanticipated areas of contamination, similar to that encountered elsewhere within the site, are identified then the process set out here will be followed:

- Excavation of materials;
- Sampling for, and undertaking chemical analysis;
- Assessment of chemical data; and
- Remediation of material, if and where necessary to allow re-use in the development.

- 7.2.3 The location of any such unanticipated contamination encountered will be recorded, including the results of chemical testing, the volumes sentenced for treatment by remediation, the validation data showing compliance with the relevant Reuse Acceptability Criteria (RAC) / Remedial Target Value (RTV) and the location of the area of use of the remediated material within the development platform.

7.3 Summary of works

- 7.3.1 The strategy is based upon excavation, testing, sentencing, remediation (if and where necessary) and engineered use of site-won materials. The following summarise the general scheme works that apply to the site as a whole:
- Removal and stockpiling of topsoil for later placement;
 - In areas of cutting and / or temporary works excavations, excavate to the design depth, classify, test, stockpile and sentence the materials for the appropriate end use, disposal, or a remediation process before re-use;
 - Apply appropriate remediation processes where necessary in designated remedial treatment areas as required to render the earthworks materials and the natural sub-formation acceptable for use in the development platform; and
 - Placement of materials to formation level (i.e., the finished development platform level) with suitable site won materials and/or engineered fill compacted by method compaction.

7.4 Performance of earthworks

- 7.4.1 The performance of earthworks will be covered in the Geotechnical Design Report.

7.5 Role of engineer

- 7.5.1 The earthworks (including sampling, testing and compaction) will be supervised by a suitably qualified Engineer and the results will be recorded in a Verification Report.
- 7.5.2 Duties of the Engineer will include the following.
- Setting up the verification testing database, using GIS or MS Access and a grid reference system based upon the site survey.
 - Supervision of site personnel in taking samples of imported and exported earthworks materials and scheduling tests in accordance with the specification.
 - Inspection of formation, bases of areas of over-dig and bases of excavations to remove unacceptable materials and recording of the geotechnical conditions at these levels.
 - Liaising with the geotechnical and chemical testing laboratories to ensure prompt receipt of information.
 - Receiving and inputting test results onto the database.
 - Supervision of boreholes for installation of groundwater and gas monitoring standpipes.
 - Taking readings from standpipes for gas emission and flow rate, and water level, and purging and sampling of standpipes for groundwater sampling.
 - Ordering and supervising ground treatment verification tests in accordance with the specification.
 - Preparing the verification (land quality) report.

- 7.5.3 The Engineer will be suitably qualified and experienced in site supervision of geotechnical and environmental reclamation/remediation. The Engineer will be qualified to degree and postgraduate Master of Science degree level in civil, geo-environmental and/or geotechnical engineering.

7.6 Approvals

- 7.6.1 Consultation will be held with the local authorities and the Environment Agency regarding the contents of this Outline Remediation Strategy before the works are undertaken.
- 7.6.2 It is the intention that the works, involving non-landfill material, will be self-regulated using the CL:AIRE Definition of Waste: Development Industry Code of Practice (DoWCoP). This removes the need to obtain an Environmental Permit or exemption to an Environmental Permit for the excavation, movement, and placement of site-won materials. Any materials excavated from the historical landfill which lies within the scheme boundary, located in the southeast within Sub Plot 3, will be considered by the Environment Agency as discarded materials and will be a Waste. To re-use such materials, it would require treatment under an Environmental Permit, (e.g., a mobile Treatment Permit. Note that a remediation process implemented to remediate made ground generally would also be carried out under a similar or the same Permit.
- 7.6.3 The remediation contractor will be required to agree and approve the Mobile Treatment Permit and prepare a Deployment Form for issue to the Environment Agency.
- 7.6.4 Any earthworks materials that do not meet the RAC, following treatment, will require disposal to an off-site licensed landfill under The Waste (England and Wales) Regulations 2014 as amended (UK Statutory Instruments, 2014).
- 7.6.5 Before disposal materials will need to be assessed to determine whether they are hazardous waste. This is to determine whether the materials can be disposed to inert, non-hazardous or hazardous waste landfill.
- 7.6.6 Materials subject to disposal must also have WAC testing to determine their waste classification.
- 7.6.7 Details of the materials sentenced for off-site disposal will include waste classification, volumes and disposal location. Records of waste transfer documentation for the materials disposed of off-site will be required.
- 7.6.8 Further details will be set out in the CEMP for items such as: A water discharge activity environmental permit (WDA-EP) and/or Trade Effluent Consent required for the temporary discharge of perched water and other incidental water encountered within the works.
- 7.6.9 Point of discharge (foul sewer or neighbouring watercourse) of contaminated perched groundwater, contaminated incidental water and uncontaminated surface water run-off to be ascertained as a result of consultation with the Environment Agency or local sewerage undertaker.

7.7 Contractors method statements

- 7.7.1 The Remediation Contractor is required to prepare Method Statements for undertaking all aspects of the works proposed for the IERRT project.

8. Potential contamination during works

8.1 Contaminated land

- 8.1.1 This section presents the response procedures for dealing with contamination encountered during the works. In the event that contamination is encountered at any time during the works at the site that was not previously identified, an investigation and a risk assessment will be undertaken and where remediation is considered necessary a remediation scheme will be prepared and agreed with the relevant authorities.
- 8.1.2 When dealing with unanticipated contamination and where run-off is a potential issue, the mitigation measures set out in Water Management Plan should be followed.
- 8.1.3 When dealing with unanticipated contamination and where dust generation is a potential issue, the best practicable means to reduce emissions as set out in the Air Quality and Dust Management Plan should be followed.
- 8.1.4 Main works activities in the area shall be stopped immediately and the incident reported to the Site Manager in the event that one or more of the following are found:
- Discoloured or oily soil (chemical or oil residues);
 - The soil has a fibrous texture (asbestos);
 - Presence of foreign objects (chemical/oil containers);
 - Evidence of underground structures and tanks;
 - Existence of waste pits or landfill material; and
 - Old drain runs and potential contamination within building, tanks, and flues.
- 8.1.5 The Site Manager must contact the Health and Safety Manager and Environmental Manager for expert advice.
- 8.1.6 Where unanticipated areas of potential contamination are identified then the process set out here will be followed:
- Demarcation of potentially contaminated area, with access restricted to key personnel with appropriate PPE;
 - Excavation of materials;
 - Sampling for, and undertaking chemical analysis;
 - Assessment of chemical data; and
 - Sentencing for re-use within the scheme [subject to passing re-use acceptability criteria], remediation or off-site disposal, as necessary.
- 8.1.7 The location, depth, and extent of any such unanticipated contamination encountered will be recorded, including the results of chemical testing, the volumes sentenced for treatment by remediation, the validation data showing compliance with the relevant RACs and the location of the area of use of the remediated material within the scheme, or the details of off-site disposal of the impacted materials.

8.2 Requirements for the geochemical sampling and testing of earthworks materials

8.2.1 Point of Excavation and Point of Placement sampling and testing is presented in Table 1/5b of the DMRB Series 600 Earthworks Specification. This table also presents the scope and frequency of testing of soils at point of excavation and again at point of placement as verification.

8.3 Bulk earthworks

8.3.1 Testing of all earthwork materials shall be undertaken at a minimum frequency listed in Table 1/5b of the DMRB Series 600 Earthworks Specification (Highways England, 2016). This table has been reproduced as Table 8.1 in this report.

8.3.2 All earthworks materials shall be subject to geochemical testing at point of excavation, at point of placement and following any treatment.

8.3.3 Where, at the point of excavation, exceedances of the RACs are identified following statistical analysis then additional trial pits shall be undertaken around the area exhibiting elevated concentrations and samples taken at the appropriate depths in order to delineate the zone of exceedances.

Table 8.1 [1/5b] Geochemical testing to be carried out (soils)

Work, Goods or Material	Test	Frequency of Testing
CHEMICAL CONTROL TESTING (Notes a, b, c, d and h)		
All material requiring excavation (excluding topsoil)	Soil Analysis Suite (Note e) and soil Leachability Suite (Note f)	1 test per 2,500 m ³ (with minimum of 12 samples per source)
All topsoil material requiring stripping	Soil Analysis Suite (Note e)	1 test per 1,000 m ³ (with minimum of 12 samples per source)
All material following completion of filling	Soil Analysis Suite (Note e) and soil Leachability Suite (Note f)	1 test per 2,500 m ³
Screening test for asbestos	1 test per 500 m ³	
ADDITIONAL CHEMICAL CONTROL TESTING (Notes a, b, c, d and h)		
All imported earthworks materials for each individual source and type	Soil Analysis Suite (Note e) and soil Leachability Suite (Note f)	1 test per 1,000 m ³ with minimum 5 tests per material source
Imported landscape fill (topsoil / subsoil) for each individual source and type	Soil Analysis Suite (Note e) and soil Leachability Suite (Note f)	1 test per 500 m ³ with minimum 5 tests per material source
All materials sentenced for off-site disposal	WAC Testing Suite	1 test per 100 m ³ with minimum 5 tests per batch of material

Notes applying to Table 1/5b:

a) Testing specified in this Table is to be undertaken on all materials;

b) Testing to be carried out shall be undertaken in accordance with the Specification for Highways Works, 600 Series and the following;

c) All chemical analysis shall be UKAS and MCERTS accredited as appropriate;

d) All sampling shall be carried out in accordance with the 'Specification for Ground Investigation' published by Thomas Telford Ltd, 1993 and reporting shall be in digital form, which is compatible with Microsoft Excel or Access, in addition to paper records as specified in Appendix III of the aforementioned documents;

e) Soil analysis suite to include the following determinands: Arsenic, Boron, Cadmium, Chromium (Total and VI), Copper, Lead, Mercury, Nickel, Selenium, Zinc, Cyanide (Free), Polycyclic Aromatic Hydrocarbons (speciated USEPA 16), Total Petroleum Hydrocarbons (TPH CWG C5-C35 aliphatic/aromatic split), Volatile Organic Compounds, Phenols (Total), pH, Ammoniacal Nitrogen, Soil Organic Matter, Asbestos Screen, Asbestos Identification and Quantification if asbestos proves positive; and

f) Leachate analysis suite to include the following determinands: Arsenic, Boron, Cadmium, Chromium (Total and VI), Copper, Lead, Manganese, Mercury, Nickel, Selenium, Zinc, Sulphate, Ammoniacal Nitrogen, Nitrate, Nitrite, pH, BTEX, Total Petroleum Hydrocarbons (carbon banded C5-C40), Polycyclic Aromatic Hydrocarbons (speciated US EPA 16), VOCs, SVOCs; g) Not used; and

h) Limits of detection for chemical testing shall be detailed as Table 8.2 and Table 8.3.

8.3.4 The soil and leachate analysis suites, together with the required limits of detection, will include the determinands presented in Table 8.2 and Table 8.3, respectively.

Table 8.2 Analysis suite of chemical laboratory testing for soils

Determinand	Method Detection Limit	Units
Arsenic	1	mg/kg
Boron (water soluble)	1	mg/kg
Cadmium	1	mg/kg
Copper	1	mg/kg
Chromium (total)	1	mg/kg
Chromium (VI)	1	mg/kg
Lead	1	mg/kg
Mercury	1	mg/kg
Nickel	1	mg/kg
Selenium	1	mg/kg
Zinc	1	mg/kg
Cyanide (total)	1	mg/kg
pH Value	0.01	pH Units
Asbestos Screen & identification	-	-
Asbestos quantification (PMOC)	0.001	%
Fraction Organic Carbon	0.1	%
Ammoniacal Nitrogen	10	mg/kg
Dependent Options		
TPH (Speciated) – CWG (C5-C35)	0.1	mg/kg
Phenols (total)	0.01	mg/kg
PAH (USEPA 16) speciated GC-FID	0.01	mg/kg

Determinand	Method Detection Limit	Units
Volatile Organic Compounds (GC-MS)	0.001	mg/kg
Semi-Volatile Organic Compounds	0.001	mg/kg
BRE SD1 (2005) Testing Suite (Greenfield or Brownfield with potential for Pyrite dependent on location of materials excavated)	# varies	-

Table 8.3 Analysis suite of chemical laboratory testing for soil leachate

Determinand	Method Detection Limit	Units
BS EN 12457-1 (single batch CEN 2:1)		
Arsenic	1	µg/l
Beryllium	1	µg/l
Boron	10	µg/l
Calcium	50	µg/l
Cadmium	0.4	µg/l
Copper	1	µg/l
Chromium	1	µg/l
Chromium (hexavalent)	1	µg/l
Iron	50	µg/l
Lead	1	µg/l
Manganese	0.001	µg/l
Mercury	0.05	µg/l
Nickel	1	µg/l
Selenium	1	µg/l
Sulphate	3	mg/l
Zinc	3	µg/l
PAH (USEPA 16) speciated GC-MS (Lowest possible level of detection)	0.01	µg/l
TPH (Carbon banded C5 – C40)	10	µg/l
BTEX by GC-MS	1	µg/l
pH Value	0.01	pH Units
Ammoniacal Nitrogen	10	µg/l
Nitrate	100	µg/l

Determinand	Method Detection Limit	Units
Nitrite	50	µg/l

8.4 Requirements for the geochemical acceptability of earthworks materials

- 8.4.1 The geochemical suitability of all earthworks materials to be used in the IERRT project are to be assessed against site specific soil RAC derived for risks to a Commercial / Industrial end-uses as detailed in Table 8.4.
- 8.4.2 The soil Reuse Acceptability Criteria for means of assessing human health risk from soils have been selected based on in-house GAC derived using the CLEA v1.07 software (utilising toxicological and chemical parameter information from various sources including the EA, LQM/CIEH and CL:AIRE). The GAC provide a conservative Tier 2 screening assessment against which to compare the levels of contaminants recorded.

Table 8.4 RAC for bulk earthwork materials (these are subject to the findings of the confirmatory GI)

Determinand	Commercial / Industrial RAC	Units
Metals and Inorganics		
Arsenic	640	mg/kg
Beryllium	63	mg/kg
Boron (water soluble)	240000	mg/kg
Cadmium	410	mg/kg
Copper	68000	mg/kg
Chromium (total)	8600	mg/kg
Chromium (VI)	49	mg/kg
Lead	2330	mg/kg
Mercury	350	mg/kg
Nickel	980	mg/kg
Selenium	12000	mg/kg
Zinc	730000	mg/kg
Cyanide (Total)	150	mg/kg
Asbestos		% w/w
Poly-cyclic Aromatic Hydrocarbons (PAHs)		
Acenaphthene	97000	mg/kg
Acenaphthylene	97000	mg/kg
Anthracene	540000	mg/kg
Benzo(a)anthracene	170	mg/kg

Determinand	Commercial / Industrial RAC	Units
Benzo(b)fluoranthene	44	mg/kg
Benzo(k)fluoranthene	1200	mg/kg
Benzo(ghi)perylene	4000	mg/kg
Benzo(a)pyrene	35	mg/kg
Chrysene	350	mg/kg
Dibenzo(ah)anthracene	3.6	mg/kg
Fluoranthene	23000	mg/kg
Fluorene	68000	mg/kg
Indeno(123cd)pyrene	510	mg/kg
Naphthalene	460	mg/kg
Phenanthrene	22000	mg/kg
Pyrene	54000	mg/kg
Total Petroleum Hydrocarbons (TPHs)		
Aliphatic >C5-C6	5,900	mg/kg
Aliphatic >C6-C8	17,000	mg/kg
Aliphatic >C8-C10	4800	mg/kg
Aliphatic >C10-C12	23,000	mg/kg
Aliphatic >C12-16	82,000	mg/kg
Aliphatic >C16-21	59,000	mg/kg
Aliphatic >C21-35	59,000	mg/kg
Aromatic >C5-C7	46000	mg/kg
Aromatic >C7-C8	110000	mg/kg
Aromatic >C8-C10	8100	mg/kg
Aromatic >C10-C12	28,000	mg/kg
Aromatic >C12-C16	37,000	mg/kg
Aromatic >C16-C21	28,000	mg/kg
Aromatic >C21-C35	28,000	mg/kg
Other Determinands		
Phenol	690	mg/kg

8.5 Total soil concentration

- 8.5.1 Compliance targets for the listed substances in materials located at depths greater than 1m below formation level may exceed the RAC as specified in Table 8.4. However, no hydrocarbon free product may be present within the soil materials, nor may materials be present which contain volatile substances exceeding the relevant RACs.

8.6 Soil leachate concentration

- 8.6.1 The chemical suitability of soil leachate (solutes from soil pore water) concentrations is to be initially assessed against Tier 2 Assessment Criteria based on EQS and DWS. Leachate testing is to be undertaken to provide corroborative data that controlled waters will not be impacted by the earthworks. The reuse acceptability criteria for soil leachate are presented in Table 8.5. These RAC values are subject to a confirmatory ground investigation.

Table 8.5 Reuse acceptability criteria for soil leachate (these are subject to the findings of the confirmatory GI)

Determinand	Commercial / Industrial RAC	Units
Metals and Inorganics		
Arsenic	10	µg/l
Beryllium	-	µg/l
Boron (water soluble)	1000	µg/l
Cadmium	0.08	µg/l
Chromium trivalent	50	µg/l
Chromium hexavalent	50	µg/l
Copper	1	µg/l
Lead	1.2	µg/l
Mercury	0.07	µg/l
Nickel	4	µg/l
Selenium	10	µg/l
Manganese	-	µg/l
Zinc	10.9	µg/l
pH	-	pH Units
Ammoniacal Nitrogen	0.3	mg/l
Sulphate	-	µg/l
Nitrate	-	mg/l
Chloride	-	mg/l
Cyanide (free)	-	µg/l
Cyanide (total)	1	µg/l

Poly-cyclic Aromatic Hydrocarbons (PAHs)

Determinand	Commercial / Industrial RAC	Units
PAH (total)	-	µg/l
Anthracene	0.1	µg/l
Benzo(a)pyrene	0.00017	µg/l
Fluoranthene	0.0063	µg/l
Naphthalene	2	µg/l
Phenanthrene	4	µg/l
Benzo(a)anthracene	3.5	µg/l
Chrysene	7	µg/l
Indeno(123cd)pyrene	-	µg/l
Benzo(ghi)perylene	0.0082	µg/l
Total Petroleum Hydrocarbons (TPHs)		
Aliphatic >C5-C6	-	µg/l
Aliphatic >C6-C8	-	µg/l
Aliphatic >C8-C10	-	µg/l
Aliphatic >C10-C12	300	µg/l
Aliphatic >C12-16	300	µg/l
Aliphatic >C16-21	300	µg/l
Aliphatic >C21-35	300	µg/l
Aromatic >C5-C7	-	µg/l
Aromatic >C7-C8	-	µg/l
Aromatic >C8-C10	-	µg/l
Aromatic >C10-C12	90	µg/l
Aromatic >C12-C16	90	µg/l
Aromatic >C16-C21	90	µg/l
Aromatic >C21-C35	90	µg/l
Other Determinands		
Benzene	1	µg/l
Toluene	74	µg/l
Ethylbenzene	20	µg/l
Xylene	190	µg/l
Phenol	5800	µg/l

8.7 Free product

- 8.7.1 Where specific organic determinands are recorded at concentrations below the RAC but above the theoretical soil saturation limit then assessment shall be made as to the presence of free product within the soil matrix.
- 8.7.2 No site won materials and/or imported soils or materials shall be used within the bulk earthworks, where free product hydrocarbons are identified.

8.8 Contaminant odour and volatility

- 8.8.1 No material shall be used in the works within 1m of the formation level, irrespective of whether the concentrations of organic determinands are within the RAC, should this material have the potential to give rise to odour nuisance.
- 8.8.2 Materials exhibiting exceedances of metal / inorganic or non/negligibly volatile organic RAC for public open space end-uses shall be deemed geochemically suitable for use at depths greater than 1m below the formation level.
- 8.8.3 Table 8.6 classifies the main contaminants in terms of volatility. The list of determinands in the table is not exhaustive and where exceedances of organic determinands not included in the table are identified during geochemical testing an assessment as to their potential volatility shall be made before determining final placement or disposal options for the material in question. Materials containing potential volatile contaminants may be placed at depth subject to site specific risk assessment indicating that the potential risk is acceptable.

Table 8.6 Volatile and negligibly / non-volatile determinands

Determinand	Nature of Contaminant
Arsenic	Negligibly / Non-Volatile
Boron (water soluble)	
Cadmium	
Copper	
Chromium (total)	
Chromium (VI)	
Cyanide (total)	
Lead	
Mercury (inorganic form)	
Nickel	
Selenium	
Zinc	
Asbestos	
TPH Carbon Bands >C16	
PAH - Anthracene	
PAH - Benzo(a)pyrene	
PAH - Benzo(a)anthracene	

PAH - Benzo(b)fluoranthene

PAH - Benzo(k)fluoranthene

PAH - Benzo(ghi)perylene

PAH - Chrysene

PAH - Dibenzo(ah)anthracene

PAH - Fluoranthene

PAH - Indeno(123cd)pyrene

PAH - Phenanthrene

PAH - Pyrene

Cyanide (free) Volatile* Volatile*

Total Phenols

Benzene

Toluene

Ethylbenzene

Xylene

TPH Carbon Bands <C16

PAH - Naphthalene

PAH - Fluorene

PAH - Acenaphthylene

PAH - Acenaphthene

*Generally, exhibits a Henrys Law Constant (dimensionless) $> 2.5 \times 10^{-3}$

8.9 Ground gas

- 8.9.1 The Ground Gas Risk Assessment (CL:AIRE RB17 (2012) methodology) using the maximum TOC of 4.34% in Made Ground has classified the site as Characteristic Situation CS3. This is defined as a *moderate* risk associated with ground gas. However, the assessment adopted a conservative approach. A confirmatory GI is being undertaken. The findings of the confirmatory GI will be assessed and detailed in an interpretative report which may reduce the CS rating.
- 8.9.2 It is anticipated that buildings will be designed for a Characteristic Situation CS3 unless ground gas monitoring and further ground gas risk assessment is undertaken following the confirmatory GI revises the designation of the site. The Characteristic Situation rating is based on the CL:AIRE RB17 (2012) methodology and is anticipated to represent the worst-case scenario. Risks relating to the accumulation of ground gas across the Scheme is considered to be present during the construction and maintenance phases of the works where temporary confined / enclosed spaces are likely to be present.
- 8.9.3 During construction, access to confined spaces and excavations should be restricted. Where work in confined spaces is unavoidable, a site specific and task specific risk assessment should be undertaken prior to the commencement of the works. This assessment should cover potential risks to both the construction staff and the local population. Monitoring of confined spaces for potential ground gas accumulation should be carried out and the works should be undertaken by suitably trained personnel with the use of specialist personal protective equipment where necessary.
- 8.9.4 Maintenance workers that are required to undertake excavations during the operational life of the Scheme will be provided with sufficient information on the nature of each sub area at the site, upon which to base site and task specific risk assessments. Such work will also include measures as detailed in the CEMP to minimise the effects of the work on human health.

9. Controlled water protection

9.1 Groundwater and incidental water

- 9.1.1 During the works, all contaminated groundwater encountered incidental to the ground treatment works shall be collected in a collection tank or lined lagoon prior to any necessary treatment.
- 9.1.2 Chemical analysis of this incidental water shall be carried out at the frequencies given in Table 9.1[1/5d]. This suite of determinands to be included in the laboratory analysis of this incidental water is detailed in the notes to Table 9.1[1/5d].

Table 9.1 [1/5d] Geochemical testing to be carried out (waters)

Work, Goods or Material	Test	Frequency of Testing
CHEMICAL CONTROL TESTING		
Incidental water	Water Analysis Suite (Note a)	Samples to be taken before to provide baseline, post treatment on a monthly basis for 3 months and during the works or at the frequency required in the discharge / trade effluent consent.

Notes for Table 9.1[1/5d]

- (a) Arsenic
- Boron
- Cadmium
- Copper
- Chromium (total)
- Chromium (VI)
- Iron
- Lead
- Manganese
- Mercury
- Nickel
- Selenium
- Zinc
- Cyanide (Free)
- pH Value
- Phenols (Total)
- Ammoniacal Nitrogen
- PAH (USEPA 16) speciated GC-FID
- TPH (Carbon Banded C8-C40)

9.2 Protection of surface watercourses

- 9.2.1 During the works operations it will be necessary to ensure any watercourse close to the working area is protected. The main surface water critical receptor is the Humber Estuary on which the site is partially located. Several surface water drains also run across the site.
- 9.2.2 Uncontaminated surface water run-off will be prevented from entering areas of open excavation in potentially contaminated ground, by means of ditches or bunds, to ensure it does not become contaminated.
- 9.2.3 A Water Management Plan has been produced as part of the CEMP to ensure that the above objectives are satisfied.

9.3 Permits and licenses

Mobile treatment licences

- 9.3.1 It is anticipated that mobile treatment plant environmental permit(s) will not be required in connection with carrying out activities included within the proposed works, subject to confirmation following the current GI being undertaken. However, if required to treat unanticipated contamination an application for deployment of and the operation of the requisite mobile treatment plant(s) will be made in accordance with applicable legislative requirements. Mobile treatment plant environmental permit(s) may be required to treat materials from the historic landfill.

Discharge consents

- 9.3.2 Uncontaminated incidental water can be discharged to the foul sewer. This activity does not require an environmental permit but would be subject to acceptance by the utility company as to volume and substance limits.

9.4 Offsite disposal of soils

Disposal of unsuitable materials

- 9.4.1 Materials displaying characteristics that render them unsuitable for use in the development and which cannot practicably be remediated for re-use, shall be segregated and sentenced for off-site disposal.

Visual identification of potential contamination during works

- 9.4.2 The Environmental Manager shall be notified immediately of any regions of potential gross contamination encountered during the works.

Criteria for deciding destination of materials that are to be disposed of offsite

- 9.4.3 All wastes to be disposed of off-site shall be subject to basic waste characterisation (e.g., source and origin of waste, composition of the waste, and the relevant European waste code) and WAC testing at the frequencies given in Table 1/5b in accordance with the Environmental Permitting (England & Wales) Regulations, 2016 (as amended). It is anticipated that materials will be reused where possible and there will be limited disposal offsite.

9.4.4 The statutory limits that apply to the waste acceptance criteria are presented in Table 9.2 and Table 9.3. Waste materials shall only be disposed of at the appropriate classification of landfill for that type of waste. The landfill operator shall be issued with the basic characterisation and WAC testing results for review before disposal.

Table 9.2 Threshold limits for categorising waste to landfill as hazardous, non-hazardous or inert based on soil leachate

Leachates for compliance using BS EN 12457-3 at L/S 10/kg (2 batch)	Waste Acceptance Criteria (mg/kg unless otherwise stated)		
	Inert Landfill	Stable, Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Landfill
Arsenic	0.5	2	25
Barium	20	100	300
Cadmium	0.04	1	5
Chromium (total)	0.5	10	70
Copper	2	50	100
Mercury	0.01	0.2	2
Molybdenum	0.5	10	30
Nickel	0.4	10	40
Lead	0.5	10	50
Antimony	0.06	0.7	5
Selenium	0.1	0.5	7
Zinc	4	50	200
Chloride	800	15,000	25,000
Fluoride	10	150	500
Sulphate (SO ₄)	1,000	20,000	50,000
Total Dissolved Solids (TDS)	4,000	60,000	100,000
Phenol Index	1	-	-
Dissolved Organic Carbon at own pH or pH 7.5 - 8.0	500	800	1,000

Table 9.3 Threshold limits for categorising waste to landfill as hazardous, non-hazardous or inert for solid soil

Solid Waste Suites	Waste Acceptance Criteria (mg/kg unless otherwise stated)			
	Inert Landfill	Stable, Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Landfill	Total
Total organic Carbon (w/w %)	3%*	5%*	6%*	3%
Loss on ignition	-	-	10%	10%
BTEX (mg/kg)	6	-	-	6
PCBs (7 congeners) mg/kg)	1	-	-	1
Mineral Oil C10-C40 (mg/kg)	100	-	-	100
pH	-	>6	-	>6
Acid neutralisation capacity	-	-	-	-

Note: These limits are for guidance. A landfill site may have different limits derived from this table, depending on its licence.

- 9.4.5 Before off-site disposal, materials requiring pre-treatment in accordance with applicable legislation will be pre-treated. Pre-treatment may take the form of the following combination of processes which shall be in accordance with applicable requirements of the landfill operator and Environment Agency:
- Removal and separate disposal of identified free product where these can be practicably separated from the soil matrix; and
 - Possible soil washing and screening to remove oversize brick, concrete and hardcore.
- 9.4.6 All off-site disposal of waste shall be undertaken by an appropriately registered waste carrier and each transfer shall be accompanied by a waste transfer note in accordance with the Waste (England and Wales) Regulations 2011.

10. Ground gas protection measures

10.1 Recommendations and proposed mitigation measures

- 10.1.1 Based on the results of the Ground Gas Risk Assessment using the maximum TOC of 4.34%, the site is considered as CS3 with a *moderate* risk classification. However, it should be noted that this is a conservative assessment of the site. Buildings on the site should therefore be designed for CS3, unless ground gas monitoring is undertaken following the confirmatory GI currently being undertaken which revises the Characteristic Situation and ground gas risk as the site.
- 10.1.2 Risks relating to the accumulation of ground gas is considered to be present during the construction and maintenance phases of the works where temporary confined/ enclosed spaces are likely to be present.
- 10.1.3 During construction, access to confined spaces and excavations should be restricted. Where work in confined spaces is unavoidable, a site specific and task specific risk assessment should be undertaken prior to the commencement of the works. This assessment should cover potential risks to both the construction staff and the local population. Monitoring of confined spaces for potential ground gas accumulation should be carried out and the works should be undertaken by suitably trained personnel with the use of specialist personal protective equipment where necessary.
- 10.1.4 Maintenance workers that are required to undertake excavations during the operational life of the IERRT project will be provided with sufficient information on the nature of the site, upon which to base site and task specific risk assessments. Such work will also include measures as detailed in the CEMP to minimise the effects of the work on human health.

11. Monitoring requirements

11.1 Ground gas monitoring

11.1.1 A programme of gas monitoring works will be undertaken as part of the confirmatory ground investigation. During those works and post completion at the frequencies given in Table 11.1.

Table 11.1 Required ground gas monitoring

Work, Goods or Materials	Test	Frequency of Testing*
Ground Gas monitoring shall be undertaken before the works, during the works and following completion of works.	Ground Gas Monitoring	Standpipes installations are to be sampled before the works, then at monthly intervals during the works, then at 3 monthly intervals post works.

*The period of monitoring may be reduced subject to findings of ground gas monitoring and ground gas risk assessment following the confirmatory ground investigation.

- 11.1.2 Where the concentrations of ground gases (and flow rates) recorded during the programme of monitoring are substantially elevated above levels previously recorded additional monitoring / increased frequency may be required at selected locations.
- 11.1.3 Where monitoring locations are within areas of the development that will be subject to earthworks excavations, placement of materials or construction, the monitoring locations shall be preserved and monitored for as long as reasonably practicable.
- 11.1.4 Table 11.2 details the gases and other parameters that will be recorded during the scheduled ground gas monitoring programme. In addition to these parameters the weather and ground conditions shall be recorded at the time of monitoring.
- 11.1.5 All monitoring results shall be inputted into a monitoring results database. All monitoring results shall be presented in a standard electronic format. The results of the ground gas monitoring programme shall be included in the verification report to be produced following completion of the works for the proposed development.

Table 11.2 Gases and other parameters to be monitored during ground gas monitoring programme

Gases / Other Parameters	Units	Accuracy
Methane	% LEL & % v/v	1 (LEL), 0.1 (v/v)
Carbon Dioxide	% v/v	0.1
Oxygen	% v/v	0.1
Hydrogen Sulphide	ppm	1
Carbon Monoxide	ppm	1
Atmospheric Pressure	mBar	1
Downhole Pressure	mBar	1
Temperature	°c	0.1
Gas Flow Rate	l/hr	0.1

Groundwater Level	m bgl	0.01
Standpipe Depth	m bgl	0.01

11.2 Groundwater and surface watering monitoring

11.2.1 A programme of groundwater monitoring and surface water monitoring shall be carried out during the earthworks and post construction for the suite of determinands and frequencies in table 1/5D of the Highways Agency Series 600 Earthworks Specification (reproduced as Table 11.3). The test suite will include as a minimum the range of determinands in Table 11.5.

Table 11.3 [1/5d] Geochemical testing (waters)

Work, Goods or Material	Test	Frequency of Testing
A: Groundwater Monitoring		
Groundwater monitoring (sampling and laboratory testing) shall be undertaken before the works, during the works and for an agreed period after completion of the works	Water analysis suite (Note a)	Frequency of testing will be weekly/monthly during the works and monthly for three months following the completion of the works
B: Any Holding Tank / Lagoon for Incidental Arisings of Perched Groundwater (Pre- and Post-Treatment)		
Holding tank / lagoon water (where incidental water (including groundwater) has been stored) before treatment and discharge	Groundwater / Surface Water analysis suite (Note a)	Samples to be taken before and post treatment on a monthly basis during the works or at the frequency required in the discharge / trade effluent consent.
C: Surface Water Monitoring		
Surface water monitoring (sampling and laboratory testing) shall be undertaken before the works, during the works and for an agreed period after completion of the works	Water analysis suite (Note a)	Frequency of testing will be weekly/monthly during the works and monthly for three months following the completion of the works
Notes applying to Table 11.3:	a) All chemical analysis shall be UKAS and MCERTS accredited as appropriate; and b) Water analysis suite to include the determinands outlined in Table 11.4 and Table 11.5.	

Table 11.4 On-site Testing Suite

Parameter	Unit	Stabilisation
Temperature	°C	± 0.2 °C
Electrical Conductivity (E.C.)	µS/cm	± 3%
Dissolved Oxygen (D.O.)	mg/l	± 10%
pH	unitless	± 0.1

Oxidation Reduction Potential
(ORP)

mV

± 10 mV

Table 11.5 Water Laboratory Test Suite

Determinand	Limit of Detection	Units
Antimony	2	µg/l
Arsenic	1	µg/l
Beryllium	1	µg/l
Boron	10	µg/l
Cadmium	0.4	µg/l
Calcium	0.012	mg/l
Copper	1	µg/l
Chromium	1	µg/l
Chromium (VI)	1	µg/l
Iron	50	µg/l
Lead	1	µg/l
Manganese	0.001	mg/l
Mercury	0.05	µg/l
Nickel	1	µg/l
Potassium	1	mg/l
Selenium	1	µg/l
Sodium	0.1	mg/l
Zinc	3	µg/l
Cyanide	0.001	µg/l
PAH (USEPA 16) speciated GC-MS (lowest possible level of detection)	0.01	µg/l
TPH (Carbon banded C5 – C40)	10	µg/l
BTEX	1	µg/l
Phenols	0.1	µg/l
Volatile Organic Compounds (GC-MS)	1	µg/l
Semi-Volatile Organic Compounds (GC-MS)	1	µg/l
Sulphate	3	mg/l
Sulphide	10	µg/l
pH Value	0.01	Unitless
Ammoniacal Nitrogen	10	µg/l
Nitrate	100	µg/l
Nitrite	50	µg/l
Chloride	10	mg/l
Phosphate	0.1	mg/l
Dissolved Organic Carbon	3	mg/l

- 11.2.2 All incidental groundwater shall be subject to sampling and subsequent laboratory analysis. Samples shall be obtained from holding tank(s) and/or storage lagoons.
- 11.2.3 All water chemical testing data shall be presented to the Engineer in a standard electronic format within 24 hours of receiving the test results.
- 11.2.4 Groundwater testing is to be undertaken to provide corroborative data that controlled waters will not be impacted by the earthworks.
- 11.2.5 The chemical suitability of the groundwater and surface water is to be initially assessed against Tier 2 Assessment Criteria based initially on EQS.
- 11.2.6 The provisional criteria are detailed in Table 11.6.

Table 11.6 EQS values for groundwater and surface water

Determinand	EQS	Units
Antimony	-	µg/l
Arsenic	50	µg/l
Beryllium	-	µg/l
Boron	2000	µg/l
Cadmium	0.08	µg/l
Copper	1	µg/l
Chromium (III)	4.7	µg/l
Chromium (VI)	3.4	µg/l
Iron	1000	µg/l
Lead	1.2	µg/l
Manganese	123	mg/l
Mercury	0.07	µg/l
Nickel	4	µg/l
Potassium	-	mg/l
Selenium	-	µg/l
Sodium	-	mg/l
Zinc	10.9	µg/l
Cyanide	1	µg/l
Sulphate	400000	µg/l
pH Value		Unitless
Anthracene	0.1	µg/l
Benzo(a)pyrene	-	µg/l
Fluoranthene	0.0063	µg/l
Naphthalene	2	µg/l
Phenanthrene	-	µg/l
Benzo(a)anthracene	-	µg/l
Chrysene	-	µg/l
Indeno(123cd)pyrene	0.00017	µg/l
Benzo(ghi)perylene	0.0082	µg/l

Aliphatic >C5-C6	-	µg/l
Aliphatic >C6-C8	-	µg/l
Aliphatic >C8-C10	-	µg/l
Aliphatic >C10-C12	-	µg/l
Aliphatic >C12-16	-	µg/l
Aliphatic >C16-21	-	µg/l
Aliphatic >C21-35	-	µg/l
Aromatic >C5-C7	10	µg/l
Aromatic >C7-C8	74	µg/l
Aromatic >C8-C10	-	µg/l
Aromatic >C10-C12	-	µg/l
Aromatic >C12-C16	-	µg/l
Aromatic >C16-C21	-	µg/l
Aromatic >C21-C35	-	µg/l
Benzene	10	µg/l
Toluene	74	µg/l
Ethylbenzene	20	µg/l
Xylene	30	µg/l
Phenol	7.7	µg/l

11.2.7 Where free product is encountered during sampling from a groundwater monitoring well additional sampling and/or assessment may be required.

11.2.8 No free product, whether LNAPL or DNAPL, shall be acceptable in incidental groundwater. If either is present the groundwater shall be remediated prior to discharge.

11.3 Air pollution

11.3.1 In the event that excessive dust arises from operations during the works, then damping down techniques will be used to prevent the generation of dust as detailed in the Air Quality and Dust Management Plan.

12. Verification strategy

12.1 Introduction

- 12.1.1 As set out in Section 1.2, the main purpose of this Outline Remediation Strategy document is to provide the strategy for managing any contamination encountered during the works for the Immingham Eastern Ro-Ro Terminal.

12.2 Demonstrating effective removal of soil contamination

- 12.2.1 Contaminated materials will be identified through the material testing and through visual inspection during the works. Sampling and testing are required to confirm that the suspected materials comply with the RAC. Where the materials do not meet the RAC then the material will be segregated and sentenced for remedial works or off-site disposal.
- 12.2.2 The results of the assessment will be presented in a verification report at the end of the works and if necessary, recommendations will be made for any further mitigation / remediation required based on the assessment findings.

12.3 Ground gas

- 12.3.1 It is considered necessary to monitor the ground gas regime during the works to identify any potential changes that could affect the works and/or potential receptors of nearby properties. Gas monitoring will be undertaken before, during and after the works, subject to the findings of the current ground investigation.
- 12.3.2 The validation report will include details of an assessment of the most recent gas monitoring results in accordance with BS8485:2015+A1:2019 (BSI, 2019) and CIRIA C665 (CIRIA, 2007). If necessary, recommendations will be made for further assessments or consideration of additional mitigation / remediation options based upon the assessment findings.

12.4 Monitoring generally

- 12.4.1 Water and ground gas monitoring requirements are detailed in Section 10 of this Strategy document. The results of the groundwater and surface water monitoring programme will be continually reviewed and assessed against the baseline conditions. prior to and during the works and if required, modifications to the remediation strategy will be agreed with the relevant regulator bodies where necessary.
- 12.4.2 Following completion of the works, monitoring will be carried out to assess the initial performance of the scheme. The results will be compared against the relevant assessment criteria (Tier 2 / Level 3).
- 12.4.3 The results of the assessment will be presented in a validation report to be prepared on completion of the works and after a sufficient period of monitoring has been carried out.
- 12.4.4 Groundwater monitoring will continue at the site for a minimum period of 3 months after the works are completed, during which time the results will be continually assessed.

- 12.4.5 If necessary, recommendations will be made for further assessments or consideration of additional mitigation / remediation options based on the assessment findings. This would be subject to discussion with the Environment Agency.

12.5 Verification reporting

- 12.5.1 The Verification Report for the Immingham Eastern Ro-Ro Terminal works shall include the following (where relevant):
- A general description of the ground improvement works;
 - Details of all remediation technologies used on the site including results;
 - Details of all imported material classifications and volumes;
 - Results of all geochemical and geotechnical testing relating to all site-won, imported and treated materials;
 - The results of the assessments of material acceptability;
 - Details of the final placement of site-won or imported materials (linked to the assessment of material acceptability);
 - Details of the materials sentenced for off-site disposal; including waste classification, volumes and disposal location;
 - Results of all WAC testing;
 - All waste transfer documentation for the materials disposed of off-site;
 - Details of any local undertaker consents obtained as part of the works;
 - The monitoring records and laboratory analysis results for all the ground gas, groundwater and surface water monitoring;
 - Details of any alterations / amendments made to the Remediation Strategy;
 - Details of any contingencies undertaken during the works;
 - Details of all correspondence with the regulator authorities during the works; and
 - As-built drawings showing surveyed finished ground levels and areas of ground improvements works and tests carried out.

13. References

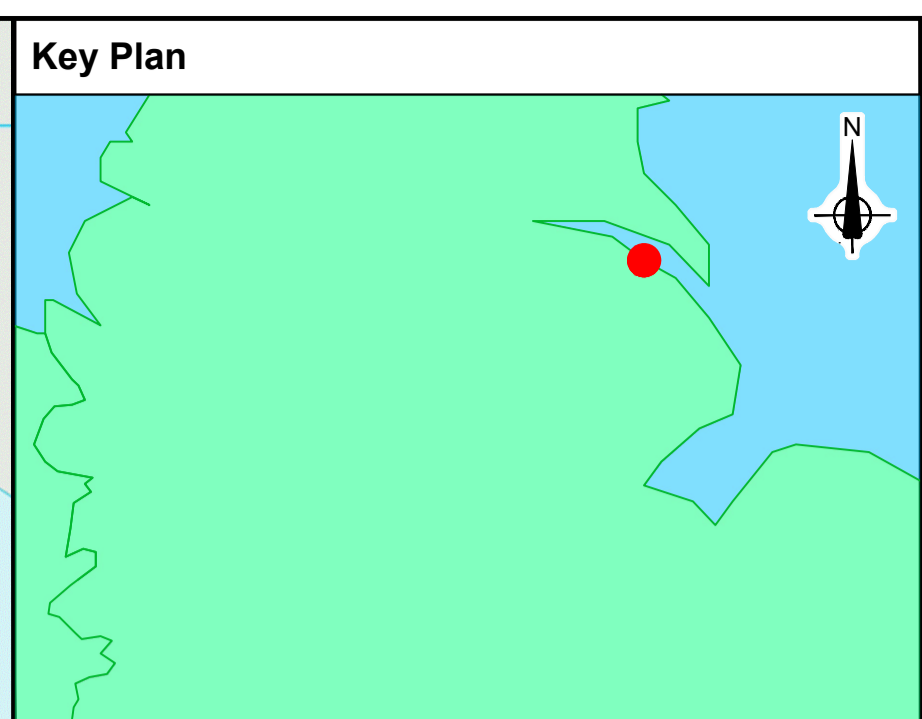
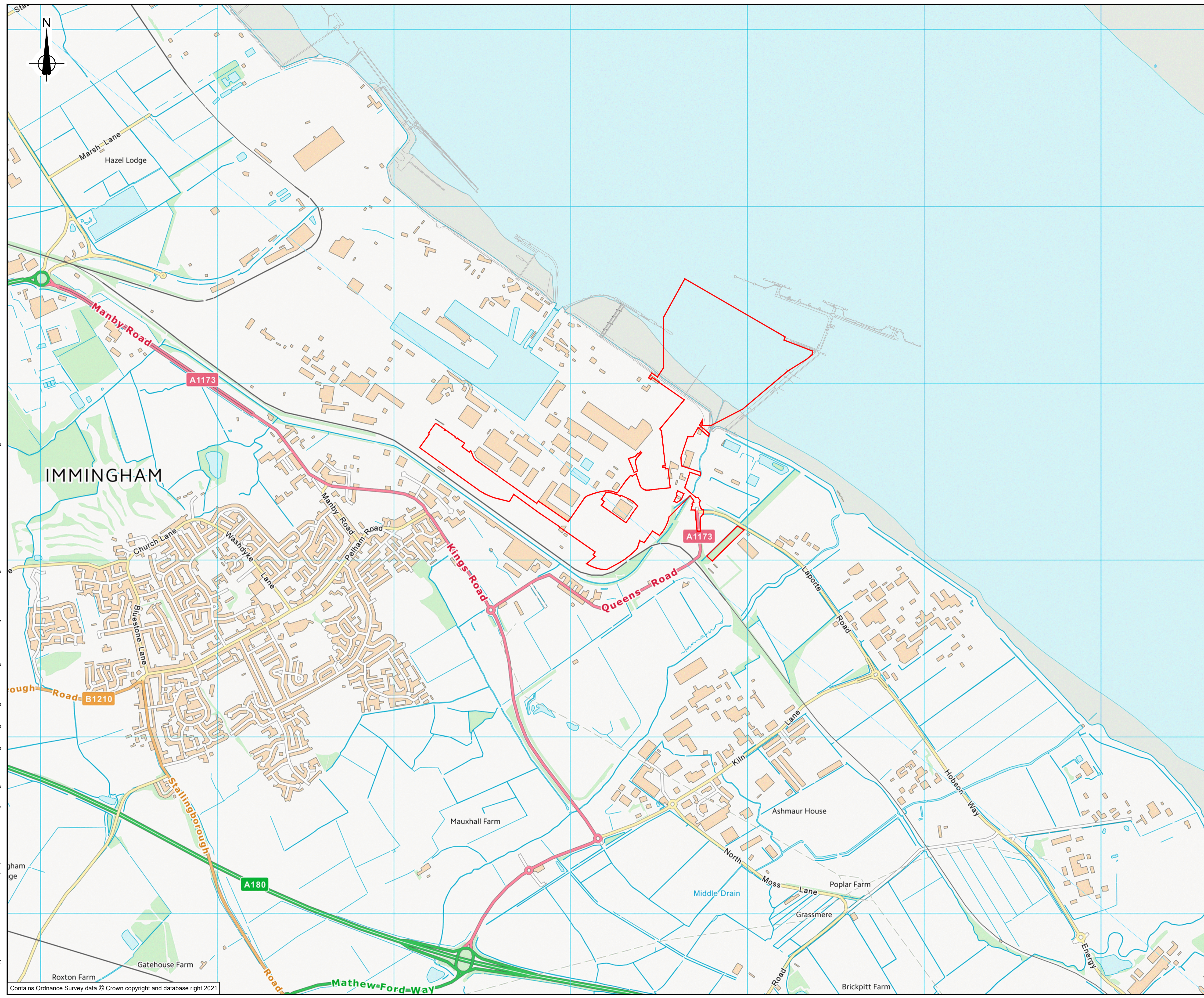
- AECOM. (2022a). Immingham Eastern Ro-Ro Terminal. Phase 1 Geo-environmental and Geotechnical Desk Study. Associated British Ports. 60664611.
- AECOM. (2022b). Immingham Eastern Ro-Ro Terminal. Phase 2 Ground Investigation Report. Associated British Ports. 60664611.
- British Geological Survey. (1991). 1:50,000 Sheet 81 (and including parts of Sheets 82 and 90) Patrington Solid and Drift Map.
- British Geological Survey. (1994). Geology of the country around Grimsby and Patrington: memoir for 1:50000 geological sheets 90 and 91 and 81 and 82 (England & Wales). London: HMSO.
- British Geological Survey. (2022a). GeoIndex Onshore. Available at: <http://mapapps2.bgs.ac.uk/geoindex/home.html> (Accessed: May 2022).
- British Geological Survey. (2022b). The BGS Lexicon of Named Rock Units. Available at: <http://www.bgs.ac.uk/technologies/the-bgs-lexicon-of-named-rock-units/> (Accessed: May 2022).
- British Standards Institute. (2009). BS6031:2009 Code of Practice for Earthworks.
- British Standards Institution. (2014). BS1997:2004+A1:2013: Eurocode 7.
- British Standards Institute. (2018). BS16907:2018-1 to BS16907:2018-7. Earthworks. Part 1 to Part 7.
- British Standards Institution. (2019). BS8485:2015+A1:2019 Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings.
- British Transport Docks Board. (1965). Proposed Oil Jetties at Immingham, Lincolnshire. Report on Site Investigation.
- CIRIA. (2010). C692 Environmental Good Practice on Site, 3rd Edition.
- CL:AIRE. (2011). Definition of Waste: Development Industry Code of Practice
- CL:AIRE. (2012). RB17 A Pragmatic Approach to Ground Gas Risk Assessment.
- Environment Agency. (2019). Guidance on Groundwater Source Protection Zones (SPZs). Available at: <https://www.gov.uk/guidance/groundwater-source-protection-zones-spzs> (Accessed: October 2021).
- Environment Agency. (2022). Environment Agency Catchment Data Explorer. Available at: <https://environment.data.gov.uk/catchment-planning/> (Accessed: July 2022).
- Exploration Associates. (1980). British Transport Docks Board Immingham Dock – Eastern Jetty Final Report on Site Investigation 22552.
- GD Pickles Ltd. (2020). Geoenvironmental Investigation Report.
- Ground Explorations Ltd. (1967). Report No. 3722/SJB. Report on Exploration of Ground Conditions for Proposed Oil Terminal, Immingham.
- Highways England. (2016). Series NG 600 Earthworks.
- NHBC, and Environment Agency and CIEH. (2008). Guidance for the Safe Development of Housing on Land Affected by Contamination R&D Publication 66: 2008 Volume 1. National House Building Council. Available at: <https://www.nhbc.co.uk/binaries/content/assets/nhbc/products-and->

services/tech-advice-and-guidance/guidance-for-the-safe-development-of-housing-on-land-affected-by-contamination.pdf (Accessed: July 2022).

UK Statutory Instruments. (2014). The Waste (England and Wales) Regulations 2014 (Amendment).

Whitehead, E.J. and Lawrence, A.R. (2006). Chalk Aquifer System of Lincolnshire Research Report (RR/06/03).

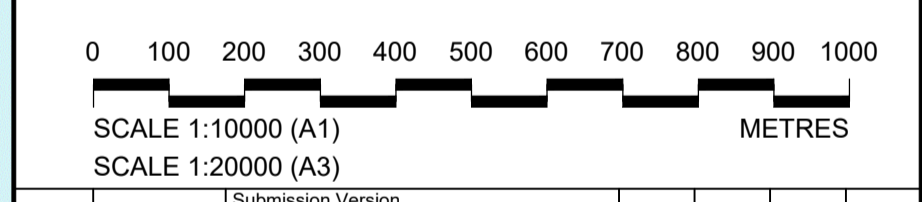
Drawings



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 2. All dimensions are in metres unless noted otherwise.

Key

Order limits



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LOCATION PLAN REGULATION 5(2)(o)

Drawing status
 SUBMISSION VERSION Suitability **S4**

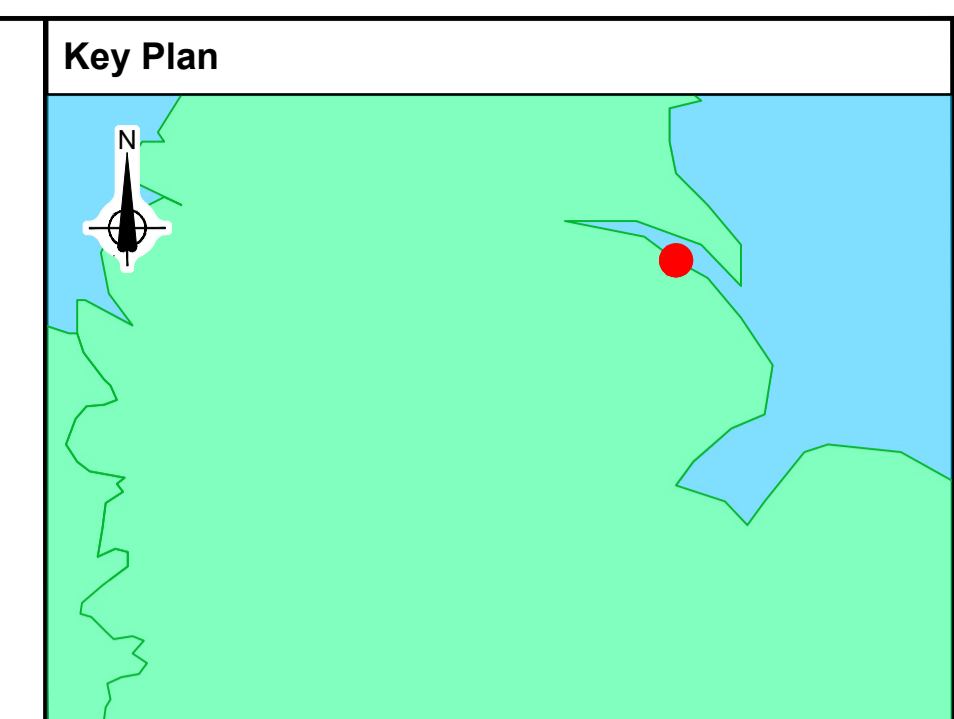
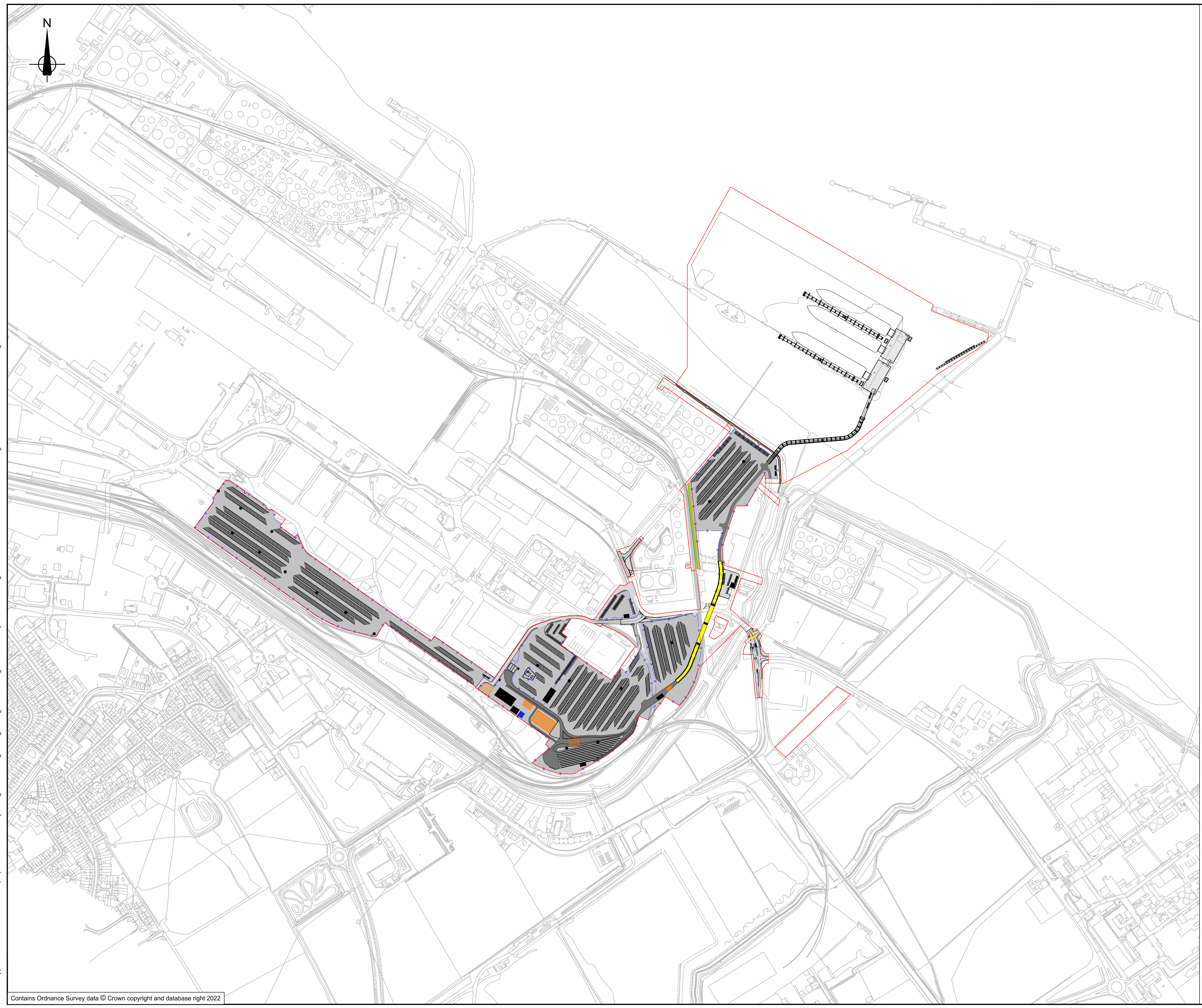
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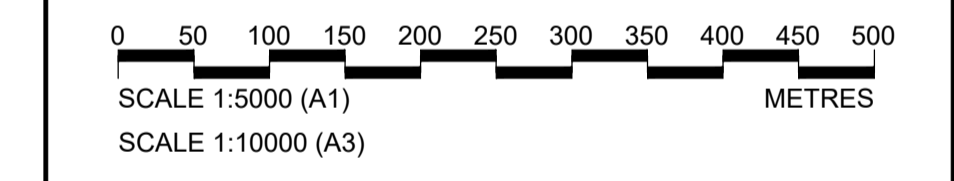
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- Legend**
- Order limits
 - Terminal fence
 - Terminal bridge
 - Above ground pipes
 - New buildings
 - New pipeline access track
 - New terminal storage areas
 - New terminal internal roads
 - External roads
 - Box junction
 - New UKBF facilities
 - New 30m high mast lighting



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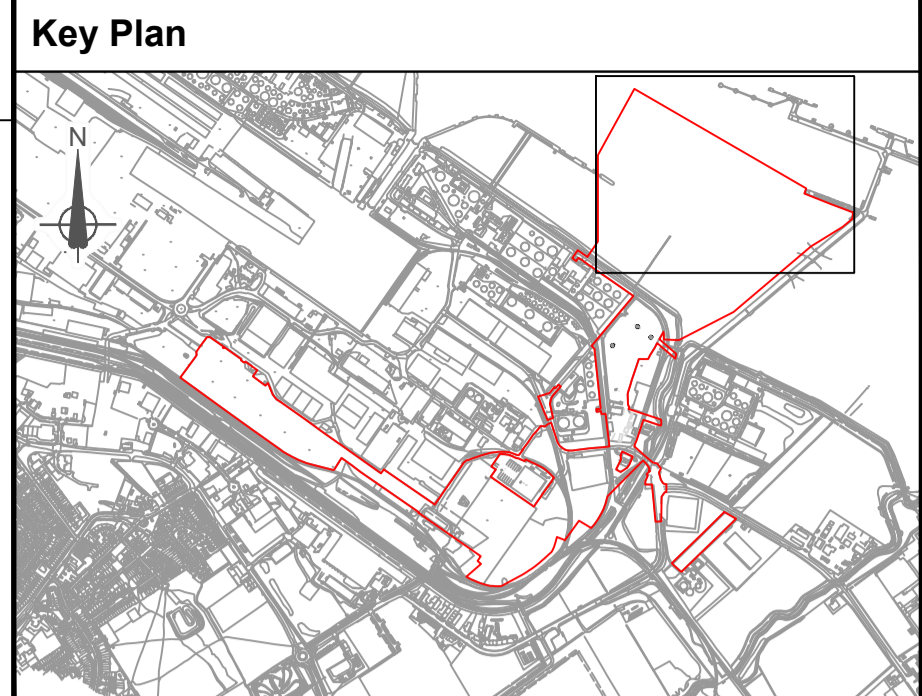
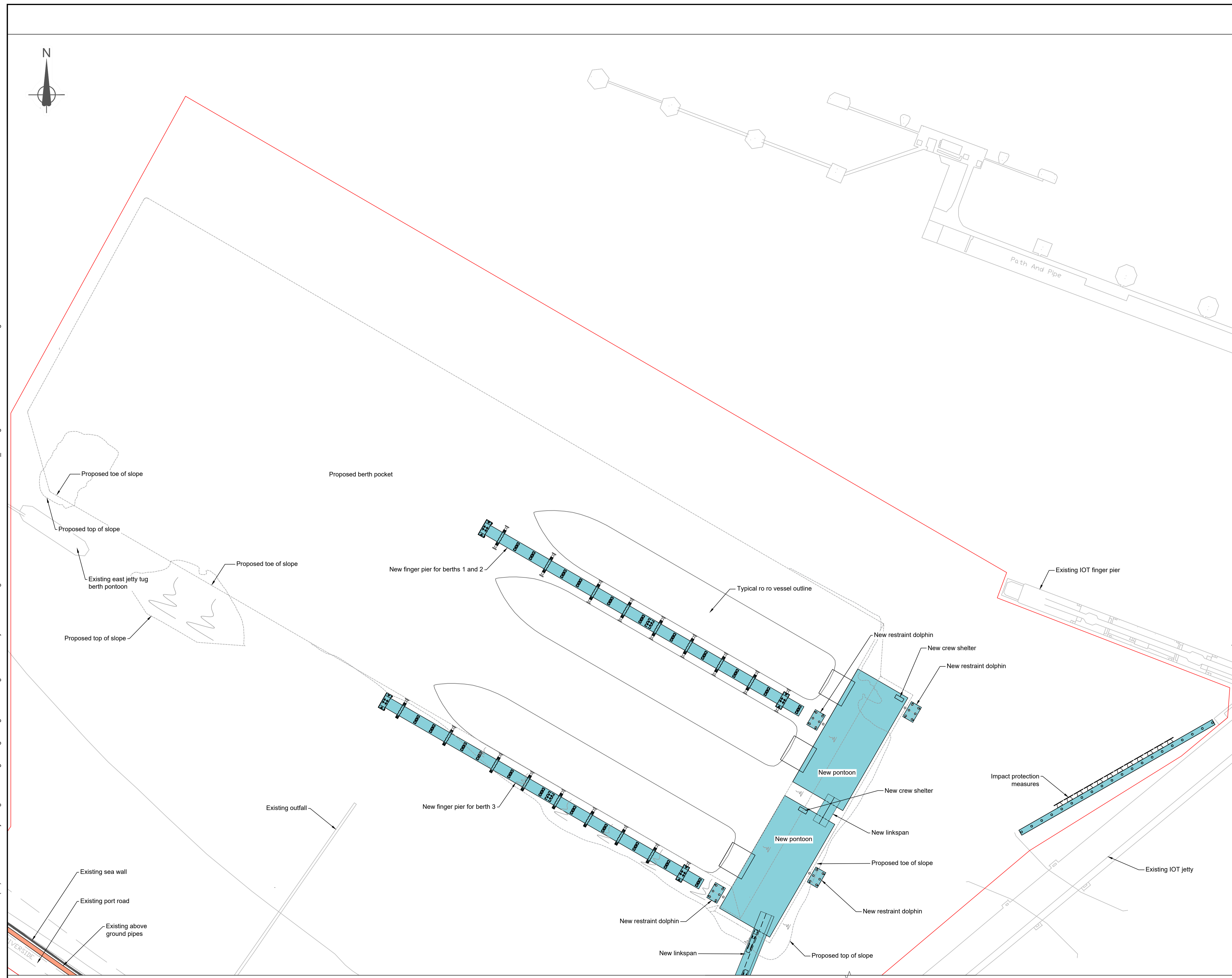
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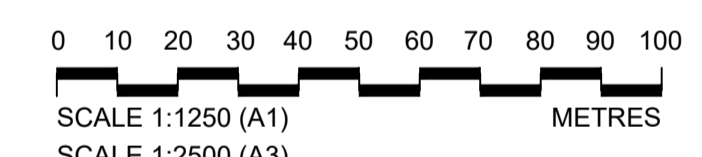
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Legend

—	Order Limits
—	Existing above ground pipes
—	Existing sea wall
 	Marine infrastructure



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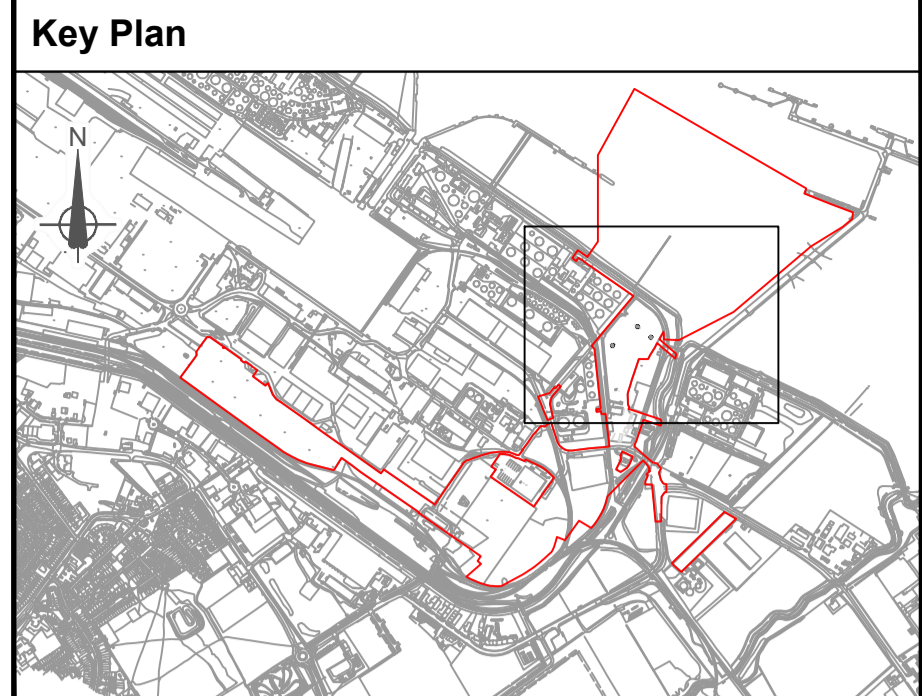
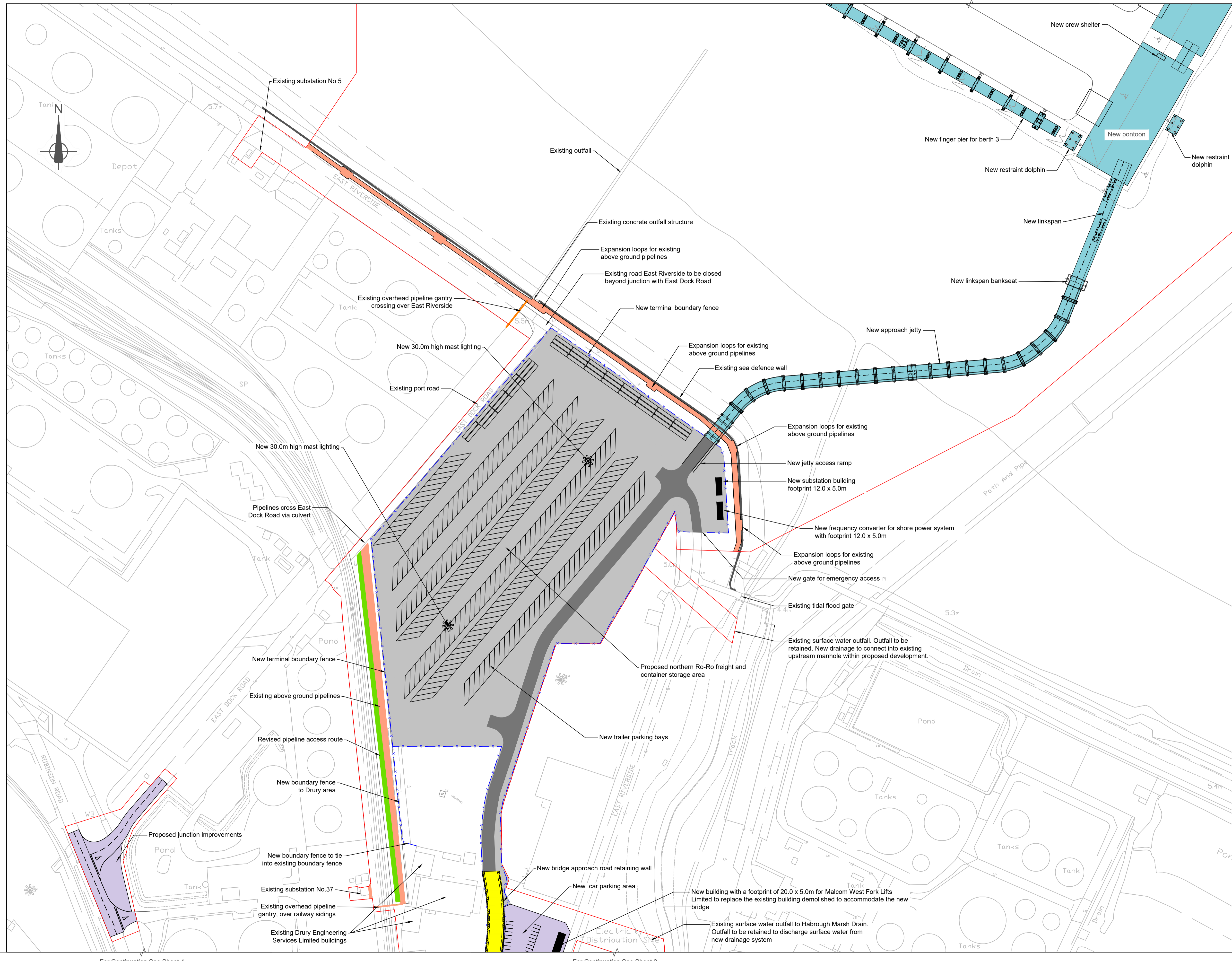
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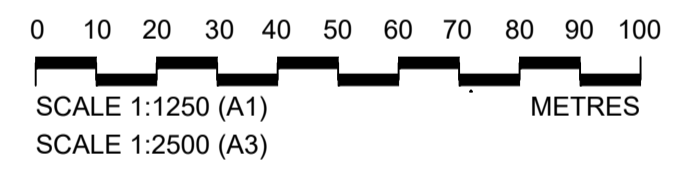
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- Legends**
- Order Limits
 - Terminal fence
 - Terminal bridge
 - Above ground pipes
 - New terminal buildings
 - New pipeline access track
 - New terminal storage areas
 - New terminal internal roads
 - Junction/External Road improvements
 - Marine infrastructure
 - Existing sea wall
 - ✱ New 30m high mast lighting



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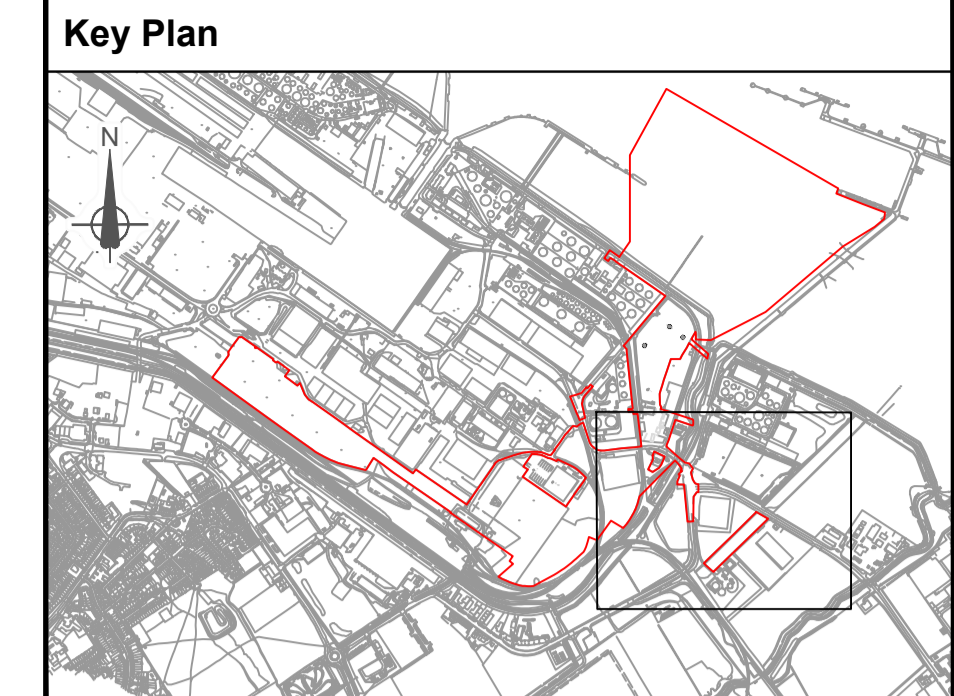
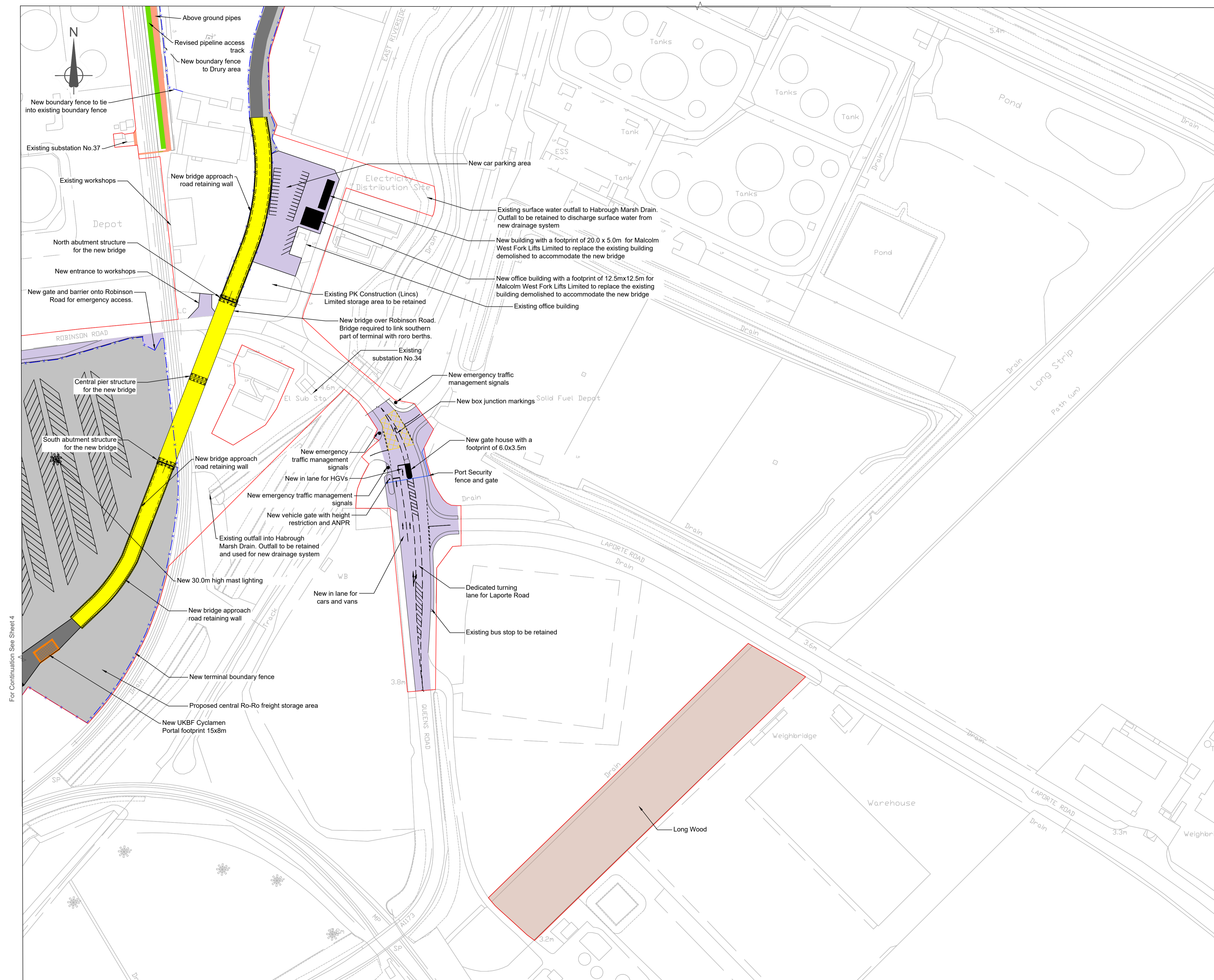
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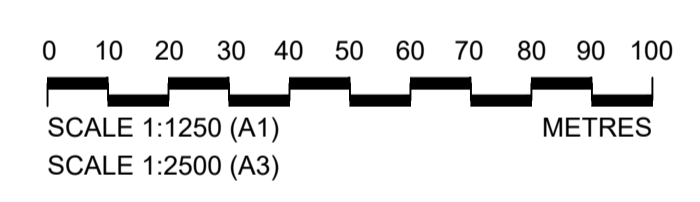
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- Legends**
- Order Limits
 - Terminal fence
 - Terminal bridge and approaches
 - New buildings
 - Woodland ecological enhancement works
 - New terminal storage areas
 - New terminal internal roads
 - External roads improvements
 - New pipeline access track
 - Above ground pipes
 - New emergency traffic management signals
 - Port Security fence and gate
 - New UKBF facilities
 - New 30m high mast lighting



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GENERAL ARRANGEMENT PLANS EAST GATE & BRIDGE REGULATION 5(2)(o) & 5(2)(k) SHEET 3 OF 5

Drawing status	SUBMISSION VERSION	Suitability	S4
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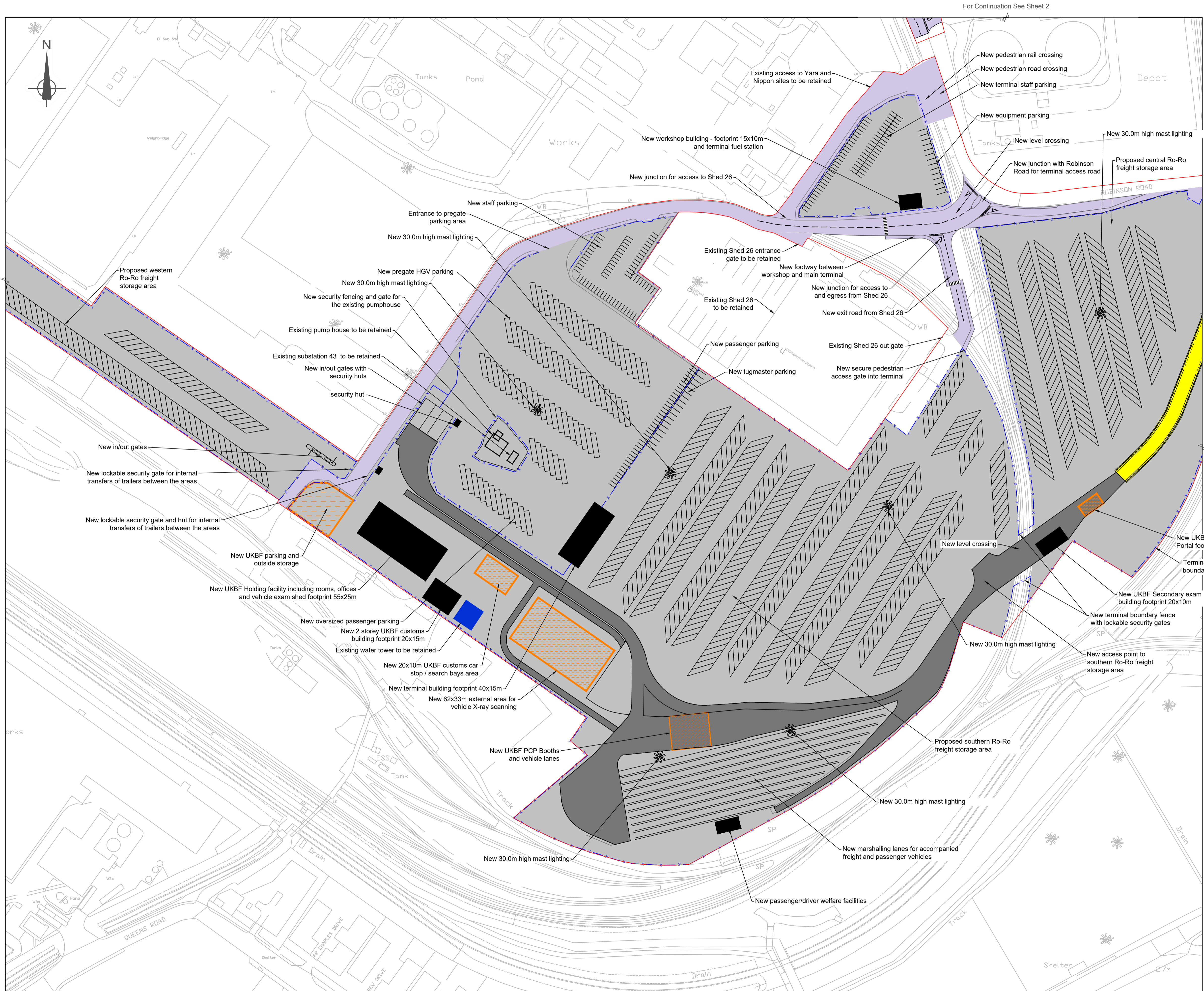
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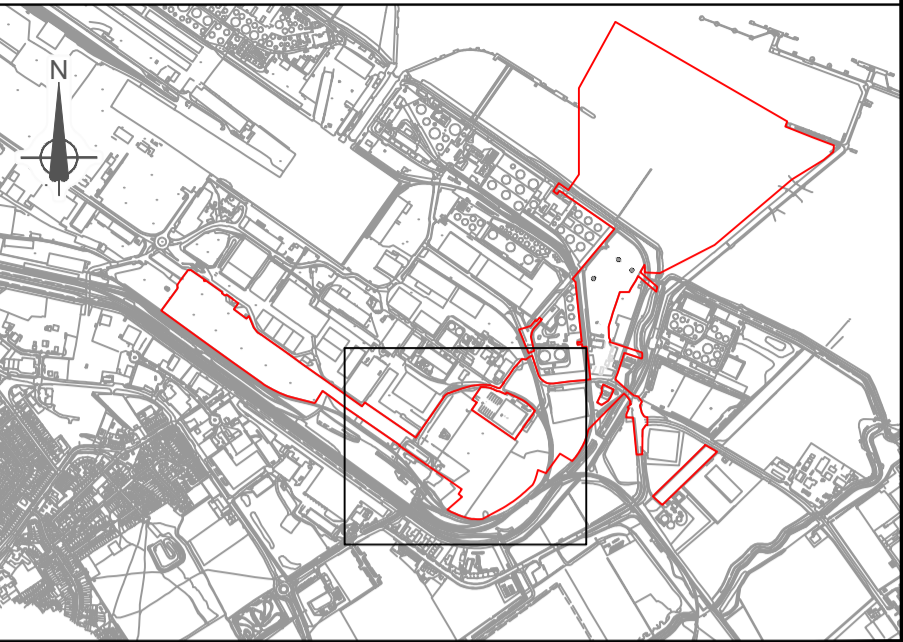
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Key Plan

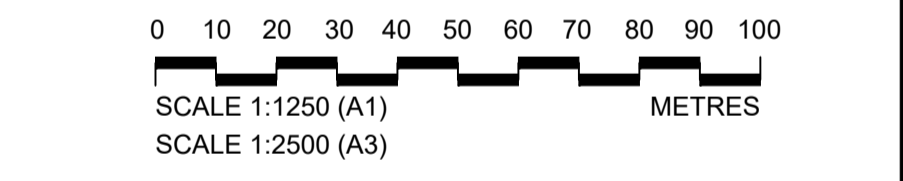


General Notes:

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- Fire hydrants will be installed to comply with Crown Fire Standards.
- Design, size and location of each element of the scheme shown here for illustrative purposes only.
- Location of parking and storage shown here for illustrative purpose only and do not indicate any minimum or maximum capacity.
- UKBF infrastructure is shown indicatively and is subject to ongoing negotiations.

Legends

- Order Limits
- Terminal fence
- Terminal bridge
- New buildings
- New terminal storage areas
- New terminal internal roads
- Junction improvements
- New UKBF facilities
- Existing water tower
- New 30m high mast lighting



P02	February 2023	Submission Version	BHW	RH	RH	CN
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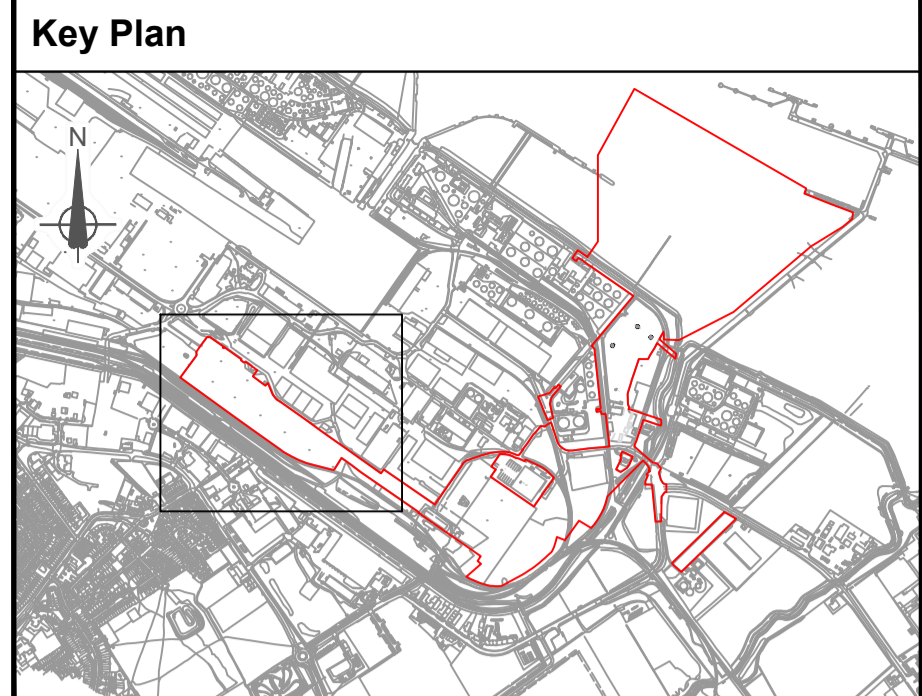
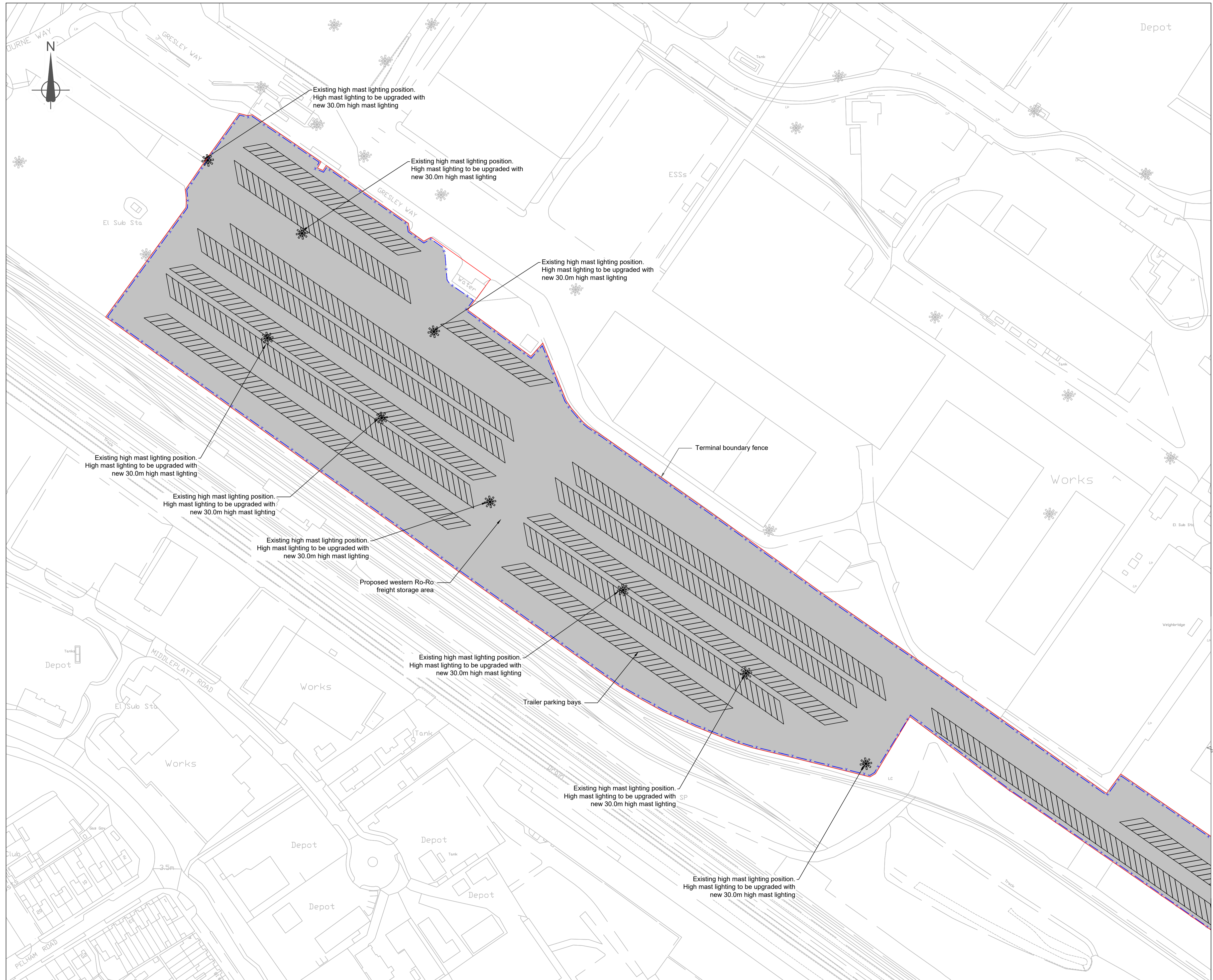
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GENERAL ARRANGEMENT PLANS SOUTHERN & CENTRAL AREAS & WORKSHOP AREA REGULATION 5(2)(o) & 5(2)(k) SHEET 4 OF 5

Drawing status	SUBMISSION VERSION	Suitability	S4
Scale	1:1250 @ A1	Rev	P02
Jacobs No.	B2429400	Client No.	

Drawing number
B2429400-JAC-00-ZZ-DR-ZZ-0205

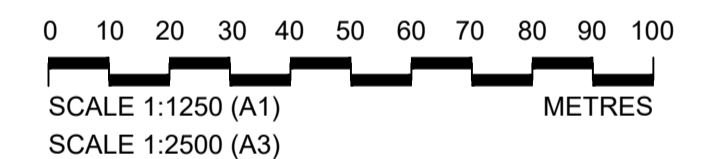
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\\uksp02\Maritime\PROJECTS\Ports\VT\B2429400-ABP-Project\Sugar\1100 Design & Engineering\1102 Drawings\01 Preliminary\02 DCO Drawings\B2429400-JAC-00-ZZ-DR-ZZ-0206 - P02.dwg - 08/02/2023 10:38:03 - 0206 - HodgeT



- General Notes:**
- This plan should be read alongside other plans and documents in the Development Consent Order application.
 - Fire hydrants will be installed to comply with Crown Fire Standards.
 - Design, size and location of each element of the scheme shown here for illustrative purposes only.
 - Location of parking and storage shown here for illustrative purpose only and do not indicate any minimum or maximum capacity.

- Legends**
- Order Limits
 - Terminal fence
 - New terminal storage areas
 - New 30m high mast lighting



P02	February 2023	Submission Version	BHW	RH	RH	CN
P01	January 2023	Submission Version	BHW	RH	RH	CN
Rev	Rev. Date	Purpose of revision	Orig	Check	Rev	Aprv

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Client
ABP ASSOCIATED BRITISH PORTS

Project
IMMINGHAM EASTERN RO-RO TERMINAL

Drawing title
GENERAL ARRANGEMENT PLANS WESTERN YARD REGULATION 5(2)(o) & 5(2)(k) SHEET 5 OF 5

Drawing status	SUBMISSION VERSION	Suitability	S4
Scale	1:1250 @ A1		
Jacobs No.	B2429400	Rev	P02
Client No.	FOR COMMENT		

Drawing number
B2429400-JAC-00-ZZ-DR-ZZ-0206

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For Continuation See Sheet 4

Annex A - Conceptual Site Model

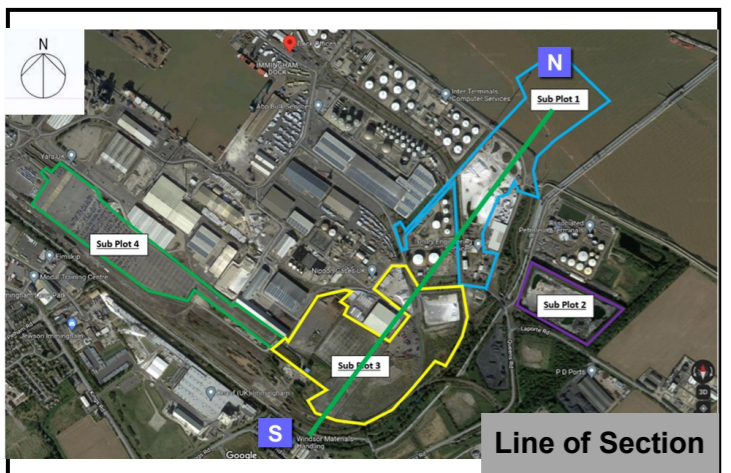
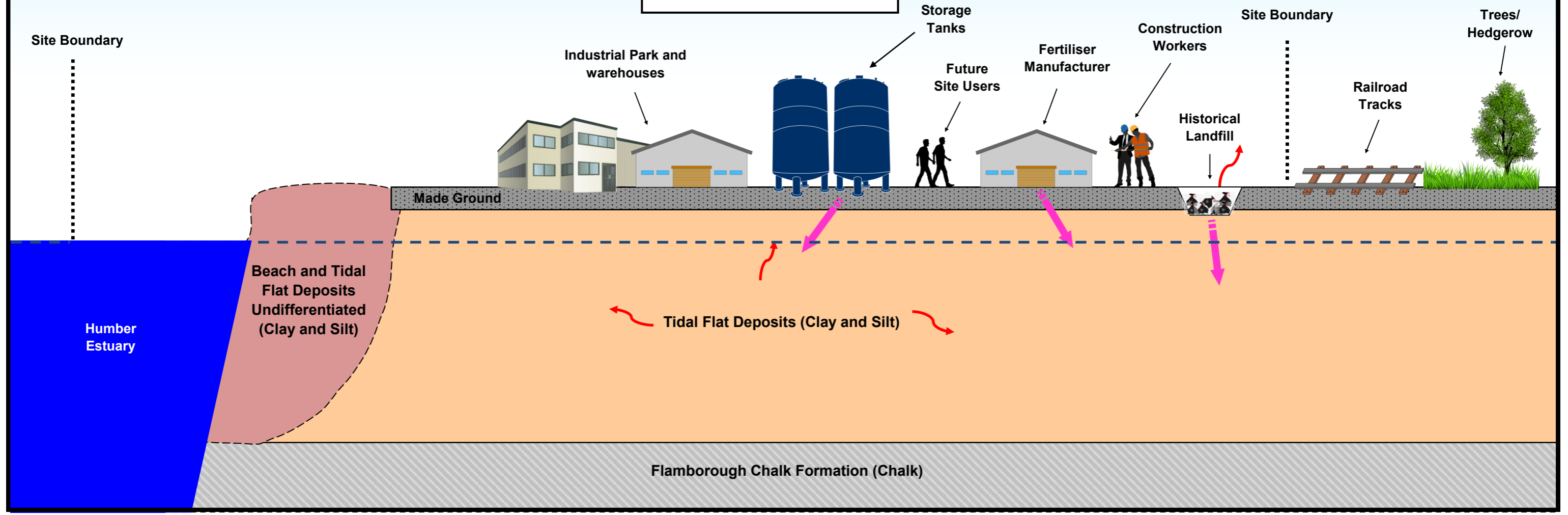
North

South

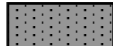






- OFF-SITE RECEPTORS**
- Humber Estuary

- ON SITE RECEPTORS**
- Future Site Users
 - Construction / Maintenance Workers
 - Buildings to be constructed
 - Humber Estuary
 - Groundwater

- OFF-SITE RECEPTORS**
- Nearby Residents and workers
 - Flora and fauna



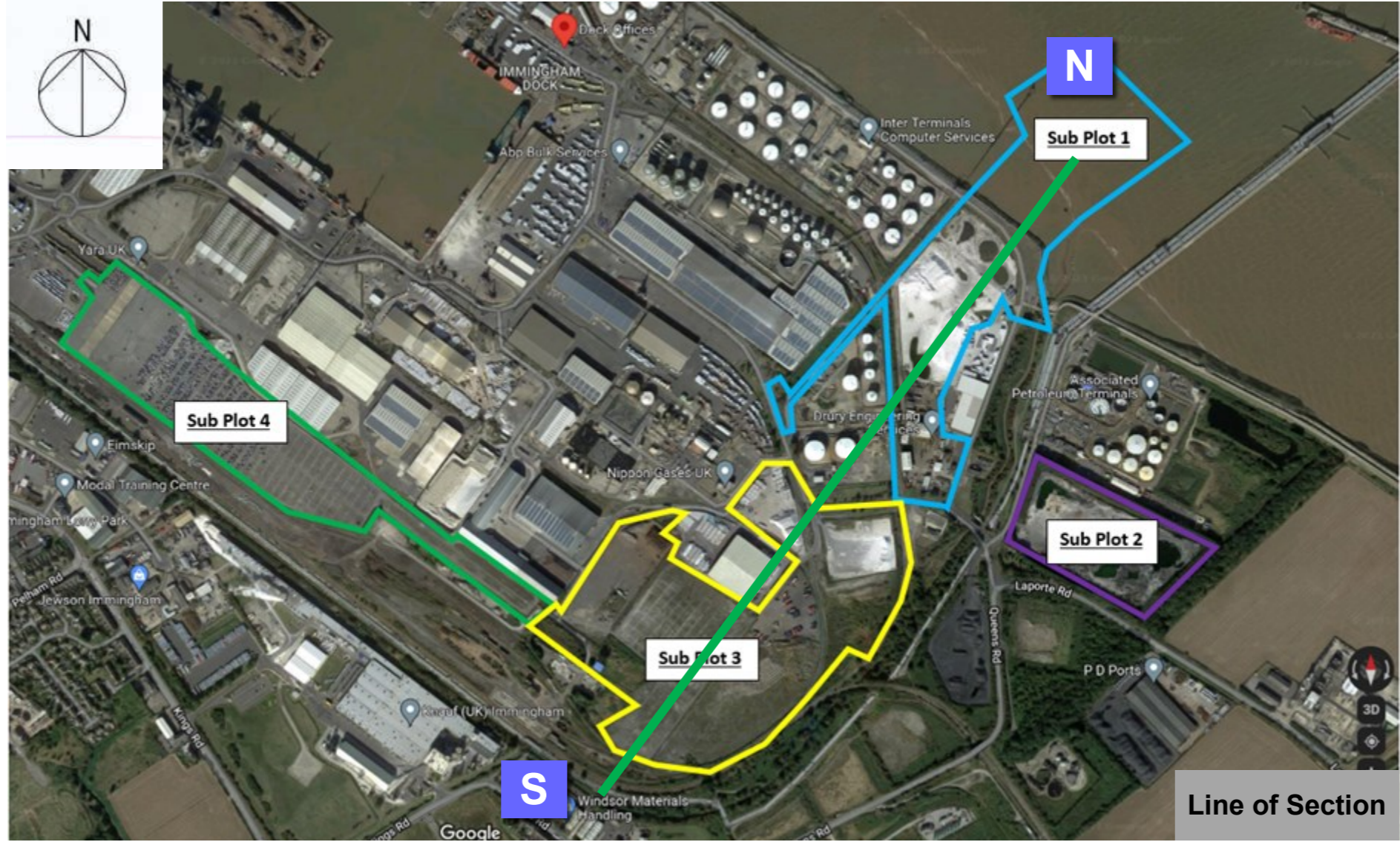
KEY

	MADE GROUND		POTENTIAL LEACHATE
	BEACH AND TIDAL FLAT DEPOSITS		INFERRED GROUNDWATER TABLE
	TIDAL FLAT DEPOSITS		POTENTIAL GAS / VAPOUR PATHWAY
	FLAMBOROUGH CHALK FORMATION		

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Title.	CONCEPTUAL SITE MODEL	
Project.	Immingham Eastern Ro-Ro Terminal	
Client.	Associated British Ports	

Scale.	Not to scale	Size	A3
Date.	September 2022		
Project.	60664611		
Drawn.	BO	Approved.	
DRAWING:			



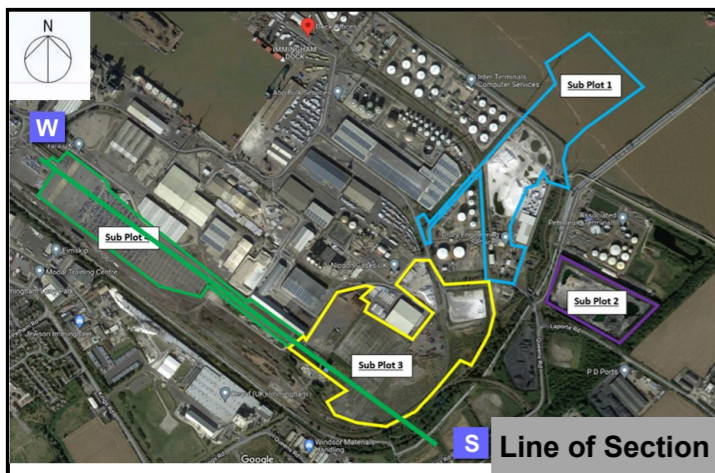
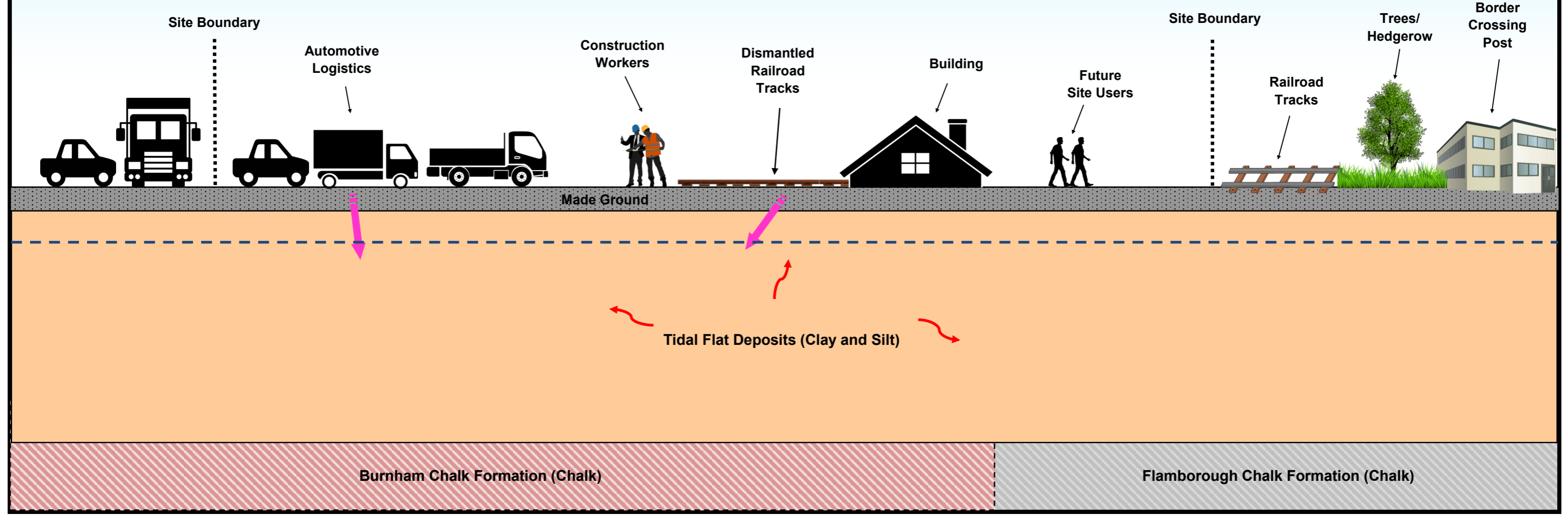
West

East

- OFF-SITE RECEPTORS**
- Nearby Workers

- ON SITE RECEPTORS**
- Future Site Users
 - Construction / Maintenance Workers
 - Buildings to be constructed
 - Groundwater

- OFF-SITE RECEPTORS**
- Nearby Residents and Workers
 - Flora and Fauna

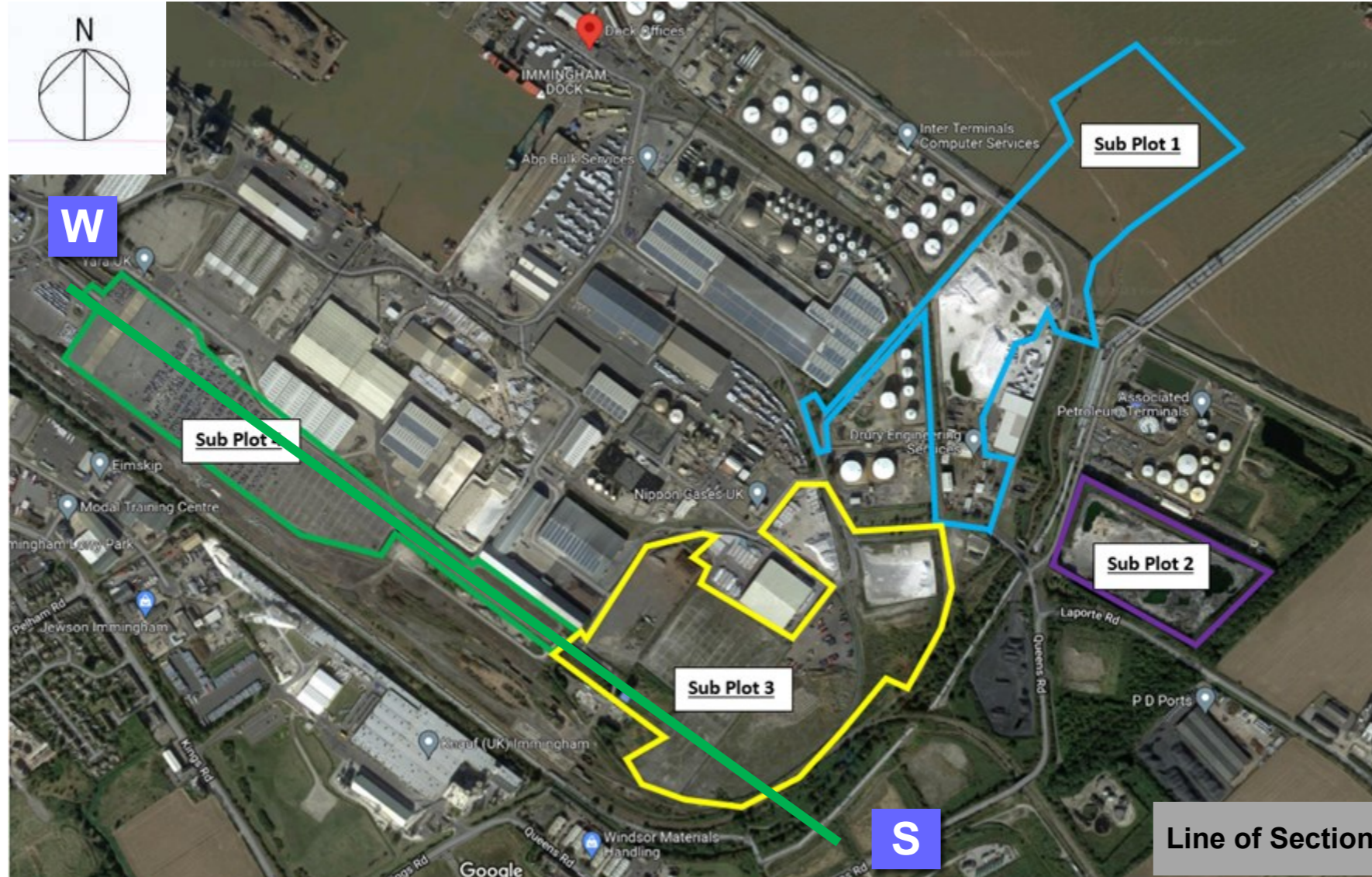


KEY

	MADE GROUND		POTENTIAL LEACHATE
	TIDAL FLAT DEPOSITS		INFERRED GROUNDWATER TABLE
	BURNHAM CHALK FORMATION		POTENTIAL GAS / VAPOUR PATHWAY
	FLAMBOROUGH CHALK FORMATION		

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Title. CONCEPTUAL SITE MODEL	Scale. Not to scale	Size. A3
	Date. September 2022	
Project. Immingham Eastern Ro-Ro Terminal	Project. 60664611	
	Drawn. BO	Approved.
Client. Associated British Ports	DRAWING:	



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