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GridLink Interconnector

Preliminary Environmental Risk Assessment

GridLink Interconnector Ltd

October 2020

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Quality information

Prepared by	Checked by	Verified by	Approved by
Maria Vigano Environmental Consultant	Katie Bruce Principal Environmental Consultant	Jonathan Larkin Technical Director	Jonathan Larkin Technical Director

Prepared for:

GridLink Interconnector Limited

Prepared by:

AECOM Infrastructure & Environment Limited
Sunley House
4 Bedford Park, Surrey
Croydon CRO 2AP
United Kingdom

T: +44 20 8639 3500
aecom.com

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1. Introduction

1.1 Terms of Reference

1.1.1 AECOM has been commissioned by GridLink Interconnector Ltd (the Client), to undertake a Preliminary Geo-Environmental and Geotechnical Risk Assessment (PRA) to support an outline planning application and environmental report for the construction and operation of a converter station and associated underground electricity cables at Kingsnorth in Kent (hereafter referred to as the 'Proposed Development'). A location plan of the application site (hereby referred to as 'the 'Site') and Site layout plan are presented in Figure 1 and Figure 2, respectively.

1.1.2 The Proposed Development forms part of the GridLink Interconnector Project (hereafter referred to as 'GridLink'). GridLink is a 1.4 Gigawatt (GW) electricity interconnector between the UK and France. In the UK, GridLink will comprise 108 kilometres (km) of submarine High Voltage Direct Current (HVDC) cable, less than 100 metres (m) of underground HVDC cable, a converter station and 1.5km of underground High Voltage Alternating Current (HVAC) cable from the converter station to the existing National Grid Kingsnorth substation.

1.1.3 The Proposed Development comprises the converter station building(s), outdoor equipment, internal roads, car parking and associated landscaping, and underground HVDC cable from the converter station to Mean High Water Springs (installed by Horizontal Directional Drilling). The submarine HVDC cable below Mean High Water Springs is subject to a Marine Licence granted by the Marine Management Organisation (MMO), therefore it is not included in the Proposed Development. In addition, the underground HVAC cable that will link the converter station to the National Grid Kingsnorth substation is considered to be permitted development and, therefore, it does not form part of the Proposed Development.

1.1.4 The interconnector will enable the UK and France to share electricity, so that any surpluses in power generation can be exported to each other and unexpected interruptions to the national grids can be mitigated to ensure security of supply. This is particularly important as the amount of renewable energy supply to the networks increases, because it is more variable and unpredictable due to weather conditions. To encourage renewable energy, GridLink provides a way to fully utilise high production from renewable sources of electricity and also a means of compensating for periods of low production. The efficient use of renewable energy and security of supply means that both the UK and France will realise environmental and economic benefits from the interconnector.

1.1.5 The European Commission has awarded GridLink the status of Project of Common Interest (PCI). This recognises the project's key contribution to realising Europe-wide goals related to energy policy and climate change. As a PCI, GridLink has been successful in securing a development funding grant of up to €15.2 million from the Connecting Europe Facility, a European funding initiative developed to direct investment into strategic infrastructure projects.

1.1.6 In accordance with Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest (known as the 'TEN-E Regulation'), each country connected by GridLink has nominated a National Competent Authority (NCA) responsible for overseeing the implementation of PCIs. The UK NCA for GridLink is delegated by the Department of Business, Energy and Industrial Strategy (BEIS) to the Marine Management Organisation (MMO). The MMO will be responsible for coordinating the procedures for the development consents and permits required to implement GridLink, including the planning application to Medway Council.

1.1.7 The Proposed Development is subject to planning permission under the Town and Country Planning Act 1990. However, onshore High Voltage Alternating Current (HVAC) underground electricity cable are considered permitted development under the Town and Country Planning (General Permitted Development) (England) Order 2015 (GPDO). Therefore, the scope of this PRA only covers the converter station location and the High Voltage Direct Current (HVDC) cable installed by horizontal directional drilling from the Mean High Water Springs to the converter station, but not the onshore HVAC underground electricity cable.

1.1.8 The objectives of this report are to review available site information, develop a preliminary ground model, evaluate the geo-environmental characteristics of the Site and make a preliminary qualitative assessment of land quality, potential ground-related risks and constraints to the Proposed Development.

1.2 Proposed Development

1.2.1 The Proposed Development comprises the converter station building(s), outdoor equipment, internal roads, car parking and associated landscaping, and underground HVDC cable from the converter station to Mean High Water Springs (installed by Horizontal Directional Drilling). The location of the converter station is shown by the red line in the eastern section of Figures 1 and 2.

1.2.2 The Site is located immediately north of the Medway Estuary in Kent (grid reference TQ 81711 72312), within the former Kingsnorth coal-fired power station site (now demolished). The landscape comprises industrial developments associated with the former power station, such as the National Grid substation, as well as Kingsnorth industrial estate, London Medway Commercial Park and Damhead Creek gas-fired power station. The wider landscape includes arable land, coastal grassland and intertidal mudflats. The Site lies immediately north of the Medway Estuary and Marshes Special Protection Area (SPA), Ramsar and Site of Special Scientific Interest (SSSI), which is designated for its internationally important bird populations.

1.2.3 The Site covers approximately 6.2ha of brownfield land at the former Kingsnorth Power Station site, within which the new converter station (4.95ha) and access road (1.25ha) will be constructed. A temporary construction laydown area (1.6ha) will also be located next to the converter site during the construction phase.

1.2.4 The redline boundary for the Site (Figure 1) includes the existing road within the former Kingsnorth Power Station site that extends from the Site to the main gate on Eschol Road. This has been included within the application boundary in order to identify the access route to be used during the construction and operation of the Proposed Development.

1.2.5 Illustrations on the development plans for the Site are provided in Appendix A.

1.3 Land Quality Assessment Methodology

1.3.1 The geo-environmental assessment presented in this report and associated requirements for intrusive investigation have been prepared in accordance with the following key guidance:

- National Planning Policy Framework (NPPF) and associated Planning Practice Guidance
- British Standard 10175:2011+A2:2017 'Investigation of Potentially Contaminated Sites – Code of Practice'
- Contaminated Land Report (CLR) 11 'Model Procedures for the Management of Land Contamination' (2004)[1] and updated guidance 'Land Contamination: Risk Management' (LCRM)
- DEFRA: Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (April 2012) and
- Environment Agency (EA), February 2018. The Environment Agency's approach to groundwater protection. Version 1.2

1.3.2 This report considers the implications of Part 2A of the Environmental Protection Act 1990 and the associated Contaminated Land (England) Regulations 2006 (and 2012 amendment) as material planning considerations through the Town and Country Planning Act 1990.

[1] Note: Environment Agency (EA) is going to publish an update to the Model Procedures for the Management of Land Contamination (CLR11). The updated online guidance Land Contamination: Risk Management (LCRM) is available at https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks. This guidance is based on the contaminated land report (CLR11); the scope, framework and purpose remain the same. The EA are currently looking at feedback and will republish the updated guidance in early 2020. The EA will withdraw CLR11 when the updated guidance is published.

1.4 Report Tasks

1.4.1. The following tasks have been performed:

- A review of the geological, hydrological, hydrogeological and ecological setting at the Site;
- Preparation of a preliminary ground model for the Site;
- A review of public domain geo-environmental information to develop an understanding of the environmental setting/sensitivity of the Site and its surroundings;
- A site walkover of the Site, undertaken on 27th February 2020;
- Review of historical land uses for the Site and surrounds with a particular emphasis on identifying potential ground hazards and potential on-site and off-site contamination sources;
- Preparation of a Conceptual Site Model (CSM) with a view to identifying any potentially significant source-pathway-receptor linkages followed by a qualitative risk assessment; and
- Presentation of a qualitative evaluation of potential geotechnical issues.

1.5 Sources of Information

1.5.1. The information and documents reviewed for this report are as follows:

- 6alpha, Detailed Unexploded Ordnance (UXO) Threat & Risk Assessment, Gridlink Interconnector, Kingsnorth, UK, dated May 2020 (Project Number 7997);
- British Geological Survey (BGS), Map Sheet 272, Chatham, 1:50,000, solid and drift edition;
- BGS Geoindex Onshore online geological mapping: http://mapapps2.bgs.ac.uk/geoindex/home.html;
- Department for Environment, Food, and Rural Affairs' Magic Map online application:http://magic.defra.gov.uk/magicmap.aspx
- The Long term flood risk information on Gov.uk: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map;
- AECOM, Environmental Due Diligence Review, Site at Former Kingsnorth Power Station, Kingsnorth, Kent, dated May 2019 (Project number: 60557465)
- RPS, Desk Study and Preliminary Risk Assessment Report, Kingsnorth Power Station, dated June 2013 (Ref: JER5486 R 130621 JG E.ON Kingsnorth - DTS & PRA Report (Rev.2));
- RPS, Ground Investigation Factual Report (Main Site), Kingsnorth Power Station, dated January 2014 (Ref: 140123 R JER5486 JG Kingsnorth Power Station – Main Site Factual Report - Draft v3);
- RPS, Ground Investigation Interpretative Report, Kingsnorth Power Station, dated October 2014 (Ref: 141117 JG JER5486 JG Kingsnorth 2014 Ground Investigation Interpretative Report - Draft.doc);
- RPS, Ground Investigation Factual Report, Kingsnorth Power Station, dated September 2015 (Ref: 150924 R JER5486 JG Kingsnorth Factual GI Report (DRAFT).doc);
- RPS, Supplementary Ground Investigation Interpretative Report, Kingsnorth Power Station, dated January 2016 (Ref: 160128 JER5486 AP Kingsnorth 2015 Ground Investigation Interpretative Report - final);
- RPS, Remediation Options Appraisal, Kingsnorth Power Station, dated September 2016 (Ref: 160913 JER5486 GM Kingsnorth Remediation Options Appraisal Draft v1);
- RPS, groundwater Monitoring Strategy, dated September 2016 (Ref: 160913RJER5486 Kingsnorth Groundwater Monitoring Strategy);
- SMF Foster Associated Limited, Flood Constraints Analysis, dated May 2019 (Ref:031/30/KINO/FCA/0519);

- RPS, Remediation Strategy, Kingsnorth Power Station, dated February 2017 (Ref: 170228 R JER5486 GM Kingsnorth Remediation Strategy);
- SOCOTEC UK Limited (SOCOTEC), Geotechnical Desk Study, dated March 2020 (Ref: No G9081-19/1);
- SOCOTEC, Geotechnical Report on Ground Investigation, dated April 2020 (Ref: No G9081-19/2 Rev.2 Issue No 2) (Volume 1, 2 and 3);
- SOCOTEC, Factual Report on Soil Contamination, dated March 2020 (Ref: No G9081-19/3/Rev.1 Issue No 1) (Volume 1 and 2);
- SOCOTEC, Factual Report on Tank Base Concrete Coring, dated April 2020 (Ref: No G9081-19/4); and
- SOCOTEC, Factual Report on Tank Base Piling Inspection, dated April 2020 (Ref: No G9081-19/4A).

2. Environmental Setting

2.1 Site Location and Description

2.1.1. The Site is located within the former Kingsnorth Power Station on the Hoo Peninsula, in Kent. A Site location map and Site plan are included as Figure 1 and Figure 2.

2.1.2. Table 2-1 summarises the findings of the AECOM site walkover undertaken on Thursday 27th February 2020 and selected documentary information. Photographs taken during the site walkover are presented in Appendix B.

Table 2-1 Site Walkover Information

Site Name:	GridLink
Site Address:	Former tank farm at the Kingsnorth power station on the Hoo Peninsula, ME3 9NQ. The Ordnance Survey grid reference for the Site is TQ 81711 72312
Size:	62,000m^2 (6.2ha)
On Site Operations	The Proposed Development is located on the northern bank of the River Medway, within the wider area of the former Kingsnorth Power Station. The Proposed Development is located within the area of a tank farm that was formerly used for the storage of heavy fuel oil (HFO) (photos 1, 2 and 4). The area is bounded by an earth bund and formerly contained six 25,000 tonne above ground storage tanks and associated above ground pipework. The above ground structures have been decommissioned and removed from the Site in late 2013, as detailed in Kingsnorth Power Station Decommissioning Report (C.J.Tye, March 2014). During the site walkover, a hydrocarbon sheen was observed in a flooded area, at the south-western extent of the Site (Photo 3). The impacted area was observed to be fenced. Hydrocarbon staining was also noted on surface soil in the northern part of the Site, in the proximity of a former site investigation location (Photo 7). During the site walkover, nine monitoring wells (BH3 to BH9) related to the site investigation carried out in November 2019 (refer to section 4.13), and several backfilled holes (approximately 10mm in diameter) were observed on-site (photo 4 and 5). Drilling materials were observed to have been left at the Site (photo 5). Sections of the piles which underlie the former fuel tanks (and were excavated during the tank base piling inspection in January 2020) were present on-site (photo 6). The piles were circular and surrounded by a thin metal sleeve (refer to Section 4.15).
Hardstanding / Landscaping:	Most of the Site (>70%) is unpaved and was partially flooded (few centimetres depth) at the time of the site walkover. The remaining part of the Site is covered by hardstanding associated with the footprints of the former storage tanks. The Site can be accessed from the south-west by a road (photo 8) and a vegetated earth bund surrounds the site. Vegetation (grass, bushes and shrubs) was observed across the Site and on the bund.
Topography / Drainage:	The Site occupies a low-lying relatively flat area, situated between Damhead Creek and the sea wall adjoining the Medway to the south. The Site and surrounding area comprise land which was reclaimed from the tidal mudflats of the Medway Estuary using dredged sediments. The topographic survey undertaken on October 2013 (RPS, January 2014) showed the Site to be at an elevation of between 2.26m AOD (at TP-Z3-20 site investigation location) and 2.96m AOD (at TP-Z3-16). A small pond covered by vegetation (photo 5) is located at the south-western corner of the Site. According to the Desk Study and Preliminary Risk Assessment (RPS, June 2013) '*water from drains surrounding the Site* (photo 9) *pass through a two bay interceptor, which is provided with separators and skimmers to collect oil. The discharge from this interceptor passes into an open ditch which also collects surface drainage from the northern perimeter of the coal stock yard (Zone 3) and Tank Farm road areas. A two stage interceptor is constructed in this open ditch prior to a penstock through which water can be discharged to the Medway. However, this penstock has not been used to discharge water to the Medway for several years and instead this water is used for dust suppression on the coal stock and ash lagoons'*.
Tanks, plant and electric substations:	The Site formerly included six 25,000 tonne above ground storage tanks and associated above ground pipework. It is understood that the tanks have a piled raft foundation and the bases are 380mm thick reinforced concrete(SOCOTEC, March 2020).
Asbestos on Site:	No visual evidence of asbestos was observed during the walkover.

2.2 Surrounding Area

2.2.1. Land uses within 250m of the Site boundary as determined from the site walkover are summarised in Table 2-2.

Table 2-2 Surrounding Land Use

Direction	Description
North:	The immediate northern area ('Former Waste Tip') is known to have been used as a waste tip since the construction of the power station in the 1960s and through the 1970s. Known previously to have held a licence to accept asbestos, the area is thought to contain hazardous materials. Putrescible material removed from the cooling water screening system during routine maintenance has also been tipped in this area (RPS, 2013). Damhead Creek natural gas-fired power station is located approximately 300m to the north of the Site. A small number of individual residential properties are present on the edge of the Kingsnorth industrial area, with the nearest property at 1.3 km to the west of the Site.
East:	The Site is adjoined to the east by the Ash Lagoons, which cover a raised area of approximately 32ha and consist primarily of four ash lagoons (settlement and storage areas for the pulverised fly ash (PFA) suspended solids, at the power station) and associated infrastructure (RPS, 2013).
South:	River Medway and its associated mud and salt flats extend to the south of the Site. An oil / water interceptor, associated with the power station (Photo 5) is located adjacent to the south-east of the Site. The town of Gillingham is located approximately 4 km to the south of the Site.
West:	The area to the west of the Site was historically occupied by an oil transfer pumphouse, associated pipelines, tanker loading station, penstock and main surface water drainage interceptor and historical boiler houses. This infrastructure all facilitated the movements of oil around the Kingsbury Power Station site as well as the transfer of oil to Grain Power Station via pipeline. These structures have been decommissioned and removed from the area. The closest residential areas are approximately 2.9 km to the west of the Site at Hoo St Werburgh.

2.3 Geology

Published Geology

2.3.1. The BGS Geoindex Onshore online geological mapping indicates the Site and the immediate surrounding area is underlain by superficial deposits of Alluvium over bedrock geology of the London Clay, subsequently underlain by the Lambeth Group and Thanet Formation, with the Upper Chalk at depth.

BGS Boreholes

2.3.2. There are no publicly available BGS borehole records within the Site boundary. There are four publicly available boreholes records located within 250m of the Site (BGS Ref: TQ87SW223, located adjacent north-east of the Site; TQ87SW231, adjacent east; TQ87SW222, adjacent north-west; and TQ87SW221, adjacent south-west). The boreholes were originally drilled in the Kingsnorth Power Station site in November 1962. The boreholes generally identified superficial deposits of Alluvium (clay, sand and gravel) up to 7.6m bgl, underlain by stiff brown clay (potentially London Clay) identified only in two boreholes (from 4.42m bgl and 5.2m bgl) to the end of the boreholes (4.57m bgl and 5.48m bgl respectively). The BGS borehole logs are provided in Appendix D.

Client Ground Investigation Data

2.3.3. The descriptions provided below are based on logs provided for intrusive positions advanced within the Site boundary during the Phase 1 Site investigation completed between August and October 2013 (RPS, January 2014) and during the site investigation completed between November 2019 and April 2020 (SOCOTEC, April 2020).

2.3.4. Ground conditions encountered within the Site during intrusive investigation works were found to comprise the following:

2.3.5. **Made ground** - Variable clay, gravelly and sandy clay, silt, sandy gravel and gravelly sand. Gravel typically flint with occasional brick, concrete, ash/clinker and wood. Cobbles of brick and concrete were encountered in BH03. Boulders of brick were encountered in BH07. Cobbles and boulders of concrete were encountered in TP3. Made ground thickness within the Site was generally recorded between 0.5 – 3.2m (maximum thickness taken from Table 3, SOCOTEC Factual Report on Soil Contamination, March 2020) The thickness of made ground has not been proven beneath the tank bases.

2.3.6. **Alluvium** - Green grey brown sandy silt, silty clay or gravelly clayey sand with occasional peat inclusions. Gravel is typically flint. Alluvial deposits were recorded to directly underlie the made ground, with a thickness of between 2.8m and 6.7m.

2.3.7. **River Terrace Deposits** – Encountered with a thickness of between 0.9m and 5.9m. These deposits were found to comprise sand and gravel in varying proportions with a smaller quantity of clay and silt and rare chert cobbles.

2.3.8. **London Clay** – Stiff to very stiff fissured and laminated clay encountered beneath the River Terrace Deposits, with a thickness of between 5.7m and 8.2m. *(SOCOTEC quoted a thickness of up to 23.95m from boreholes at the eastern end of the proposed cable corridor)*

2.3.9. **Lambeth Group** – Interbedded dense to very dense sand and stiff to very stiff clay, encountered from between 10.7m and 16.4m bgl.

Ground Stability and Mining Hazards

2.3.10. The Envirocheck® Report (included as Appendix 2 of the Desk Study and preliminary Risk Assessment Report, RPS January 2013) provides details of geological and ground stability hazards, which are summarised in Table 2-3 below. Note that the Envirocheck® Report refers to the whole Kingsnorth Power Station site and is dated April 2008.

Table 2-3 Envirocheck® listed geological and ground stability hazards

Hazard Category	Site Hazard
Coal Mining	No hazard
Collapsible Soils	No hazard
Compressible soils	Moderate
Dissolution Risks	No hazard
Landslide Risks	Very low
Running sands	Very low to moderate
Shrinking/swelling clay	Very low to low

Radon

2.3.11. The Public Health England (PHE) interactive map for radon (UKRadon.org) indicates that the Site is within a low probability radon area (less than 1% of homes are estimated to be at or above the Action Level).

2.3.12. The Envirocheck® Report (source data: BGS and National Geoscience Information Service) states that radon protection measures are not required in any area of the Site during the construction of new dwellings and extensions.

2.4 Hydrogeology

2.4.1. The Magic maps indicate that the Alluvium is classified as a Secondary Undifferentiated Aquifer and the underlying River Terrace Deposits as Secondary A Aquifers. The status of Secondary Undifferentiated is assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type. Secondary A Aquifers defined by the Environment Agency as permeable layers capable of supporting water supplies

at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

2.4.2. The London Clay bedrock is designated as an Unproductive Strata. Unproductive Strata are described by the Environment Agency as rock layers or drift deposits with low permeability that has negligible significance for water supply or river base flow.

2.4.3. The underlying solid geology of Lambeth Group and Thanet Formation is classified as a Secondary A Aquifer and the Chalk strata, which is at depth beneath the Thanet Formation, is classified as a Principal Aquifer. These are layers of rock or drift deposits that have inter-granular and/or fracture permeability and can often provide a high level of water storage. They may support water supply and/or river base flow in a strategic scale. Due to their high permeability, Principal Aquifers are considered to be highly vulnerable to pollutants. In terms of receptor sensitivity, the Principal Aquifer is assessed as being of 'High Sensitivity'.

2.4.4. The DEFRA Magic Application maps (accessed on March 2020) show that the Site is not in a Source Protection Zone (SPZ) designated by the Environment Agency for the protection of potable water supply. The closest SPZ is located approximately 4.8km south-west of the Site.

2.4.5. Groundwater monitoring was carried out in nine boreholes at the Site in January 2020 (SOCOTEC, April 2020). Groundwater levels were reported ranging from 0.30m to 2.67m bgl; and being affected by tidal water level variations in the nearby estuary. The deep instruments showed a small tidal water level variation, typically around 0.3m. The instruments within the shallow monitoring wells recorded a greater variation in water level, typically around 1.0m.

Table 2-4 Preliminary Ground Model

Stratum	Typical Description	Anticipated Thickness (m)
Made ground	Variable - Typically orange-brown sandy gravel with occasional cobbles of flint, brick and concrete. Gravel is medium to coarse subrounded to subangular fragments of flint and chert.	Variable (0.5 to 1.6)
Alluvium	Silt, clay and sand with occasional peat inclusions.	2.8 to 6.7
River Terrace Deposits	Sand and gravel	0.9 to 5.9
London Clay	Clay	5.7 to 8.2
Lambeth Group	Interbedded (sands, silty & clays)	10.7 to 16.4
Thanet Formation	Sand with beds of sandy clay at its base.	Approximately 30 [2]
Upper Chalk	Chalk with occasional beds of flint.	Approximately 100 [2]
Groundwater		
Designation	**Description**	**Reported Groundwater Levels (m bgl)**
Made ground	-	Seepage reported at various locations. Reported groundwater strikes between 0.3m and 0.6m bgl in a number of the exploratory holes (SOCOTEC, April 2020)
Secondary Undifferentiated Aquifer Alluvium	Secondary Undifferentiated Aquifer Groundwater strikes not encountered in historical investigation locations at the Site	Reported groundwater strikes between 1.5m to 4.4m bgl (SOCOTEC, April 2020)
Secondary A Aquifer River Terrace Deposits	Secondary A Aquifer	Reported groundwater strikes between 4.7m to 6.7m bgl
London Clay	Unproductive Strata	Groundwater strikes were observed at the base of the London Clay, very close to the top of the Lambeth Group.

[2] Solid Geology summary from the Desk Study and preliminary Risk Assessment Report, RPS, dated June 2013

Lambeth Group	Secondary A Aquifer	Reported groundwater strikes between 15.2m to 20.5m bgl. (SOCOTEC, April 2020)
Thanet Formation	Secondary A Aquifer	No data available
Upper Chalk	Principal Aquifer	No data available

3. Historical Review

3.1 Historical Development Summary

3.1.1. Prior to construction of the power station in the early 1970s and final commissioning in 1975, the Site had no industrial usage, having been agricultural use, with artificial drainage channels and saltings. Historical mapping from 1971 shows the Site to be developed with six tanks.

3.1.2. It is understood[3] that the construction of the plant required the dewatering and damming of Damhead Fleet, and extensive piling for foundation purposes. There have been several significant operational changes to the power station over time, including:

- Change from predominantly oil-fired use during the 1970's to subsequent coal-fired use. The facility to co-fire biomass was introduced in 2004.
- Water supply for power station boilers switched from mains water to groundwater, abstracted from the deep chalk aquifer by a series of boreholes (refer to drawing no 2451141-GI-S006 and 2451141-GI-S005 in the Desk Study and Preliminary Risk Assessment Report, RPS, June 2013) in the northern part of the former Kingsnorth Power Station (approximately 400m north of the Site).
- Improvements to the site drainage system, including reed beds for treatment of run-off from the coal stocking area.

3.1.3. Between 1928 and 1975, an oil refinery was located immediately to the north of the Kingsnorth power station site. The area of land between Damhead Creek and the area of the Site was used in the past for tipping of (non-hazardous) waste, though this ceased in the late 1990s.

3.1.4. Kingsnorth Power Station (and the Site itself) was decommissioned between 2013 and 2014 (except for few areas as their retention is required to facilitate ongoing site operations or maintain the long term integrity of the site infrastructure). The buildings and infrastructure of the Kingsnorth Power Station has been demolished, and the site levelled including infilling of any underground voids.

3.2 Unexploded Ordnance (UXO)

3.2.1. The Site is assessed as being Moderate Risk in respect of air dropped World War II ordnance (Zetica online UXB risk map, 2020) (Appendix C).

3.2.2. However, it should be noted that the Site has been developed since WWII and several site investigations have been carried out in 2013 and 2014, reducing the likelihood of UXO remaining on site.

3.2.3. A specialist UXO threat and risk assessment has been carried out by 6alpha on behalf of GridLink Interconnector Ltd. 6alpha have assessed the overall UXO risk as Low, stating that while there is a risk of residual UXO in the study area, they do not believe there to be a significant risk pathway to warrant on-site pro-active UXO risk mitigation measures.

[3] Kingsnorth Power Station Decommissioning Report (C.J.Tye, March 2014).

4. Ground Investigations

4.0.1. Site investigation works have been undertaken at Kingsnorth Power Station between June 2013 and February 2017 by RPS. These investigations covered the Kingsnorth Power Station as a whole and include works undertaken on the Site.

4.0.2. In addition, a site-specific topographic, geophysical, geotechnical and environmental survey was carried out of the Site from November 2019 to April 2020 by SOCOTEC.

4.0.3. In figures 4-1 to 4-6 inclusive and 4-10 within Chapter 4, a red shaded area has been overlain to show the approximate extent of the 'the Site' for the purposes of this report.

4.1 RPS, Desk Study and Preliminary Risk Assessment Report, Kingsnorth Power Station, dated June 2013

4.1.1. RPS was commissioned by E.ON UK Limited (E.ON) to produce a Desk Study and Preliminary Risk Assessment for Kingsnorth Power Station (which includes the Site). The report assesses the available information for the wider Kingsnorth Power Station area (as shown by the dashed red line in Figure 4-1) and presents a conceptual site model identifying preliminary levels of risk associated with potential and known contamination. The report identified a number of known and potential contaminant sources that may have arisen during the site's operation under the environmental permit (ref: CP3237SJ), which could have led to deterioration of the site's condition. The report states that although environmental controls have been in place since the permit was issued, and no large pollution releases have been recorded, it is possible that smaller, localised spills have occurred, which may have resulted in contamination of the ground. The recommendations included to undertake a ground investigation to assess the presence, type and extent of land contamination and ground conditions at the Kingsnorth Power Station site in order to support the surrender of the environmental permit.

Figure 4-1. Site Layout and Zone (Extract from RPS Drawing No: JER5486-K-005)

4.2 RPS, Ground Investigation Factual Report (Main Site), Kingsnorth Power Station, dated January 2014

4.2.1. RPS designed and completed a ground investigation to assess the ground conditions, and presence, type and extent of any land contamination at Kingsnorth Power Station. Investigations were undertaken

to characterise existing environmental ground conditions and site sensitivity, including contamination, geological, hydrogeological and hydrological conditions.

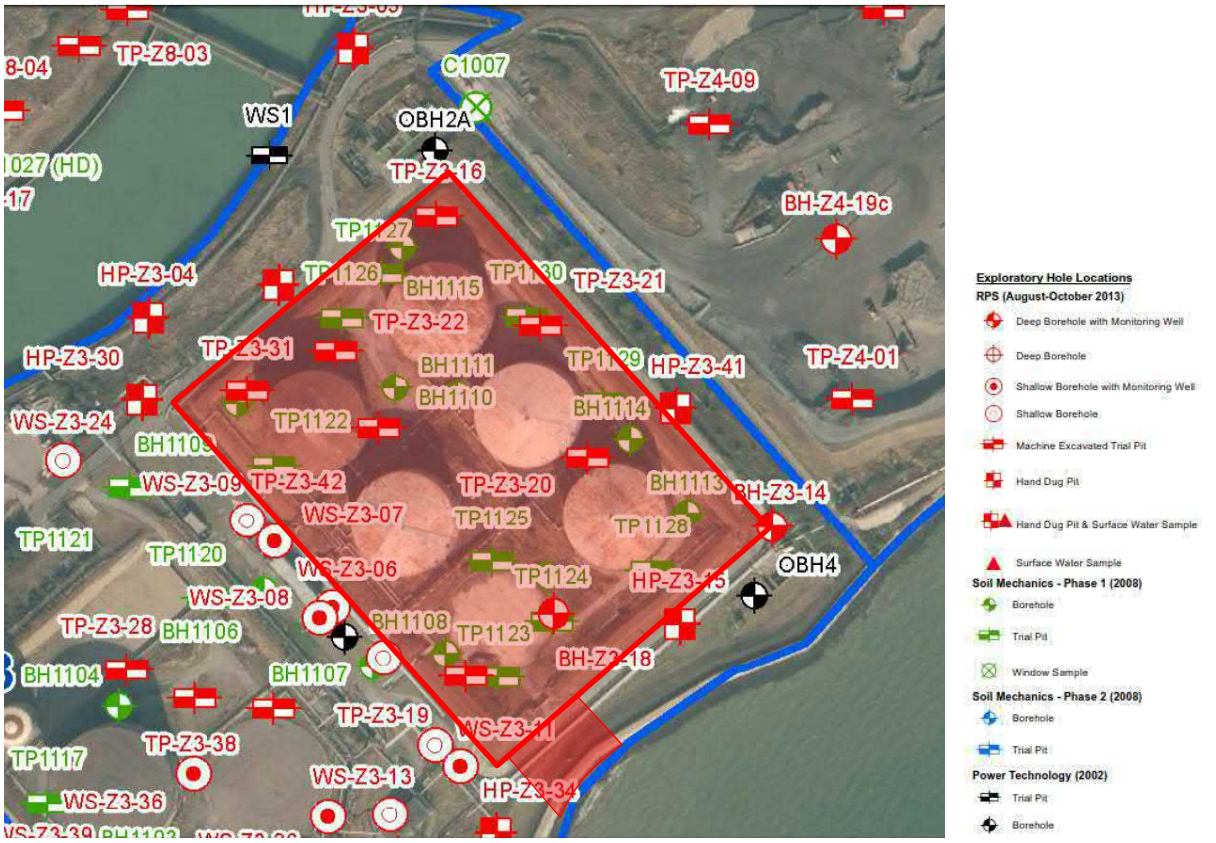
4.2.2. The main phase of intrusive ground investigation works within the Kingsnorth Power Station site was undertaken between 27th August and 11th October 2013 and comprised cable percussive boreholes, window sample boreholes, trial pits and hand pits. For the purposes of this report, eleven of the site investigation locations were located within the area of the Site (BH-Z3-18, TP-Z3-16, TP-Z3-19, TP-Z3-20, TP-Z3-21, TP-Z3-22, TP-Z3-31, TP-Z3-42, WS-Z3-06, WS-Z3-07 and WS-Z3-41 – see Figure 4-2). Of these locations, one exploratory hole location (BH-Z3-18) was installed with a 50 mm HDPE combined gas and groundwater monitoring well, with a response zone between 5.7m and 9.7m bgl. Two other exploratory hole locations (WS-Z1-06 and WS-Z1-07) were installed with 19 mm HDPE combined gas and groundwater monitoring wells, with a response zone between 1.0m and 4.0m bgl.

4.2.3. A soil gas and water (both ground and surface water) monitoring programme was undertaken for three rounds at approximately monthly intervals in October, November and December 2013.

4.2.4. A total of 190 no. soil samples were submitted to the laboratory for analysis of various suites of chemical determinants, including metals (As, Cd, Cr, Hg, Pb, Cu, Ni, Zn, Va, Se), total petroleum hydrocarbons (TPH) (C8-C35), TPH aliphatic/aromatic split (CWG), organic matter content, speciated PAH, semi volatile organic compounds (SVOC), volatile organic compounds (VOC), polychlorinated biphenyls (PCB), boron, asbestos (including screening, identification and fibre count), phenol, water soluble sulphate and pH.

4.2.5. A total of 104 no. groundwater samples and 9 no. surface water samples were submitted to the laboratory for analysis of various suites of chemical determinands, including metals and inorganics, pH, conductivity, total alkalinity as CaCo3, chloride, ammoniacal nitrogen as N, nitrite as N, nitrate as N, PCB, dissolved oxygen, PAHs, TPH, VOCs and SVOCs.

Figure 4-2. Ground Investigation Locations, 2013 (Extract from RPS Drawing No: JER5486-K-064)



Field Observations of Contamination

4.2.6. Visual and/or olfactory evidence of contamination (staining, sheens or odour) was observed during the ground investigation at the Site, generally in the Made Ground, and included 'strong hydrocarbon odour'

(TP-Z3-16), 'visual and olfactory evidence of heavy fuel oil (HFO) contamination' (TP-Z3-20) and 'hydrocarbon staining' (TP-Z3-21 and TP-Z3-31).

4.2.7. Volatile Organic Compound (VOC) screening (head space testing) was carried out on each environmental sample using a Photo-Ionisation Detector (PID). The results showed VOCs ranging from 2ppm to 20ppm in the samples collected at the Site.

Ground Gas Monitoring

4.2.8. Three ground-gas monitoring events were undertaken at the Site from WS-Z3-06 and WS-Z3-07 on the 15th October 2013, 19th November 2013 and 10th December 2013. Concentrations of carbon dioxide, methane, oxygen, hydrogen sulphide and gas flow were measured in the installations using a portable gas analyser. The atmospheric pressure reading was between 1009mb and 1029mb. A summary of results is presented in Table 4-1. Stabilised readings indicate low concentrations of carbon dioxide (maximum 4.5%), and no detectable methane or hydrogen sulphide concentrations were recorded during the monitoring rounds.

Table 4-1 Summary of Ground Gas Monitoring Results

Gas	WS-Z3-06 Concentration Range (%)	WS-Z3-07 Concentration Range (%)
Methane*	0	0
Carbon dioxide*	0– 4.5	0 – 4
Oxygen*	17.3 – 20.9	17.8 – 21.1
Hydrogen Sulphide**	0	0
Maximum Flow rate***	9	0.1

Notes

* Gas concentration measured in % v/v (% by volume)

** Hydrogen sulphide measured in part per million (ppm)

*** Gas flow measures in l/h (litres per hour)

Groundwater Monitoring

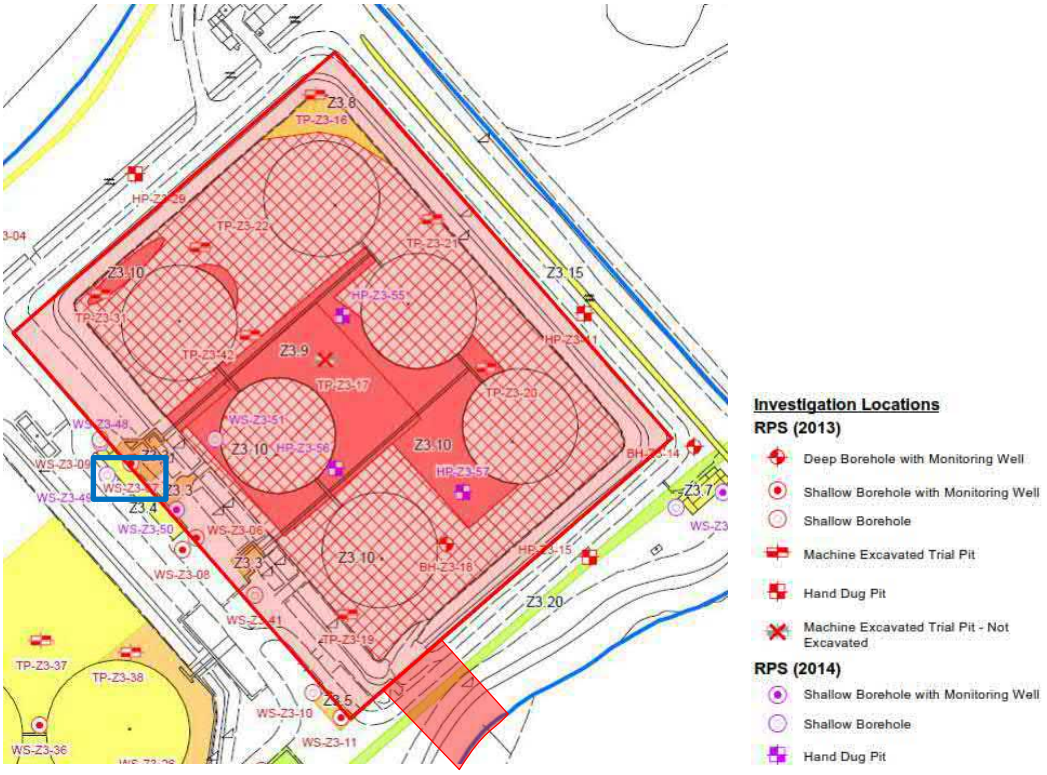
4.2.9. Three rounds of groundwater monitoring and sampling were undertaken on a monthly basis, commencing in October 2013. Groundwater level was recorded to be between 1.08m and 1.65m bgl in WS-Z3-06, between 1.62m and 2.46m bgl in WS-Z3-07, and between 1.50m and 2.93m bgl in BH-Z3-18. The report does not indicate any non-aqueous phase liquids (LNAPL) observed during the monitoring at the Site.

4.3 RPS, Ground Investigation Factual Report, Kingsnorth Power Station, dated October 2014

4.3.1. RPS completed a supplementary ground investigation to assist in the delineation and assessment of contamination identified during the previous phase of investigation (undertaken in 2013) at the Kingsnorth Power Station site, to define the extent of soil and groundwater contamination within each of the defined contamination source locations to allow completion of a remediation options appraisal.

Figure 4-3. Additional Ground Investigation Locations, 2014 (Extract from RPS Drawing No: JER5486-KZ3-005i Rev C)

(The blue square indicates the location of WS-Z3-07, for



which groundwater level monitoring data is available.)

4.3.2. The intrusive ground investigation was undertaken in August 2014 and included the following activities:

- Drilling of 30 no. window sample boreholes to depths of between 0.65 and 4.00m bgl, with one location (WS-Z3-51) targeting the Site (see Figure 4-3);
- Installation of gas and groundwater monitoring well standpipes at various depths within 19 window sample boreholes. WS-Z3-51 (located within the Site) was not installed as a monitoring well; and
- Excavation of 5 no. hand pits dug to depths of up to 0.3m bgl within Kingsnorth Power Station. The hand pits were located to obtain samples of heavy fuel oil (HFO) present at the ground surface within the two tank farm bunds, located within the area of the tank farm. Four of hand pits targeted the Site (HP-Z3-50, HP-Z3-55, HP-Z3-56 and HP-Z3-57).

4.3.3. A total of 62 soil samples (from the entire site) were submitted to the laboratory for analysis for various suites of chemical determinants including· TPH Aliphatic/aromatic split (CWG), PAHs, PCB, asbestos screen, total organic matter and waste acceptance criteria (full suite).

Field Observations of Contamination

4.3.4. Visual and/or olfactory evidence of contamination (staining, sheens or odour) was observed within the Made Ground, and included ‘strong hydrocarbon odour, HFO present’ (WS-Z3-51), ‘black staining due

to hydrocarbon contamination present' (HP-Z3-55), 'black staining from hydrocarbon contamination' (HP-Z3-56) and 'hydrocarbon odour present and signs of hydrocarbon staining at surface level' (HP-Z3-57). Volatile organic compound (VOC) screening was carried out on each environmental sample using a Photo-Ionisation Detector (PID). The results showed VOCs ranging from 0ppm to 5ppm in the samples collected at the Site.

Groundwater Monitoring and Sampling

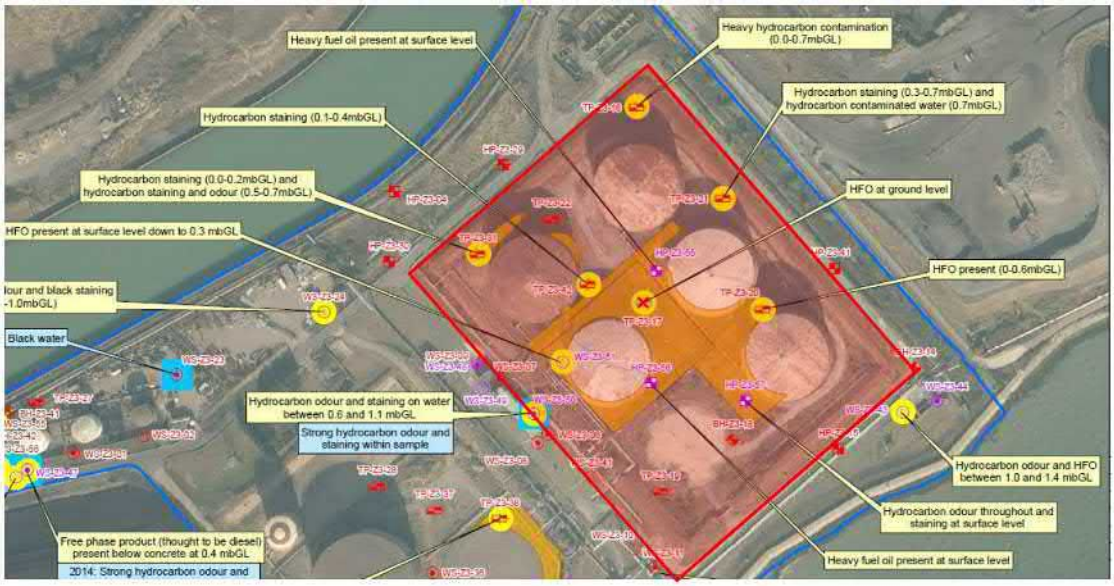
4.3.5. One round of groundwater monitoring and sampling of the monitoring wells was undertaken on the 2nd and 3rd of September 2014. Groundwater level at WS-Z3-07 located at the Site was reported to be 3.75m bgl (which is not located within the area of the Site, but is very close to the boundary – see Figure 4-3). The report does not indicate any LNAPL in WS-Z3-07 observed during the monitoring at the Site.

4.4 RPS, Ground Investigation Interpretative Report, Kingsnorth Power Station, dated November 2014

4.4.1. This report provides an interpretation of the findings of the previous investigation (RPS, January 2014), plus a supplementary ground investigation (RPS, October 2014).

4.4.2. According to the historical investigations, evidence of HFO contamination (odour / staining) was encountered across the majority of the Site (Figure 4-4). The contamination encountered at the Site was noted to be generally confined to the top 0.5m of the soil profile within the made ground.

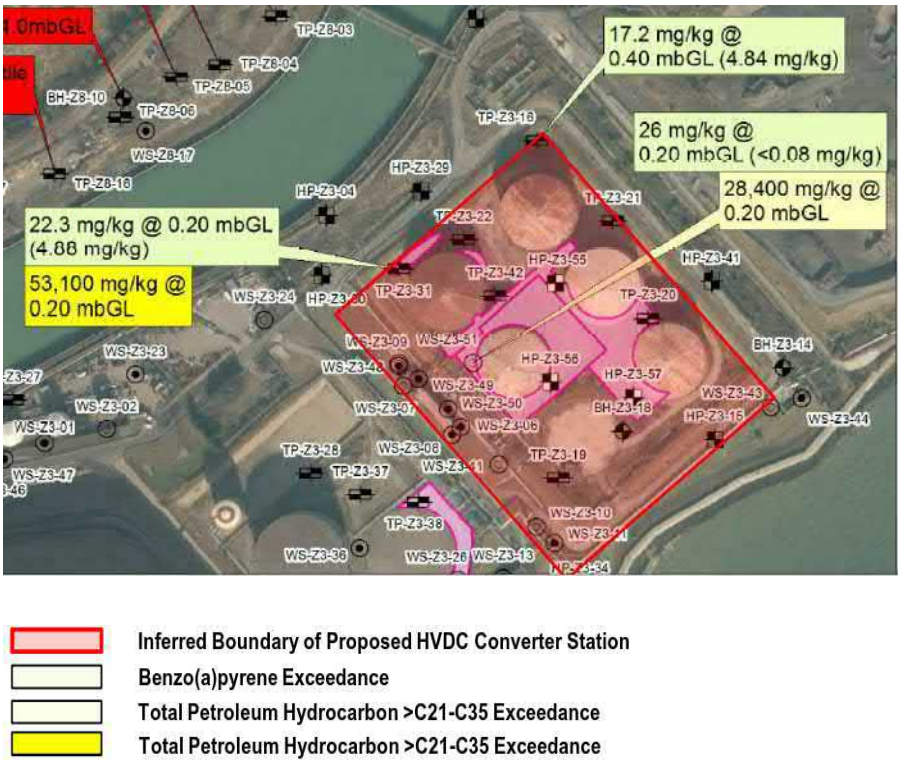
Figure 4-4. Evidence of contamination on-site (Extract from RPS Drawing No: JER5486-KZ3-003 Rev F)



4.4.3. A Tier 2 human health risk assessment was undertaken using the results of the soil TPH, PAH and PCB laboratory analysis. The assessment combined the results of the ground investigations undertaken by RPS in 2013 and 2014 to assess potential risks to human health from the presence of hydrocarbon contamination within the soils. The assessment compares the contaminant concentrations against relevant SGVs / GACs for the commercial use scenario.

4.4.4. On the basis of the laboratory data, and with comparison to commercial Generic Assessment Criteria (GAC), localised human health exceedances were recorded for benzo(a)pyrene (17.2 – 26.0 mg/kg; with a GAC of 14.0 mg/kg) and heavy end (C21 – C35) total petroleum hydrocarbon (TPH) banding (28,400 - 53,100 mg/kg; with a GAC of 28,000 mg/kg) at three intrusive positions (TP-Z3-16, TP-Z3-31 and WS-Z3-51) (Figure 4-5).

Figure 4-5 Soil exceedances on-site (Extract from RPS Drawing No: JER5486-K-082 Rev D)



Controlled Waters Detailed Quantitative Risk Assessment

4.4.5. To assess the potential risks to controlled waters at the Kingsnorth Power Station site, a Tier 1 risk assessment was undertaken to determine potential sources of chemical contamination within groundwater. The assessment was completed based on data from four rounds of groundwater sampling undertaken in October to December 2013 and in September 2014.

4.4.6. Within the Site boundary, there was one marginal exceedance of the controlled water screening criteria for polyaromatic hydrocarbons (PAH) reported in groundwater collected from BH-Z3-18. Further controlled water screening criteria exceedances were reported for PAH compounds and TPH in positions located along the western boundary of the Site (WS-Z3-07, WS-Z3-50 and WS-Z3-06) (Figure 4-6). The exceedances appear to be inconsistent and were not reported for every monitoring round. These exceedances were not considered to represent a significant concern following completion of a detailed quantitative risk assessment (DQRA).

4.4.7. The groundwater risk assessment concluded that the presence of hydrocarbons within groundwater was unlikely to pose a risk to Damhead Creek.

4.4.8. Following completion of the risk assessment, remedial actions recommended at the Site consisted of the removal of HFO contaminated soils across the central part of the Site, including the area in the vicinity of borehole WS-Z3-51 (refer to Figure 4-5), where shallow TPH and benzo(a)pyrene contamination had been identified; and to undertake remediation verification sampling.

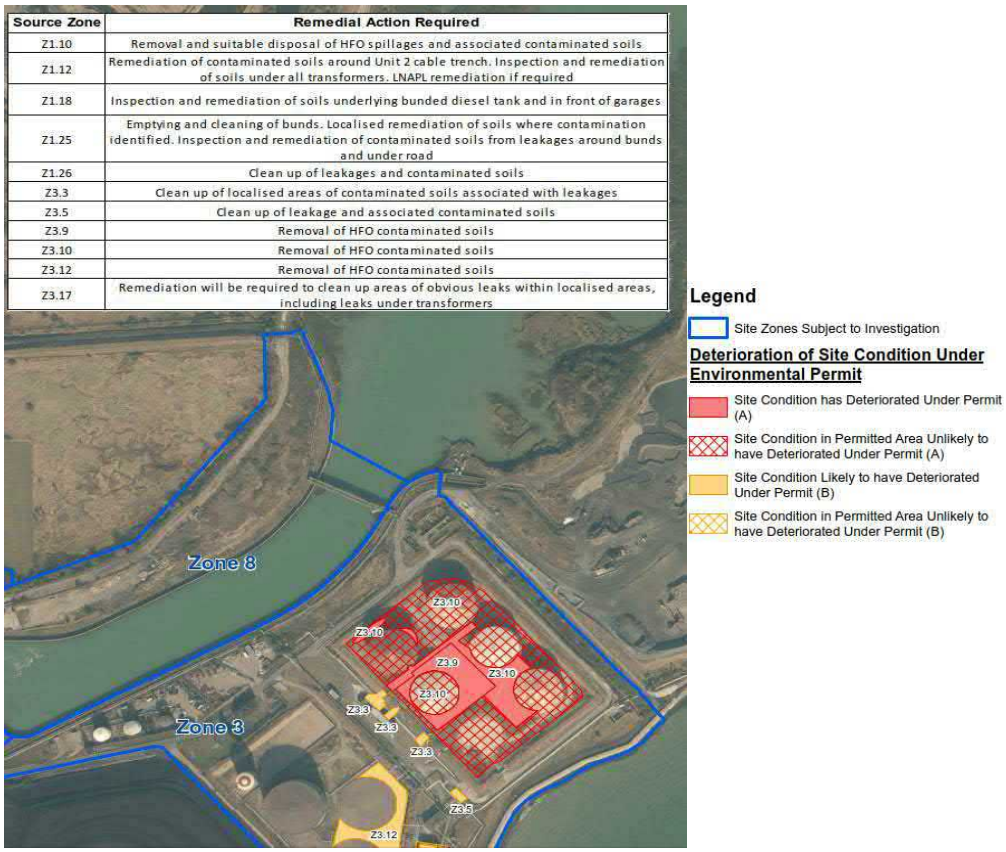
4.5 RPS, Supplementary Ground Investigation Interpretative Report, Kingsnorth Power Station, dated January 2016

4.6.1. RPS completed an additional ground investigation to further assist in the delineation and assessment of contamination identified during prior phases of intrusive investigations. The aim was to define the extent of soil and groundwater contamination within each of the defined contamination source locations, to allow completion of a remediation options appraisal and allow development of a remediation strategy. The updated site condition assessment identified a number of source locations where remediation was considered to be required. Table 4-2 provides an updated summary of the Contaminant Source Locations (CSLs) pertinent to the Site and the corresponding actions.

Table 4-2 Summary of recommended remedial actions for the areas relevant to the Site

Source	Contamination Identified	Action Recommended
Z3.9 – Central area of Tanks 1 – 6	No ground investigation data in source location. HFO present at surface	Removal of HFO contaminated soils and remediation verification sampling
Z3.10 – HFO Tanks 1 – 6	Elevated TPH and benzo(a)pyrene in soils and PAHs in groundwater. HFO present at surface	Removal of HFO contaminated soils and remediation verification sampling
Z3.3 – Pipe works leaving tank farm	Elevated TPH and PAHs in groundwater, evidence of hydrocarbons under pipework	Clean up of localised areas of contaminated soils associated with leakages and remediation verification sampling.

Figure 4-7. Remedial action required (Extract from RPS Drawing No: JER5486-K-086 Rev B)



Source Zone	Remedial Action Required
Z1.10	Removal and suitable disposal of HFO spillages and associated contaminated soils
Z1.12	Remediation of contaminated soils around Unit 2 cable trench. Inspection and remediation of soils under all transformers. LNAPL remediation if required
Z1.18	Inspection and remediation of soils underlying bunded diesel tank and in front of garages
Z1.25	Emptying and cleaning of bunds. Localised remediation of soils where contamination identified. Inspection and remediation of contaminated soils from leakages around bunds and under road
Z1.26	Clean up of leakages and contaminated soils
Z3.3	Clean up of localised areas of contaminated soils associated with leakages
Z3.5	Clean up of leakage and associated contaminated soils
Z3.9	Removal of HFO contaminated soils
Z3.10	Removal of HFO contaminated soils
Z3.12	Removal of HFO contaminated soils
Z3.17	Remediation will be required to clean up areas of obvious leaks within localised areas, including leaks under transformers

4.6 RPS, Remediation Options Appraisal, Kingsnorth Power Station, dated September 2016

4.6.1 RPS was commissioned by Uniper Energy Ltd (Uniper) to undertake a remediation options appraisal in relation to contamination identified at Kingsnorth Power Station.

4.6.2 The appraisal considered remediation of HFO contaminated soils, residual hydrocarbon contaminated soils, hardstanding that has been contaminated by leaks and spillages and localised areas of groundwater contaminated with hydrocarbons.

4.6.3 Table 4-3 below summarises the CSLs where remediation was deemed to be required at the Site. Figure 4-8 identifies the location of these CSLs.

Table 4-3 Summary of CSLs Identified by RPS as Requiring Remediation

Contamination Source Location	Contaminant Type	Maximum Concentrations of Contaminants of Concerns (CoC)		Justification provided by RPS	Action Recommended by RPS
		Soil	Groundwater		
Z3.3 – Pipe works leaving Tank Farm	HFO / Light Fuel Oil (LFO)	Total TPH - 88,200 mg/kg Total PAHs - <406.73	Total TPH - 1.954 mg/l Total PAHs - <0.977 ug/l	E.ON confirm that there is no history of spills in this area since EP issue in 2007. There were several incidents pre this date i.e. pre EP. During commissioning and demolition, pits and pipework were cleaned of oil and no evidence of hydrocarbon contamination was noted on ponded water during site inspection in November 2015. Although pipework has been removed and pits cleaned, adjacent soils are still likely to be required to be remediated.	Clean up of localised areas of contaminated soils associated with leakages and remediation verification sampling.
Z3.8 – NW Corner of Tank Farm	HFO / LFO	Total TPH - 16,070 mg/kg Total PAHs - 100.31 mg/kg	No data	Area has been impacted from previous site operation, however area bunded off in early 2000s and it is unlikely that anything has been placed in the bunded area since.	No specific remedial action recommended for permit surrender. HFO contaminated soils could be remediated during remediation of adjacent areas.
Z3.9 – Central Area of Tanks 1-6	HFO / LFO	Total TPH - 388 mg/kg Total PAHs - <2.23 mg/kg	No data	No known significant leaks since 2008, however small leaks may have occurred. HFO present at the surface.	Removal of HFO contaminated soils and remediation verification sampling.
Z3.10 – HFO Tanks 1-6	HFO / LFO	Total TPH - 86,400 mg/kg Total PAHs - 116.68 mg/kg	Total TPH – 0.025 mg/l Total PAHs - <0.174 ug/	No known significant leaks since 2008, however small leaks may have occurred. HFO present at the surface. Oil contaminated material from Zone 2 currently being stored in area.	Removal of HFO contaminated soils and remediation verification sampling

Figure 4-8. Location of Remediation areas Proposed in 2016 (Extract from RPS Drawing No: JER5486-K-087)

4.7 RPS, Remediation Strategy, Kingsnorth Power Station, dated February 2017

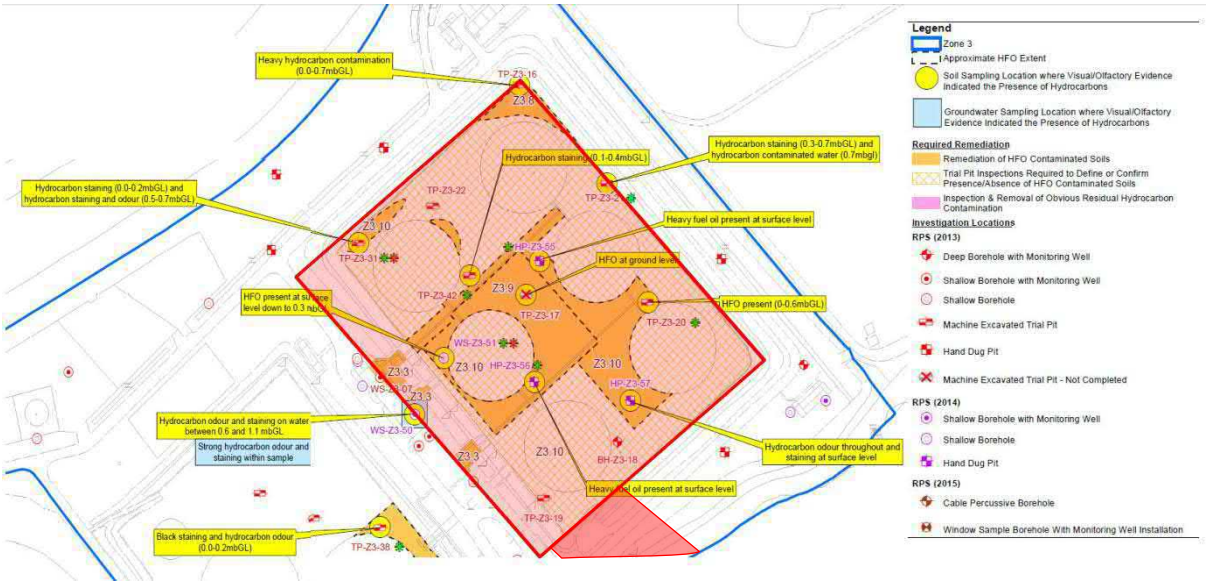
4.7.1 RPS was commissioned by Uniper to develop a remediation strategy for the Kingsnorth Power Station site, in relation to contamination identified during previous intrusive investigations. The objective was to provide an outline strategy for the remediation of each specific site area, referred to as CSLs, including the area where the Site is located (Zone 3).

4.7.2 A plan highlighting the remedial works proposed to be undertaken within the Site is provided as Figure 4-10.

4.7.3 Areas requiring remediation are highlighted in orange. These include several areas which are located within the Site (labelled as Z3.8, Z3.9 and Z3.10) as well as Z3.3, located on the western boundary of the Site (area where above ground pipework left the bunded area). The remaining areas of the tank farm that have not been directly investigated were highlighted as requiring additional trial pitting works to confirm the presence / absence of HFO contamination and refine the proposed remedial areas.

4.7.4 On the basis of the available information, RPS assumed that a total of 7,726m3 of material would require remediation, based on the assumption of excavation depths of 0.5m within the tank farm area, and 1.5m in the area of the above ground pipes on the western boundary of the Site. No areas of hardstanding were included within these estimations. Remediation options considered for soil by RPS included ex-situ thermal desorption or ex-situ bioremediation with 50% off-site disposal. No groundwater remediation was considered to be required.

Figure 4-10. Proposed remedial works at the Site (Extract from RPS Drawing No: JER5486-KZ3-012i Rev A)



4.8 SOCOTEC, Geotechnical Desk Study, dated March 2020

4.8.1 SOCOTEC carried out a Geotechnical Desk Study at the former Kingsnorth power station site in November 2019. The desk study included the Site and the area of the connecting high voltage underground cable.

4.8.2 The report identified the following potential geotechnical hazards that could affect the Proposed Development and the connecting high voltage underground cable:

- *'Buried obstructions from previous and existing buildings and infrastructure.*
- *Variable made ground with unpredictable settlement characteristics.*
- *Weak and compressible alluvial soils.*
- *Superficial soils with an increased risk of instability during excavation.*
- *Elevated risk of aggressive ground conditions for buried concrete.*

- *Relatively high groundwater levels.*
- *Destabilisation of existing earth structures during cable trench excavation.'*

4.8.3 An intrusive site investigation was recommended to confirm the ground conditions and groundwater levels at the Site and at the area of the proposed underground cable; and to provide information for the assessment of geotechnical parameters to be used for the preliminary design of the structures and associated temporary works.

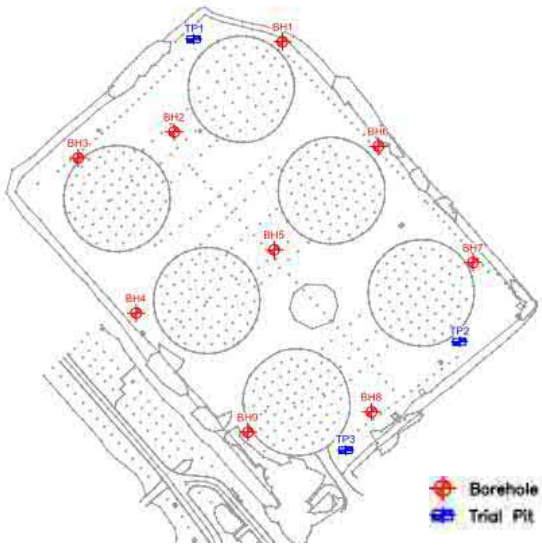
4.9 SOCOTEC, Geotechnical Report on Ground Investigation, dated April 2020

4.9.1 This report presents the factual records of the geotechnical site investigation carried out by SOCOTEC in November 2019 at the Site and at the area of the proposed cable route.

4.9.2 The investigation comprised nine cable percussion boreholes (BH01 to BH09), to a depth of 30m bgl and three trial pits (TP1 to TP3), excavated to depth of between 0.5m and 3.20m bgl, as indicated in Figure 4-11.

4.9.3 Geo-environmental laboratory testing was carried out on the soil samples recovered during the fieldwork, and included pH, sulphate, sulphide, chloride, cyanide, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total organic carbon, volatile and extractable hydrocarbons, heavy metals (arsenic, barium, beryllium, boron, cadmium, chromium, copper, lead, mercury, nickel, vanadium and zinc) and asbestos. The results are reported in Section 4.10.

Figure 4-11. Investigation location (Extract from SOCOTEC, April 2020. Drawing No: A2)



4.9.4 During excavation, groundwater was encountered in all exploratory locations except for TP3. Water strikes were reported at depths between 0.3m and 20.50m bgl, when drilling the boreholes, commonly associated with the presence of more permeable sand layers.

4.9.5 Groundwater monitoring was carried out in each borehole. Diver groundwater data loggers (and a single barometric logger) were installed in the monitoring wells between 14th January 2020 and 17th January 2020, to allow effective continuous groundwater monitoring to be carried out and to assess water level movement in response to tidal fluctuations in the Medway Estuary.

4.9.6 Geochemical testing for the assessment of subsurface concrete was carried out on soil samples of the various geological strata encountered at the Site and included acid soluble sulphate, water soluble sulphate, total sulphur and pH tests. Tests for sulphate reducing bacteria were also conducted on soil samples recovered from all exploratory holes.

4.10 SOCOTEC, Factual Report on Soil Contamination, dated March 2020

4.10.1 This report includes the borehole and trial pit logs and chemical results of the geo-environmental site investigation.

4.10.2 Visual and olfactory evidence of contamination was reported in four exploratory locations and included slight to strong hydrocarbon odour in made ground and/or natural deposits, as summarised in Table 4-4. Organic odour and organic contents were reported within the alluvial deposits in the majority of the investigation locations.

Table 4-4 Visual and olfactory evidence of contamination

Location	Deph (m bgl)	Strata	Description
BH2	0.5	Alluvium	Strong hydrocarbon odour
BH2	5.0	Alluvium	Strong hydrocarbon odour
BH2	6.0	River Terrace Deposits	Strong hydrocarbon odour
BH4	0.8	Alluvium	Strong hydrocarbon odour
BH10	1.5	Made ground	Presence of cables
TP1	0.5	Made ground	Strong hydrocarbon odour and oily sheen
TP1A	0.2	Made ground	Slight hydrocarbon odour
TP1A	0.8	Alluvium	Slight hydrocarbon odour

4.10.3 Geo-environmental laboratory data for soil included pH, sulphate, sulphide, chloride, cyanide, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total organic carbon, volatile and extractable hydrocarbons, heavy metals and asbestos. The results are summarised as follows:

- Metals – The following maximum concentrations for metals are shown in the laboratory certificates: boron (31.1mg/kg); arsenic (28.5mg/kg); cadmium (1.14mg/kg); chromium (69mg/kg); copper (325.6mg/kg); lead (485mg/kg); mercury (0.87mg/kg); vanadium (82.4mg/kg); zinc (422mg/kg); barium (203mg/kg).
- PCB - no measured concentration was recorded above the laboratory detection limit.
- Cyanide - measured concentration was generally recorded below the laboratory detection limit, except for 1.5mg/kg in TP1A.
- TPH – recorded above the limit of detection in the majority of the soil samples, with the following maximum concentrations:
  - Maximum concentration TPH (>C10-C12): 34.1mg/kg (TP1A)
  - Maximum concentration TPH (>C10-C40): 3110mg/kg (TP1A)
  - Maximum concentration TPH (>C12-C16): 295mg/kg (TP1A)
  - Maximum concentration TPH (>C16-C21): 366mg/kg (TP1A)
  - Maximum concentration TPH (>C21-C35): 1860mg/kg (TP1A)
  - Maximum concentration TPH by GCFID: 3120mg/kg (TP1A)
- PAH – measured concentrations were generally recorded below the laboratory detection limit, except for:
  - chrysene (maximum concentration of 2.13mg/kg);

- fluoranthene (maximum concentration: 3.99mg/kg);
- Trichloroethene (maximum concentration: 29mg/kg);
- o-xylene (maximum concentration: 6.2 mg/kg);
- naphthalene (maximum concentration: 114.3 mg/kg);
- trichloroethene (maximum concentration: 30.5 mg/kg);

- Asbestos (chrysotile - free fibres) was identified in three samples: BH03(0.5), BH04(0.5) and BH07(0.5)

4.11 SOCOTEC, Factual Report on Tank Base Concrete Coring, dated April 2020

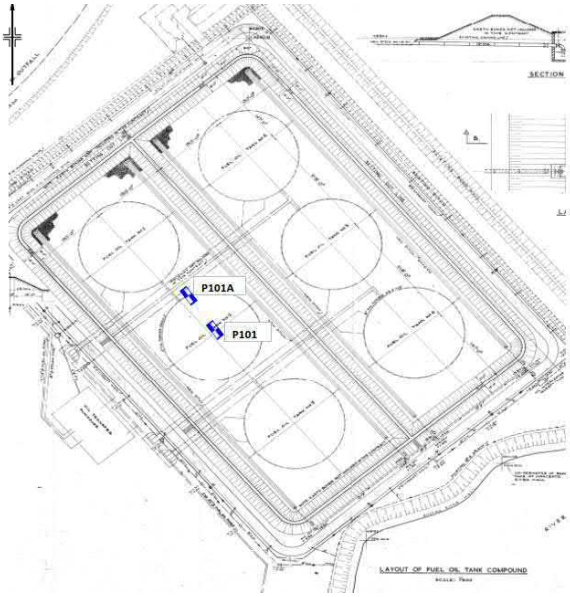
4.11.1 In addition to the geotechnical investigation described in Section 4.9, SOCOTEC carried out a supplementary investigation of one of the underlying concrete bases to the former fuel tanks.

4.11.2 The investigation, carried out in January 2020, consisted in breaking through a section of one of the former tank base slabs, using a mechanical excavator and hydraulic breaker unit, to obtain samples of the underlying piles for subsequent laboratory testing. On completion, the excavation was backfilled, and the broken concrete from the slab placed at ground level.

4.11.3 Three piles were encountered within the excavation. The piles were noted to be circular, with reinforcement bar located at varying distances from the outer wall. The piles were surrounded by a thin metal sleeve. The concrete of the overlying tank slab was noted as being reinforced.

4.11.4 Testing on a representative section of each pile included compressive strength, cement content, aggregate/cement ratio and chloride ion ratio. The results are included in the Factual Report on Tank Base Concrete Coring (SOCOTEC, April 2020)

Figure 4-12. Exploratory locations Plan (Extract from SOCOTEC, April 2020. Drawing No: A2)

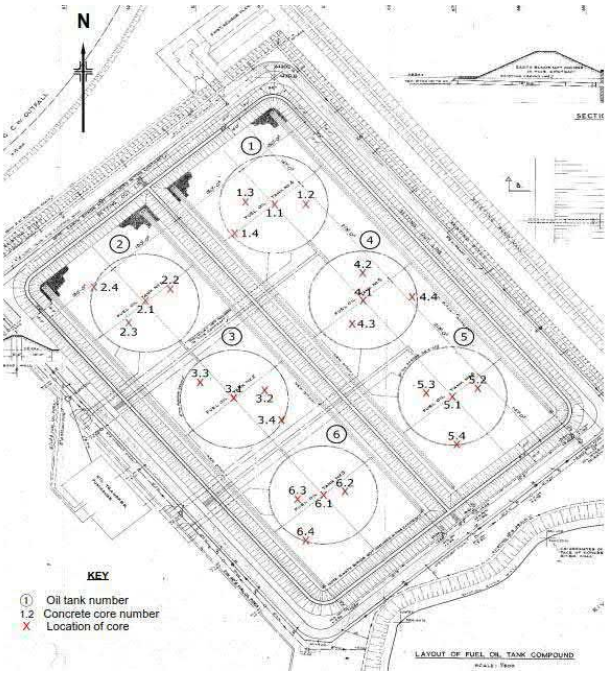


4.12 SOCOTEC, Factual Report on Tank Base Piling Inspection, dated April 2020

4.12.1 In addition to the geotechnical investigation described in Section 4.9, SOCOTEC carried out a programme of concrete coring in November 2019.

4.12.2 The fieldworks included one core completed in the central part of each tank base, one on the outer rim, and the remaining two over the main area of the slab, as indicated in Figure 4-13. The cores were undertaken utilising bolt down electrical coring equipment. Testing on a representative selection of cores included strength, cement content and cement / aggregate ratio. The results are included in the Factual Report on Tank Base Piling Inspection (SOCOTEC, April 2020)

Figure 4-13. Concrete Core Location Plan (Extract from SOCOTEC, April 2020. Drawing No: A2)



5. Regulatory Records

5.1 Introduction

5.1.1 The following section presents a summary of the most relevant environmental conditions at the Site based on the historical reports, including an Envirocheck® Report dated 2008 appended to the Desk Study and Preliminary Risk Assessment Report (RPS, June 2013).

5.2 Pollution Incidents to Controlled Water

5.2.1 The available information on historic spills is provided in Sections 3.9 of the RPS desk study report, which covers historical pollution incidents that have been recorded at the Kingsnorth site (up to 2018). It is understood that Uniper has verified that these are the only historical records of incidents involving HFO.

5.2.2 The following incidents are reported to have occurred within or immediately adjacent to the area of the Site.

Table 5-1 Pollution Incident to Controlled Water

Location	Pollutant	date	Incident Severity	Additional Information
On Site (Zone 3 / HFO Tank 4)		15th March 2002	Moderate	HFO spill within tank bund whilst emptying remaining HFO below suction level. Hose on mobile plant failed. Oil solidified on ground and was removed for disposal.
On Site (Zone 3 / Tank Farm HFO Pipeline over road)		15th October 2003	Major	Ash Lorry, with tipping back raised, hit and ruptured Oil Pipeline bridge. Major oil spill onto surrounding area. Subsequent clean up made difficult by surrounding pipeline infrastructure.

5.2.3 Therefore, there are no records of ruptures of the HFO tanks or overflows/losses directly from the tanks themselves. The RPS desk study report also states that the two recorded incidents were subject to clean-up.

5.3 Waste Management Facilities

5.3.1 Defra Data Service Platform[4] and the Envirocheck Report included in the RPS desk study report (RPS, 2013) show four historical landfill sites and one waste treatment facility within 500m from the Site, as presented in table 5.2.

Table 5-2 Historic Landfills and Registered Waste Treatment or Disposal Sites

Location	Operator	Type	Waste	Last waste Received	Distance from the Site
Kingsnorth Power Station	Central Electricity Generating Board	Landfill	Not supplied	December 1990	Approx. 150m north
Kingsnorth	Bristol Oil	Landfill	Inert	December 1990	Approximately 500m north
Lagoons, Damhead Creek	Central Electricity Generating Board	Landfill	Not supplied	No supplied	Adjacent east
Lagoons, Damhead Creek	Central Electricity	Landfill	Special waste and liquid sludge	Not supplied	460m north-east

[4] https://environment.data.gov.uk/DefraDataDownload/?mapService=EA/HistoricLandfill&Mode=spatial, accessed March 2020

Location	Operator	Type	Waste	Last waste Received	Distance from the Site
	Generating Board				
Kingsnorth Power Station	Powergen Plc	Waste Treatment Facility – Storage	Not supplied	June 1977	Approx. 150m north

6. Conceptual Site Model and Environmental Risk Assessment

6.1 General

6.1.1 Current legislation relating to contaminated land in the UK is contained within Part 2A of the Environmental Protection Act 1990, which was inserted by Section 57 of the Environment Act 1995, and by Section 86 of the Water Act 2003, and elaborated within the Contaminated Land (England) Regulations 2006 [S.I 2006/1380] (amended 2012 [S.I. 2012/263]).

6.1.2 Land affected by contamination is also a material consideration under the Town and Country Planning Act 1990 and is aligned with the requirements under Part 2A of the EPA through the DCLG National Planning Policy Framework (NPPF) and associated online Planning Practice Guidance (PPG). Under the Planning regime, the Part 2A requirements are applied to the intended future use of the land so that following redevelopment, as a minimum, the site should be in such a condition that it cannot meet the definition of Contaminated Land.

6.1.3 The “suitable for use” approach is adopted for the assessment of contaminated land where remedial measures are only undertaken when unacceptable risks to human health or the environment are considered to be present taking into account the use (or proposed use) of the land in question together with the environmental setting.

6.1.4 Current best practice recommends that the determination of health hazard and hazards to the environment due to contaminated land is based on the principle of staged risk assessment, as outlined in Part 2A of the Environmental Protection Act 1990, the Contaminated Land Statutory Guidance and Environment Agency guidance document CLR11 ‘Model Procedures for the Management of Land Contamination’ and updated guidance Land Contamination: Risk Management (LCRM, 2020).

6.1.5 The risk assessment process for environmental contaminants is based on a source-pathway-receptor analysis. These terms can be defined as follows:

- **Source**: substance that has the potential to cause adverse impacts to human health, property or the environment.
- **Pathway**: route whereby the source may come into contact with the receptor: examples include ingestion of contaminated soil and leaching of contaminants from soil into watercourses.
- **Receptor**: target that may be affected by contamination: examples include human occupants/users of site, water resources (surface waters or groundwater), or structures.

6.1.6 For a risk to be present, there must be a viable pollutant linkage (PL); i.e. a mechanism whereby a source impacts on a sensitive receptor via a pathway.

6.1.7 The following sections detail the Conceptual Site Model (CSM), which has been developed for the Site with a view to assessing the potential risks.

6.2 Potential Sources of Contamination

6.2.1 This section uses the information obtained regarding former/current on-site and off-site activities, regulatory records, ground investigations and site walkover observations to identify potential sources of contamination on the Site and in its surroundings that could pose a risk to the proposed industrial/commercial development.

6.2.2 Potential contamination sources have been identified as follows:

On Site

- Potential hotspots of soil and groundwater contamination within the made ground caused by leaks and spills associated with its former use as a tank farm. Evidence of HFO contamination (odour / staining) was encountered across parts of the Site. The contamination encountered has been identified in the made ground and in the underlying natural deposits. Human health exceedances were recorded for benzo(a)pyrene (17.2 – 26.0 mg/kg) and the heavy end (C21 – C35) TPH banding (28,400 - 53,100 mg/kg) at three intrusive positions. Within the boundary of the main tank farm area a marginal exceedance of the controlled water guidance value for individual PAH compound was reported in groundwater collected from BH-Z3-18 on one occasion. Further controlled water guidance value exceedances have been reported for individual PAH compounds and TPH in positions advanced on the western boundary of the converter station site (WS-Z3-07, WS-Z3-50 and WS-Z3-06). Asbestos (chrysotile) fibres were identified in three samples at the Site: BH03(0.5), BH04(0.5) and BH07(0.5).

Off-Site (Within 250m from the Site)

- Potential hotspots of soil and groundwater contamination within the made ground and natural deposits. Historical investigations for the Kingsnorth Power Station site identified localised areas of TPH and benzo(a)pyrene contamination in soil and concentrations of inorganic and PAH and TPH within the groundwater. Asbestos containing materials and asbestos fibres were identified within the soil matrix at a number of locations to the north of the Site).

6.3 Potential Geo-chemical Parameters

6.3.1 In view of the former Kingsnorth Power Station site activities (on the Site and within 250m from the Site), it is considered that the following may be present in soil and groundwater on parts of the Site and surroundings:

- Metals – associated with made ground on-site; and the former off-site features of the Kingsnorth Power Station site, including coal stock yard (Zone 2 in Figure 4-1), scrap metal burial area (Zone 2), sewage plant (Zone 3), surface water drains (Zone 3), Lagoons area (Zone 4) and waste storage area (Zone 8);
- Total petroleum hydrocarbons (TPH) and Polycyclic aromatic hydrocarbons (PAHs) - associated with made ground on-site; and former off-site features of the Kingsnorth Power Station site, including gas turbine oil tanks and waste oil tank (Zone 3), fuel oil pipe line and ash pipeline (Zone 3), pipe works leaving the Site (Zone 3), oil transformer pumphouse (Zone 3), pig receiving station (Zone 3), tanker loading pumphouse (Zone 3) and main drainage / oil interceptor (Zone 3);
- Asbestos containing materials (ACMs) and asbestos fibres – potentially associated with made ground on-site; and former off-site features of the Kingsnorth Power Station site, including potential buried materials on the northern edge of the Lagoon areas (Zone 4) and waste storage area (Zone 8);

- Miscellaneous inorganics – associated with made ground and the former off-site features of the Kingsnorth Power Station site (sulphate, ammoniacal nitrogen, acidic/alkaline pH);
- Volatile Organic Carbons (VOCs) including ether oxygenates - associated with made ground on-site; and former off-site features of the Kingsnorth Power Station site, including gas turbine oil tanks and waste oil tank (Zone 3), fuel oil pipe line and ash pipeline (Zone 3), pipe works leaving the Site (Zone 3), oil transformer pumphouse (Zone 3), pig receiving station (Zone 3), tanker loading pumphouse (Zone 3) and main drainage / oil interceptor (Zone 3);
- Polychlorinated biphenyls (PCBs) - associated with the main drainage and oil interceptor (Zone 3);
- Methane and carbon dioxide in ground gases – potentially associated with made ground depending on its thickness and organic matter content. Made ground was recorded to be up to 2.2m thick on the Site.

6.3.2 The list above is based on information provided by the EA/NHBC/CIEH 'Guidance for the Safe Development of Housing on Land Affected by Contamination', together with the Department of the Environment Industry Profiles, and with the Desk Study and Preliminary Risk Assessment Report (RPS, 2013) and the findings of the intrusive site investigations.

6.4 Receptors and Pathways

6.4.1 The potential receptors and pathways associated with the Proposed Development are summarised in Table 6.1 below.

Table 6-1 Source-Pathway-Receptor Linkages

Potential Source	Pathway	Receptor
Metal, inorganic and organic chemical impact within the made ground (possibly including ACM)	Direct contact (ingestion, dermal contact, inhalation of dusts) with contaminated soils and potentially asbestos fibres in areas of soft landscaping.	Site Users
Vapours from potential volatile organic compounds (VOCs) associated with historical on and off-site activities related to the Kingsnorth Power station.	Inhalation of ground gas or soil vapours from impacted soils	Site Visitors
	Inhalation of impacted soil dusts (including asbestos) during construction works	Site Neighbours (industrial/commercial)
Ground-gas (CH_4 and CO_2) associated with landfill adjacent to the Site and also from naturally occurring organic soils of the alluvium.	Leaching via surface water infiltration Direct transfer of chemicals in made ground to the aquifer during piling.	Groundwater (in Secondary A and Secondary Undifferentiated Aquifers)
Possible ACM in made ground (applicable to human health only)	Leaching of contaminants in soils by infiltrating rainfall and migration, or direct migration of dissolved contaminants into groundwater, and subsequent migration to surface water features and/or costal water	Surface water (Damhead Creak, River Medway (estuary) and Drainage ditches)
	Corrosion of foundations / services	Development Infrastructure
	Ground gas ingress to buildings resulting in hazardous atmospheres (toxic and explosive)	Building occupants Buildings
Chemical impact within groundwater	Inhalation of vapours from chemically impacted groundwater (either due to on-site sources or migrating to the Site from off-Site sources).	Site Users

Potential Source	Pathway	Receptor
	Vertical migration to underlying aquifers, lateral migration to wider aquifer	Water quality within Secondary A and Secondary Undifferentiated Aquifers

6.4.2 Construction/maintenance workers involved in any ground and construction works are excluded from the list of potential receptors for this assessment as the methodology and assumptions do not consider the short-term, and typically high frequency of exposure for this receptor group. Short-term risks to construction workers are discussed further in Section 6.6.

6.4.3 The Principal Aquifer in the Chalk is excluded from the list of the potential receptors, as potential pathway from not decommissioned deep wells is unlikely, given that the former abstraction wells from the Chalk are located over 400m from the Site.

6.5 Environmental Risk Evaluation

Risk Assessment Principles

6.5.1 Current good practice recommends that the determination of hazards due to contaminated land is based on the principle of risk assessment, as outlined in the Environment Agency guidance on Model Procedures for the Management of Land Contamination (CLR 11; 2004) and updated guidance Land Contamination: Risk Management (LCRM, 2020)

6.5.2 For a risk to be present, there must be a viable pollutant linkage; i.e. a mechanism whereby a source impacts on a sensitive receptor via a pathway. The potential pollutant linkages that have been identified for this Site are presented in Section 6.4.

6.5.3 Using criteria broadly based on those presented in EA, Chartered Institute of Environmental Health (CIEH) and National House Building Council (NHBC) R&D Publication 66 'Guidance for the Safe Development of Housing on Land Affected by Contamination' (2008), the magnitude of the risk associated with potential contamination at the Site has been assessed. To do this an estimate is made of:

- The magnitude of the potential consequence (i.e. severity)
- The magnitude of probability (i.e. likelihood)

6.5.4 The risk assessment principles adopted in this assessment are presented in Appendix E.

Preliminary Environmental Risk Assessment

6.5.5 An evaluation of the environmental risks associated with the identified potential sources on-site and off-site to the various receptors (human, groundwater and property/infrastructure) is presented in the following section.

6.5.6 Table 6-2 presents an evaluation of the level of risk based on the current condition of the Site (i.e. the effects of mitigation measures are not included). The risk ratings assigned pre-mitigation will form the basis for considering whether further assessment/mitigation is needed.

Table 6-2 Risk Evaluation of Potential Pollutant Linkages without Mitigation Measures

Source	*Pathway*	*Receptor*	*Risk Evaluation without mitigation measures*			*Justification*
			Severity	*Likelihood*	*Risk*	
Hazards to Human Health						
Metal, inorganic and organic chemical impact within the made ground (possibly including ACM)	Direct contact with contaminated soils in soft landscape areas	Site Users Site Visitors	Medium	Low	Moderate/Low	As part of the Proposed Development, areas of soft landscaping will be present along the south western and south eastern boundaries. Therefore, the potential for direct contact with potentially impacted made ground exists if maintenance works require excavations. This risk can be mitigated by soil remediation and good practice working procedures for any excavation works.
	Inhalation of impacted soil dusts during construction works	Site Neighbours (Industrial/commercial)	Medium	Low	Moderate/Low	Adjacent industrial and commercial enterprises are in proximity to the Site. This risk can be mitigated by soil remediation and good practice working procedures for any construction works, in particular associated with excavations.
Organic material within made ground and landfill adjacent north.	Inhalation of ground-gas	Site Users	Medium	Low	Moderate/Low	Ground gases, including methane and carbon dioxide, could be present at the Site. The two primary sources are the areas where waste has been tipped (eg. Damhead Creek Former Waste Tip, adjacent to the north of the Site) and also from naturally occurring organic soils of the Alluvium. This risk can be mitigated by a ground gas assessment prior to construction and the design of buildings and ventilation.
Volatile compounds associated with the former on-site tanks farm.	Ingress and accumulation of vapours from soil or groundwater on-site and migrating in groundwater from off-site.	Site Users	Medium	Low	Moderate/Low	The contamination detected within the tank farm is reflective of the nature of the fuel that was formerly stored at the Site. It is considered to be non-volatile and relatively immobile, so is unlikely to generate hazardous vapours or migrate any great distances. This risk can be mitigated by soil remediation and good practice working procedures for any construction works, in particular associated with excavations.
	Inhalation of volatile organic vapours migrating in groundwater from on-site	Site neighbours (Industrial/commercial)	Medium	Low	Moderate/Low	
Hazards to Controlled Waters						
Metal, inorganic and organic chemical impact within the made ground and groundwater	Leaching of contaminants (if any) from overlying soils	Groundwater (Secondary Undifferentiated and Secondary-A Aquifers)	Medium	Low	Moderate/Low	General construction works, including excavations and piling for foundations, could create pathways for contamination of groundwater by soil contamination. During construction, any risks to groundwater can be mitigated by soil remediation and controlled collection and disposal of groundwater and rainwater.

Source	Pathway	Receptor	Risk Evaluation without mitigation measures			Justification
			Severity	Likelihood	Risk	
						During operation, any risks to groundwater can be mitigated by buildings and hardstanding to limit infiltration and site drainage to ensure that surface water is captured and discharged appropriately.
	Direct transfer of chemicals in made ground to the aquifer during piling.	Groundwater (Principal Aquifer)	Medium	Unlikely	Low	Piled foundations are expected to be required, which could potentially be founded in the strata underlying the London Clay. This risk can be mitigated by soil remediation and non-displacement piling techniques for any deep piles, if necessary.
	Direct transfer of chemicals in made ground to surface water	Surface water (River Medway and Damhead Creek)	Medium	Unlikely	Low	Groundwater within shallow alluvial strata where permeable and in continuity with surface watercourses are capable of acting as a diffuse pathway for potentially contaminated groundwater to migrate to River Medway and Damhead Creek. During construction, any risks to surface water can be mitigated by soil remediation and controlled collection and disposal of groundwater and rainwater. During operation, any risks to surface water can be mitigated by buildings and hardstanding to limit infiltration and site drainage to ensure that surface water is captured and discharged appropriately.
Hazards to Sensitive Sites						
Metal, inorganic and organic chemical impact within the made ground and groundwater.	Direct transfer of chemicals in made ground to sensitive sites	Medway Estuary and Marshes and Damhead Creek Ramsar site, SSSI and SPA.	Medium	Unlikely	Low	Rainwater run-off could connect to the nearby Medway Estuary directly or via local drainage ditches if uncontrolled. During construction, any risks to sensitive sites can be mitigated by soil remediation and controlled collection and disposal of groundwater and rainwater. During operation, any risks to sensitive sites can be mitigated by buildings and hardstanding to limit infiltration and site drainage to ensure that surface water is captured and discharged appropriately.
Hazards to Structures and Services						
Sulphate based contaminants and acidity within soils.	Direct chemical attack on concrete	Development Infrastructure	Medium	Low	Moderate/Low	Intrusive investigation and assessment carried out in accordance with the BRE Special Digest 1 (2005) (Concrete in Aggressive Ground Guidance) identified the following scenarios (source: Geotechnical Report on Ground Investigation, SOCOTEC, dated April 2020): - **Scenario 1**: this scenario relates to construction where the ground is disturbed such that air can enter and oxidize any pyrite. This would typically apply to shallow or near surface infrastructure (spread foundations, slabs, manhole, drains and the like) in contact with the made ground, Alluvium and possibly River Terrace Deposits. From the total sulphur results a characteristic total potential sulphate (TPS) value

Source	Pathway	Receptor	Risk Evaluation without mitigation measures			Justification
			Severity	Likelihood	Risk	
						of 1.35% has been determined for this data set. This value marginally exceeds the lower threshold of 1.3% for the DS-4 design class. BRE Special Digest 1 advises selection of the highest design class for the assessment methods, in this case a design sulphate class of DS-4. **Scenario 2**: this scenario relates to deep structures such as piles, in contact with the London Clay and Lambeth Group where the piling operations do not generally result in disturbed ground. The results have been assessed following BRE Special Digest 1 to give the characteristic sulphate value as 928 mg/l. For this value and a characteristic pH value of 7.8 BRE Special Digest 1 indicates a design sulphate class of DS-2. - This risk can be mitigated by selection of appropriate construction materials.
Organic chemical impact within the Made Ground.	Ground gas ingress to buildings resulting in hazardous atmosphere	Development Infrastructure	Medium	Low	Moderate/Low	Complete pollutant linkages may present a risk of accumulation of ground gas within enclosed spaces, such as buildings. As listed above in Table 4-1 ground gas includes: CH_4, CO_2, O_2 and H_2S. This risk can be mitigated by a ground gas assessment prior to construction and the design of buildings and ventilation.

6.6 Remediation of Contaminated Soils

6.6.1 The primary option for the mitigation of the environmental risks that will be implemented is remediation of the contaminated soils to remove the pollutant source.

6.6.2 A remediation options appraisal has been prepared for the Site. The remediation of the HFO soil contamination encountered at the Site may comprise one of the following options:

- Excavation and disposal at landfill;
- In-situ bio-remediation;
- Excavation and off-site bio-remediation;
- Excavation and off-site thermal treatment.

6.6.3 After bio-remediation or thermal treatment, the treated soil could be returned to backfill the original excavated voidspace at the Site. Alternatively, clean material may be used as backfill to replace excavated material to ensure that the material has suitable engineering properties.

6.6.4 In order to facilitate the availability of the Site for construction as soon as practicable, the best practicable remediation option has been selected as excavation of contaminated soil for off-site bio-remediation and/or thermal treatment. The resulting voidspace will then be backfilled with clean, engineering grade material

6.6.5 Although the treated soil may not be available in sufficient time to use as backfill, it will be suitable for re-use by a third party as clean fill material when ready (and not disposed to landfill).

6.6.6 All contractors, transport vehicles and waste management facilities used for the remediation activities will hold appropriate waste management licenses and registrations.

6.7 Additional Construction / Maintenance Mitigation Measures

6.7.1 As there is a potential for disturbance of residual contaminated materials present within made ground during construction or maintenance activities requiring excavations, workers may potentially be impacted by contaminated soils and dusts as well as any contamination in shallow groundwater.

6.7.2 The UK human health risk assessment process focuses on long-term chronic health risks. An assessment of this type is not applicable to the potential risk to temporary site workers during construction or maintenance works, which are typically of shorter duration.

6.7.3 Risks to construction/maintenance workers will be mitigated by implementation of job-specific measures, based on a risk assessment of the work activity taking into account the ground investigation findings and requirements for excavations. This risk assessment will identify the potential risks to both workers and migration of residual contamination, and appropriate mitigation measures will be implemented during any temporary works.

6.7.4 It is expected that all temporary excavation works will apply good practice working procedures, including the following mitigation measures:

- Use of appropriate site control measures to minimise the generation of dust;
- Use of appropriate site control measures to minimise the dispersion of dust and extracted groundwater from excavations to adjacent areas;
- Visual observation of any excavations, together with the use of ground gas monitoring and soil/groundwater sampling as required;
- Use of appropriate Personal Protective Equipment (PPE) for construction workers - including gloves and, where appropriate, dust masks;
- Provision of hygiene facilities.

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6.7.5 In addition, a watching brief will be maintained during groundworks in any unremediated areas, so that actions can be taken as appropriate if additional unforeseen contamination is identified.

6.8 Additional Design Mitigation Measures

6.8.1 During operation, the Proposed Development will include extensive areas of hardstanding / buildings. It is considered that the potential risk from the marginally elevated concentrations of contaminants detected in soil beneath the Site to future site users will be low as the main pathway between source and receptor will be broken.

6.8.2 The proposed areas covered by buildings and hardstanding will mitigate against the infiltration of rainwater and the potential leaching of contamination to underlying groundwater and the nearby Medway Estuary, as the site drainage will be designed to ensure that surface water is captured and discharged appropriately.

6.8.3 The potential effect of any residual contamination and geochemical properties of the soil on construction materials will be subject to design studies to inform the selection of construction materials and ensure resilience to the ground conditions that are expected to be encountered.

6.8.4 There is a potential residual risk from ground gas due to the nature of the underlying Alluvial deposits, which may migrate and accumulate in buildings. The risks to future site users will be mitigated by a ground gas assessment, including pre-construction gas monitoring if required, to assess the potential risk from ground gas and the level of protection required to be incorporated into the design of any buildings proposed to be constructed on-site.

7. Conclusions

7.1 Site history and setting

7.1.1 The Proposed Development is within the area of a tank farm that was formerly used for the storage of Heavy Fuel Oil (HFO). The area formerly contained six 25,000 tonne above ground storage tanks and associated above ground pipework. During historical site investigations, evidence of surface contamination (hydrocarbon staining) was observed within the area of the tank farm and beneath the above ground pipelines at the point where they left the tank farm.

7.1.2 Site investigations show made ground to be present across the Site, with a variable thickness of between 0.4m and 3.2m. The superficial deposits comprise Alluvium over River Terrace Deposits, with a maximum thickness of 6.7m and 5.9m respectively. The solid bedrock is shown to comprise the London Clay (typically between 5.7m and 8.2m thick), Lambeth Group over Thanet Formation, underlain by Chalk.

7.1.3 Shallow groundwater may be present in the superficial deposits, particularly in the Alluvium and River Terrace Deposits which are classified as Secondary Undifferentiated and Secondary-A aquifers respectively. The London Clay is classified as Unproductive Strata. The Chalk is a Principal aquifer.

7.1.4 The Site is not located within a Source Protection Zone (SPZ) for potable water supply. The River Medway is located along the southern boundary of the Site, with Damhead Creek, a tributary of the River Medway, located along the northern boundary of the Site.

7.1.5 The Site is bounded to the south and north by the Medway Estuary and Marshes and Damhead Creek, which are areas designated as a Special Protection Area (SPA), Ramsar site and Site of Special Scientific Interest (SSSI).

7.2 Ground Investigations

7.2.1 RPS undertook three phases of ground investigation between 2014 and 2015 at the Kingsnorth Power Station site. The ground investigations identified that contamination is present in some areas (including the Site) that have been impacted by historical site operations.

7.2.2 During ground investigations, evidence of HFO contamination (odour / staining) was encountered across part of the Site. The contamination encountered has been generally confined to the top 0.5m of the soil profile within the made ground deposits. Based on the laboratory data obtained during the intrusive investigation work localised human health exceedances were recorded for benzo(a)pyrene (17.2 – 26.0 mg/kg) and the heavy end (C21 – C35) TPH banding (28,400 - 53,100 mg/kg) at three investigation locations.

7.2.3 A marginal exceedance of the controlled water guidance value for individual PAH compounds was reported on the Site in groundwater sample collected from BH-Z3-18 on one occasion. Further controlled water guidance value exceedances have been reported for individual PAH compounds and TPH in positions advanced on the western boundary of the Site (WS-Z3-07, WS-Z3-50 and WS-Z3-06). The exceedances appear to be inconsistent and have not been reported during every monitoring round. The exceedances were not considered to represent a significant concern following completion of a detailed quantitative risk assessment (DQRA) carried out by RPS in 2014.

7.3 Environmental Risk

7.3.1 The environmental risk assessment has indicated that the potential contaminant linkages associated with the current Site are generally classified as Low to Moderate in the absence of mitigation/control measures.

7.3.2 Remediation of HFO soil contamination will be the primary mitigation measure to reduce the environmental risk. In order to facilitate the availability of the Site for construction as soon as practicable, the planned remediation option is excavation of contaminated soil for off-site bio-remediation and/or thermal treatment at an appropriately licensed waste management facility, The resulting voidspace would then be backfilled with clean, engineering grade material.

7.3.3 Based on the remediation of the Site being carried out prior to any construction works, the residual risks are summarised below.

7.4 Construction

7.4.1 Construction Workers – The post-remediation risks to construction workers are low and can be managed using good practice working procedures and appropriate PPE/RPE as required. The contamination previously detected within the tank farm is reflective of the nature of the heavy fuel oil that was formerly stored at the Site. It is non-volatile and relatively immobile, so is unlikely to volatilise or migrate any significant distance. However, as a precaution, a watching brief will be maintained during groundworks in any unremediated areas, so that actions can be taken as appropriate if additional unforeseen contamination is identified.

7.4.2 Controlled Waters – The post-remediation risks to controlled water receptors are low and can be mitigated through implementation of good practice working procedures to manage groundwater dewatering from any excavations, including deep or perched groundwater, and stormwater run-off. The mitigation measures will include controlled collection, temporary storage, monitoring and discharge of any collected waters.

7.4.3 Corrosion / Degradation of Construction Materials – The post-remediation risk of corrosion/degradation of construction materials is low, but depends on the type, characteristics and performance specifications of the materials. The potential effect of any residual contamination and geochemical properties of the soil will be subject to design studies to inform the selection of construction materials and ensure resilience to the ground conditions that are expected to be encountered.

7.4.4 Ground Gas – There is a potential residual risk from hazardous ground gas due to the nature of the underlying Alluvial deposits, which may migrate and accumulate in buildings. Therefore, a ground gas assessment will be carried out as part of the detailed design of the buildings and other enclosed spaces to determine appropriate design and construction measures to prevent ingress of ground gas and/or ventilation measures.

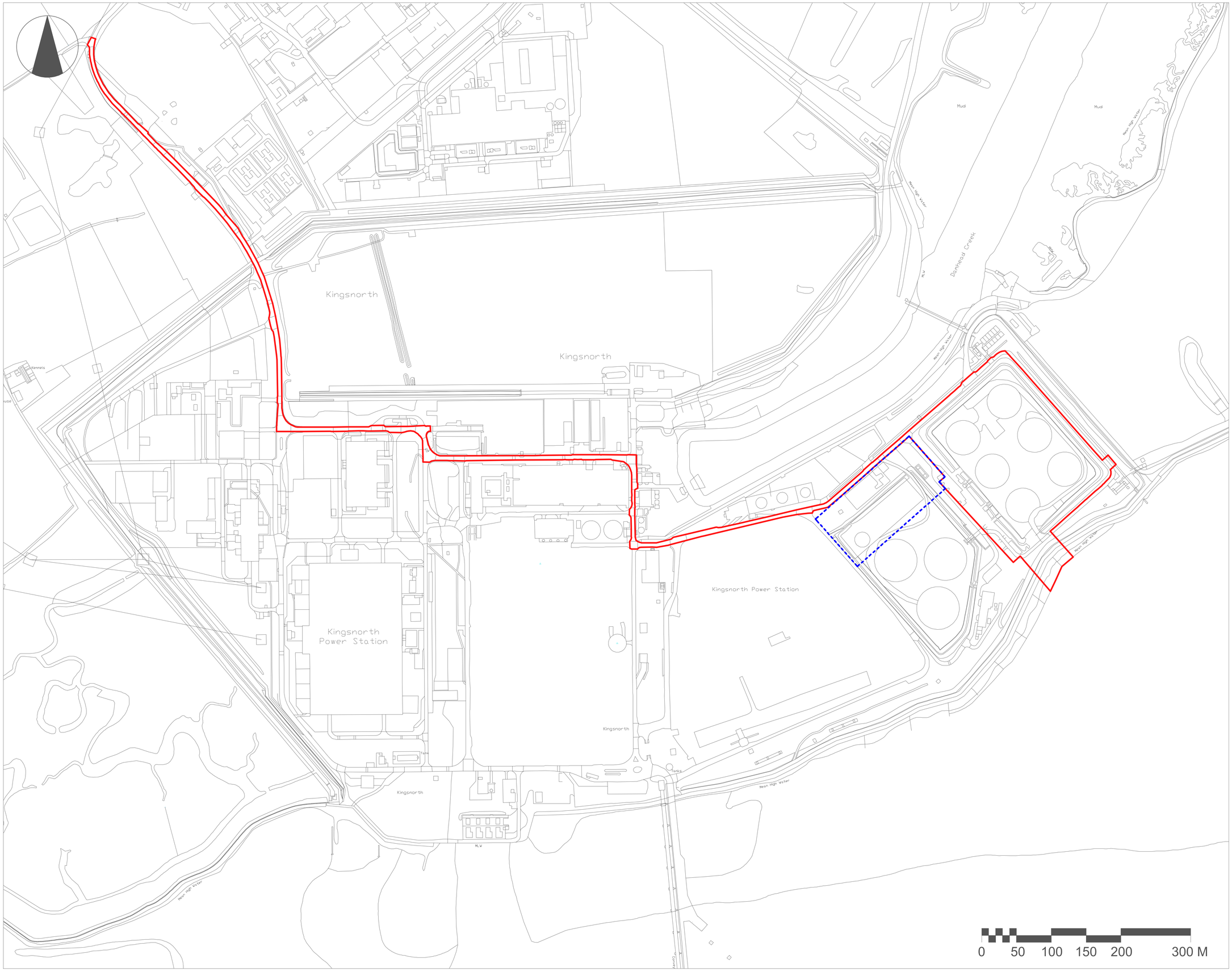
7.5 Operation

7.5.1 Operations Workers – As the Proposed Development will include extensive areas of hardstanding / buildings, any residual risk will be low as the main pathway between source and receptor will be broken. Therefore, the risk is minimal and no additional mitigation measures are required.

7.5.2 Maintenance Workers – Any maintenance workers requiring to break ground (e.g. excavation of service trenches) in areas not previous subject to construction excavations may be exposed to the same (low) residual risk experienced by construction workers. Therefore, good practice working procedures and appropriate PPE/RPE will be implemented and a watching brief will be maintained during groundworks in any unremediated areas so that actions can be taken as appropriate if additional unforeseen contamination is identified.

7.5.3 Controlled Waters –The Proposed Development will include extensive areas of hardstanding / buildings with a contained site drainage system, therefore the infiltration of rainwater and the potential leaching of contamination into underlying groundwater and the nearby Medway Estuary will be mitigated and no additional mitigation measures are required.

Figures



AECOM

CLIENT

GRIDLINK INTERCONNECTOR

PROJECT

Gridlink Interconnector

CONSULTANT

AECOM
Aldgate Tower
2 Leman Street
London, E1 8FA, United Kingdom
www.aecom.com

Planning Application Boundary

Temporary Construction Laydown Area

ISSUE/REVISION

I/R	DATE	BY	DESCRIPTION
-	23/10/2020	IE	Final for issue

KEY PLAN

PROJECT NUMBER

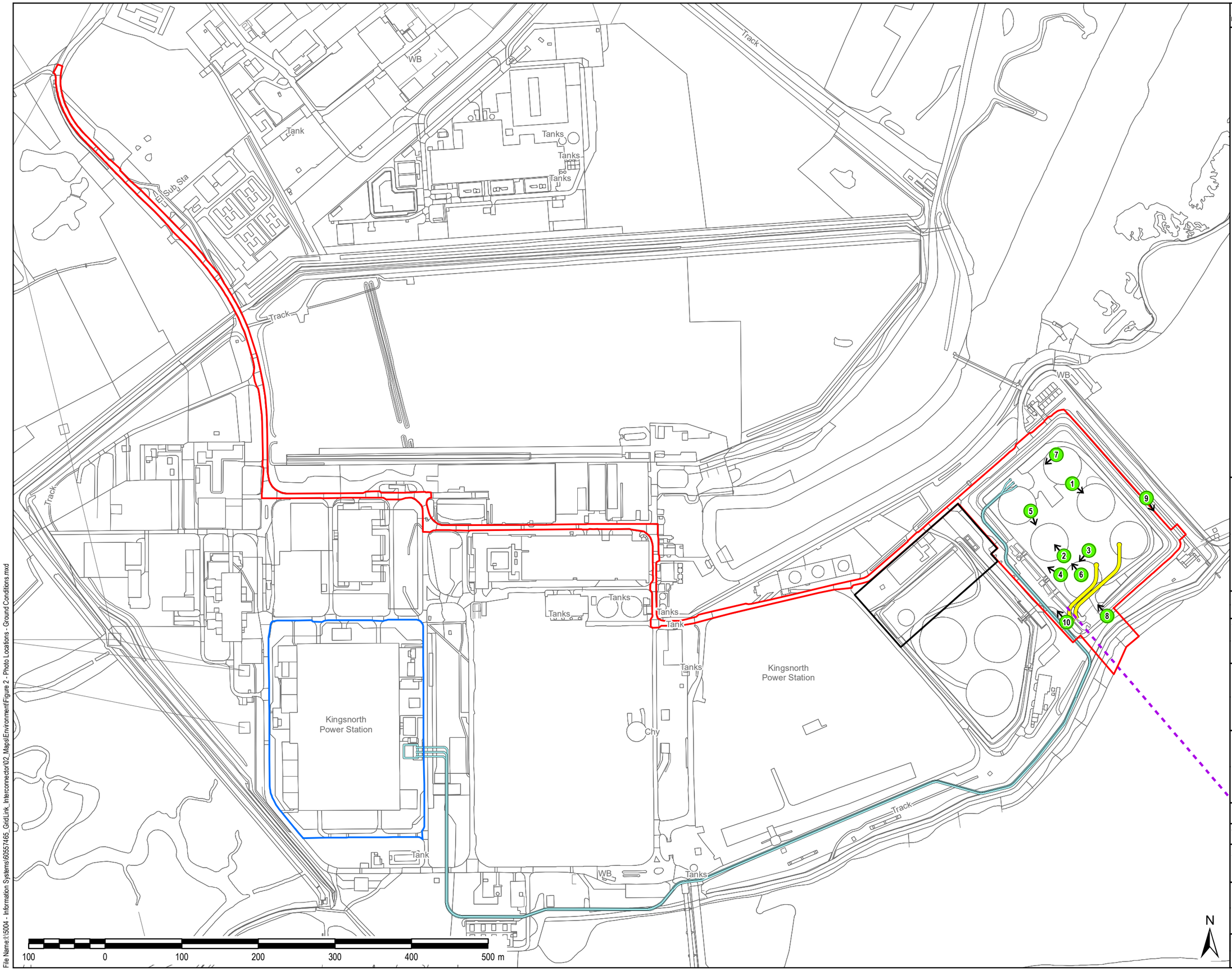
60557465

SHEET TITLE

Site Location
For Approval
1: 2,500 @ A1

SHEET NUMBER

60557465-ZZ-DWG-0001



THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

LEGEND

- Site Boundary
- Kingsnorth Sub-station
- Temporary Construction Laydown Area
- Offshore Cable Route
- Proposed HVAC Cable Route
- Proposed HVDC Cable Route
- Photo Location

Purpose of Issue
FINAL

Client
GRIDLINK INTERCONNECTOR LIMITED

Project Title
GRIDLINK

Drawing Title
SITE PLAN SHOWING PHOTO LOCATIONS

Drawn	Checked	Approved	Date
CN	AK	MV	24/06/2020

AECOM Internal Project No.	Scale @ A3
60557465	1:4,500

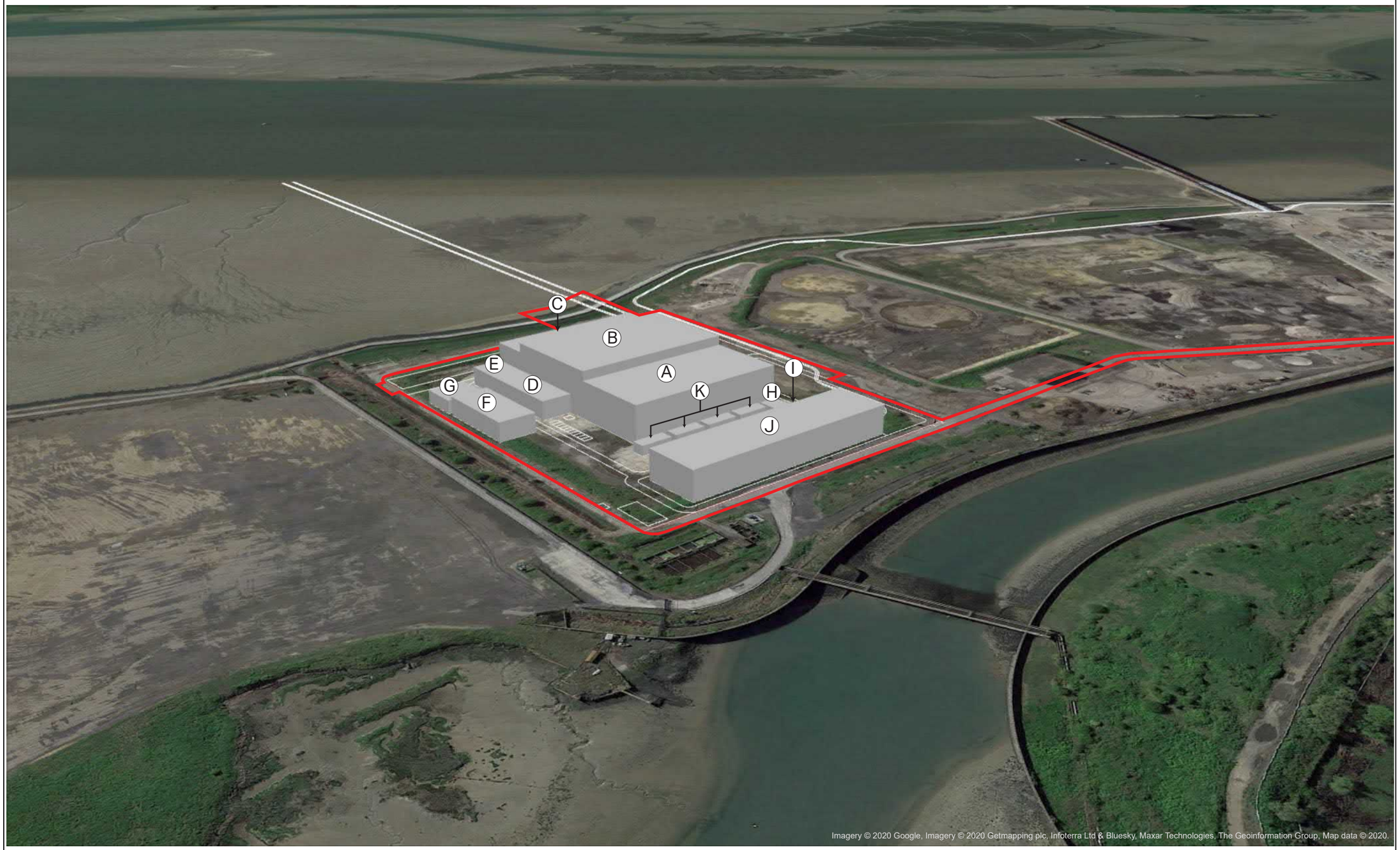
AECOM
Midpoint
Alençon Link, Basingstoke
Hampshire, RG21 7PP
Telephone (01256) 310200
Fax (01256) 310201
www.aecom.com

Drawing Number
FIGURE 2

Rev
03

File Name:I:\5004 - Information Systems\60557465_GridLink_Interconnector\02_Maps\Environment\Figure 2 - Photo Locations - Ground Conditions.mxd

Appendix A Proposed Development Plans



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CONSULTANT

AECOM
Aldgate Tower
2 Leman Street
London, E1 8FA, United Kingdom
www.aecom.com

Planning Application Boundary - Illustrative

A - Reactor Hall, 30 x 87m, height 20m

B - Valve Hall, 57 x 87m, height 25m

C - Dc Hall, 21 x 87m, height 20m

D - Service Building, 46 x 16m, height 10m

E - Spares/Workshop Building, 20 x 16m, height 10m

F - Spares/Maintenance Building, 45 x 20m, height 10m

G - Cooling Fans, 20 x 20m, height 7m

H - Diesel Generator, 10 x 10m, height 3m

I - Fire-fighting Storage, height 3m

J - AC Yard, 117 x 30m, height 15m

K - Transformers, 17 x 7m, height 5m

ISSUE/REVISION

I/R	DATE	BY	DESCRIPTION
-	23/10/2020	IE	Final for issue

KEY PLAN

PROJECT NUMBER

60557465

SHEET TITLE

Kingsnorth 3D Block Diagram
Illustrative
Not to scale

SHEET NUMBER

60557465-ZZ-BD-0003

AECOM

CLIENT

GRIDLINK INTERCONNECTOR

PROJECT

Gridlink Interconnector

CONSULTANT

AECOM
Aldgate Tower
2 Leman Street
London, E1 8FA, United Kingdom
www.aecom.com

Planning Application Boundary - Illustrative

A - Reactor Hall, 30 x 87m, height 20m

B - Valve Hall, 57 x 87m, height 25m

C - Dc Hall, 21 x 87m, height 20m

D - Service Building, 46 x 16m, height 10m

E - Spares/Workshop Building, 20 x 16m, height 10m

F - Spares/Maintenance Building, 45 x 20m, height 10m

G - Cooling Fans, 20 x 20m, height 7m

H - Diesel Generator, 10 x 10m, height 3m

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KEY PLAN

PROJECT NUMBER

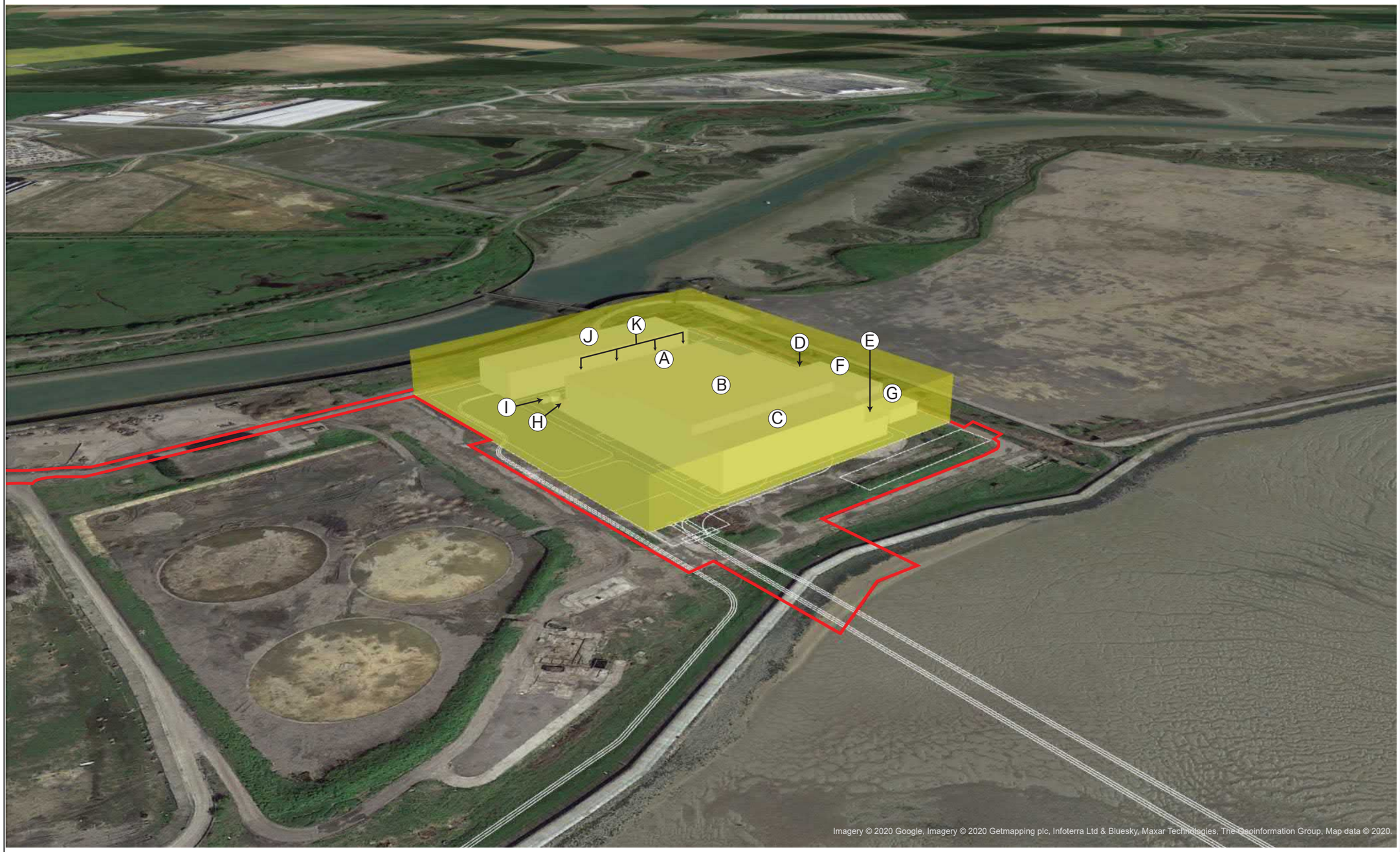
60557465

SHEET TITLE

Kingsnorth 3D Block Diagram
Illustrative
Not to scale

SHEET NUMBER

60557465-ZZ-BD-0001



AECOM

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PROJECT

Gridlink Interconnector

CONSULTANT

AECOM
Aldgate Tower
2 Leman Street
London, E1 8FA, United Kingdom
www.aecom.com

Planning Application Boundary - Illustrative

Maximum extent of building footprint

A - Reactor Hall, 30 x 87m, height 20m

B - Valve Hall, 57 x 87m, height 25m

C - Dc Hall, 21 x 87m, height 20m

D - Service Building, 46 x 16m, height 10m

E - Spares/Workshop Building, 20 x 16m, height 10m

F - Spares/Maintenance Building, 45 x 20m, height 10m

G - Cooling Fans, 20 x 20m, height 7m

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J - AC Yard, 117 x 30m, height 15m

K - Transformers, 17 x 7m, height 5m

ISSUE/REVISION

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-	23/10/2020	IE	Final for issue

KEY PLAN

PROJECT NUMBER

60557465

SHEET TITLE

Kingsnorth 3D Block Diagram
Illustrative
Not to scale

SHEET NUMBER

60557465-ZZ-BD-0002

AECOM

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Aldgate Tower
2 Leman Street
London, E1 8FA, United Kingdom
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Planning Application Boundary - Illustrative

Maximum extent of building footprint

A - Reactor Hall, 30 x 87m, height 20m

B - Valve Hall, 57 x 87m, height 25m

C - Dc Hall, 21 x 87m, height 20m

D - Service Building, 46 x 16m, height 10m

E - Spares/Workshop Building, 20 x 16m, height 10m

F - Spares/Maintenance Building, 45 x 20m, height 10m

G - Cooling Fans, 20 x 20m, height 7m

H - Diesel Generator, 10 x 10m, height 3m

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J - AC Yard, 117 x 30m, height 15m

K - Transformers, 17 x 7m, height 5m

ISSUE/REVISION

I/R	DATE	BY	DESCRIPTION
-	23/10/2020	IE	Final for issue

KEY PLAN

PROJECT NUMBER

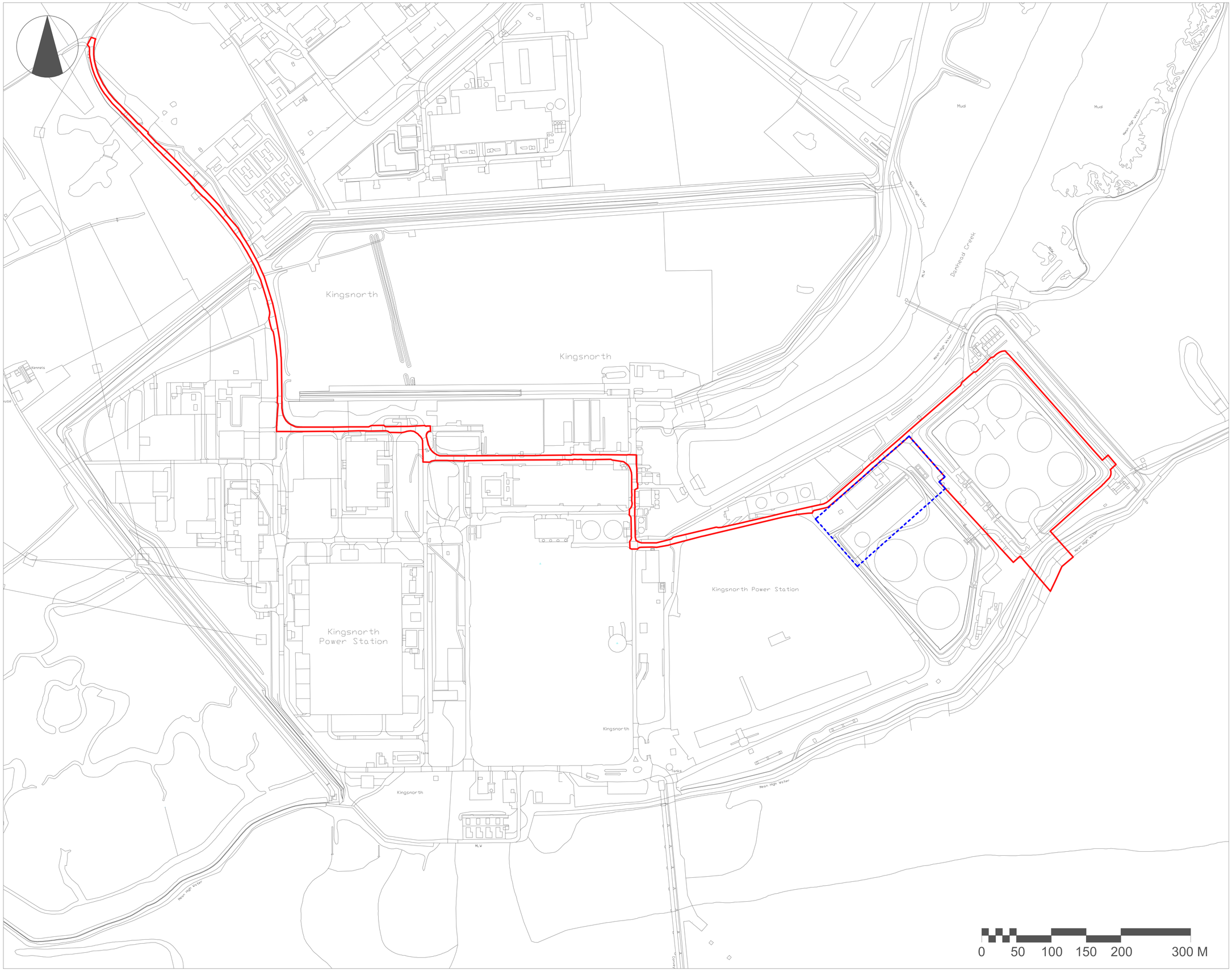
60557465

SHEET TITLE

Kingsnorth 3D Block Diagram
Illustrative
Not to scale

SHEET NUMBER

60557465-ZZ-BD-0004



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PROJECT

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Planning Application Boundary

Temporary Construction Laydown Area

ISSUE/REVISION

I/R	DATE	BY	DESCRIPTION
-	23/10/2020	IE	Final for issue

KEY PLAN

PROJECT NUMBER

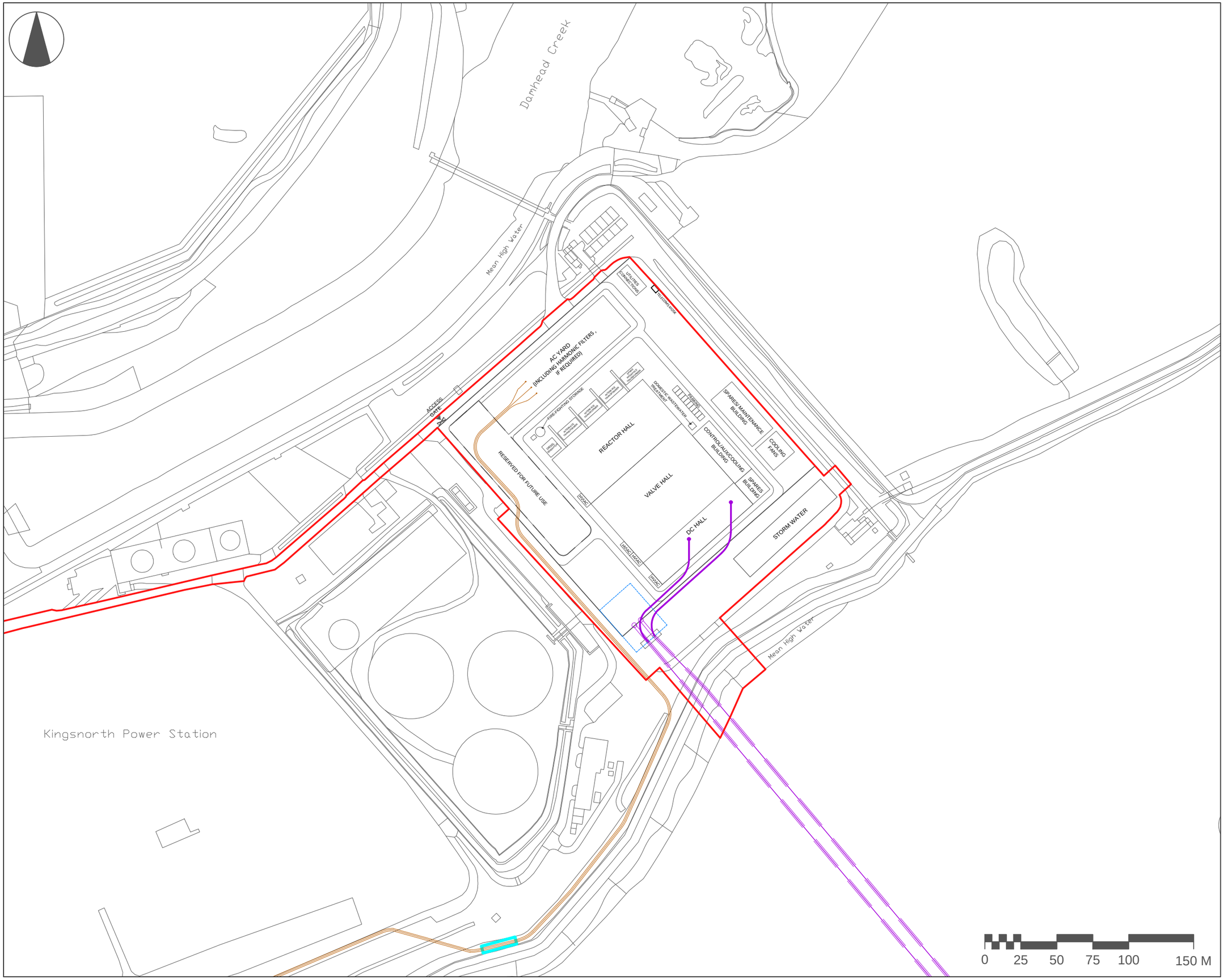
60557465

SHEET TITLE

Site Location
For Approval
1: 2,500 @ A1

SHEET NUMBER

60557465-ZZ-DWG-0001



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PROJECT

Gridlink Interconnector

CONSULTANT

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Aldgate Tower
2 Leman Street
London, E1 8FA, United Kingdom
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- Planning Application Boundary
- DC Cable Route (Illustraitve)
- HDD Duct (Illustraitve)
- AC Cable Route (Illustraitve)
- HDD Entry/Exit Pit
- Suitable Joint Bay Location

ISSUE/REVISION

I/R	DATE	BY	DESCRIPTION
-	23/10/2020	IE	Final for issue

KEY PLAN

PROJECT NUMBER

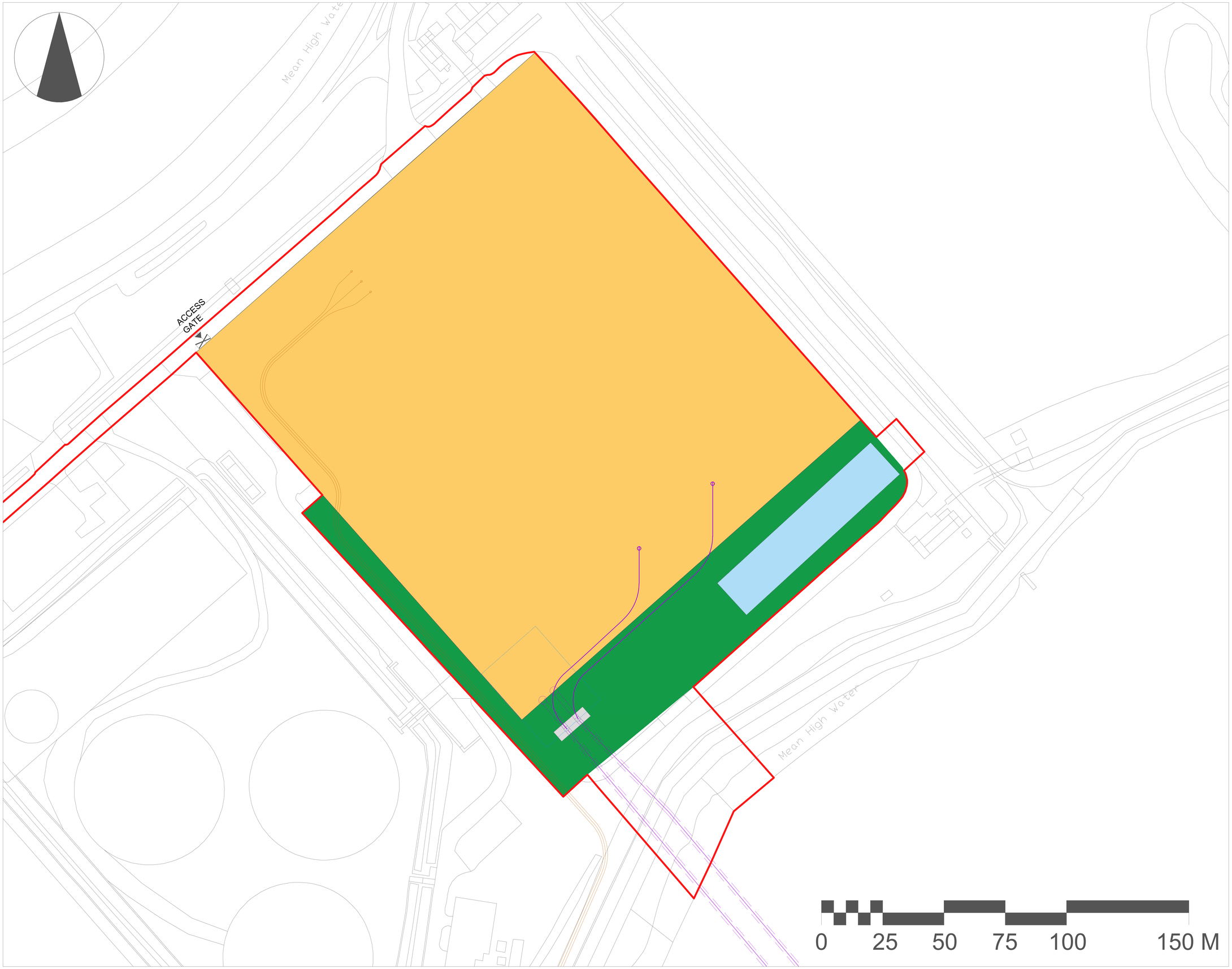
60557465

SHEET TITLE

Outline Layout
Illustrative
1: 2,500 @ A3

SHEET NUMBER

60557465-ZZ-DWG-0002



AECOM

CLIENT

GRIDLINK INTERCONNECTOR

PROJECT

Gridlink Interconnector

CONSULTANT

AECOM
Aldgate Tower
2 Leman Street
London, E1 8FA, United Kingdom
www.aecom.com

- Planning Application Boundary
- DC Cable Route (Illustrative)
- HDD Duct (Illustrative)
- AC Cable Route - route within site undertaken through permitted development (Illustrative)
- Maximum extent of building footprint, 200 x 185m, maximum height 25m
- HDD Entry/Exit Pit, 40 x 30m, maximum height 1m
- Area of Hard and Soft Landscaping
- Storm Water

ISSUE/REVISION

I/R	DATE	BY	DESCRIPTION
-	23/10/2020	IE	Final for issue

KEY PLAN

PROJECT NUMBER

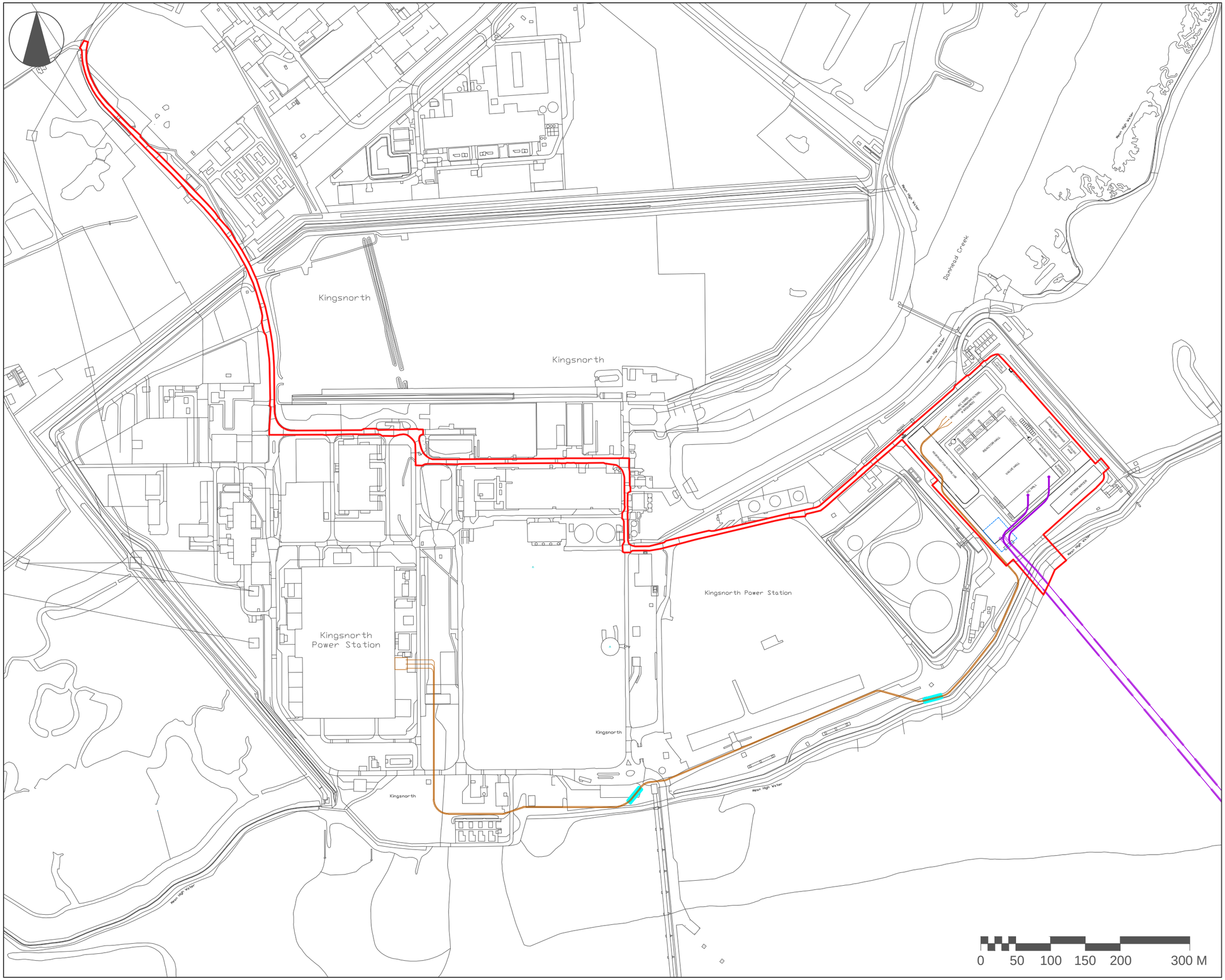
60557465

SHEET TITLE

Parameter Plan
For Approval
1: 500 @ A0

SHEET NUMBER

60557465-ZZ-DWG-0003



AECOM

CLIENT

GRIDLINK INTERCONNECTOR

PROJECT

Gridlink Interconnector

CONSULTANT

AECOM
Aldgate Tower
2 Leman Street
London, E1 8FA, United Kingdom
www.aecom.com

Planning Application Boundary

DC Cable Route (Illustraitve)

HDD Duct (Illustraitve)

AC Cable Route (Illustraitve)

HDD Entry/Exit Pit

Suitable Joint Bay Locations

ISSUE/REVISION

I/R	DATE	BY	DESCRIPTION
-	23/10/2020	IE	Final for issue

KEY PLAN

PROJECT NUMBER

60557465

SHEET TITLE

Outline Layout - Proposed AC Cable Route
Illustrative
1: 5,000 @ A3

SHEET NUMBER

60557465-ZZ-DWG-0004

Appendix B Site Walkover Photographs

PHOTOGRAPHIC LOG

Client Name: GridLink Interconnector Limited	GridLink, Medway	Project No. 60557465

Photo No. 1	Date: 27th February 2020

View of Site, including hardstanding associated with the footprints of the former storage tanks. River Medway in the background.

The photograph aspect is south-east.

Photo No. 2	Date: 27th February 2020

View of Site, including hardstanding associated with the footprints of the former storage tanks and the earth bund beyond. Damhead Creek Power Station in the background.

The photograph aspect is north-west.

PHOTOGRAPHIC LOG

Client Name: GridLink Interconnector Limited	GridLink, Medway	Project No. 60557465

Photo No. 3	Date: 27th February 2020

Evidence of hydrocarbon sheen in a puddle of water was observed at the south-western extent of the Site. The area was fenced.

Photo No. 4	Date: 27th February 2020

View of the western aspects of the Site. During the site walkover, a number of historical site investigation locations were observed on the Site, including seven monitoring wells. Damhead Creek Power Station in the background.

The photograph aspect is north-west.

PHOTOGRAPHIC LOG

Client Name: GridLink Interconnector Limited	GridLink, Medway	Project No. 60557465

Photo No. 5	Date: 27th February 2020

Drilling materials were observed at the Site. A small pond, covered in vegetation, is at the south-western corner of the Site.

The photograph aspect is south.

Photo No. 6	Date: 27th February 2020

Debris assumed to be from the decommissioning were abandoned at the Site.

The photograph aspect is north-west.

PHOTOGRAPHIC LOG

Client Name: GridLink Interconnector Limited	GridLink, Medway	Project No. 60557465

Photo No. 7	Date: 27th February 2020

Evidence of recent site investigations (including hydrocarbon staining) was observed on the Site.

The photograph aspect is south-west.

Photo No. 8	Date: 27th February 2020

The area is bounded by the vegetated earth bund and can be accessed from the south-west.

The photograph aspect is north-west.

PHOTOGRAPHIC LOG

Client Name: GridLink Interconnector Limited	GridLink, Medway	Project No. 60557465

Photo No. 9	Date: 27th February 2020

View of the drain along the north-eastern boundary of the Site. It is understood that the water from the network of drains surrounding the Site passes through a two bay interceptor. The interceptor (in the background of the photo) has separators and skimmers to collect oil.

The photograph aspect is south-east.

Photo No. 10	Date: 27th February 2020

View of the road along the south-western boundary of the Site.

The photograph aspect is north-west.

Appendix C Zetica Map

UNEXPLODED BOMB RISK MAP

zeticauxo

SITE LOCATION

Location: Kingsnorth, Medway
Map Centre: 580500,172500

LEGEND

- **High:** Areas indicated as having a bombing density of 50 bombs per 1000acre or higher.
- **Moderate:** Areas indicated as having a bombing density of 15 to 49 bombs per 1000acre.
- **Low:** Areas indicated as having 15 bombs per 1000acre or less.

miltary | **industry** | **UXO find**
transport | **dock** | **Luftwaffe targets**
utilities | **Bombing decoy** | **other**

How to use your Unexploded Bomb (UXB) risk map?

The map indicates the potential for Unexploded Bombs (UXB) to be present as a result of World War Two (WWII) bombing.

You can incorporate the map into your preliminary risk assessment* for potential Unexploded Ordnance (UXO) for a site. Using this map, you can make an informed decision as to whether more in-depth detailed risk assessment* is necessary.

What do I do if my site is in a moderate or high risk area?

Generally, we recommend that a detailed UXO desk study and risk assessment is undertaken for sites in a moderate or high UXB risk area.

Similarly, if your site is near to a designated Luftwaffe target or bombing decoy then additional detailed research is recommended.

More often than not, this further detailed research will conclude that the potential for a significant UXO hazard to be present on your site is actually low.

Never plan site work or undertake a risk assessment using these maps alone. More detail is required, particularly where there may be a source of UXO from other military operations which are not reflected on these maps.

If my site is in a low risk area, do I need to do anything?

If both the map and other research confirms that there is a low potential for UXO to be present on your site then, subject to your own comfort and risk tolerance, works can proceed with no special precautions.

A low risk really means that there is no greater probability of encountering UXO than anywhere else in the UK.

If you are unsure whether other sources of UXO may be present, you can ask for one of our **pre-desk study assessments (PDSA)**

If I have any questions, who do I contact?

tel: **+44 (0) 1993 886682**

email: **uxo@zetica.com**

web: **www.zeticauxo.com**

The information in this UXB risk map is derived from a number of sources and should be used in conjunction with the accompanying notes on our website: **(https://zeticauxo.com/downloads-and-resources/risk-maps/)**

It is important to note that this map is not a UXO risk assessment and should not be reported as such when reproduced.

*Preliminary and detailed UXO risk assessments are advocated as good practice by industry guidance such as CIRIA C681 'Unexploded Ordnance (UXO), a guide for the construction industry'.

Appendix D BGS Boreholes Logs

TERRESEARCH LIMITED

BOREHOLE NO. 3

Contract Name Hoo — Report No. S. 496/12

Client Taylor Woodrow Construction Ltd., Site Address Hoo Borrow Pit.

Address 345, Ruislip Road,
Southall,
Middlesex.

Standing Water Level — Diameter 8"

Water Struck 10'0" — Method of Boring Shell/Auger

Ground Level — Start 23.11.62 Finish 23.11.62

Remarks:

Description of Strata	Thickness	Depth	Disturbed Samples	'U' Cores and 'N' P. Test
Soft grey clay	8'0"	8'0"		U933 3'0" - 4'6"
Sand and gravel	9'0"	17'0"	B934 12'0" B935 12'0"	
Stiff brown clay	1'0"	18'0"		
TOTALS	18'0"	18'0"		

NOTES: 1. Descriptions are given in accordance with the B.S. Civil Engineering Code of Practice C.P.2001 "Site Investigations".
2. J indicates Jar Samples.
B ,, Bulk Samples.
W ,, Water Samples.
U ,, Undisturbed Core Samples. These are nominal 4 in. diam. and 18 in. long. Depths shown are top of sample.

TERRESEARCH LIMITED

BOREHOLE NO. 11

Contract Name Hoo

Report No. S. 496/12

Client Taylor Woodrow Construction Ltd

Site Address Hoo Borrow Pit via Jacobs Lane

Address 345 Ruislip Road, Southall, Middlesex

Standing Water Level 4'0"

Diameter 8"

Water Struck 8'0"

Method of Boring Shell/Auger

Ground Level

Start 1.11.62 Finish 2.11.62

Remarks:

Description of Strata	Thickness	Depth	Disturbed Samples	'U' Cores and 'N' P. Test
Brown clay	3'0"	3'0"		
Soft grey clay	5'0"	8'0"		U956 3'0"
Sand and gravel	6'6"	14'6"	B957 12'0"	
Stiff brown clay	0'6"	15'0"		
TOTALS	15'0"	15'0"		

NOTES: 1. Descriptions are given in accordance with the B.S. Civil Engineering Code of Practice C.P.2001 "Site Investigations".
2. J indicates Jar Samples.
B ,, Bulk Samples.
W ,, Water Samples.
U ,, Undisturbed Core Samples. These are nominal 4 in. diam. and 18 in. long. Depths shown are top of sample.

TERRESEARCH LIMITED

BOREHOLE NO. 1

Contract Name Hoo

Report No. S.496/12

Client Taylor Woodrow Construction Ltd.

Site Address Hoo Borrow Pit, Via Jacobs Lane.

Address 345 Ruislip Road, Southall, Mddx.

Standing Water Level

Diameter 8"

Water Struck 10' 0"

Method of Boring shell/auger

Ground Level

Start 21.11.62 Finish 21.11.62

Remarks:

Description of Strata	Thickness	Depth	Disturbed Samples	'U' Cores and 'N' P. Test
Stiff clay	2'0"	2'0"		
Soft Clay	18'0"	20'0"	B.928 - 10'0"	
TOTALS	20'0"	20'0"		

NOTES: 1. Descriptions are given in accordance with the B.S. Civil Engineering Code of Practice C.P.2001 "Site Investigations".
2. J indicates Jar Samples.
B ,, Bulk Samples.
W ,, Water Samples.
U ,, Undisturbed Core Samples. These are nominal 4 in. diam. and 18 in. long. Depths shown are top of sample.

TERRESEARCH LIMITED

BOREHOLE NO. 2

Contract Name: Hoo

Report No. S. 496/12

Client: Taylor Woodrow Construction Ltd.

Site Address: Hoo Borrow Pit.

Address: 345, Ruislip Road,
Southall,
Middlesex.

Standing Water Level: 4'0"

Diameter: 8"

Water Struck: 10'0"

Method of Boring: Shell/Auger

Ground Level:

Start: 22.11.62

Finish: 22.11.62

Remarks:

Description of Strata	Thickness	Depth	Disturbed Samples	'U' Cores and 'N' P. Test
Brown and grey mottled clay	3'6"	3'6"		U929 1'2'-6"
Soft grey clay	5'6"	9'0"	B930 9'0"	
Clay and pebbles	2'0"	11'0"	B931 15'0"	
Soft brown clay	9'0"	20'0"		
Sand and gravel	5'0"	25'0"	B932 23'0"	
TOTALS	25'0"	25'0"		

NOTES: 1. Descriptions are given in accordance with the B.S. Civil Engineering Code of Practice C.P.2001 "Site Investigations".
2. J indicates Jar Samples.
B ,, Bulk Samples.
W ,, Water Samples.
U ,, Undisturbed Core Samples. These are nominal 4 in. diam. and 18 in. long. Depths shown are top of sample.

Appendix E Environmental Risk Assessment Principles

Appendix E: Environmental Risk Assessment Principles

Using criteria based on those presented in Section 6.3 of the CIRIA Report "Contaminated Land Risk Assessment: A Guide to Good Practice" (CIRIA Report C552) the magnitude of the risk associated with potential contamination at the Site has been assessed. To do this an estimate is made of:

- The potential severity of the risk; and
- The likelihood of risk occurring.

The severity of the risk is classified according to the criteria in Table D1 below.

Table D1. Severity of Risk

Severity	Examples
High	Acute risks to human health likely to result in "significant harm" (e.g. very high concentrations of contaminants/ground gases) Catastrophic damage to buildings/property (e.g. by explosion, sites with high gassing potential, extensive VOC contamination) Major pollution of controlled waters (e.g. surface watercourses or principal aquifers/source protection zones) Short term risk to a particular ecosystem
Medium	Chronic (long-term) risk to human health likely to result in "significant harm" (e.g. elevated concentration of contaminants/ground gases) Pollution of sensitive controlled waters (e.g. surface watercourses or principal/secondary A aquifers) Significant effects on sensitive ecosystems or species
Mild	Pollution of non-sensitive waters (e.g. smaller surface watercourses or Secondary B aquifers or unproductive strata) Significant damage to crops, buildings, structures or services (e.g. by explosion, sites with medium gassing potential, elevated concentrations of contaminants)
Minor	Non-permanent human health effects (requirement for protective equipment during site works to mitigate health effects) Damage to non-sensitive ecosystems or species Minor (easily repairable) damage to buildings, structures or services (e.g. by explosion, sites with low gassing potential)

Source: "Contaminated Land Risk Assessment: A Guide to Good Practice" (CIRIA Report C552)

The probability of the risk occurring is classified according to the criteria in Table D2.

Table D2. Probability of Risk

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

Source: "Contaminated Land Risk Assessment: A Guide to Good Practice" (CIRIA Report C552)

An overall evaluation of the level of risk is gained from a comparison of the severity and probability, as shown in Table D3.

Table D3. Combination of Severity and Probability

		Severity			
		High	**Medium**	**Mild**	**Minor**
Probability	**High likelihood**	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

Source: "Contaminated Land Risk Assessment: A Guide to Good Practice" (CIRIA Report C552)

The requirements for further works or mitigation are dependent on the significance of the risk. Generally, 'Moderate' to 'Very High' risks are considered to be significant and in need of further assessment/mitigation, and 'Very Low' to 'Low' risks are generally considered insignificant and not requiring further assessment/mitigation. Professional judgement is often required in the determination of whether an effect is considered to be significant by taking account of whether effects are considered to be positive or negative, permanent or temporary, direct or indirect, the duration and frequency of the effect and whether any secondary effects are caused.