



NQMS SQP Declaration of Document Adequacy

Project

Project Name NGET Arriva Bus Depot, Tottenham
Project Address Leaside Road, Tottenham, N17 0SG
[NQMS](#) Declaration Reference 0224-I1201

Summary Description of Project / Proposed development

The site is owned by National Grid Property Holdings Ltd and was formerly leased to a third party. The site is due to be developed in association with a substation upgrade as part of the North London Reinforcement Project. This report is an Outline Remediation Strategy to support discharge of a DCO requirement relating to Stage 3a of the development works. Stage 3a of the works constitutes the preparatory stages of work to clear the site and demolish the on-site structures, to enable Stages 3b and 4 to take place, which comprises the construction of the infrastructure to upgrade the adjacent substation. Further options appraisals and remediation strategies will be developed for later stages of the project.

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Declaration

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I have reviewed the document described in the Document Details section, in relation to the project and site described in the Site Details section, and I am satisfied that:

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 - ii. accord with relevant good practice guidance and standards and
 - iii. are based upon appropriately robust science and
 - iv. are factually correct and
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3. That all specialist aspects have been reviewed by an appropriately qualified/competent person with relevant skills and experience in that specialist area.
4. That the interpretation and conclusions are reasonable.
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 - b. The work of this review and Declaration are within the limits of my knowledge, competence and professional capacity.

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0224-I1201

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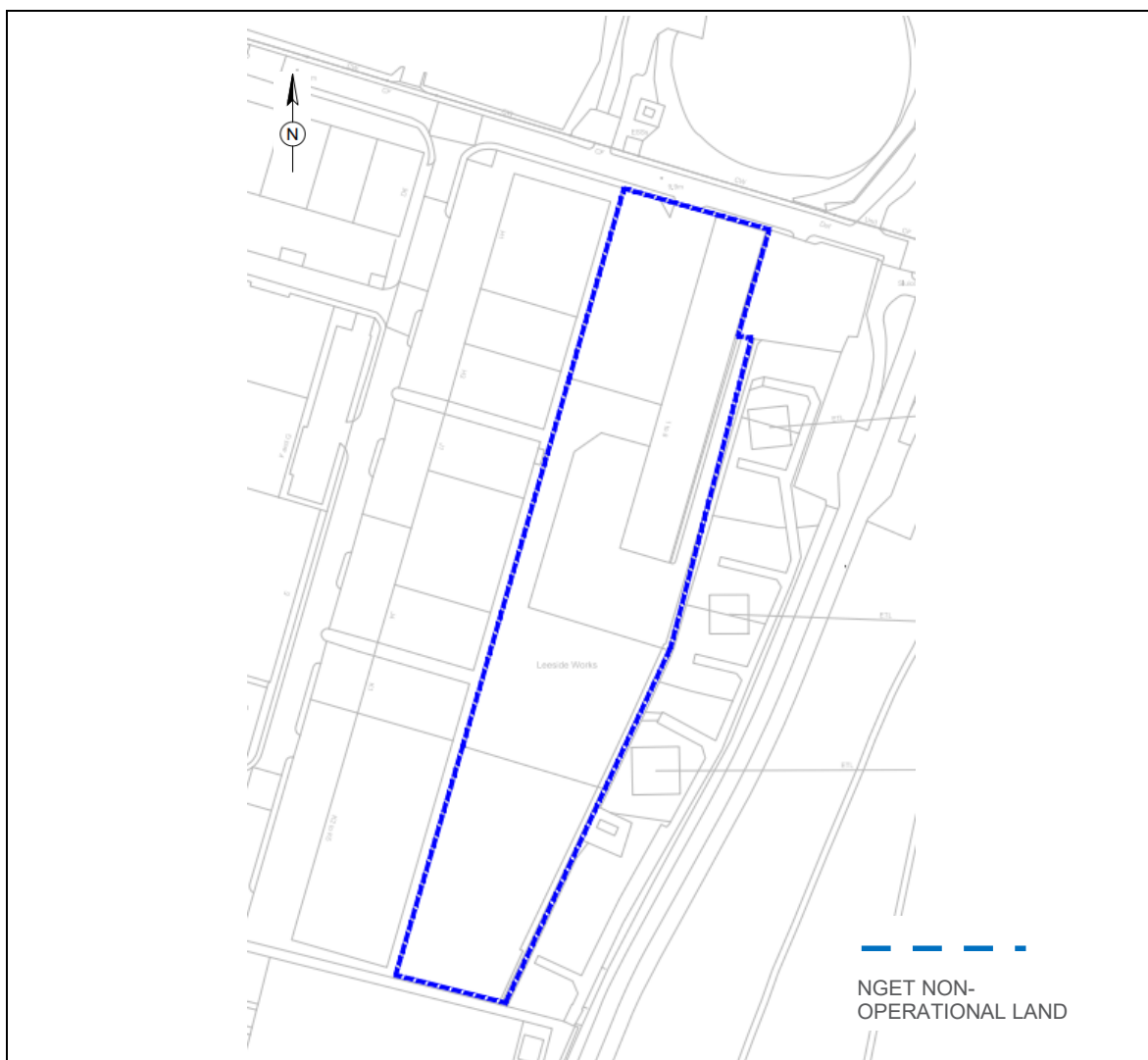
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NGET Former Bus Depot, Tottenham (8021)

Outline Remediation Strategy

National Grid Electricity Transmission

February 2024



Site Address	Leaside Road, Tottenham, N17 0SG	NGP Document Tracking code	
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Work Stage*	Remediation		
Brief description of contents	Outline remediation strategy for the non-operational land at Tottenham (8021)		
Access Permitted	NGET Land Regeneration Team	NGET Contact	LRM: Simon Dunstan LRA: Charlotte Foster

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Document history

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Client signoff

Client	National Grid Electricity Transmission
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1. Introduction

1.1. General

AtkinsRéalis Ltd has been commissioned by National Grid Electricity Transmission (NGET) to undertake an outline remediation strategy for the former Bus Depot (non-operational land) off Leaside Road, Tottenham, N17 0SG (herein referred to as 'the site').

The site is proposed for redevelopment as part of the wider North London Reinforcement Project, which will see the site redeveloped to facilitate an upgrade to the adjacent NGET owned substation to the east and south. Remediation of the site is required to enable the development works to continue, and to ensure that the site is suitable for use as an operational substation site.

The intention of this document is to provide an outline strategy for the proposed remediation works to partially discharge Requirement 11 of the North London Reinforcement Development Consent Order (DCO) (2014 No. 1052) for Stage 3a of the development works.

Stage 3a of the works constitutes the preparatory stages of work to clear the site and demolish the on-site structures, to enable Stages 3b and 4 to take place, which comprises the construction of the infrastructure to upgrade the adjacent substation. The Tottenham Substation forms part of the North London Reinforcement project to upgrade the 275kV overhead lines between Waltham Cross and Tottenham, to a higher voltage (400kV).

The proposed upgrade works on site, and beneath Tottenham Marshes to the east, comprise the construction of underground cables and a cable sealing end compound in the north-east of the site.

The document will be used to develop subsequent options appraisals, detailed remediation design and method statements, and verification requirements. Remediation of the site will be further refined as each phase is progressed.

This report forms part of a package of four documents that will be submitted to support the discharge of Requirement 11 of the DCO, ahead of the proposed demolition of the former depot building. The other three reports of the package are listed below:

- Atkins, NGET Arriva Bus Depot, Tottenham (8021). Factual Site Investigation Report. 2023. [1]
- Atkins, NGET Arriva Bus Depot, Tottenham (8021). Interpretative Site Investigation Report. 2023. [2]
- Atkins, NGET Arriva Bus Depot, Tottenham (8021). Controlled Waters Detailed Quantitative Risk Assessment. 2024. [3]

These documents should be sought for full details on the site and any pertinent details are summarised in the report.

1.2. Background

The site is located off Leaside Road, Tottenham, London, N17 0SG and situated in the north-east of the Mowlem Trading Estate, approximately 1.5 km to the east of Tottenham. The site is centred on the National Grid Reference 535413, 191516.

The site comprises Non-Operational NGET-owned land, which was formerly leased to Arriva for use as a bus depot, and currently comprises a building and plumbing merchant, steel fabricators, and haulage and storage yard. Demolition of the existing structures on site, which formerly housed the bus depot is required to allow for redevelopment of the site.

Historically the site has been used as a bus depot which also included associated infrastructure such as above and below ground oil tanks. Prior to this, the north of the site was occupied by an engineering works and an infilled pond is anticipated to be present beneath the south of the site. A historical sludge pond is also understood to have been located in the central extent of the site. The land off-site to the north of the site was used as a gasworks and other heavy industrial uses were also present.

A site layout plan is provided in Figure 2.

The following previous site investigations and assessments by other consultants have taken place at the site between 2013 and 2016:

- Advisian, Indoor Air Quality Assessment Letter Report, Tottenham Arriva Bus Depot. 2016. Ref 51576-03 [4];
- WorleyParsons. Geotechnical and Environmental Assessment Site Investigation Factual Report. Proposed Cable Route, Tottenham, 1 August 2013. Ref: 305008-00018 51603-00 [5].
- WorleyParsons. Environmental Assessment, Factual Site Investigation, Arriva Bus Depot, Tottenham, April 2013. Ref 51576-00 [6]; and

1.3. Objectives and Scope

The purpose of this document is to provide an outline remediation strategy, which will be subsequently developed into a detailed remediation design and implementation plan by AtkinsRéalis.

Due to a need to demolish the onsite buildings to carry out further source characterisation and delineation work at the site, the proposed remediation is to be designed in phases that are set out in Table 1-1. This phasing approach will ensure that timeframes for design of the Phase 2 remediation will not impact the Stage 3a and subsequent construction programme, as set by the DCO. This phasing approach also allows for refinement of the remediation throughout the process.

Table 1-1 Phasing Plan and Objectives

Phase 0	Demolition of the former depot building	The demolition of the building must be carried out to allow the Phase 1 and 2 remediation to take place. This sits outside the scope of this document.
Phase 1	Remediation to enable the development works	The remediation is to mitigate the risks to the development and risks to controlled waters in the north-east of the site. Carry out remediation to enable the development works associated with the underground cables in the north-east of the site. This is to comprise shallow excavation works, soils treatment and non-aqueous phase liquid (NAPL) recovery, where encountered. This is set out in this remediation strategy.
Phase 2	Remediation to mitigate risks to controlled waters across the wider site	Enablement Phase. • Works to be completed by Contractor to refine and delineate shallow contamination sources in the north of the site. • Works to be completed by Contractor to refine deeper contamination encountered in the south of the site. • Possible pilot trials to inform the recovery of NAPL in the south and centre of the site. • Cost benefit analysis of suitable remedial options across the site. Remediation Phase. • Remediation of gross contamination across the site to mitigate risks deemed unacceptable to controlled waters receptors and to render the site suitable for use as an operational substation site with a cable sealing end compound.

This remediation strategy shall cover the proposed works required for Phase 1 as detailed in Table 1-1. The objectives of this outline strategy are to address possible pollutant linkages which have been identified by previous ground investigations [1], [6] and subsequent controlled waters quantitative risk assessments [3] in the north east of the site.

As detailed in Table 1-1, further investigation is recommended to address current uncertainty in the ground and support the development of the strategy for the Phase 2 remediation. This document will be prepared subsequent to the recommended further works.

The Land Contamination: Risk Management (LCRM) guidance [7] has been used to assess the risks and forms the basis of this report. This report has also been prepared in line with relevant

industry guidance including the National Planning Policy Framework, specific guidance to London Borough of Haringey and pre-application advice.

1.4. Report Limitations

This report has been produced subject to the following exclusions and limitations:

- This report is prepared and written in the context of an agreed scope of work and should not be used in a different context. Furthermore, new information, improved practices and changes in legislation may necessitate a re-interpretation of the report in whole or in part after its original submission.
- Data from previous reports undertaken by third parties have been incorporated into this report. These data have been assumed to be correct for the purposes of this assessment. Atkins does not accept responsibility for inaccuracies in the data supplied by any other party.
- The accuracy of historical maps cannot be guaranteed, and it should be recognised that different conditions on site may have existed between and subsequent to the various map surveys.
- Any borehole data from British Geological Survey sources are included on the basis that “The British Geological Survey accept no responsibility for omissions or misinterpretation of the data from their Data Bank as this may be old or obtained from non-BGS sources and may not represent current interpretation”.
- This report draws upon data from the intrusive ground investigation and monitoring of a relatively small proportion of the sub-surface site conditions. Therefore, this information is not necessarily exhaustive and further information relevant to the site may be available from other sources. Inferences drawn from these assessments are subject to the inherent limitations of any such study.
- Climate change impacts to the site have been considered in the modelling for the quantitative risk assessment based on the UKCP18 projections, current at the time of writing. Any future changes to climate change projections which may significantly alter the relevant modelling parameters have not been accounted for.
- This assessment has been made on the basis of the current ground conditions and the current information provided on the development design. Changes to the ground conditions and development design could result in further assessments being required. NGET has provided information about the proposed end development that Atkins has used in modelling future ground conditions. Atkins does not take any responsibility for any inaccuracies in the information that NGET has provided.

2. Site Information

The factual site investigation report [1] includes the detailed site information and supporting references, which should be sought for full details. A summary is included herein.

2.1. Site Setting

A summary of relevant background information is presented in Table 2-1.

Table 2-1 Site Information

Site Details	Site Address: NGET Arriva Bus Depot, Leaside Road, N17 0SG Site access is from Leaside Road. Ordnance Survey (OS) Grid reference: 535413, 191516 A site location plan is provided in Figure 1.
Site Description	The site is roughly rectangular and covers an area of approximately 1.2 hectares (ha). It has formerly been utilised as a bus depot and is currently leased to a building and plumbing merchants, a steel fabricators and a storage and haulage yard.
Site Ownership and boundaries	The site is owned by NGET with the land leased to J O'Doherty Group who sublet the northern extent of the site, and the existing building to Build It Limited, L. Jeffrey (Roofing Contractor) and Lomas Steel Structures Limited. A site layout plan is provided as Figure 2. Palisade fencing abounds the site in all directions. The entrance gate to the site is present in the north.
Adjoining and nearby land uses, including sensitive and contaminative	North: Former gas holder site, currently used as a temporary car parking area; East: NGET owned substation infrastructure and the Pymmes Brook surface water course 30 m east; South: NGET Tottenham Substation and Tottenham Marshes; and West: Mowlem Trading Estate (various commercial and industrial uses).
Site Topography	The site is largely flat, with small localised depressions, and is located at approximately 10 m Above Ordnance Datum (AOD).
Ground cover and description	The site is covered by concrete and asphalt hardstanding. The approximate proportions of ground cover are 80% hardstanding and 20% covered by the footprints of buildings.
Services	A composite drawing that presents information from service providers that have assets on, or in the near vicinity of the site is included in the Atkins 2023 Factual Site Investigation Report [1]. The following services are located on-site: • BT telecommunications entering the site from Leaside Road serving the existing building, crossing the site and continuing along the western boundary exiting in the south-west corner; and, • A surface drain entering from Leaside Road crossing the site in a north-east to south-west alignment before exiting the site at the eastern boundary.
Proposed development	An extension of the substation to the east and south of the site, comprising a cable sealing end compound to be constructed in the north-east of the site
Published Geology	Made Ground was encountered to a maximum depth of 6.0 m below ground level (bgl), underlain by superficial deposits of Alluvium to a maximum depth of 5.85 m bgl and River Terrace Deposits (RTD), namely the Kempton Park Gravels (KPGR), to a maximum depth of 7.8 m bgl. Alluvium was not found to be present

	within the southern portion of the site, in the vicinity of the anticipated southern and central infilled ponds (noting the central pond was labelled as a 'sludge pit') The bedrock geology comprises the London Clay Formation and although not proven on site, a historical borehole located approximately 150 m to the south of the site recorded the base at 19 m bgl. This formation is in turn underlain by the Lambeth Group, Thanet Sand and White Chalk Group at depth. There is one Brit Pit reported within 250 m of site associated with the Tottenham Marshes sand and gravel commodity to the south.
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2.2. Hydrogeology

The hydrogeology on-site is summarised in Table 2-2.

Table 2-2 Hydrogeological conditions beneath the site

Strata	Classification	Description
Superficial: Alluvium	Secondary Undifferentiated Aquifer	Aquifer where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type.
Superficial: Kempton Park Gravel (KPGR)	Secondary A Aquifer	Described 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. These are generally aquifers formerly classified as minor aquifers. EA Groundwater Vulnerability classification: High vulnerability
Bedrock: London Clay Formation (LCF)	Unproductive Strata	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.
Bedrock: Lambeth Group, Thanet Sand	Secondary A Aquifer	Described 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. These are generally aquifers formerly classified as minor aquifers.

The factual site investigation report [1] indicates that the site is located within an Outer Catchment (Zone 2) Source Protection Zone (SPZ), a groundwater abstraction license is active 320 m west of the site. Areas classified as Inner Zone SPZ1 are present to the north, east and south of the site.

Recorded groundwater levels in the Made Ground (where Alluvium is present beneath the Made Ground) ranged between 0.74 m bgl (9.84 m AOD) in WS12-02 located in the southern portion of the site in the area where the historical pond is located, and 1.94 (8.61 m AOD) at WS12-06 located and in the centre of the site. It is expected that groundwater in the Made Ground is continuous.

Recorded groundwater levels in the KPGR ranged between 2.56 m bgl (7.59 m AOD) in the north of the site in BH12-06 and 4.27 m bgl (6.26 m AOD) in BH6 located on the Wild Marsh West, to the south-east of the site.

2.3. Hydrology

The closest surface water feature to the site is the Pymmes Brook located approximately 30 m east of the site parallel to the eastern site boundary. The Brook flows from the north-north-east to south-west direction. The River Lea Navigation Canal is located 230 m east of the site and the River Lea is located approximately 250 m east of the site. Other water features include the Banbury Reservoir

located approximately 360 m east of the site and the Lockwood Reservoir located approximately 530 m south of the site.

It is understood that the Lee River Reservoir Chain are primarily fed by surface waters, including Pymmes Brook, River Lee Diversion and River Lee Flood Relief Channel.

There are no reported licensed surface water abstractions within 1 km of the site.

3. Previous Works Undertaken

3.1. Previous Site Investigation

As outlined in Section 1, data from several historical sources have been considered when developing the remediation strategy including previous phases of intrusive site investigation and detailed quantitative risk assessment (DQRA). Three phases of site investigation were carried out for the site by WorleyParsons in 2013 and 2014 and by Atkins in 2023. The exploratory hole locations are shown on Figure 3 and Figure 4.

The following reports have been consulted at this stage:

- Atkins, NGET Arriva Bus Depot Controlled Waters Detailed Quantitative Risk Assessment Report, 2023 [3];
- Atkins, NGET Arriva Bus Depot Factual Site Investigation Report, 2023 [1]
- WorleyParsons. Geotechnical and Environmental Assessment Site Investigation Factual Report. Proposed Cable Route, Tottenham, 1 August 2013. Ref: 305008-00018 51603-00 [8]; and
- WorleyParsons. Environmental Assessment, Factual Site Investigation, Arriva Bus Depot, Tottenham, April 2013. Ref 51576-00 [6].

3.1.1. WorleyParsons Environmental Assessment Factual Site Investigation Report, Arriva Bus Depot, January 2013

The site investigation undertaken by WorleyParsons in January 2013, for environmental purposes and to assess liabilities, included:

- Six boreholes progressed using combined percussive sampling with rotary follow-on techniques to a maximum depth of 8.00 m bgl (BH12-01 to BH12-06);
- Eight windowless sample borehole locations to 5.40 m bgl (WS12-01 to WS12-08);
- Installation of six groundwater monitoring standpipes screened within the KPGR (BH12-01, BH12-02D, BH12-03 to BH12-06);
- Installation of six shallow groundwater monitoring standpipes screened within the Made Ground deposits (WS12-01 to WS12-03 and WS12-06 to WS12-08);
- Two rounds of groundwater monitoring and sampling from the 12 newly installed monitoring wells undertaken on 14 February 2013, and the 27 and 28 February 2013; and
- Soil, groundwater and non-aqueous phase liquid samples were collected and scheduled for analysis for a range of inorganic and organic determinands.

3.1.2. WorleyParsons Geotechnical and Environmental Assessment Site Investigation Factual Report, Proposed Cable Route, April 2013

A combined geotechnical and environmental assessment was undertaken by WorleyParsons between April and May 2013 to inform geotechnical design and environmental assessment. The investigation included exploratory holes on site and in the surrounding area. The intrusive works undertaken within the site boundary included:

- Two boreholes progressed using combined percussive sampling with rotary follow-on techniques to a maximum depth of 15.60 m bgl (BH11 and BH12);
- Excavation of one hand-dug inspection pit to a maximum depth of 1.00 m bgl for thermal resistivity testing;
- Installation of two groundwater monitoring standpipes screened within the RTD in BH11 and BH12);
- Thermal resistivity testing in one hand-dug inspection pit undertaken within the Made Ground deposits;
- Two rounds of groundwater monitoring and sampling; and

- Soil and groundwater samples were collected and scheduled for analysis for a range of inorganic and organic determinands.

3.1.3. Atkins Site Investigation, April 2023

The Atkins 2023 site investigation included the following:

- Three boreholes were progressed using a combination of vacuum excavation and combined percussive and rotary drilling techniques to a maximum depth of 5.70 m bgl (BH23-03 to BH23-05);
- Installation of three groundwater monitoring standpipes screened in both the Made Ground (BH23-03 and BH23-05) and the KPGR (BH23-04);
- Two rounds of groundwater monitoring and sampling from 14 boreholes (monitoring round 1) and 15 boreholes (monitoring round 2), including the three newly installed wells and historical wells;
- Drawdown testing of dense non-aqueous phase liquid (DNAPL) in BH11 and BH12-01 with DNAPL sampling; and,
- Soil, groundwater, surface water and DNAPL samples were collected and scheduled for analysis for a range of inorganic and organic determinands.

3.2. Atkins Human Health GQRA, 2023

A human health generic quantitative risk assessment (GQRA) compared the recent (2023) and historical (2013) [5] site investigation data against generic assessment criteria (GAC) for a commercial end use. The main findings were:

- A potential moderate risk to off-site workers to the south and west of the site associated with the impacted soils in the south of the site, in the vicinity of the infilled ponds that includes hydrocarbon contamination and dense non aqueous phase liquid (DNAPL). There is considered to be a low risk from vapours to existing and future on site workers on site, confirmed by an indoor air quality assessment carried out by Advisian [4].
- A low risk to human health from ingestion and dermal contact pathways to impacted soils across the site due to the presence of hardstanding and building footprints across the majority of the site.
- A moderate risk to existing on-site workers from the inhalation of dust fibres associated with the presence of asbestos in shallow soil, as a matter of prudence, given the limited area of exposed soil to the east of the depot. Although it is acknowledged that the existing tenants are due to vacate the site, leaving it unoccupied. There is considered to be a moderate / low risk for future on-site workers and off-site commercial users associated with the presence of asbestos in shallow soil, based on asbestos positively identified in historical investigations. Asbestos should be assumed to be present in the shallow Made Ground across the site, and as such, there is considered to be a moderate risk to on-site workers in excavations.

3.3. Atkins Controlled Waters DQRA, 2023

A controlled waters DQRA [3] was produced to refine the conceptual site model with respect to controlled waters and assess the identified potentially unacceptable risks from impacted soil and groundwater present at the site.

The detailed hydrogeological assessment found that the Pymmes Brook is potentially in hydraulic connectivity with the groundwater beneath the site. It is also considered likely that the KPGR is hydraulically connected to the River Lee Diversion to the east of the site, that partially feed the reservoir system.

Due to the historical land use in the wider area (gas works and other industry), background groundwater quality in the KPGR is considered to be poor. Additionally due to the limited thickness of the unit (observed average 2.5 m) it is not considered to be a viable resource for water supply.

The assessment was undertaken using the Environment Agency's Remedial Targets Methodology Worksheet V3.2. The calculated site-specific assessment criteria (SSAC), when screened against

available site data, indicated a large percentage of exceedances within soil, soil-leachate and groundwater for ammonium and organic contaminants. The main findings were as follows:

- The majority of contaminant concentrations in groundwater that exceeded SSACs in 2023 are noted to be markedly lower than those detected in samples obtained in 2013, apart from ammonium and benzene;
- Ammonium concentrations observed in groundwater represent a potential unacceptable risk to controlled waters receptors, the source of the dissolved phase ammonium is considered to be either to be from the degradation of onsite organic contamination or from the migration of offsite contamination from the wider area (gas works);
- DNAPL present within the site boundary is considered to be an ongoing source of organic contamination to groundwater which poses a potentially unacceptable risk to controlled waters;
- Soil in the north of the site described as 'sweet smelling' in the logs may present an unacceptable risk to controlled waters, no groundwater (RTD) data is available to fully assess this potential risk; and
- Hydrocarbon impacted soil within the vicinity of BH12-04, BH23-04 and BH23-05.

4. Remedial Conceptual Site Model

4.1. Introduction

Land contamination is evaluated through the identification and assessment of Potential Contaminant Linkages (PCLs) denoting where plausible source-pathway-receptor relationships have been identified and a potential risk to the receptor is present.

The approach adopted involves the development of a Conceptual Site Model (CSM) to describe sources of contamination, potential migration/exposure pathways and potential receptors that may exist at the site, and subsequently identified PCLs.

As discussed in Section 1 and summarised in Section 3, several environmental assessments including site investigation reports and a DQRA have previously been produced for the site. The 2023 interpretative site investigation and risk assessment reports [3] [1] present a refined CSM that combines historical data with that from investigations completed in 2023. The PCLs that are relevant to the remediation strategy pathways have been summarised within this section in accordance with guidance provided in LCRM [7].

This remediation strategy considers the future end use of the site as an operational substation comprising a cable sealing end compound to be constructed in the north-east of the site. This end use is consistent with a commercial end use. The cable sealing end compound and remainder of the site is understood to be unoccupied without any operational buildings.

In addition, the proposed development has not been finalised at this stage, but it is assumed that the ground surface shall comprise hardstanding only and there will be no areas of soft landscaping.

DNAPL has been recorded at the site over the historical and 2023 investigations. LNAPL has not been recorded but is suspected. For the purpose of this document, we have assumed that LNAPL and DNAPL could be present on site.

4.2. Potential Contaminant Linkages

Following the site investigation, GQRA and subsequent controlled waters DQRA discussed in Section 3, a summary of the CSM and remaining PCLs to be addressed by this remediation strategy and subsequent options appraisal and detailed design, are summarised within Table 4-1. PCLs were classified in accordance with CIRIA 552 guidance [9].

Table 4-1 Conceptual Site Model and Risk Assessment

Source and Area/Structure	Critical Receptors	Pathway	Potential Consequence of Complete Contaminant Linkage	Likelihood of Complete Contaminant Linkage	Risk
Asbestos in shallow soils.	Existing site users	Dust/fibre inhalation	Severe	Unlikely	Moderate Risk
	On-site workers in excavations	Dust/fibre inhalation	Severe	Unlikely	Moderate Risk
Hydrocarbon impacted Made Ground in the vicinity of BH12-04 (associated with possible below ground oil tank), BH23-04, BH23-05 and WS12-07 (associated with industrial use). LNAPL is also suspected.	Surface water and downgradient groundwater in the Secondary A Aquifer	Leaching/dissolution from contaminated soil followed by migration in groundwater;	Moderate	Likely	Moderate Risk
		Leaching / dissolution of NAPL followed by migration in groundwater	Moderate	Likely	Moderate Risk
		Soil erosion/surface flooding resulting in discharge of contaminants to surface water	Moderate	Unlikely	Low Risk
Impacted groundwater within the KPGR in the vicinity of BH12-01.	Off-site workers to the west and south of the site	Inhalation of vapours	Moderate	Likely	Moderate Risk
	Surface water and downgradient groundwater in the Secondary A Aquifer	Migration in groundwater	Moderate	Likely	Moderate Risk
Ammonium impacted groundwater at the site.	Surface water and downgradient groundwater in the Secondary A Aquifer	Migration in groundwater	Moderate	Likely	Moderate Risk

Source and Area/Structure	Critical Receptors	Pathway	Potential Consequence of Complete Contaminant Linkage	Likelihood of Complete Contaminant Linkage	Risk
Dense non-aqueous phase liquid (DNAPL) at the base of the KPGR at BH12-01 and BH11.	Off-site workers to the west and south of the site	Inhalation of vapours	Moderate	Likely	Moderate Risk
	Surface water and downgradient groundwater in the Secondary A Aquifer	Leaching / dissolution of NAPL followed by migration in groundwater	Moderate	Likely	Moderate Risk
		NAPL migration and discharge to surface water	Moderate	Likely	Moderate Risk

4.3. Summary of Human Health PCLs

Table 4-1 shows that the PCLs are related to the potential vapour risk to off-site workers associated with the presence of gross contaminated soils and DNAPL in the south of the site, and impacted groundwater, classified as a moderate risk. This area requires remedial action to remove any potential risks from vapour ingress to off-site existing buildings and to make the site suitable for the future use as an unoccupied operational substation comprising a cable sealing end compound to be constructed in the north-east of the site (commercial end use).

A moderate risk to existing on-site workers and workers in excavations is considered to be present associated with asbestos in shallow soils, related to an area of exposed soil to the east of the depot building. This is discussed further in Section 5.

The site is due to be vacated by the existing tenants and will not be accessible by the public and therefore, there are no mitigation measures proposed for current site users. Considering the future use of the site as a substation, specifically an unoccupied sealing end compound, the ground cover is likely to comprise hardstanding with limited areas of gravel cover. As there are no proposed areas of soft landscaping and any occasional visitors will likely use pedestrian walkways to traverse the site, there is not considered to be a pathway from asbestos or contamination in soils to future site end users. No specific remediation for asbestos is recommended but it should be presumed to be present in shallow soils and the infilled pond areas.

4.4. Summary of Controlled Waters PCLs

As detailed in Table 4-1, risks to controlled waters are considered to be moderate. The DNAPL identified within the site boundary is an ongoing source of contamination and requires remediation along with hydrocarbon impacted soils in the vicinity of BH12-04, BH23-04 and BH23-05.

Impacted soil in the north may also present an unacceptable risk to controlled waters but further investigation is recommended in this area before any remediation design can be finalised, as detailed in Table 1-1.

Ammonium impact in groundwater is considered to be site wide and has the potential to impact surface waters. There are numerous off-site sources of ammonium in proximity to the site, including a former gas works, and an unsaturated soil source at the site that has not been defined. It is therefore considered likely that the ammonium observed in groundwater at the site is attributable to the degradation of organic contamination present at the site and/or from offsite historical activities.

Considering the above, remedial action that directly targets ammonium at the site is not recommended as any remediation driven by remedial target values would likely be impractical. It is noted that remediation proposed to remove unsaturated zone sources and NAPL within the saturated zone should result in a longer-term improvement in ammonium concentrations in the aquifer.

5. Remediation Strategy

5.1. Site-wide Objectives

The primary technical objectives of the remediation for the site are outlined for Phases 1 and 2 as follows:

- to address remaining PCLs identified in Section 4 as far as is reasonably practicable;
- to recover NAPL, considering potential off-site sources to the north and east of the site;
- to implement a sustainable remediation scheme, which balances the aspiration to reduce waste and maximise materials re-use against the need to minimise impact on the local community in terms of nuisance, health and safety as far as reasonably practicable.

This remediation strategy will not cover the proposed Phase 2 remediation in detail as it is acknowledged that further investigation is required to delineate and refine identified sources of contamination. A separate detailed Remediation Design and Options Appraisal shall be produced in accordance with LCRM [7] following the investigation that should be submitted to London Borough of Haringey to contribute to the discharge of Requirement 11 for Stage 3a of the DCO.

5.2. Remediation Phase Objectives

Phase 1 – Remediation

- to address possible PCLs identified in Section 4 to allow the excavation of cable corridors associated with the proposed development and to render the site suitable for use as an operational substation;
- remediation detailed design should be agreed and implemented within the agreed programme so that it does not delay the construction phase of the proposed substation upgrade scheme. This will be submitted to London Borough of Haringey to partially discharge sub-requirements of the DCO application; and
- re-use of available site-won aggregate to backfill excavations, where deemed to be suitable.

Phase 2 – Enablement

- completion of intrusive works to refine and delineate shallow contamination in the north and deeper impacted soils in the south of the site;
- completion of pilot trials to assess physical properties and recoverability of deep contamination in the south of the site, if required;
- reduce uncertainties in the ground to refine the design of the Phase 2 remediation;
- completion of an options appraisal and detailed design using the SuRF framework [10]. Seek advice from the Environment Agency and submit final documents to London Borough of Haringey to partially discharge further sub-requirements of the DCO application; and,
- completion of a cost benefit analysis of the proposed remedial options that considers social and environmental costs and benefits, together with financial costs associated with the implementation of each option.

Phase 2 – Remediation

- to address remaining PCLs identified in Section 4 and mitigate gross contamination present to render the site suitable for use as an operational substation.

5.3. Scope

5.3.1. Rationale

The recommended scope for the Phase 1 remediation is based on a maximum cable trench width and depth proposed by Atkins and Powersure Technology for the upgrade works to the adjacent Tottenham Substation [11]. It is understood that NGET have not yet decided on the final preferred cable solution and therefore maximum trench dimensions have been assumed for the purpose of

this strategy. The maximum width of the trench is assumed to be 9 m and the maximum depth is 3.5 m bgl and these will form the basis of the remediation excavations in the north-east of the site. In addition, the resultant geotechnical and thermal properties of the infill materials have not yet been finalised by NGET.

The recommended works are required to enable the development; however, there will be a consequential benefit in reducing the contaminant load in the aquifer. The necessary excavation of the cable corridors and backfilling with thermal, chemical and geotechnically suitable materials will provide a degree of mitigation to some of the PCLs to controlled waters. Observations gained during the Phase 1 remediation will provide benefit for the design of the Phase 2 remediation.

The remediation will also mitigate unsaturated zone hotspots within the cable trench footprints as well as in the vicinity, such as the suspected underground oil tank to the east of the centre of the site.

The recommended Phase 1 remediation is therefore to enable the construction of the cable routes whilst providing site betterment. This zone is shown on Figure 5.

Removal of the concrete slab across the entire site is to be carried out as part of the demolition works and will facilitate further investigation, and delineation work can be more easily achieved. This will be completed as part of the enablement works to the Phase 2 remediation and has been proposed in this manner to limit the impacts to the construction programme, caused by further intrusive works and assessment.

5.3.2. Remediation Options Appraisal

As the construction programme for the site is a major driver for the Phase 1 remediation and the required works are likely to comprise a need to excavate a trench, install cables, backfill the trench and reinstate hardstanding, the possible remedial options available are limited. Source removal by excavation and capping are the only options considered to be practical.

In addition, due to the anticipated volume of excavated soils generated, on-site treatment and re-use at the site is also unlikely to be feasible. It is likely that excavated soils will be taken off-site, treated, and disposed of. Any water and potential LNAPL encountered may be managed and treated on site prior to disposal. This shall be further detailed in the remediation detailed design document, where the wider sustainability and potential off-site impacts of disposal options are considered, given the urban setting, proximity of commercial neighbouring properties and timescales for delivery.

A variety of remediation options and technologies could be used to achieve the Phase 2 remediation objectives, such as excavation and off-site disposal together with various forms of on-site treatment, such as in-situ injections, and pump and treat. A detailed options appraisal shall be completed following further intrusive works.

5.3.3. Phase 1 Remediation Scope

The outline scope for the Phase 1 remediation works (see Figure 5) includes:

- Excavation of the cable trenches to 3.5 m bgl and installation of a temporary sheet pile wall on all sides. This is likely to key into the Alluvium or London Clay to limit ingress of perched water, and prevent recontamination of the clean backfill. An impermeable permanent barrier may also be required where the trench extends below the water table;
- Excavation and removal of any below ground oil tanks, if encountered;
- Dewatering of any perched water and groundwater, followed by treatment and discharge;
- Potential LNAPL recovery by pumping, if encountered;
- Excavation and off-site treatment of soils as they are unlikely to be suitable for re-use under a Materials Management Plan (MMP), unless treated;
- Removal of unforeseen below ground features likely to present risks to controlled waters receptors, if encountered;
- Backfilling of excavations with suitable re-used and imported material in accordance with the WRAP Quality Protocol [14]. This material shall also meet the geotechnical and thermal properties required for the cable installation. Site won aggregate from the former concrete slab should be used, where possible, and where visual contamination and asbestos is absent. Any

remaining voids shall be backfilled with suitable imported product, under WRAP Quality Protocol guidelines and according to the Standards for Highways: Series 600 [15]; and

- Reinstatement of hardstanding across the development area.

5.3.4. Phase 2 Remediation Scope

As discussed in Section 5.2, further intrusive investigation is recommended as an enablement phase to the Phase 2 remediation. This investigation will aim to reduce any current uncertainty in the ground and enable a robust detailed options appraisal and remediation scheme to be designed, that mitigates unacceptable risks to controlled waters and neighbouring human health receptors. This investigation is likely to be followed by pilot trials to determine the most appropriate remedial method for the DNAPL and organic contamination identified in the RTD at depth in the south of the site.

Based on the assessment completed to date, it is envisaged that an outline scope for the Phase 2 remediation may comprise:

- Excavation of shallow gross contamination (as defined in Section Table 5-1) in the north-west, centre and south of the site;
- NAPL recovery in the centre and south of the site as far as is reasonably practicable;
- Selective excavation, waste characterisation (by the Contractor in accordance with WM3 [12]), re-use and disposal of material. Where appropriate, on-site treatment may be used to maximise re-use within the project and minimise the removal of soils from the site. However, an appraisal of time / space limitations along with environmental controls will need to be considered for any re-use approach;
- Removal of unforeseen below ground features likely to present risks to controlled waters receptors, if encountered; and
- Backfilling of excavations with suitable re-used and imported material in accordance with a Materials Management Plan (MMP) in line with the Definition of Waste Code of Practice (DoWCoP) [13] and the WRAP Quality Protocol [14]. Site won aggregate from the former concrete slab should be used, where possible, and where visual contamination and asbestos is absent; and
- Risk assessment and updates to cost benefit analysis to account for any residual contamination following the remediation.

Soils re-use and import requirements for the Phase 2 remediation will be re-defined following the further investigation across the site.

5.4. Segregation, Stockpiling and Pre-treatment

To ensure non-hazardous materials and inert materials are not cross-contaminated with potentially hazardous material, as a minimum, excavated soils will be appropriately segregated and stockpiled according to type and origin. Particular care will be taken to ensure grossly contaminated materials are stockpiled separately, and in compliance with the environmental controls detailed in Section 6. Site-derived materials of a similar nature will be stockpiled together and any changes in the physical and/or chemical properties will prompt further segregation.

Prior to the use of any of the remediation techniques, including removal of soil arisings from the site, pre-treatment of soils shall be undertaken. As a minimum, larger constituents including concrete and demolition rubble shall be removed from the soil matrix by screening. Screened oversize materials will be crushed with other recovered hard materials to manufacture a secondary aggregate, which, subject to meeting acceptability criteria, will be re-used on-site if there is a requirement for the material. The remediation contractor will be responsible for the management and recording of all material movements, which could include an agreed MMP in accordance with DoWCoP. The remediation contractor will also be responsible for obtaining relevant permits to undertake any pre-treatment works such as mobile plant licence for the crushing of hard materials.

5.5. Validation Sampling Strategy

The remediation excavations will be inspected for visual/olfactory indicators of potential contamination in the first instance. The presence of a sheet pile wall will form the lateral extent of

the Phase 1 remediation excavation, and therefore no further validation sampling is deemed necessary.

For the anticipated Phase 2 remediation excavations, when the final extents have been reached based on visual/olfactory indicators, validation sampling and testing of the excavation sides will be undertaken to demonstrate compliance with the relevant assessment criteria included in Appendix A. The approach for validation shall be confirmed following the further investigation proposed and the strategy will be defined as part of the detailed design of the remediation.

In the event that contamination is identified through visual/olfactory indicators or exceedance of the assessment criteria, the project team will be notified to agree an appropriate course of action. In the majority of cases, where visual/olfactory indicators of potential contamination are encountered, further action will include additional, targeted validation sampling/testing followed by subsequent assessment and potentially additional excavation of identified contamination hotspots.

If works other than excavation and / or groundwater treatment are proposed, an alternative validation approach will need to be developed and agreed with the Environment Agency and Local Planning Authority.

5.5.1. Validation of Fill Materials

Excavated materials will be pre-characterised in stockpiles. It is unlikely that material excavated as part of the Phase 1 remediation excavation will be suitable for re-use and shall be stockpiled, awaiting off-site treatment and disposal. This is a result of requirement for space and timescales for project delivery.

Any material imported to the site shall not be a waste and the supplier of any fill that is not a primary material must be able to demonstrate that their product has been fully recovered and is no longer a waste. The latter shall be achieved by the use of the appropriate Waste and Resources Action Programme (WRAP) Quality Protocol. Infill materials may comprise primary, recycled or secondary aggregate or other material, including imported or site won aggregate. This material must also meet the thermal properties defined by the design of the cable sealing end compound and geotechnical properties in accordance with the Standards for Highways: Series 600 [15].

As part of the Phase 2 remediation, excavated material will be stored in stockpiles. Imported naturally occurring material, if used, will be proven to be chemically and geotechnically acceptable as a backfill material in accordance with CL:AIRE Definition of Waste Code of Practice (see Section 5.14) [13].

Materials demonstrating visual and olfactory indicators of potential contamination will be segregated and stockpiled in controlled areas on site, with material likely to be suitable as general fill being stockpiled separately. All site-won fill materials will be analysed for the determinants provided in Appendix A. It is noted that these criteria may be re-defined following further investigation across the site.

Suitability of any material imported to site for use in the Phase 2 works shall be demonstrated through use of the WRAP Quality Protocol or the Definition of Waste: Development Industry Code of Practice.

5.6. Imported Fill Requirements

Any material imported to the site shall not be a waste and the supplier of any fill that is not a primary material must be able to demonstrate that their product has been fully recovered and is no longer a waste. Imported WRAP compliant materials including, but not limited to, recovered aggregates, demolition materials require details to be provided pertaining to the source of material, source testing and on-going testing during placement, along with details of quantity and timing (dates for importation, placement and works commencement date for subsequent works).

Validation of fill materials will be undertaken on a 1 per 1000m³ basis by sampling materials prior to placement with a minimum of three samples per source. Samples will be analysed for the determinants provided in Appendix A.

5.7. Perched Water and Surface Water Management

Shallow groundwater/perched water encountered within excavations will be removed, tested and discharged to foul sewer wherever possible, under an appropriate discharge consent. Should NAPL

be encountered at any point during intrusive works on site, this will be removed via pumping/excavation in line with the earthworks and remediation contractor's remediation documentation (also see Section 5.15).

5.8. Groundwater Monitoring

Groundwater monitoring as part of the Phase 1 remediation is not recommended due to the presence of identified gross contamination across the site that is to remain in situ until the Phase 2 remediation phase.

As part of the Phase 2 remediation, groundwater monitoring within the RTD shall be undertaken prior to, during and post works, to demonstrate that the remediation is not having an adverse impact on groundwater quality. This will be detailed in a Borehole Management Plan that shall be completed as part of the detailed design of the Phase 2 remediation.

5.9. Unexpected Contamination

There is potential for unexpected contamination to be encountered where excavations extend beyond the areas already investigated.

Suitably trained members of the contractor's team will be present on-site during excavation works to monitor excavations/arising and obtain validation samples. Details of all visual and olfactory observations, validation samples collected and photo-ionisation detector (PID) readings will be recorded throughout this phase of the works. Unexpected contamination will be identified using these methods to identify common indicators of contamination, including unusual colouration, hydrocarbon odours, and deleterious materials.

In the event that unexpected contamination (materials not previously identified during site investigation/ validation works) is encountered, the Contractors Remediation Implementation Plan (RIP) will be reviewed and amended if necessary, and the project team informed of any changes. This will include an assessment of the contamination encountered including laboratory testing and the production of a method to contain, treat and/or remove the contamination.

If unexpected asbestos in soil is encountered, the works will be paused and appropriate control measures put in place by the Contractor, such as dampening down the excavation face and undertaking asbestos air monitoring.

5.10. Gross Contamination

As part of the works required to meet the objectives outlined in Section 5.1, material that meets the definition of gross contamination (as defined in Table 5-1, below) should be treated for re-use as site won materials or removed from site if no other treatment options are available. This should include NAPL in unsaturated soils.

Table 5-1 Gross Contamination Definition

Contaminant / Indicator	Criteria
Free Cyanide	Visual: Blue oxide staining.
Polycyclic Aromatic Hydrocarbons (PAHs) and Coal Tar	Visual: Black liquid or semi-solid tar in veins or zones. Heavily stained or coated surfaces. Solid tar/bitumen. Headspace ² : Over 100 parts per million (ppm) ³ , olfactory ⁴
Mineral Oils (Total Petroleum Hydrocarbons)	Visual: Liquid oil, oil saturated solids in veins or zones. Heavily stained or coated surfaces. Headspace ² : Over 100 ppm ³ , olfactory ⁴

This table should be read with the following associated notes:

- Where multiple contaminants are present, the selection criteria for each contaminant will be applied sequentially, starting with the perceived major contaminant.
- Headspace analysis criteria shall be subject to calibration of instruments.
- 100 ppm headspace reading is not an absolute threshold, but a guide which should be considered in conjunction with visual and olfactory indicators.
- Olfactory assessment shall always be confirmed by headspace analysis.

5.11. Asbestos in Soil

Asbestos was identified in 13 of the 18 samples obtained across the site in 2013 but subsequent asbestos quantification testing was not undertaken. It should be assumed that asbestos could be encountered across the site, particularly in shallow soils and the infilled ponds. The potential for asbestos to be present in soil should be considered as part of the earthworks and remediation programme and relevant precautions taken to avoid disturbance of known asbestos.

The final surfacing for the development works comprises hardstanding and gravel cover, and therefore the pollutant pathway will be broken between in situ Made Ground soils/general fill and future site users (occasional on-site workers of the substation and visitors). The principal receptors that could potentially be exposed to asbestos containing soils across the site are therefore ground workers. Additionally, consideration must be given to the potential for release of asbestos fibres into the wider environment during construction works. Appropriate protocols will therefore be established to deal with the presence of asbestos containing materials and asbestos within soils.

Relevant mitigation/control measures will be adopted during the earthworks and remediation phase to address potential risks to construction workers and off-site receptors. Details of the mitigation to be applied will be provided in the Contractor's method statement, however, this is likely to include some/all of the following when excavating, working, or moving soils which are known to contain asbestos:

- An appropriate exclusion zone will be created around the excavations (where excavating in Made Ground / sub-grade soils);
- Soils will be appropriately moistened or 'dampened down' to prevent mobilisation of asbestos fibres where present. Soils which are uncovered may be dry and friable despite potential wet weather conditions and may still require dampening down;
- The Contractor must consider potential risks to ground workers, particularly when working with general fill and undisturbed ground. Contact with such soils to be solely by machine wherever possible;
- Tracking of plant through asbestos contaminated soils to be avoided where possible. Wheel wash facilities to be installed on site to prevent the spread of potential asbestos containing soils;
- If required, all ground workers and personnel must wear appropriate personal protective equipment (PPE) (and respiratory protective equipment (RPE) where appropriate), including Protective Cat 3 Type 5/6 Coveralls, non-laced safety footwear, nitrile gloves, and FFP3 face masks. Any PPE or RPE shall be disposed of (or thoroughly washed in the case of footwear and full-face masks) at a decontamination area on the border of the dirty work area. All ground workers must undergo face fit testing and be trained in a suitable decontamination procedure prior to working within these areas;
- All open excavations and stockpiled soils, which are either known or suspected to contain asbestos fibres and fragments, shall be dampened down and covered with plastic sheeting (e.g. Visqueen®) when not being worked upon, particularly at the end of the working day; and
- Decontamination arrangements shall be implemented for personnel, vehicles and equipment (entry/exits from exclusion zones were via decontamination units).

Asbestos in air reassurance monitoring will also be undertaken by the Contractor in order to verify that on-site and off-site receptors are not exposed to asbestos for the duration of the works.

Appropriate PPE will be available for all relevant personnel should detectable levels be identified during the works. All works shall take into account the Control of Asbestos Regulations (2012) (CAR) [16] and CAR-SOIL [17]. CAR sets control limits (0.1 f/ml over four hours and 0.6 f/ml over ten minutes) and a clearance indicator threshold (<0.01 f/ml) for the concentration of asbestos in air associated with work activities. However, employers are required to reduce exposures to asbestos to the lowest level reasonably practicable below the control limit.

5.12. Buried Structures

Below ground obstructions within the remediation zones shall be removed from site, where practical. Further assessment should be undertaken by the Contractor to determine potentially contaminative structures, including below ground tanks, which should be removed as soon as practicable in the earthworks and remediation programme. It is likely that arisings generated during the removal of obstructions will require specialist testing and treatment prior to re-use on site.

5.13. Stockpiling

Temporary stockpiles of excavated materials should be constructed in such a way to reduce rainwater infiltration and to minimise the release of odours or dust. This will be by either:

- secure covering; or
- shaped and compacted/sealed. In dry weather excessive dust will be controlled by water mist suppression.

To control run off from the stockpile:

- the stockpile will be constructed on an impervious surface; and
- bunds will be provided to catch the contaminated run-off.

The Contractor is responsible for selecting appropriate stockpiling locations protective of excessive loading on surface/below ground constraints including utilities. In addition, no materials with the potential to pollute adjacent watercourses shall be stored near these watercourses and no materials shall be stored in such a manner that they may fall or be carried into the watercourse. Any drainage arising from the storage of such materials shall not enter a watercourse.

Stockpiling operations shall be designed in such a way to minimise any potential nuisance to on-site/adjacent site users via mitigation measures to prevent excessive dust, odours or visual impacts (see Section 6).

5.14. Materials Management

A MMP is unlikely to be required for the Phase 1 remediation and all excavated soils are likely to be excavated and treated off-site. Any void that is remaining following backfill with suitable site-won aggregate, shall be backfilled with imported product that meets the required geotechnical and thermal properties, and is also in line with the WRAP Quality Protocol [14].

It is anticipated that an MMP will be developed for the Phase 2 remediation and will be prepared on behalf of the Client, likely to be completed by the Contractor, in accordance with the CL:AIRE Definition of Waste: Development Industry Code of Practice [13]. This will be completed for site won soils that are scheduled to be re-used on site or for clean, naturally occurring material to be imported for use on site.

AtkinsRéalis shall consult with the Environment Agency to agree appropriate areas for materials re-use ahead of finalising the MMP.

The MMP will consider the proposed earthworks and materials management at the design stage and provide a risk-based approach to the characterisation of arisings and control of material re-use. The derived criteria in Appendix A shall be reviewed and updated, where necessary for any re-use of material under this MMP and shall take into account any previously completed or proposed remediation undertaken at the site. This will include the designation of a Qualified Person, who must review evidence relating to the proposed re-use of materials and submit a declaration to the Environment Agency via CL:AIRE, which confirms that the material re-used will not be deemed a waste if activities are carried out according to the MMP and established codes of practice.

Excavated materials proposed to be re-used will be pre-characterised in stockpiles to confirm chemical compliance with destination SSAC and recorded for validation purposes.

All materials should be suitably tracked using industry standard software to comply with the terms of the CL:AIRE Definition of Waste Code of Practice. Site won material may be used provided that it is proven to be chemically and geotechnically acceptable as a backfill material in accordance with the CL: AIRE Definition of Waste Code of Practice [13]. All site-won fill materials proposed for re-use will be analysed for the determinants provided in Appendix A.

Material that is surplus to requirements may be classified as waste and require removing from site in accordance with the current waste management legislation and guidance [18]. For any materials destined for landfill, Waste Acceptance Criteria (WAC) analysis will be required to demonstrate to the landfill site that the material is acceptable for disposal at the specific landfill.

All off-site disposal or treatment shall be at licensed facilities and associated waste disposal notes shall be held for a minimum of two years and shall be available for inspection by the Environment Agency if required.

5.15. Remediation Implementation Plan

A separate RIP shall be produced by the Contractor prior to commencing intrusive works for each phase of remediation. This shall contain as a minimum:

- details of remedial techniques to be employed (where required) in accordance with statutory requirements, UK guidance and best practice current at the date of submission;
- the locations where those techniques will be used;
- the type and areas of contaminated material to be remediated;
- plant and equipment to be used;
- emissions and control measures and any required environmental authorisations;
- a programme for implementing the earthworks/remediation; and
- details of how the remediation works will be validated (e.g. sampling frequencies, chemical testing suites and the SSAC to be used to validate the works).

5.16. Licences and Notices

The Contractor shall obtain all applicable licences and consents as necessary including, but not limited to, the following:

- Mobile Treatment Licence and Deployment Form from the Environment Agency for the screening or remediation of soils and groundwater where required;
- Environmental permit for the treatment of soils and groundwater, if carried out on site;
- Consent Notice in accordance with Section 60 or Section 61 of the Control of Pollution Act (COPA) 1974;
- Local Authority Consents required for crushing and screening plant where required;
- CL:AIRE Definition of Waste Code of Practice submissions [13]; and
- Party wall notices and consents where required.

5.17. Nuisance to Local Residents

The Contractor shall use all reasonable measures to prevent site operations becoming a nuisance to the occupiers of adjacent land. If, for any reason, complaints from occupiers occur, these shall be duly recorded and brought to the immediate attention of the client and their community relations consultant. Where practicable, the Contractor shall propose measures to alleviate or eliminate the nuisance caused by his operations and include this in the tender. Measures shall be implemented by the Contractor from the start of the works.

The Contractor shall maintain the site and the working areas, including all excavations, stockpiles and soil/groundwater treatment compounds, in a tidy and controlled manner at all times. The Contractor shall also be mindful that the site is located in a residential setting. The safety of the public is paramount and the Contractor's method statements shall consider the health and safety implications of working within this environment. The Contractor shall maintain access for shared tenants of the site at all times. Further Contractor requirements to minimise nuisance are detailed in Section 6.

6. Environmental Management

6.1. Introduction

This section provides a preliminary review of the environmental aspects and impacts associated with the earthworks and remediation and will assist the Contractor in the development of a Construction Phase Environmental Management Plan (EMP), to be produced to include:

- procedures to ensure compliance with the requirements of BS EN ISO 14001:2004;
- identification of and methods to address the environmental aspects including air quality, dust, noise and vibration; and
- management plans detailing monitoring and control procedures to be adopted as part of the works in sufficient detail to obtain regulatory approval for these plans.

The Construction Phase EMP requires the Contractor to maintain and update a register of environmental considerations and control measures as appropriate during the works. The register shall be reviewed regularly, with respect to potential changes occurring on or around the site, for example, discovery of new contaminants, pathways and/or receptors (including protected wildlife species); the requirement to use alternative forms of mechanical plant etc.

A preliminary COSHH assessment is included in Appendix B, which appraises likely hazards to site staff during the works and will assist the Contractor in developing the COSHH assessment.

6.2. Project Environmental Objectives and Targets

The overarching environmental objective of the project is to complete the remedial works defined herein in such a way as to minimise the impact on the environment. In summary, the primary objectives are to:

- minimise impact to the local environment during implementation of the works (noise, dust, odour etc.);
- conduct storage, handling, use, transport and disposal of materials in such a way as to minimise the potential for environmental damage, minimise local infrastructure usage and impact on the local community, reduce production of waste materials and minimise the requirement to import materials to site by maximising the re-use of site-won materials;
- minimise/mitigate impacts to environmentally sensitive receptors on or near the site;
- design a remediation in line with SuRF-UK that incorporates the reuse of materials where possible;
- ensure compliance with all current environmental legislation and the requirements of ISO14001; and
- comply with any additional requirements as defined by the Client.

Given the commercial setting of the site particular importance will be placed on minimising impact to neighbouring site users, in terms of nuisance, and health and safety.

6.3. Environmental Management

Some potential environmental aspects requiring specific consideration within the Construction Phase EMP are presented in Table 6-1 below. This table is not exhaustive, and the Contractor shall ensure that adequate provision is made for all foreseeable environmental aspects considered to require specific consideration during the works.

Table 6-1 Potential Environmental Considerations and Control Measures

Item	Details	Project Specific Objectives and Targets
Air emissions	The Contractor shall develop an appropriate strategy for the management of air emissions associated with the works, inclusive of dust, odours and vapours. Materials stockpiled on-site shall be covered appropriately to minimise dust generation. All equipment used on the site shall be checked prior to use for the level of emissions. If considered to be above an acceptable level, the equipment shall be repaired or removed from site.	Results of monitoring for dusts and vapours not to exceed set targets that should be included in the Contractor's Construction Environment Management Plan (CEMP). Mitigation measures to be in place. The Contractor's attention is drawn to the presence of asbestos in some soils, and the need to maintain appropriate cover in these areas.
Water discharges	Perched water may be generated/identified during earthworks excavations. The Contractor shall make adequate provision for storage, treatment, testing and disposal in accordance with current legislative requirements. Should the Contractor intend to discharge wastewater to sewer and/or surface water (subject to cost implications), this shall only be undertaken under an appropriate licence/consent.	Compliance with any discharge consent license or receiving treatment facilities limits. Run-off from material stockpiles to be appropriately captured in bund sumps, managed and disposed of accordingly.
Land contamination	The remedial works shall be designed to address identified risks to environmental receptors. Potential land contamination issues relating to waste management and the storage of materials and control of spillages are discussed below.	The remedial activities shall not result in an adverse impact on the land (on- or off-site). Oils/fuels and water are to be stored in bunded/double skinned tanks. Appropriate spill kits are to be provided by the Contractor, who will produce emergency response plans for spillages of contaminated materials and liquids.

Item	Details	Project Specific Objectives and Targets
Waste management	The remediation works will result in a range of waste types likely to include concrete, steel work, wastewater and contaminated soil. The Contractor shall make adequate provision for segregation, storage, testing and disposal in accordance with current legislative requirements. Where possible waste shall be sent for re-use/recycling rather than disposal to landfill. Aggregate should be reused on site in line with the WRAP Quality Protocol, where possible. This aggregate should be absent of gross contaminated (as defined in Table 5-1) and asbestos.	Volume of waste to be minimised as far as practicable. All concrete and non-impacted pipework to be recycled, where possible. All waste transfer and consignment records to be retained by the Contractor. Soils which cannot be treated for re-use to be disposed of to an appropriately licensed facility. Pre-treatment prior to disposal may be required. Water to be either disposed of via foul sewer under a discharge consent or removed from site. Odours and dust from stockpiles will need to be managed according to good practice. Results of monitoring for dusts and vapours not to exceed set targets. Consideration required of the risks to the on-site drainage network from materials stored on site. Stockpiles to be appropriately designed to prevent mixing with the underlying material and prevent leaching of contaminants either to the underlying ground or to the site drainage.
Energy management	Maintenance records for mechanical equipment shall be checked and an assessment of the efficient running of the equipment made.	Switching off plant and machinery when not in use Minimising vehicular movements both on-site and to and from site. Use of car sharing where reasonable.
Storage of materials, spillage control	Oils/fuels and water shall be stored in suitably bunded/double skinned tanks. Fuel storage on-site shall be kept to a minimum and EA guidance relating to fuel storage should be followed. Absorbent materials suitable for all liquid types stored on-site shall be provided at each liquid storage area. All plant and equipment shall be checked, serviced, and maintained to reduce the potential for spillages and leaks to ground. Incident response procedures and emergency contact details shall be contained within the construction phase EMP.	Appropriate management and reporting of any spills with no adverse impact to environmental receptors.

Item	Details	Project Specific Objectives and Targets
Noise	Anticipated working hours, subject to formal planning consent, are as follows: between 08:00 – 18:00 Monday to Friday unless otherwise stated by the Client. It is anticipated that the works will generate elevated noise levels. However, where reasonably practicable, methodologies to reduce noise emissions shall be adopted. Site layout shall be designed and maintained to ensure minimal possibility of disturbance to neighbours.	Preliminary agreement to be reached with EHO for Section 60 or 61 notice. A vibration survey is to be undertaken or relevant thresholds suggested by the Contractor. On and offsite commercial and residential properties must be suitably protected and protection measures agreed with NGET. Results of noise and vibration monitoring not to exceed the targets. Minimise the impact on above and below ground Cadent assets, through agreement of appropriate vibration monitoring and mitigation with plant protection. Equipment to be turned off when not in use.
Service suppliers and sub-Contractors and customers	The Contractor shall screen all suppliers and sub-Contractors, as appropriate, to ensure compliance with Client and ISO14001 requirements.	All service suppliers, subcontractors who may work on the site to be fully briefed on environmental controls and be inducted prior to any works being undertaken. Mandatory inductions for all personnel working or visiting the site.
Transport	The Contractor shall design a suitable traffic management plan for the site. Maximising re-use of materials on site would reduce the number of vehicle movements to and from the site.	Minimal disruption to local traffic. Large vehicular deliveries require LA approval and may only be permitted at certain times. Vehicle movements to be minimised. Access to Cadent facilities to be kept Open. Minimise the impact on below ground Cadent assets, including high pressure pipelines, through agreement of appropriate protection and vehicle crossing points with plant protection.
Employee induction EMS awareness	The site induction will include the contents of the Construction Phase Environmental Management Plan (to be prepared by the Contractor).	All site operatives/visitors to be inducted with regards to environmental aspects. Records of inductions to be maintained on site.

Item	Details	Project Specific Objectives and Targets
Site security	The site will be secure and fenced.	Measures shall be taken to ensure that no environmental incidents are likely as the result of a breach in security. The Contractor shall engage with the Client and site tenants to assess whether 24-hour security and/or CCTV is required.
Visual impact	There are no specific requirements in relation to any potential visual impacts relating to the works. Good housekeeping to be maintained.	Roads to be kept clear of soil via use of a wheel wash/road sweeper as appropriate.
Ecosystems	No vegetation is present in the immediate vicinity of the site. The Pymmes Brook is located approximately 30 m to the east of the site.	Contractor to assess any ecological mitigation requirements arising from the works and may require an ecological survey/assessment.
Neighbours (Impact to)	Leeside Road is located adjacent to the north of the site, with cars occasionally parked along this site boundary. Cyclists and pedestrians also use this access road to cross the Pymmes Brook and access Tottenham Marshes to the east of the site. The Mowlem Trading Estate is located adjacent to the west of the site and is operational. Potential impacts to workers and residents shall be minimised, where practicable, and provision shall be made for response to complaints and general public relations requirements before and during the project works. The above and below ground infrastructure located adjacent to the east is owned by NGET and associated easements shall be built into the remediation design.	Working hours to be agreed with the Local Authority and adhered to. Dust, noise, vibration and air monitoring to be undertaken with mitigation measures in place if required. Results of dust, noise, vibration and vapour monitoring not to exceed the set targets.
Incident reporting	Incident response procedures and emergency contact details shall be contained within the construction phase EMP. All environmental incidents and near misses shall be reported to the Client, Atkins and to the statutory authorities if/as appropriate.	All reports should be made within 24 hours.
Operating adjacent to NGET-owned electricity infrastructure that includes pylons	The proposed remediation excavations are located near to the electricity infrastructure, including pylons, to the east of the site. The impact that water discharges, air emissions and vibration may have on the infrastructure, from these activities should be considered as part of the works and any necessary mitigation measures adhered to.	Safety guidance (including safe operating distance) for work carried out on or near electrical and mechanical equipment are available on the NGET website (Electricity Safety Rules National Grid ET). All mitigation measures should be adhered to and incorporated into the remediation design and sequencing.

Item	Details	Project Specific Objectives and Targets
Other considerations	Any other potential impact that comes to light during the works.	Contractor to assess potential mitigation requirements as the remediation works progress.

7. Verification

The Contractor's verification plan shall be included as part of their design and a verification report shall be produced following the completion of each phase or part phase of the remediation works. Both documents shall be produced in accordance with LCRM [7].

7.1. Verification Plan

In accordance with LCRM [7], the verification plan shall include the following information:

- introductory information (site details and stakeholders);
- the scope and objectives of the remediation, referencing PCLs;
- planning conditions and the planned approach to enable discharge;
- remediation criteria;
- how the remediation performance will be verified (perched water sampling to include locations, frequencies and numbers, site records and who is responsible for carrying out);
- schedule of planned verification reports; and,
- contingency plans should remedial targets fail to be met and/or rebound occurs.

7.2. Verification Report

Verification Reports shall be produced per phase to facilitate the release of areas for construction as early as possible. The Verification Reports shall be reviewed by the Client prior to submission to the Regulators.

The reports shall provide a complete record of all remediation activities on site and the data collected, as identified in the Verification Plan, to support compliance with agreed remediation objectives and criteria. The Verification Reports will include details of the final strategy, works undertaken (including volumes treated/disposed), third-party approvals, verification, quality assessment, monitoring, final site conditions, wayleaves, warranties and contact details of involved parties/consultees, tip locations, excavation profiles, copies of waste transfer documents and health and safety information.

With reference to the LCRM [7], the verification report should include the following information:

- background information (site details, personnel and roles, reasons and objectives for the remediation);
- remediation;
 - methodology and programme (to include criteria)
 - verification
 - monitoring
 - testing regime
 - ongoing works
- final site condition (monitoring requirements, restrictions on site use);
- details of residual contamination (soil, groundwater, NAPL);
- third party agreements (records of regulator liaison);
- supporting information (plans, drawings, photographs, field and laboratory test results, progress reports and meeting minutes);
- results of the groundwater monitoring programme completed for the aquifer;
- decommissioning details for the groundwater monitoring wells installed on site (authorised for decommissioning by the Environment Agency); and,
- a risk assessment for any residual contamination identified.

The verification report shall be produced to also satisfy the requirements of the CL:AIRE Definition of Waste Code of Practice [13] and hence should contain all details and records pertaining to the MMP including (but may not be limited to):

- materials tracking;

- transfer notes;
- delivery notes;
- weighbridge tickets;
- the as-built records including any alterations made;
- site plans which show sample locations;
- site plans showing areas of excavation and material placement (for re-used, treated, and imported material); and,
- photographic record of earthworks movements.

8. References

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- [20] HSE, The Construction (Design and Management) Regulations 2015, 2015.

Figures

Appendices