



NQMS SQP Declaration of Document Adequacy

Project

Project Name NGET Arriva Bus Depot, Tottenham
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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. The objectives of the report were to assess data from historical and recent intrusive investigations and quantify the potential risks, liabilities and constraints relating to land contamination. The findings of the risk assessment were then used to inform an updated assessment of potentially unacceptable risks to human health and controlled waters receptors. This assessment considers the proposed future use of the site as an operational electricity substation.

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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:

1. The assessment has been carried out by appropriately capable people with reference to the Brownfield Skills Framework.
2. That the assessment carried out is, to the best of my knowledge, undertaken with reasonable skill and care, and the information and data reported:
 - i. describe an appropriate scope and objectives and
 - ii. accord with relevant good practice guidance and standards and
 - iii. are based upon appropriately robust science and
 - iv. are factually correct and
 - v. have been appropriately reviewed.
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.
5. That proposals to mitigate actual, potential, or residual risks are appropriate (where relevant to the report type).
6. I am competent to sign this Declaration and that
 - a. I am fully aware of and comply with the SiLC Code of Practice and the Code of Conduct of Institution of Environmental Sciences through which I hold Chartership .
 - b. The work of this review and Declaration are within the limits of my knowledge, competence and professional capacity.

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Signed:

C. Hughes



0124-H8757

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NGET Arriva Bus Depot, Tottenham (8021)

Interpretative Site Investigation Report

National Grid Property Holdings Ltd

January 2024



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This document and its contents have been prepared and are intended solely as information for National Grid Energy Transmission and National Grid Property Holdings and use in relation to the Former Bus Depot, Leaside Road, Tottenham, London, N17 0SG.

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1. Introduction

1.1. General

Atkins Limited (Atkins) was commissioned by National Grid Property Holdings Limited (NGET), to undertake an intrusive site investigation of their NGET Non-Operational Land at Former Bus Depot, Leaside Road, Tottenham, N17 0SG (herein referred to as 'Bus Depot site'). A site location plan is included as Figure 1.

This report has been produced in accordance with Atkins' Offer of Services dated 16 March 2023 [1].

A Site Location Plan is included as Figure 1 and a Site Layout Plan is included as Figure 2.

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 comprises Non-Operational NGET-owned Land, which was formerly leased to Arriva for use as a bus depot, and currently comprises a builder's merchants, steel fabricator and logistics yard. The site is included in the National Grid site registry as the 'Former Bus Depot' referring to the former site usage.

It is understood that the lease on the site is ending in early 2024 to allow for an upgrade to the existing substation adjacent to the east and south, from 275kV to 400kV. This redevelopment forms part of the North London Reinforcement Project (NLRP), comprising five sites collectively named the Hackney - Waltham Cross 275kV to 400kV Upgrading (HWUP) scheme.

This document is to be submitted 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, that comprises the construction of the infrastructure to upgrade the adjacent substation.

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.

1.3. Objectives and Scope of Works

The objectives of the investigation and report detailed herein are as follows:

- To provide information on the current conditions of the site with respect to land contamination based on historical investigation information and data obtained in 2023;
- To quantify or mitigate the potential risks, liabilities and constraints associated with the site; and
- To provide recommendations for further works and assessments, if required.

Full details of the intrusive work undertaken in April to July 2023 are provided in the Atkins 2023 Factual Site Investigation Report [2], which should be read in conjunction with this report.

1.4. Data Sources

This report incorporates factual information from previous the following sources:

- Atkins 2023 NGET Arriva Bus Depot Factual Site Investigation Report [2];
- UK Government and Environment Agency (EA) website, accessed in June 2023 [3];
- Groundsure Report (Ref: GS-8774421, 25 May 2022) [4];
- WorleyParsons. Environmental Assessment, Factual Site Investigation, Arriva Bus Depot, Tottenham, April 2013. Ref 51576-00 [5];
- WorleyParsons, Environmental Assessment, Interpretative Site Investigation, Arriva Bus Depot, Tottenham March 2013. Ref 305008-00018 51576-00 [6];
- Geological maps from the BGS website, accessed in May and June 2023 [7];
- WorleyParsons. Flood Risk Assessment, Tottenham Arriva Bus Depot, March 2014 [8];
- WorleyParsons. Remediation Strategy, Arriva Bus Depot, Tottenham. March 2014. Ref 51576-01 [9];

- Advisian, Indoor Air Quality Assessment Letter Report, Tottenham Arriva Bus Depot. Ref 51576-03 [10]; and
- WorleyParsons. Geotechnical and Environmental Assessment Site Investigation Factual Report. Proposed Cable Route, Tottenham, 1 August 2013. Ref: 305008-00018 51603-00 [5].

1.5. Assumptions and Limitations

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

- While it is considered that the site investigation conducted is adequate to meet the objectives stated in Section 1.3 and as defined by Atkins' Offer of Services, due to site constraints there is still the potential for unidentified issues to be present on-site, such as localised areas of contamination, or additional contaminants not analysed for as part of the site investigation.
- The report draws upon data from the intrusive investigation and monitoring of a relatively small proportion of the sub-surface site conditions, including but not limited to where access was constrained by site constraints including site traffic, the presence of site buildings, above and below-ground services and infrastructure associated with the site's present occupation and former occupation as a bus depot. Inferences drawn from these assessments are subject to the inherent limitations of any such study.
- In addition to the 2023 site investigation data, this report utilises chemical data for soils from 2013 due to access restrictions for any further ground investigation in 2023. The assessment is subject to limitations associated with the use of data that is over ten years old. The 2013 results are unlikely to reflect any impact associated with more recent contamination sources or pollution incidents that may have taken place since then.
- This report is prepared and written in the context of an agreed scope of works and should not be used in a different context. Furthermore, new information, improved practices and changes in legislation may necessitate the re-interpretation of the report in whole, or in part, after its original submission.
- Atkins has not undertaken consultation with relevant regulatory bodies in association with this work at this stage.
- Where any data supplied by NGET or from other sources, including that from previous site investigations, have been used it has been assumed that the information is correct. No responsibility can be accepted by Atkins for inaccuracies in the data supplied by any other party.

2. Site Status

2.1. Location

The site is located off Leaside Road, Tottenham, N17 0SG and situated in the north-east of the Mowlem Trading Estate, approximately 1.5 km to the east of the centre of Tottenham, London at Ordnance Survey (OS) National Grid Reference 535413E, 191516N. The site is located approximately 300 m west of Tottenham Reservoirs.

The average elevation of the site is 10 metres above ordnance datum (m AOD), and the topography of the land is generally flat. A site location plan is presented as Figure 1.

2.2. Current Site Layout

The site is accessed from Leaside Road, in the north-east of the Mowlem Trading Estate. The site covers an area of 1.21 hectares (ha) of non-operational land within a rectangular parcel of land. The boundary of the site is secure and comprises an approximately 2.5 m high steel palisade fence with access via a double steel palisade gate from Leaside Road. There are a variety of internal palisade fences throughout the site to splitting current operations.

The site includes several active commercial units housed within a two-storey, rectangular, brick building, with steel cladding exterior and an adjacent concrete/tarmac surfaced storage yard. Within the site boundary there is a small brick structure that appears to be a maintenance/security hut. Historically the site had been used as a bus depot.

The site is leased from NGET to J O'Doherty Group that uses the southern third of the site for the storage/parking of empty waste skips, vehicles, trailers and storage of tonne-bags of aggregates. J O'Doherty Group sublet the northern two thirds of the site to three businesses. A small portion of the north-west of the site and a small portion of the bus depot building is sublet by L. Jeffery, a roofing contractor. The majority of the northern two thirds of the bus depot building and two yards are sublet to Build It Limited which is a builder's merchants. Build It Ltd use the lower floor of the building for trade and the upper level is used as office space and storage. The yard areas are used for materials storage and parking. The southern third of the building and some adjacent yard space is sublet to Lomas Steel Structures Limited for metal fabrication. It is understood that the lease of the site will end in early 2024.

A site layout plan is presented as Figure 2.

2.2.1. Site Walkover

A site walkover completed by Atkins on 2 March 2023 noted that no electricity transmission infrastructure is present on-site. High voltage overhead cables are present in the substation land immediately to the east. The ground cover at the site was comprised of concrete and tarmac, no exposed soils or soft landscaping were noted by Atkins during the site walkover.

An additional site walkover identified an 'oily patch' in the middle of the builder's yard, however no known spill incidents are understood to have occurred.

The construction of the former depot building present on-site comprises concrete, brickwork and steel, with no obvious asbestos-containing materials (ACM) observed during the walkover. .

An above ground fuel tank housed in a plastic bund on concrete hardstanding was noted to be present to the west of the main depot building. Two further banded disused fuel tanks with a capacity of 1400 L were also observed to the south of the remaining fuel tank.

Vehicle parts and waste strewn including rubble, tiles and water tanks were present on the land to the east of the main depot building. Litter was also noted to be present across the site, along boundary fencing.

The steel fabricator's yard, present to the south of the main depot building, is used for spray coating primer and treating the steel under an external shelter. The primer used 'Red Oxide' and is understood to be flammable, an irritant and a potential carcinogen. The underlying concrete, surrounding fencing and shelter have been sprayed red in this area. Gas canisters were also in this yard.

In the south of the site, adjacent to the off-site substation, several large trailers were noted to be present. The contents of the skips are unknown; however, one displayed an asbestos containing material sticker but was empty during the walkover.

3. Initial Conceptual Site Model

3.1. Introduction

Land contamination is assessed through the identification of Potential Contaminant Linkages (PCLs). The assessment involves the development of a conceptual site model (CSM) which describes the relationship between on and off-site potential sources of contamination (and contaminants), potential receptors to such contamination and anticipated pathways between the two. Where all three (source-pathway-receptor linkage) are present or considered to be present, they are described as a PCL which can be subject to the risk assessment process.

The initial CSM presented in Sections 3.2 to 3.5 has been produced following the site walkover undertaken on the 2 March 2023 and a review of historical data obtained during previous ground investigations, including the 2013 Worley Parsons Ground Investigations [5] [6].

The initial CSM considers the past use of the site as a civil engineering works and a bus depot, and the current use as commercial tenanted properties and the proposed future use as an operational electricity substation.

3.2. Potential Sources

The potential sources of contamination at the site are based on observations made during the Atkins site walkover undertaken on the 2 March 2023 and a review of available information and previous investigations carried out at the site. For the purposes of this assessment current use refers to the site's use under the existing tenancy, the previous use refers to the historical use of the site as a bus depot and an engineering works.

As stated in the Atkins factual report [2], and the 2013 WorleyParsons report [5] there is a possible underground fuel tank, listed below as Source 4. No further information is available on whether it is above or below ground, the dates at which it was present nor the exact location of the feature.

On-site Sources

- Source 1 – Made Ground associated with past and current industrial use including a civil engineering works, a bus depot and commercial builders yard;
- Source 2 – Asbestos in soils associated with the historical development of the site and infilled ponds;
- Source 3 – Made Ground associated with infilled ponds and a former sludge pit located in the south of the site, that includes the presence of dense non-aqueous phase liquid (DNAPL);
- Source 4 – Historical suspected below ground fuel tank in central eastern part of site;
- Source 5 – Historical above ground fuel storage tank associated with the former use of the site as a bus depot;
- Source 6 – Contaminated groundwater (perched groundwater and groundwater in the shallow Kempton Park Gravels impacted by hydrocarbon contamination);
- Source 7 – Non-aqueous phase liquid (NAPL) encountered in the Made Ground / Alluvium;
- Source 9 – Two above ground bunded fuel tanks adjacent to the depot building (two 1400L tanks); and
- Source 10 – Two disused trailer bowzers associated with the site's former use.

Off-site Sources

- Source 8 – Off-site sources associated with former gasworks and surrounding historical industry.

3.3. Receptors

3.3.1. Human Health

Human receptors (under current commercial use and future use as an operational substation) include:

- on-site workers - on-site workers in existing depot building / future on-site workers associated with the planned electricity substation;
- on-site workers in excavations;
- public open space users - Tottenham Marshes 60 m to the east of the site;
- trespassers under current use (not anticipated for future use as it is anticipated to be a secure substation);
- off-site residents – closest off-site residents located approximately 400 m west of the site;
- off-site workers - off-site workers immediately to the south and west of the site; and,
- off-site workers in excavations.

It is assumed that workers in excavations will be completing their tasks in line with occupational health and safety legislation such as the Health and Safety at Work Act 1974. This includes the provision of personal protective equipment, risk assessments etc and other measures that will mitigate potential exposure to land contamination.

3.3.2. Controlled Waters

The following potential controlled waters receptors have been identified:

- surface waters including Pymmes Brook, River Lea, River Lea Navigation Canal and Banbury Reservoir; and
- groundwater in the underlying Kempton Park Gravels classified as a Secondary 'A' aquifer.

3.3.3. Ecological

The following ecological receptors have been identified:

- Tottenham Marshes 60 m to the east of the site (non-statutory designation);

3.3.4. Property

The following potential property receptors have been identified:

- on-site buildings and infrastructure; and
- off-site property (buildings and structures).

3.4. Pathways

3.4.1. Human Health

The following plausible human health pathways have been identified:

- Direct contact and / or ingestion with contaminated soils and / or groundwater;
- dust/fibre inhalation;
- direct contact/dust inhalation;
- dust/fibre inhalation and inhalation/direct contact with dusts that have blown off-site; and,
- inhalation of ground gases / ground vapours from contaminated soils; and,
- inhalation of ground gases / ground vapours from contaminated groundwater.

The presence of hardstanding across the site reduces the likelihood of plausible direct contact pathways.

In addition, it should be noted that the Advisian 2016 Vapour Assessment [10] indicated that a plausible pathway to human health receptors on-site from vapours was unlikely to exist. An indoor vapour intrusion assessment was carried out beneath the footprint of the existing depot building and did not assess the potential off-site inhalation risk.

3.4.2. Controlled Waters

The following plausible controlled waters pathways have been identified:

Potential pathways for the Secondary A aquifer receptor include:

- Leaching / dissolution from contaminated soil to surface water;
- Leaching / dissolution of NAPL into surface water;

- Migration into aquifer

Potential pathways to the off-site surface water receptors include:

- Leaching/dissolution from contaminated soil followed by migration in groundwater;
- Leaching / dissolution of NAPL followed by migration in groundwater;
- Migration via surface water / drainage;
- NAPL migration and discharge to surface water; and
- Soil erosion/surface flooding resulting in discharge of contaminants to surface water.

3.5. Preliminary Conceptual Site Model

Table 3-1 provides the qualitative risk matrix, based on CIRIA guidance [11], in which the likelihood or probability of each pollutant linkage being realised is ranked against the severity of the consequences. The result is the relative risk classification, the results of which can inform the due diligence process and allow prioritisation of any further assessments or the implementation of risk management measures.

Table 3-1 - Qualitative Risk Matrix

Risk Matrix		Severity of Consequence			
		Severe	Medium	Mild	Minor
Probability of pollutant linkage	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

Definitions of the risk classifications presented in the guidance are given in Table 3-2 below.

Table 3-2 - Risk Classifications

Risk Classification	Definition
Very High Risk	There is a high probability that severe harm could arise to a designated receptor from an identified source, or there is evidence that severe harm to a designated receptor is currently happening.
High Risk	Harm is likely to arise to a designated receptor from an identified source.
Moderate Risk	It is possible that harm could arise to a designated receptor from an identified source. However, it is relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild.
Low Risk	It is possible that harm could arise to a designated receptor from an identified source, but it is likely that this harm, if realised, would at worst normally be mild.
Very Low Risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

The individual sources, pathways and receptors identified in previous sections are judged against this risk matrix and professional judgement has been used to estimate the combination of probability of a pollutant linkage being realised and the consequence of the harm that might result in line with CIRIA C552 [11].

Details of the potential pollutant linkages and associated risks are recorded in the CSM presented in Table 3-3.

Table 3-3 - Initial CSM summarising PCLs for current and the proposed future

Source	Receptor	Pathway	Potential Consequence of Complete Contaminant Linkage	Likelihood of Complete Contaminant Linkage	Risk Rating
Source 1 – Made Ground associated with past and current industrial use including a civil engineering works, a bus depot and commercial builders yard	On-site workers	Direct contact and / or ingestion with contaminated soils and / or groundwater	Medium	Low Likelihood	Moderate / Low
	On-site workers in excavations	Direct contact and / or ingestion with contaminated soils and / or groundwater	Medium	Likely	Moderate
	Secondary A Aquifer (Kempton Park Gravels)	Leaching/dissolution from contaminated soil/NAPL	Medium	Likely	Moderate
	Surface water (Pymmes Brook)	Leaching/dissolution from contaminated soil/NAPL followed by migration in groundwater	Medium	Likely	Moderate
		Migration via surface water/drainage	Medium	Likely	Moderate
		NAPL migration and discharge to surface water	Medium	Likely	Moderate
		Soil erosion/surface flooding resulting in discharge of contaminants to surface water	Medium	Likely	Moderate
Source 2 – Asbestos in soils associated with the historical development of the site and infilled ponds.	On-site workers	Dust/fibre inhalation	Severe	Low likelihood	Moderate
	On-site workers in excavations	Dust/fibre inhalation	Severe	Low likelihood	Moderate
	Off-site residents	Dust/fibre inhalation and inhalation/direct contact with dusts that have blown off-site	Severe	Low likelihood	Moderate
	Off-site workers	Inhalation/direct contact with dusts that have blown off-site	Severe	Low likelihood	Moderate

Source	Receptor	Pathway	Potential Consequence of Complete Contaminant Linkage	Likelihood of Complete Contaminant Linkage	Risk Rating
	Off-site workers in excavations	Inhalation/direct contact with dusts that have blown off-site	Severe	Low likelihood	Moderate
Source 3 – Made Ground associated with infilled ponds and a former sludge pit located in the south of the site, that includes the presence of dense non-aqueous phase liquid (DNAPL).	On-site workers	Direct contact and / or ingestion with contaminated soils and / or groundwater	Medium	Low Likelihood	Moderate / Low
	On-site workers in excavations	Direct contact and / or ingestion with contaminated soils and / or groundwater	Medium	Likely	Moderate
	Off-site workers	Inhalation of ground gases / ground vapours from contaminated soils	Medium	Unlikely	Low
	Secondary A Aquifer (Kempton Park Gravels)	Leaching/dissolution from contaminated soil/NAPL	Medium	Likely	Moderate
	Surface water (Pymmes Brook)	Leaching/dissolution from contaminated soil/NAPL followed by migration in groundwater	Medium	Likely	Moderate
		Migration via surface water/drainage	Medium	Likely	Moderate
		NAPL migration and discharge to surface water	Medium	Likely	Moderate
		Soil erosion/surface flooding resulting in discharge of contaminants to surface water	Medium	Likely	Moderate
Source 4 – Historical suspected below ground fuel	On-site workers	Direct contact and / or ingestion with contaminated soils and / or groundwater	Medium	Low Likelihood	Moderate / Low

Source	Receptor	Pathway	Potential Consequence of Complete Contaminant Linkage	Likelihood of Complete Contaminant Linkage	Risk Rating
tank in central eastern part of site.	On-site workers in excavations	Direct contact and / or ingestion with contaminated soils and / or groundwater	Medium	Likely	Moderate
	Secondary A Aquifer (Kempton Park Gravels)	Leaching/dissolution from contaminated soil/NAPL	Medium	Likely	Moderate
	Surface water (Pymmes Brook)	Leaching/dissolution from contaminated soil/NAPL followed by migration in groundwater	Medium	Likely	Moderate
		Migration via surface water/drainage	Medium	Likely	Moderate
		NAPL migration and discharge to surface water	Medium	Likely	Moderate
		Soil erosion/surface flooding resulting in discharge of contaminants to surface water	Medium	Likely	Moderate
Source 5 – Historical above ground fuel storage tank associated with the former use of the site as a bus depot.	Secondary A Aquifer (Kempton Park Gravels)	Leaching/dissolution from contaminated soil/NAPL	Medium	Likely	Moderate
	Surface water (Pymmes Brook)	Leaching/dissolution from contaminated soil/NAPL followed by migration in groundwater	Medium	Likely	Moderate
		Migration via surface water/drainage	Medium	Likely	Moderate
		NAPL migration and discharge to surface water	Medium	Likely	Moderate
		Soil erosion/surface flooding resulting in discharge of contaminants to surface water	Medium	Likely	Moderate

Source	Receptor	Pathway	Potential Consequence of Complete Contaminant Linkage	Likelihood of Complete Contaminant Linkage	Risk Rating
Source 6 - Contaminated groundwater (perched groundwater and groundwater in the shallow Kempton Park Gravels impacted by hydrocarbon contamination)	Secondary A Aquifer (Kempton Park Gravels)	Migration to aquifer	Medium	Likely	Moderate
	Surface water (Pymmes Brook)	Migration in groundwater	Medium	Likely	Moderate
		Migration via surface water drainage	Medium	Likely	Moderate
	On-site workers	Inhalation of ground gases / ground vapours from contaminated groundwater	Medium	Unlikely	Low
	On-site workers	Direct contact and / or ingestion of contaminated groundwater	Medium	Low likelihood	Moderate / Low
	On-site workers in excavations	Direct contact and / or ingestion of contaminated groundwater	Medium	Likely	Moderate
Source 7 - Non-aqueous phase liquid (NAPL) encountered in the Made Ground / Alluvium.	Secondary A Aquifer (Kempton Park Gravels)	Leaching/dissolution from contaminated soil/NAPL	Medium	Likely	Moderate
		Migration to aquifer	Medium	Likely	Moderate
	Surface water (Pymmes Brook)	Leaching/dissolution from contaminated soil/NAPL followed by migration in groundwater	Medium	Likely	Moderate
		Migration via surface water drainage	Medium	Likely	Moderate
		NAPL migration and discharge to surface water	Medium	Likely	Moderate
	On-site workers	Inhalation of ground gases / ground vapours from contaminated soils	Medium	Unlikely	Low

Source	Receptor	Pathway	Potential Consequence of Complete Contaminant Linkage	Likelihood of Complete Contaminant Linkage	Risk Rating
	On-site workers	Direct contact and or ingestion of contaminated groundwater	Medium	Low likelihood	Moderate / Low
	On-site workers in excavations	Direct contact and or ingestion of contaminated groundwater	Medium	Likely	Moderate
Source 8 – Off-site sources associated with former gasworks and surrounding historical industry.	Secondary A Aquifer (Kempton Park Gravels)	Migration of NAPL/contaminated groundwater on-site	Medium	Likely	Moderate
Source 9 – Two above ground bunded fuel tanks adjacent to the depot building (two 1400L tanks).	Secondary A Aquifer (Kempton Park Gravels)	Leaching/dissolution from contaminated soil/NAPL	Medium	Likely	Moderate
	Surface water (Pymmes Brook)	Leaching/dissolution from contaminated soil/NAPL followed by migration in groundwater	Medium	Likely	Moderate
	Secondary A Aquifer (Kempton Park Gravels)	Migration via surface water/drainage	Medium	Likely	Moderate
		NAPL migration and discharge to surface water	Medium	Likely	Moderate
		Soil erosion/surface flooding resulting in discharge of contaminants to surface water	Medium	Likely	Moderate
Source 10 – Two disused trailer bowlers associated with the site's former use.	Secondary A Aquifer (Kempton Park Gravels)	Leaching/dissolution from contaminated soil/NAPL	Medium	Likely	Moderate
	Surface water (Pymmes Brook)	Leaching/dissolution from contaminated soil/NAPL followed by migration in groundwater	Medium	Likely	Moderate
		Migration via surface water/drainage	Medium	Likely	Moderate

Source	Receptor	Pathway	Potential Consequence of Complete Contaminant Linkage	Likelihood of Complete Contaminant Linkage	Risk Rating
		NAPL migration and discharge to surface water	Medium	Likely	Moderate
		Soil erosion/surface flooding resulting in discharge of contaminants to surface water	Medium	Likely	Moderate

3.6. Summary of PCLs

The potential contaminant linkages that require further consideration are largely those that relate to Controlled Waters, that include the underlying Secondary A Aquifer and the nearby Pymmes Brook.

The risks to the Secondary A Aquifer are considered to be moderate, resulting from leaching and / or dissolution of contaminants from several on-site sources including former fuel tanks, NAPL within the Made Ground and Alluvium, contaminated groundwater, infilled historical features and site-wide impacted Made Ground. A moderate risk to the aquifer is considered to be present associated with the off-site historical industry including the gasworks to the north of the site.

The risks to the Pymmes Brook are also considered to be moderate, associated with several on-site sources including former fuel tanks, impacted Made Ground, contaminated groundwater, NAPL in the Made Ground and Alluvium, and infilled historical features. Several plausible pathways remain for contamination to impact upon the Pymmes Brook including migration and leaching / dissolution of contaminants in soils and groundwater.

Risks to human health receptors from contamination in soils and groundwater are considered to be moderate to moderate / low at this stage of assessment. Whilst risks posed to on-site workers from direct contact and / or ingestion are reduced due to the presence of hardstanding at the site, the risks shall be reassessed as part of the generic risk assessment and updated in the revised conceptual site model.

Risks posed to human health receptors including on-site and off-site receptors are still considered to be moderate associated with the potential presence of asbestos in soils on-site.

The risk to existing on-site workers in the depot is considered to be low following an indoor vapour intrusion assessment completed by a previous consultant. As the proposed development does not comprise any occupied buildings, this indoor vapour intrusion pathway is not considered further. There is however a potential vapour risk to off-site workers from contaminated soils and groundwater in the south of the site.

4. Human Health Generic Quantitative Risk Assessment

4.1. Introduction

The human health GQRA has been designed to assess potential risks to human health receptors under the site's current use as leased commercial properties and the proposed future use as an electricity substation also equivalent to an open storage end use. The GQRA involves comparing contaminant concentrations observed at the site with appropriate generic assessment criteria (GACs). The GQRA forms Tier 2 of the tiered approach to assessing risks from land contamination as set out in the Environment Agency 2020, Land Contamination Risk Management Framework (LCRM) [12].

The site is predominantly covered by hardstanding/buildings. The hardstanding/buildings present across the site reduce the potential risk to human health receptors by acting as a barrier and mitigating against direct contact with soils. In the future land use scenario as a substation, the site will be devoid of soft landscaping and the surface of the site will remain as hardstanding/gravel, limiting human exposure to shallow soils.

The assessment has been undertaken using data collected from two 2013 Worley Parsons [5] site investigations and the Atkins 2023 site investigation. An exploratory hole plan for the Atkins 2023 site investigation is provided as Figure 5 and the Worley Parsons 2013 site investigations are attached in Appendix C.

To support the evaluation of potential risks to human health, soil data from the Worley Parsons 2013 Investigation and Atkins 2023 site investigations have been screened against:

- Category 4 Screening Levels (C4SLs); and
- Atkins' soil screening values (SSVs).

These are collectively referred to as Generic Assessment Criteria (GAC).

C4SLs are values that have been derived for use in England and Wales to define sites posing low or no risk to human health. The Environmental Protection Act 1990 Contaminated Land Statutory Guidance (DEFRA, 2012) [13] includes a categorisation for land contamination assessment, ranging from Category 4 (low risk) to Category 1 (significant/high risk and potentially significant possibility of significant harm (SPoSH)). C4SLs are utilised to determine whether further assessment is required for Category 4 sites and are less conservative than SSVs, that are based on minimal risk. C4SLs have been adopted by the Department for Communities and Local Government (DCLG) for use under UK planning to define whether land is suitable for use. To date, C4SLs have been published for ten contaminants (benzo(a)pyrene, benzene, lead, arsenic, cadmium, chromium, chloroethene (vinyl chloride), trichloroethene (TCE), tetrachloroethene (PCE) and 1,2-dichloroethane by CL:AIRE [14].

In the absence of C4SLs, the Atkins SSVs have been utilised which are based on minimal risk levels to human health. Atkins has produced SSVs for a variety of land uses based on soil organic matter (SOM) contents of 1% and 6% SOM. The 1% values provide more conservative SSVs and are based on a sandy soil type, whereas the 6% values are based on a sandy loam soil type (the default within the Environment Agency SR3 document). Atkins has derived SSVs for a number of volatile or potentially volatile contaminants based on both soil saturation limits (where the contaminant will theoretically reach saturation and form free-phase product), and health-based modelled values (given by the Contaminated Land Exposure Assessment (CLEA) model).

To assess risk to current and future site users, the scenario for a commercial land use has been adopted. In a commercial land use scenario, the key receptor is considered to be a female worker aged 16 to <65 years. It is assumed that working adults spend on average 8.3 hours per day indoors on working days, for 230 days of the year. The exposure pathways considered relevant to working adults on site include:

- direct contact with soils and / or groundwater;
- ingestion of soils and / or groundwater;
- inhalation of dust derived from soil (outdoors);
- inhalation of vapours (indoors); and
- inhalation of vapours (outdoors).

The GACs are derived for a variety of soil organic matter contents at 1% and 6%. As part of the Atkins 2023 site investigation SOM analysis was completed on representative samples. The geometric mean fraction organic carbon (FOC) for the site has been calculated as 0.15; however, it is noted that all samples were obtained from Made Ground that was impacted with hydrocarbons. The FOC results may not be considered representative of site wide conditions and as such, the SOM has been calculated using soil samples obtained from the Worley Parsons 2013 investigation across the site. The SOM has been calculated as 9.3% and GACs for a 6% SOM have been used.

The potential for exposure from asbestos in soil is based on a number of factors including (amongst others) the quantity and type of asbestos present, the properties of the soil, the presence of any confining or covering layer, bioturbation, and rates of weathering and erosion due to site use or climate, as well as the actions undertaken on site and exposure scenario. Due to the nature of risk associated with asbestos and key uncertainties associated with the above properties, a GAC cannot be derived. Therefore, for the purposes of this GQRA, the presence of asbestos in soil as reported from field observations or laboratory analysis is considered to be an appropriate initial screening criterion.

Polycyclic Aromatic Hydrocarbons (PAHs) have been assessed using benzo(a)pyrene (BaP) as a surrogate marker. The ratio of the concentrations of genotoxic PAH compounds has been compared against the upper and lower limits as set out in the C4SL guidance. The data indicate that the ratios to BaP are within the defined limits for most compounds. As such, BaP has been used as a marker compound for other genotoxic compounds in the assessment.

The Atkins 2023 laboratory data are presented in the Atkins 2023 Factual Site Investigation Report [2] and results of the screening for the Worley Parsons 2013 [5] reports and Atkins 2023 data is presented in Appendix A of this report.

4.1.1. Atkins 2023 Soils Assessment

A total of four soil samples including a single duplicate from the Atkins 2023 site investigation were collected from depths between 0.10 m bgl and 1.70 m bgl and scheduled for a suite of contaminants as detailed in the factual report.

The soil analytical data were screened against the GAC protective of a commercial land use, where available. A number of soil exceedances were identified during the investigation. Full screening results are included in Appendix A.

4.1.1.1. Asbestos

A total of four soil samples collected were analysed for asbestos and asbestos was not identified in any of the samples.

4.1.1.2. Soil Exceedances against Commercial GAC

Of the four samples obtained during the 2023 investigations, exceedances of the commercial GAC are identified in three of the samples. These exceedances are presented in Table 4-1 and in Figure 6.

Table 4-1 - Soil Exceedances against the GAC

Determinand	GAC (mg/kg)	No. of samples	No. of exceedances	Min Value (mg/kg)	Max. Value (mg/kg)	Location of Exceedance (maximum concentration denoted with a *)
Volatile aromatic petroleum hydrocarbons (VPH) >C5-C7	98	4	2	<0.05	410	BH23-04, 1.70m; BH23-04*
Benzene	98	4	1	0.0047	170	BH23-04*, 1.70 m
Naphthalene	1050	4	1	0.93	1600	BH23-04*

Determinand	GAC (mg/kg)	No. of samples	No. of exceedances	Min Value (mg/kg)	Max. Value (mg/kg)	Location of Exceedance (maximum concentration denoted with a *)
Benzo(a)pyrene	76.3	4	2	0.95	260	BH23-04*, 1.70 m; BH23-05, 1.20 m

4.1.1.3. Atkins Soil Exceedance Discussion

Exceedances of benzene (and corresponding Aromatic VPH >C5-C7) were identified in soil samples taken from BH23-04 at 1.70 m depth. Soils at this location, and at this depth were recorded to contain visual and olfactory evidence of contamination, as reflected in the exploratory log for BH23-04. This sample was obtained from the Made Ground on-site and a corresponding PID reading recorded a value of 55.4 ppm. A single exceedance for benzo(a)pyrene was also recorded in BH23-05 at 1.20 m depth, a corresponding olfactory description of a “strong hydrocarbon odour” was noted at the same depth.

The locations of both boreholes (BH23-04 and BH23-05) were in an area of the site which has historically housed tanks, and therefore these exceedances could be reflecting historical contamination from tanks historically stored at this location.

4.1.2. Worley Parsons April 2013 Asbestos Assessment

A total of 18 samples were submitted for asbestos screening analysis as part of the Worley Parsons April 2013 [5] ground investigation. A total of 13 of the 18 samples were reported to contain chrysotile fibres. The remaining five did not report any presence of asbestos. Of the 13 samples containing asbestos, 11 of the samples were scheduled for asbestos characterisation and 10 were found to contain amosite and one sample was shown to contain anthophyllite. It is stated in the WorleyParsons 2013 report that no asbestos quantification was undertaken on the samples and as such, the quantifiable fibre concentration is unknown.

During the site investigation potential asbestos containing material (ACM) was noted in the Made Ground in BH12-02B and BH12-02C while completing the hand pits (between ground level and 0.30 m bgl).

The full asbestos laboratory reporting from the 2013 ground investigation is found in the Worley Parsons Report [6].

4.1.3. Worley Parsons August 2013 Soils Assessment

As part of the Worley Parsons 2013 investigation, soil samples from exploratory locations within the site boundary were screened against Commercial GACs (6% SOM). This includes a total of 15 samples including one duplicate from the following exploratory locations; BH10, BH11, and BH12.

No exceedances for any determinands were identified in any of the 2013 soil samples, including those located in the vicinity of the potential tank (source 4).

Full screening results are presented in Appendix A.

4.2. Summary of Human Health Risk Assessment

Whilst no exceedances were identified in the soil samples taken during the 2013 Worley Parsons site investigation, exceedances were recorded from the soil samples taken during the 2023 Atkins site investigation for benzene, naphthalene and benzo(a)pyrene in BH23-04 and BH23-05 at depth. Both locations from which these samples were taken are in an area which has been shown to historically house tanks and require further assessment.

It is noted that majority of the data used in the soils assessment was obtained in 2013 and this is a limitation based on the age of the data. The 2013 results are unlikely to reflect any impact associated with more recent contamination sources or pollution incidents that may have taken place since then. It is however noted that the sources of contamination considered at the site largely pre-date 2013. In addition, as the site is largely surfaced in hardstanding or covered by buildings and the future end use of the site is an unoccupied substation, it is not considered likely that this limitation will impact the outcome of the human health risk assessment. Present day soil concentrations may also be lower than those identified in 2013 due to leaching and degradation processes in the soil.

Positive identifications of asbestos were recorded in the 2013 investigation, and exceedances of PAHs during the 2023 site investigation. The site is largely covered by hardstanding and therefore human exposure to these contaminants across the site is considered to be unlikely, and the risk to human health receptors is low. There is however a limited area of exposed soil adjacent to the east of the depot building, that contains a skip and is used to store waste materials. This walkway is traversed by those working in the steel fabricators throughout the day for short periods of time. No asbestos was detected in the soils in BH23-03 to BH23-05 in this area as part of the 2023 investigation; but due to the historical occurrences across the site, there is considered to be a moderate risk to existing site users, as a matter of prudence.

Considering the future use of the site as a substation, the ground cover is likely to be hardstanding with potentially limited areas of gravel cover, however at this stage it is yet to be confirmed. As there are no proposed areas of soft landscaping and any visiting site workers will likely use pedestrian walkways surfaced in hardstanding, there is not considered to be a pathway from contamination or asbestos in soils to site end users. The generation of soil derived dusts is considered unlikely as bare soils are not likely to be exposed under the future site use as a substation.

There is a risk associated with the lateral migration of soil vapours arising from contaminated groundwater to off-site workers and commercial space users. This was not reported by Advisian in their 2016 vapour DQRA [10] as their assessment focussed on the risks posed to on-site workers within the depot building in the north of the site from soil vapours. Further assessment of the risks posed to off-site workers and commercial space users is recommended.

5. Controlled Waters Risk Assessment

5.1. Introduction

The controlled waters GQRA has been designed to assess the potential risks posed to the controlled waters receptors identified in the preliminary CSM, presented in Section 3.

The assessment has been undertaken using soil-derived leachate, groundwater, surface water and interceptor water data collected during the Atkins 2023 site investigation and subsequent monitoring rounds. Based on the groundwater monitoring data from the superficial deposits, collected in 2013 and 2023, the groundwater flow direction is inferred to be towards the south / south-east, in the direction of the River Thames.

5.2. Hydrogeological Conceptual Model

The site is underlain by Made Ground, and superficial deposits of Alluvium (ranging in thickness from 1.4 m and 3.7 m [5]) and Kempton Park Gravels (ranging in thickness from 0.95 m to 2.25 m [5]). The Alluvium was described by Worley Parsons as “*brown/grey silts and clays with some sand and gravel*” [5]. Therefore, it is possible that these deposits are creating an impermeable layer which may create perched groundwater within the granular Made Ground deposits. The superficial deposits are classified as Secondary A aquifers and are considered to be the sensitive controlled groundwater receptors beneath the site. The groundwater encountered within the Made Ground deposits on-site may be perched groundwater due to the presence of the clay and silt of the Alluvium. This perched groundwater is unlikely to be in hydraulic continuity with the underlying groundwater baseflow.

The underlying bedrock, the London Clay Formation, is classified as a non-aquifer. The London Clay Formation below the site is understood to be over 12 m thick and is considered to be acting as an aquiclude to the underlying bedrock aquifers associated with the Lambeth Group, Thanet Sands and Chalk.

The site is within a Source Protection Zone (SPZ) 2 likely to be associated with the presence of nearby groundwater abstractions, the Banbury Reservoir to the east and the Lockwood Reservoir to the south-east of the site. The nearest active potable abstraction well is located approximately 540 m to the east, thus indicating that groundwater in proximity to the site is being utilised as a resource. It is noted that this abstraction is not located down hydraulic gradient of the site.

There is also an active groundwater abstraction located 320 m to the west of the site for laundry purposes.

The nearest surface water body, and thus the controlled surface water receptor for the site, is the Pymmes Brook located 30 m to the east of the site at its nearest point, that is heavily modified. It is understood that the base of this watercourse is concrete lined given the age of the feature, but this has not been confirmed by Atkins and therefore the condition of this potential hydraulic pathway is not known. The Pymmes Brook is also a Water Framework Directive Designated Waterbody and a Statutory Main River as classified by the Environment Agency. As such, it is considered possible that groundwater present beneath the site in the superficial aquifer could be providing baseflow to the sensitive Pymmes Brook, and it cannot be fully discounted at this stage. There is also potential that surface water runoff from the site could reach the watercourse as it is situated lower than ground level at the site, with steep banks

The brook flows generally southward to enter the River Lee Navigation canal (also referred to as the Salmon Brook) approximately 1.80 km to the south of the site.

The River Lee Navigation, located approximately 200 m to the east, may also be in hydraulic continuity with groundwater beneath the site. Although given the distance, overland surface water runoff from the site to the River Lee Navigation is considered to be unlikely. The river is channelised but it is also unknown if it has a concrete base.

5.3. Assessment Methodology

The screening criteria for controlled waters assessment are dependent on the nature of the principal receptors being considered.

Based on the above, soil-leachate, surface water, groundwater and interceptor data have been screened against the following:

- Drinking Water Standards (DWS) to assess the risk to the Secondary A Aquifer located in a SPZ 2 (where no DWS values are available alternative applicable criteria have been selected); and

- Environmental Quality Standards (EQS) for inland surface waters protective of the Pymmes Brook and the River Lee Navigation.

The screening sheets are presented within Appendix B.

The bioavailability of certain metals (copper, lead, nickel, zinc) varies depending on the hydrochemical characteristics of the receiving surface water body. Published EQS values are unadjusted values which assume 100% bioavailability and are therefore highly conservative. Therefore, site specific Predicted No Effect Concentrations (PNEC) values have been derived using the WFD-UK rivers and lakes metal bioavailability assessment tool (mBAT) [15], to define site-specific EQS that accounts for the bioavailability for each relevant metal. The receiving water parameters were defined by calculating average values from surface water samples taken during the ground investigation. Calcium and pH were not tested for as part of the 2023 ground investigation, therefore data was attained from the Environment Agency Water Quality Archive [16]. Calcium and pH values were attained from a sampling point within the Pymmes Brook, located approximately 500 m north of the site, on the 11 July 2023 (sampling point ID TH-PLER0110). The Atkins surface water sample locations are shown on Figure 5. The mBAT analysis is summarised in Table 5-1.

Table 5-1 - Summary of mBAT Analysis

Average Dissolved Organic Carbon (mg/l)	Calcium (mg/l)	pH	Average Site-specific PNEC Dissolved Copper (mg/l)	Average Site-specific PNEC Dissolved Zinc (mg/l)	Average Site-specific PNEC Dissolved Nickel (mg/l)	Average Site-specific PNEC Dissolved Lead (mg/l)
8.24	92.18	7.83	0.03153	0.03917	0.01679	0.00989

5.4. Soil Derived Leachate Results

5.4.1. Comparison of Soil Leachate Results to Drinking Water Standards

A total of three soil leachate samples were collected during the Atkins 2023 site investigation and screened against DWS. Soil leachate screening results are included in Appendix B and a summary of the exceedances in Table 5-2 below. A soil leachate DWS exceedance plan is presented in Figure 7.

Table 5-2 - Summary of Leachate Exceedances against DWS

Determinand	DWS (mg/l)	No. of samples	No. of exceedances	Min Value (mg/l)	Max. Value (mg/l)	Location of Exceedance (maximum concentration denoted with a *)
Ammonium	0.5	3	2	<0.05	2.4	BH23-04*, 1.7m; BH23-05, 1.2 m
Arsenic (Dissolved)	0.01	3	2	0.0035	0.08	BH23-04, 1.7m; BH23-05*, 1.2 m
Iron (Dissolved)	0.2	3	2	0.015	9.8	BH23-04, 1.7m; BH23-05*, 1.2 m
Aliphatic TPH >C8-C10	0.3	3	1	<0.0001	1.7	BH23-04*, 1.7m
Aromatic TPH >C5-C7	0.01	3	1	<0.0001	0.13	BH23-04*, 1.7m
Aromatic TPH >C8-C10	0.3	3	1	<0.0001	4.4	BH23-04*, 1.7m
Aromatic TPH >C10-C12	0.09	3	1	<0.0001	0.55	BH23-04*, 1.7m

Determinand	DWS (mg/l)	No. of samples	No. of exceedances	Min Value (mg/l)	Max. Value (mg/l)	Location of Exceedance (maximum concentration denoted with a *)
Aromatic TPH >C12-C16	0.09	3	1	<0.0001	0.97	BH23-04*, 1.7m
Aromatic TPH >C16-C21	0.09	3	1	<0.0001	0.13	BH23-04*, 1.7m
Benzene	0.001	3	2	<0.001	1.9	BH23-04*, 1.7m; BH23-05, 1.2 m
Phenol	0.05	3	2	<0.005	0.13	BH23-04*, 1.7m; BH23-05, 1.2 m

5.4.2. Comparison of Soil Leachate Results to Environmental Quality Standards

A total of three soil leachate samples were collected during the 2023 site investigation and screened against EQS. Soil leachate screening results are included in Appendix B and a summary of the exceedances in Table 5-3 below. A soil leachate EQS exceedance plan is presented in Figure 8.

Table 5-3 - Summary of Leachate Exceedances against EQS

Determinand	EQS (mg/l)	No. of samples	No. of exceedances	Min Value (mg/l)	Max. Value (mg/l)	Location of Exceedance (maximum concentration denoted with a *)
Ammonium	0.26	3	2	<0.05	2.4	BH23-04, 1.7m; BH23-05, 1.2 m
Arsenic (Dissolved)	0.05	3	1	0.0035	0.08	BH23-04*, 1.7m
Iron (Dissolved)	1	3	1	0.015	9.8	BH23-05*, 1.2 m
Aliphatic TPH >C6-C8	0.01	3	1	<0.0001	0.14	BH23-04*, 1.7m
Aliphatic TPH >C8-C10	0.01	3	1	<0.0001	1.7	BH23-04*, 1.7m
Aliphatic TPH >C10-C12	0.01	3	1	<0.0001	0.068	BH23-04*, 1.7m
Aromatic TPH >C5-C7	0.01	3	1	<0.0001	0.13	BH23-04*, 1.7m
Aromatic TPH >C7-C8	0.01	3	1	<0.0001	0.42	BH23-04*, 1.7m
Aromatic TPH >C8-C10	0.01	3	1	<0.0001	4.4	BH23-04*, 1.7m
Aromatic TPH >C10-C12	0.01	3	1	<0.0001	0.55	BH23-04*, 1.7m
Aromatic TPH >C12-C16	0.01	3	1	<0.0001	0.97	BH23-04*, 1.7m
Aromatic TPH >C16-C21	0.01	3	1	<0.0001	0.13	BH23-04*, 1.7m

Determinand	EQS (mg/l)	No. of samples	No. of exceedances	Min Value (mg/l)	Max. Value (mg/l)	Location of Exceedance (maximum concentration denoted with a *)
Naphthalene	0.002	3	1	<0.0001	0.077	BH23-05*, 1.2 m
Fluoranthene	0.0000063	3	1	<0.0001	0.013	BH23-05*, 1.2 m
Benzene	0.01	3	1	<0.001	1.9	BH23-04*, 1.7m
Toluene	0.074	3	1	<0.001	0.19	BH23-04*, 1.7m
Phenol	0.0077	3	2	<0.005	0.13	BH23-04*, 1.7m; BH23-05, 1.2 m

5.5. Groundwater Results

A total of 35 groundwater samples (including four duplicates) were collected following the 2023 Atkins site investigation over three monitoring rounds, these were taken from boreholes installed in the Made Ground (Atkins BH23-03 and BH23-05 and Worley Parsons window sample locations, installed in 2013) and others screened in the underlying natural strata of the Kempton Park Gravels (Atkins BH23-04 and Worley Parsons borehole locations).

Exceedances against the DWS and EQS are widespread across the site, in samples obtained from historical and newly installed monitoring locations. Due to the number of exceedances, a selection of contaminants of concern have been identified (benzene, ammonium, naphthalene and aromatic TPH C12-C16 and are presented on Figures 9 to 12. These compounds have been selected based on their prevalence across the site, their designation as a hazardous substance in groundwater and relation to historical sources on site and in the surrounding area. Contaminants of concern at the site shall be redefined as part of any further assessment.

5.5.1. Groundwater DWS Assessment

A summary of exceedances against DWS for the 35 samples obtained is presented in Table 5-4 below.

Table 5-4 - Summary of Groundwater Exceedances against DWS

Determinand	DWS (mg/l)	No. of samples	No. of exceedances	Min. value (mg/l)	Max. value (mg/l)
Chloride	250	35	10	19	1000
Ammonium	0.5	35	33	0.054	110
Sulphate	250	35	25	<1	2400
Cyanide (Total)	0.05	35	23	<0.05	1.3
Cyanide (Complex)	0.05	35	23	<0.05	1.3
Arsenic (Dissolved)	0.01	35	17	0.0003	0.36
Iron (Dissolved)	0.2	35	17	0.0067	170
Nickel (Dissolved)	0.02	35	9	0.0021	0.085
Lead (Dissolved)	0.01	35	5	<0.0005	0.19
Selenium (Dissolved)	0.01	35	6	<0.0005	0.027
Aliphatic TPH >C8-C10	0.3	35	6	<0.0001	12
Aliphatic TPH >C10-C12	0.3	35	2	<0.0001	21
Aliphatic TPH >C12-C16	0.3	35	2	<0.0001	36
Aromatic TPH >C5-C7	0.01	35	16	<0.0001	36

Determinand	DWS (mg/l)	No. of samples	No. of exceedances	Min. value (mg/l)	Max. value (mg/l)
Aromatic TPH >C7-C8	0.7	35	11	<0.0001	64
Aromatic TPH >C8-C10	0.3	35	18	<0.0001	72
Aromatic TPH >C10-C12	0.09	35	21	<0.0001	160
Aromatic TPH >C12-C16	0.09	35	18	<0.0001	380
Aromatic TPH >C16-C21	0.09	35	12	<0.0001	270
Aromatic TPH >C21-C35	0.09	35	6	<0.0001	190
Benzene	0.001	35	27	<0.001	140
Toluene	0.7	35	13	0.001	16
Ethylbenzene	0.3	35	5	<0.001	4.5
Phenol	0.05	35	17	0.005	12

5.5.2. Groundwater EQS Assessment

A total of 35 groundwater samples (including four duplicates) were collected following the 2023 Atkins site investigation over three monitoring rounds.

A summary of exceedances against EQS is presented in Table 5-5 below.

Table 5-5 - Summary of Groundwater Exceedances against EQS

Determinand	EQS (mg/l)	No. of samples	No. of exceedances	Min. value (mg/l)	Max. value (mg/l)
Chloride	250	35	10	19	1000
Ammonium	0.26	35	33	0.054	110
Sulphate	400	35	14	<1	2400
Arsenic (Dissolved)	0.05	35	9	0.0003	0.36
Cadmium (Dissolved)	0.00008	35	5	<0.00011	0.00085
Iron (Dissolved)	1	35	10	0.0067	170
Nickel (Dissolved)	0.01679	35	9	0.0021	0.085
Lead (Dissolved)	0.00989	35	6	<0.0005	0.19
Selenium (Dissolved)	N/A	35	2	<0.0005	0.027
Zinc (Dissolved)	0.04247	35	6	<0.0025	0.35
Aliphatic TPH >C5-C6	0.01	35	4	<0.0001	0.17
Aliphatic TPH >C6-C8	0.01	35	8	<0.0001	1.6
Aliphatic TPH >C8-C10	0.01	35	11	<0.0001	12
Aliphatic TPH >C10-C12	0.01	35	6	<0.0001	21
Aliphatic TPH >C12-C16	0.01	35	2	<0.0001	36
Aliphatic TPH >C16-C21	0.01	35	2	<0.0001	48
Aliphatic TPH >C21-C35	0.01	35	7	<0.0001	25
Aliphatic TPH >C35-C44	0.01	35	2	<0.0001	2.5
Aromatic TPH >C5-C7	0.01	35	16	<0.0001	36

Determinand	EQS (mg/l)	No. of samples	No. of exceedances	Min. value (mg/l)	Max. value (mg/l)
Aromatic TPH >C7-C8	0.01	35	19	<0.0001	64
Aromatic TPH >C8-C10	0.01	35	22	<0.0001	72
Aromatic TPH >C10-C12	0.01	35	22	<0.0001	160
Aromatic TPH >C12-C16	0.01	35	22	<0.0001	380
Aromatic TPH >C16-C21	0.01	35	14	<0.0001	270
Aromatic TPH >C21-C35	0.01	35	12	<0.0001	190
Benzene	0.01	35	19	<0.001	140
Toluene	0.074	35	16	0.001	16
Ethylbenzene	0.02	35	17	<0.001	4.5
Naphthalene	0.002	35	24	<0.0001	98
Anthracene	0.0001	35	11	<0.0001	5.5
Fluoranthene	0.0000063	35	10	<0.0001	4.9
Phenol	0.0077	35	21	0.005	12

5.5.3. Surface Water EQS Assessment

A total of four soil surface water samples were collected during the 2023 site investigation and screened against EQS. A single exceedance of ammonium has been identified. Surface water screening results are included in Appendix B.

Table 5-6 - Surface Water Samples Exceeding EQS

Determinand	EQS (mg/l)	No. of samples	No. of exceedances	Min. value (mg/l)	Max. value (mg/l)	Locations of exceedances (maximum concentration denoted with a *)
Ammonium	0.26	8	1	0.16	0.27	SW2*

5.5.4. DNAPL Summary

A summary of observations of measurable NAPL have been presented in Table 5-7, while observations of free product in the water column have been noted in Table 2-4. It should be noted that observations from BH12-02D from 2023 have been excluded from the report as the depth to base measured in 2023 is above the response zones. There is a potential that this borehole is compromised, and data collected in 2023 may also be compromised.

Table 5-7 - NAPL Measurements

Borehole	NAPL Measurement	Date
BH11	0.69 m DNAPL	10/05/2023
	0.45 m DNAPL	04/07/2023
BH12-01	1.50 m DNAPL	01/03/2013
	0.10 m DNAPL	14/02/2023

Table 5-8 - Observations of Potential NAPL

Borehole	Date	Observation
BH12-01	08/06/2023	Droplets and oily sheen in sample
BH12-02D	01/03/2013	Product maybe running down the side of the well rather than an identifiable layer
BH12-03	10/05/2023	Sheen on water observed.
WS12-01	01/03/2013	Trace product noted on end of interface probe
WS12-02	07/06/2023	Free product noted and oil sheen on water

Two samples of DNAPL were obtained from BH11B and BH12-01 during the third monitoring round and sent for product testing to further understand the composition of DNAPL underlying the site. The DNAPL is described as viscous, dark brown, coloured oil and is interpreted by the testing laboratory to be coal tar. Corresponding visual and olfactory evidence from the groundwater monitoring rounds were recorded for both locations.

5.5.5. LNAPL Summary

LNAPL was identified in BH23-03 during the site investigation where free product was encountered on the surface of the perched groundwater between 0.35 and 0.70 m bgl. During the first monitoring round LNAPL was noted on groundwater at 0.33 m bgl but was not recorded during the second and third visits. As such, it was not possible to obtain a sample for testing. Historical tanks were formerly located in this area and are considered to be the source of this contamination.

BH12-04, installed by WorleyParsons in 2013 [5], was monitored during the Atkins 2023 monitoring rounds. During the second and third round of monitoring a hydrocarbon odour was noted in the monitoring notes for BH12-04. WS12-06, that is understood to be in the vicinity of the potential underground tank (source 4), could not be located during the monitoring rounds, and therefore was not monitored or sampled.

There was no evidence of LNAPL contamination in either BH23-04 or BH23-05 during the 2023 site investigation, and LNAPL was not encountered in any of the historical boreholes during the monitoring rounds completed in 2023 by Atkins.

5.6. Discussion of Potentially Unacceptable Risks to Controlled Waters

5.6.1. Soil-Leachate

Soil leachate exceedances of ammonium, arsenic, iron, aliphatic TPH >C6 to C12, aromatic TPH >C5 to C21, naphthalene, fluoranthene, benzene, toluene and phenol have been identified in samples taken from BH23-04, and BH23-05 at 1.7 m bgl and 1.2 m bgl, respectively. The exploratory locations from the Atkins 2023 ground investigation, are both located in the north-east of the site, adjacent to where a historical tank is known to have been formerly present. Exploratory logs indicate both visual and olfactory evidence of organic contamination at these locations, comprising black staining and hydrocarbon odours. Figure 7 indicates the locations of these concentration exceedances against the EQS and DWS criteria.

5.6.2. Groundwater

5.6.2.1. Inorganics

A variety of inorganic contaminants were observed to exceed both the DWS and EQS, these include chloride, ammonium, sulphate, and cyanide (total, free and complex). Inorganic exceedances were reported across the entirety of the site, either within, or greater than an order of magnitude of the assessment criteria, recorded at a variety of depths, in the Made Ground, and within the underlying superficial Secondary A aquifer.

The exceedances of ammonium across the site are widespread and are therefore considered to be a contaminant of concern for this site. Corresponding exceedances of ammonium were also recorded in two of the soil leachate samples taken from the north-east of the site, and therefore on-site soils could be acting as a potential source of the ammonium exceedances in the underlying groundwater. Figure 8 demonstrates the distribution of the ammonium concentration exceedances in groundwater on-site.

Widespread exceedances of cyanide (total and complex) have been recorded against the DWS, these exceedances range from within an order of magnitude and up to two orders of magnitude greater than the DWS. There were no corresponding exceedances of cyanide in the soil leachate samples taken from the 2023 Atkins boreholes.

It is noted that cyanide and ammonium are commonly identified in soils and groundwater on or surrounding gasworks sites; as a former gasworks was present to the north of the site, this may have impacted groundwater quality in the underlying superficial aquifer. Although the gasworks is no longer present, residual contamination may be acting as an ongoing source. In addition, the origin of the material used to backfill the sludge pit and pond is not currently known or reported, therefore it is possible that this material could be contributing to the contaminant load in the aquifer.

5.6.2.2. Metals

A number of samples recorded concentrations of metals in exceedance of the assessment criteria, including iron, copper, lead, nickel, arsenic, mercury, zinc and cadmium. It is noted that fragments of clinker, and other anthropogenic materials were noted in some locations of Made Ground. All metal exceedances excluding iron are within one order of magnitude of the assessment criteria. Iron was observed to exceed the DWS above an order of magnitude of the screening criteria, posing a potential risk to controlled waters receptors.

The exceedances of cadmium and chromium against the DWS were isolated to BH12-01 and WS12-02D located in the south of the site within the infilled pond footprint. Exceedances of copper, lead, iron, nickel and zinc were widespread across the site and over the course of the monitoring.

Of the observed metal exceedances only iron and arsenic were observed to exceed the WQS within leachate samples taken on site; however, it is noted that leachate samples were not obtained across the site as part of previous ground investigations.

5.6.2.3. Organics

Exceedances of organic compounds were seen for both the EQS and DWS across the entirety of the site. During the 2023 Atkins investigation evidence of hydrocarbon contamination was seen in a number of exploratory locations, including BH11B, BH12-01, WS12-01, WS12-02D and BH23-03. It is considered likely that these impacted soils are acting as a source of organic contamination in the groundwater. Figures 9 to 12 demonstrate concentration exceedances for organic contaminants of concern for the site in groundwater.

Within BH23-04, hydrocarbon saturated soils, and free product (LNAPL) was encountered, corresponding with the exceedances for aromatic TPH C5 to C21 and the presence of benzene and toluene several orders of magnitude greater than the EQS and DWS.

BH23-03 was noted to contain visual evidence of LNAPL contamination during the ground investigation and the first monitoring round. The location of BH23-03 is adjacent or within the footprint of former fuel tanks. However, it is noted that no corresponding TPH exceedances were recorded in the soil leachate sample taken from BH23-03 at 0.3 m bgl.

Concentrations of petroleum hydrocarbons were also noted in groundwater sampled from BH12-04, which is understood to be within the vicinity of the potential underground tank identified by WorleyParsons [5]. These exceedances of TPH may be attributed to this potential source; however, as this feature has not been encountered by WorleyParsons or Atkins, it is not possible to confirm whether the tank has already been removed or is still present. At this stage, a suspected underground tank at this location is assumed to be present.

DNAPL was observed at the base of the Kempton Park Gravels at a number of locations, including three historical locations in the south of the site (BH12-01, WS12-01, WS12-02D), and one in the centre of the site (BH11). DNAPL samples obtained during the monitoring round have been characterised as coal tar. Three of the four locations in which DNAPL was recorded lie within the infilled pond formerly located in the south of the site between the 1950s and the 1960s as the origin of the backfill material is unknown. The DNAPL within BH11 in the centre of the site has also been characterised as coal tar. As this position lies outside of the historical sludge tank; it is possible that the historical mapping does not demonstrate the true extent of historical below ground features, or that DNAPL has migrated from the former gasworks to the north of the site.

Exceedances of polyaromatic hydrocarbons are present in groundwater samples, largely corresponding to locations in which groundwater also recorded exceedances of aromatic TPH fractions. Benzene, toluene and ethylbenzene exceedances are widespread across the site, with the greatest exceedances associated with BH12-01 located in the south of the site. This location is associated with the infilled pond structure present in the south of the site. The second maximum concentration of benzene is located in WS12-07 in the north-west of the site, that is the nearest position to the former off-site gas works.

Exceedances of phenol were also recorded to be widespread across the site, the locations of the greatest exceedances corresponded with high concentrations of DNAPL in BH12-01, and the presence of LNAPL in BH23-04. Corresponding exceedances of phenol in soil leachate samples were recorded in BH23-04 and BH23-05 indicating that shallow soils may be contributing to the phenol exceedances in groundwater. Phenol is recognised as an indicator contaminant often associated with gas works contamination, the presence of widespread phenol exceedances in groundwater alongside widespread ammonium exceedances indicate that the former gas works located off-site to the north are likely contributing to the contamination of on-site groundwater.

The presence of LNAPL and DNAPL at the site present an ongoing source of contamination to groundwater that requires further assessment.

5.6.3. Surface Water

Ammonium exceedances against the EQS were identified in the downstream surface water sample obtained from the Pymmes Brook. Only SW2, the downstream sample, taken on the third monitoring round was found to marginally exceed the EQS. These determinands also exceeded EQS in groundwater samples taken on-site.

No other observed determinands seen within leachate or groundwater samples were found to exceed the respective EQS within the samples obtained from the Pymmes Brook. This suggests that on-site contaminants may not be impacting the adjacent sensitive surface water receptor. As the Pymmes Brook is heavily channelised and likely lined, this may be limiting the potential for onsite dissolved phase contamination to impact the receptor.

5.7. Summary of Controlled Waters Risk Assessment

Following the assessment of groundwater and soil leachate samples taken from locations on-site, it is considered that there is an unacceptable risk posed to controlled surface and groundwater receptors from on-site contamination sources. At this stage, Atkins have not confirmed the condition of the concrete lining of the Pymmes Brook and as such, there is a presumed risk present to this surface water receptor.

Exceedances have been recorded for a range of inorganic and organic contaminants including heavy end and light end TPH, benzene, toluene, ethylbenzene and metals. Corresponding exceedances have also been identified in soil leachate samples and groundwater within the underlying strata on-site, including corresponding exceedances of benzene, toluene and phenol.

Visibly contaminated groundwater was also encountered in the newly installed groundwater monitoring locations and in the historical wells. Free phase product, in the form of LNAPL and DNAPL, has been encountered in varying thicknesses across the site. In the south, DNAPL contamination was recorded in the groundwater, with thicknesses recorded up to 0.87 m. Exceedances of aliphatic C12-C35 TPH were also recorded in the groundwater sample taken from BH12-01 at concentrations greater than three orders of magnitude of the screening criteria.

Groundwater underlying the site is within a Secondary A aquifer that also lies within a SPZ 2, and therefore the underlying groundwater receptor is considered to be sensitive. Groundwater abstraction is also shown to be active within 1 km of the site and therefore the potential impact of further migration of on-site contaminants poses an unacceptable risk to off-site receptors.

Surface water samples obtained from the Pymmes Brook did not identify exceedances of TPH or PAHs; there was only a single exceedance recorded that was for ammonium in the downstream sample. Notwithstanding this, it is not possible to fully discount this as a receptor at this stage due to the degree of contamination encountered at the site, in close proximity to the receptor.

As the contamination identified in the groundwater is considered to present an unacceptable risk to controlled waters receptors, further assessment in the form of detailed quantitative risk assessment (DQRA) is recommended. This will inform the need for any remediation across the site and will also appraise the likelihood that dissolved phase concentrations identified onsite are reaching and impacting the Pymmes Brook.

Atkins is aware of plans to restore some sections of the Pymmes Brook by removal of the concrete culvert. It is understood this does not currently include the section directly adjacent to the site, however changes to the river elsewhere may affect groundwater and surface water levels, flows and interactions at the site. It is recommended that this impact is incorporated into the DQRA.

The historical potential underground tank in the east of the site has not been encountered or delineated at this stage, and as such may be acting as an ongoing source of hydrocarbon contamination in groundwater. It should be assumed to be present and incorporated into any future remediation at the site.

The presence of LNAPL and DNAPL at the site also present an ongoing source of contamination to groundwater and it is likely that further investigation, and subsequent assessment is required. This will provide information for any future remediation options appraisal.

6. Refined Conceptual Site Model

Following the site investigation and the human health and controlled waters GQRAs presented in Sections 4 and 5 respectively, the CSM reported in Section 3 has been updated. All changes from the CSM presented in Section 3 are shown in bold. A graphical CSM is provided in Figure 13.

Table 6-1 - Refined CSM Summarising PCLs for Current and Future End Use

Source	Receptor	Pathway	Potential Consequence of Complete Contaminant Linkage	Likelihood of Complete Contaminant Linkage	Risk Rating
Source 1 - Made Ground associated with past and current industrial use including a civil engineering works, a bus depot and commercial builders yard.	On-site workers	Direct contact and / or ingestion with contaminated soils and / or groundwater	Medium	Unlikely	Low
	On-site workers in excavations	Direct contact and / or ingestion with contaminated soils and / or groundwater	Medium	Low likelihood	Moderate / Low
	Secondary A Aquifer (Kempton Park Gravels)	Leaching/dissolution from contaminated soil/NAPL	Medium	Likely	Moderate
	Surface water (Pymmes Brook)	Leaching/dissolution from contaminated soil/NAPL followed by migration in groundwater	Medium	Likely	Moderate
		Migration via surface water/drainage	Medium	Likely	Moderate
		NAPL migration and discharge to surface water	Medium	Likely	Moderate
		Soil erosion/surface flooding resulting in discharge of contaminants to surface water	Medium	Likely	Moderate
Source 2 – Asbestos in soils associated with the historical development of the site and infilled ponds.	On-site workers	Dust/fibre inhalation	Severe	Low likelihood	Moderate
	On-site workers in excavations	Dust/fibre inhalation	Severe	Unlikely	Moderate / Low
	Off-site residents	Dust/fibre inhalation and inhalation/direct contact with dusts that have blown off-site	Severe	Unlikely	Moderate / Low
	Off-site workers	Inhalation/direct contact with dusts that have blown off-site	Severe	Unlikely	Moderate / Low

Source	Receptor	Pathway	Potential Consequence of Complete Contaminant Linkage	Likelihood of Complete Contaminant Linkage	Risk Rating
	Off-site workers in excavations	Inhalation/direct contact with dusts that have blown off-site	Severe	Unlikely	Moderate / Low
Source 3 – Made Ground associated with infilled ponds and sludge pit located in the south of the site	On-site workers	Direct contact and / or ingestion with contaminated soils and / or groundwater	Medium	Unlikely	Low Risk
	On-site workers in excavations	Direct contact and / or ingestion with contaminated soils and / or groundwater	Medium	Low likelihood	Moderate / Low
	Off-site workers	Inhalation of ground gases / ground vapours from contaminated soils	Severe	Unlikely	Moderate / Low
	Secondary A Aquifer (Kempton Park Gravels)	Leaching/dissolution from contaminated soil/NAPL	Medium	Likely	Moderate
	Surface water (Pymmes Brook)	Leaching/dissolution from contaminated soil/NAPL followed by migration in groundwater	Medium	Likely	Moderate
		Migration via surface water/drainage	Medium	Likely	Moderate
		NAPL migration and discharge to surface water	Medium	Likely	Moderate
		Soil erosion/surface flooding resulting in discharge of contaminants to surface water	Medium	Likely	Moderate
Source 4 – Historical suspected below ground	On-site workers	Direct contact and / or ingestion with contaminated soils and / or groundwater	Medium	Unlikely	Low

Source	Receptor	Pathway	Potential Consequence of Complete Contaminant Linkage	Likelihood of Complete Contaminant Linkage	Risk Rating
fuel tank in central eastern part of site	On-site workers in excavations	Direct contact and / or ingestion with contaminated soils and / or groundwater	Medium	Low likelihood	Moderate / Low
	Secondary A Aquifer (Kempton Park Gravels)	Leaching/dissolution from contaminated soil/NAPL	Medium	Likely	Moderate
	Surface water (Pymmes Brook)	Leaching/dissolution from contaminated soil/NAPL followed by migration in groundwater	Medium	Likely	Moderate
		Migration via surface water/drainage	Medium	Likely	Moderate
		NAPL migration and discharge to surface water	Medium	Likely	Moderate
		Soil erosion/surface flooding resulting in discharge of contaminants to surface water	Medium	Likely	Moderate
Source 5 – Historical above ground fuel storage tank associated with the former use of the site as a bus depot	Secondary A Aquifer (Kempton Park Gravels)	Leaching/dissolution from contaminated soil/NAPL	Medium	Likely	Moderate
	Surface water (Pymmes Brook)	Leaching/dissolution from contaminated soil/NAPL followed by migration in groundwater	Medium	Likely	Moderate
		Migration via surface water/drainage	Medium	Likely	Moderate
		NAPL migration and discharge to surface water	Medium	Likely	Moderate

Source	Receptor	Pathway	Potential Consequence of Complete Contaminant Linkage	Likelihood of Complete Contaminant Linkage	Risk Rating
		Soil erosion/surface flooding resulting in discharge of contaminants to surface water	Medium	Likely	Moderate
Source 6 - Contaminated groundwater (perched groundwater and groundwater in the shallow Kempton Park Gravels impacted by hydrocarbon contamination)	Secondary A Aquifer (Kempton Park Gravels)	Migration to aquifer	Medium	Likely	Moderate
	Surface water (Pymmes Brook)	Migration in groundwater	Medium	Likely	Moderate
		Migration via surface water drainage	Medium	Likely	Moderate
	On-site workers	Direct contact and / or ingestion of contaminated groundwater	Medium	Unlikely	Low
	On-site workers in excavations	Direct contact and / or ingestion of contaminated groundwater	Medium	Low likelihood	Moderate / Low
	Off-site workers	Inhalation of ground gases / ground vapours from contaminated groundwater	Severe	Unlikely	Moderate / Low
Source 7 - Light non-aqueous phase liquid (LNAPL) within the Made Ground / Alluvium.	Secondary A Aquifer (Kempton Park Gravels)	Leaching/dissolution from contaminated soil/NAPL	Medium	Likely	Moderate
		Migration to aquifer	Medium	Likely	Moderate
	Surface water (Pymmes Brook)	Leaching/dissolution from contaminated soil/NAPL followed by migration in groundwater	Medium	Likely	Moderate
		Migration via surface water drainage	Medium	Likely	Moderate
		NAPL migration and discharge to surface water	Medium	Likely	Moderate

Source	Receptor	Pathway	Potential Consequence of Complete Contaminant Linkage	Likelihood of Complete Contaminant Linkage	Risk Rating
	On-site workers	Direct contact and or ingestion of contaminated groundwater	Medium	Unlikely	Low
	On-site workers in excavations	Direct contact and or ingestion of contaminated groundwater	Medium	Low likelihood	Moderate / Low
	Off-site workers	Inhalation of ground gases / ground vapours from contaminated soils	Severe	Unlikely	Moderate / Low
Source 8 – Off-site sources associated with former gasworks/surrounding historical industry	Secondary A Aquifer (Kempton Park Gravels)	Migration of NAPL/contaminated groundwater on-site	Medium	Likely	Moderate
Source 9 – Two above ground bunded fuel tanks adjacent to depot building (2 1400L tanks)	Secondary A Aquifer (Kempton Park Gravels)	Leaching/dissolution from contaminated soil/NAPL	Medium	Likely	Moderate
	Surface water (Pymmes Brook)	Leaching/dissolution from contaminated soil/NAPL followed by migration in groundwater	Medium	Likely	Moderate
	Secondary A Aquifer (Kempton Park Gravels)	Migration via surface water/drainage	Medium	Likely	Moderate
		NAPL migration and discharge to surface water	Medium	Likely	Moderate
		Soil erosion/surface flooding resulting in discharge of contaminants to surface water	Medium	Likely	Moderate
Source 10 – Two disused trailer bowzers	Secondary A Aquifer (Kempton Park Gravels)	Leaching/dissolution from contaminated soil/NAPL	Medium	Likely	Moderate

Source	Receptor	Pathway	Potential Consequence of Complete Contaminant Linkage	Likelihood of Complete Contaminant Linkage	Risk Rating
associated with the site's former use	Surface water (Pymmes Brook)	Leaching/dissolution from contaminated soil/NAPL followed by migration in groundwater	Medium	Likely	Moderate
		Migration via surface water/drainage	Medium	Likely	Moderate
		NAPL migration and discharge to surface water	Medium	Likely	Moderate
		Soil erosion/surface flooding resulting in discharge of contaminants to surface water	Medium	Likely	Moderate

7. Summary and Recommendations

7.1. Summary of Remaining PCLs

The objective of the interpretive report comprised the compilation of available environmental databases and previous reports to construct an initial CSN, assessment of the site investigation data and the subsequent revision of the initial CSM. This revised CSM details the remaining PCLs that are considered to present potential risks to human health and controlled waters receptors. These are the drivers for further stages of assessment.

The sources that require further assessment following the 2023 Atkins site investigation are largely related to potential risks to controlled waters, namely the Secondary A Aquifer beneath the site and the nearby Pymmes Brook. These are summarised below:

- Source 1 – Impacted Made Ground across the site;
- Source 3 – Made Ground associated with the infilled pond and sludge pit;
- Source 4 – Historical below ground fuel tank in the central eastern extent of the site;
- Source 5, 9 and 10 – Former above ground fuel tanks;
- Source 6 – Contaminated groundwater (perched in the Made Ground and in the Kempton Park Gravels); and,
- Source 7 – NAPL in the Made Ground and Alluvium.

It is noted that Source 8 (historical off-site industrial land use including the gasworks to the north) is considered to be acting as a continuous source of contamination to the Secondary A Aquifer to the north of the site.

There is a potential vapour risk to off-site users of the commercial buildings to the west and south of the south of the site, associated with the impacted soils, groundwater and NAPL identified in the south of the site (Source 3 and 7). This requires further consideration.

Due to the historical redevelopment of the site, asbestos should be presumed to be present in the shallow Made Ground and infilled ponds. Whilst this is unlikely to present an unacceptable risk to future site end users due to the presence of hardstanding across most of the site, there is considered to be a moderate risk (Source 2) to existing site users due to the exposed soils to the rear of the depot building. There is also a moderate risk to future earthworks, remediation and construction works. Asbestos should be included as a potential hazard for such works and appropriate mitigation measures incorporated.

7.2. Recommendations and Conclusions

The previous data from 2013 and the newly obtained data from 2023 used in the assessment is considered relevant to the risks being assessed related to human health and controlled waters. All data has been obtained from within the site boundary and the principal sources of contamination identified at the site are considered to pre-date the historical investigations. Representative site conditions are considered to have been investigated.

A detailed quantitative risk assessment (DQRA) for controlled waters is required to further assess the potentially unacceptable risks to controlled waters from impacted soil and groundwater during all phases of the proposed development.

A remediation strategy is likely to be required, following the completion of the DQRA, due to the close proximity of the receptors to the site and to accord with Requirement 11 of the DCO for the proposed scheme. Remediation of the Made Ground and superficial deposits are likely to be required to mitigate unacceptable risks to controlled waters.

Further intrusive investigation is recommended across the site to refine and delineate shallow contamination in the north and deeper impacted soils in the south of the site. This will reduce the uncertainty around contamination sources and impacted soil zones to facilitate the design of the remediation. This investigation should also be targeted at the location for source 4, the suspected below ground tank, to understand the extent of the tank and the condition of this structure.

The NAPL in the south of the site is likely to require a degree of remedial action to limit the ongoing risks to controlled waters. This will also remove any potential risks from vapour ingress to off-site existing buildings and to make the site suitable for the future use as an operational substation.

8. References

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Figures

Appendices