

11. Ground Conditions

Environmental Statement

Volume I

11 Ground Conditions

Introduction

- 11.1 This chapter of the Environmental Statement (ES) reports the findings of an assessment of the likely significant effects on ground conditions as a result of the proposed Peel Centre Hybrid Planning Application (hereafter referred to as the 'Proposed Development') in the London Borough of Barnet (LBB).
- 11.2 In particular, it considers the potential effects on the current ground conditions including potential contamination risks associated with the historical activities undertaken at the Site. It assesses how the redevelopment of the Site may affect existing ground conditions which might have subsequent effects on sensitive receptors at and near to the Site such as groundwater, current and future Site users and sub-surface services. Where appropriate, measures to prevent, minimise or control those effects are presented and residual effects following the adoption of those measures are assessed. The potential for effect interactions and combined effects ('Type 1' effects) and combined cumulative effects ('Type 2' effects) of the Proposed Development with other development schemes are discussed in **Chapter 18: Effect Interactions and Cumulative Effect Assessment**.
- 11.3 This assessment and ES chapter has been produced by URS Infrastructure and Environment UK Limited (URS).

Legislation and Planning Policy Context

National Legislation

- 11.4 There are three key legislative drivers for dealing with risks to human health and the environment from historical land contamination, namely:
- Part 2A of the Environment Protection Act (EPA) 1990 (the Contaminated Land Regime) (Ref. 11-5);
 - The Water Resources Act, 1991 (Ref. 11-6); and
 - The Town and Country Planning Act(s), 1990, and subsequent amendments (Ref. 11-7).
- 11.5 Part 2A of the EPA, as introduced by Section 57 of the Environment Act 1995 (Ref. 11-8), provides the legislative framework within which site data are to be assessed. Under Part 2A sites are identified as 'contaminated land' if they are causing significant harm or if there is a significant possibility of significant harm or if the Site is causing, or could cause, pollution of controlled waters. Controlled waters are defined as including both surface and groundwaters.
- 11.6 The Water Act 1991 and its subsequent amendments (2003 and 2009) (Ref. 11-9) introduced a revision to the wording of the EPA, which now requires that if a site is causing or could cause significant pollution of controlled waters it may be determined as contaminated land. Once a site is determined to be "contaminated land" then remediation is required to render significant pollutant linkages insignificant (i.e. the source-pathway-receptor relationships that are associated with significant harm to human health and/or significant pollution of controlled waters), subject to a test of reasonableness. The Water Resources Act 1991 provides statutory protection for controlled waters (streams, rivers, canals, marine environment and groundwater) and makes it an offence to make a discharge to controlled waters without the permission or consent of the regulators of these areas.
- 11.7 The Building Act (Ref. 11-10) and the Building Regulations (Ref. 11-11) are the two key legislative drivers when considering structural and design aspects of a development proposal in terms of geotechnical properties of the ground. The Building Regulations require that buildings are constructed so that ground movement caused by swelling, shrinkage, freezing, landslip or subsidence of the sub-soils will not impair the stability of any part of the building.

National Planning Policy and Guidance

National Planning Policy Framework (2012)

- 11.8 The National Planning Policy Framework (NPPF) (Ref. 11-12) was published in March 2012, replacing Planning Policy Statement (PPS) 23: 'Planning and Pollution Control' (Ref. 11-13), and Planning Policy Guidance 14 (PPG14) 'Development on Unstable Land' (Ref. 11-14). The NPPF confirms that land contamination and its risk to health should be a material consideration under planning and development control. Of importance is land contamination and its risk to human health in the context of the intended end use of the Site.
- 11.9 Section 109 of the NPPF states that: "*The planning system should contribute to and enhance the natural and local environment by:*...
- *Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability; and*
 - *Remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.*"
- 11.10 A core planning principle described in Section 111 of the NPPF states that "*Planning policies and decisions should encourage the effective use of land by re-using land that has been previously developed (brownfield land), provided that it is not of high environmental value.*"
- 11.11 In Section 121 it also states that: "Planning policies and decisions should also ensure that:
- *The Site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation;*
 - *After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990; and*
 - *Adequate site investigation information, prepared by a competent person is presented.*"

National Planning Practice Guidance (2014)

- 11.12 The National Planning Practice Guidance (NPPG) (Ref 11-43) was launched on the 6th March 2014 and provides a web-based resource in support of the NPPF. Following public consultation on a 'beta' version ending on 9th October 2013, the NPPG has been amended to include greater emphasis on the importance of bringing brownfield land into use and issuing more robust guidance with regards to flood risk.
- 11.13 Following its launch, a number of previously published planning guidance documents have been cancelled and are detailed within the Written Ministerial Statement titled 'Making the planning system work more efficiently and effectively' (Ref 11-44), also dated 6th March 2014.
- 11.14 The NPPG contains no changes relative to the NPPF or additional information that are relevant to ground conditions.

Regional Planning Policy

The London Plan – Spatial Development Strategy for Greater London (2011)

- 11.15 The London Plan 2011 (Ref. 11-14) was formally adopted in July 2011. It sets out the new spatial development strategy for Greater London. The London Plan sets out an integrated economic, environmental, transport and social framework for the development of London over a 20-25 year period (to 2031).

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11.16 Of particular reference to ground conditions is Strategic Policy 5.21 – Contaminated Land. The policy states that:

- “The Mayor supports the remediation of contaminated sites and will work with strategic partners to ensure that the development of brownfield land does not result in significant harm to human health or the environment and to bring contaminated land to beneficial use”.

11.17 In addition, the policy requires that appropriate measures should be taken to ensure that development on previously contaminated land does not activate or spread contamination.

11.18 The London Plan (2011) identifies Colindale and Burnt Oak as an Opportunity Area and in doing so sets a minimum delivery target of 12,500 homes and 2,000 jobs across the area to 2031.

Revised Early Minor Alterations to the London Plan (October 2013)

11.19 The Revised Early Minor Alterations (REMA) (Ref. 11-15), published for consultation in June 2012, set out proposed minor alterations to the London Plan Policy to ensure consistency with the NPPF. The REMA underwent Examination in Public in November 2012 and was published by the Mayor on 11 October 2013. From this date, the REMA are operative as formal alterations to the London Plan (the Mayor’s spatial development strategy) and forms part of the development plan for Greater London.

11.20 As part of this update, the Mayor conducted a policy by-policy assessment of the London Plan’s consistency with the NPPF, following advice from leading counsel. As such a number of minor alterations have been made to the London Plan.

11.21 The revision added new paragraph 5.95A to support Policy 5.21 – Contaminated Land. Paragraph 5.95A states that:

- “Where potentially contaminating activities are proposed, development should include appropriate measures to mitigate any potential harmful effects.”

11.22 The revision also amends clause A and adds new clause D of Policy 5.22 Hazardous Substances and Installations. Policy 5.22 states:

- “Strategic:
 - The Mayor will work with all relevant partners to ensure that hazardous substances, installations and materials are managed in ways that limit risks to London’s people and environment. He will consider publishing supplementary guidance to support the application of this policy.
- Planning Decisions:
 - When assessing developments near hazardous installations:
 - Site specific circumstances and proposed mitigation measures should be taken into account when applying the Health and Safety Executive’s Planning Advice Developments near Hazardous Installations (PADHI)¹ methodology.
 - The risks should be balanced with the benefits of development and should take account of existing patterns of development.
- LDF Preparation:
 - A. In preparing LDFs, boroughs should:
 - a. Identify the locations of major hazards (including pipelines carrying hazardous substances).
 - b. Consult and give due weight to advice from the Health and Safety Executive to ensure that land use allocations take account of proximity to major hazards.

c. Consult utilities to ensure that the timing of decommissioning and the implications for development are reflected in proposals.

d. Ensure that land use allocations for hazardous installations take account of the need to incentivise and fund decommissioning.

B. Boroughs should periodically review consents granted under the Planning (Hazardous Substances) Act 1990 to ensure they reflect current conditions and the physical capacity of the Site”.

Draft Further Alterations to the London Plan (2014)

11.23 On 15 January 2014, the Mayor published Draft Further Alterations to the London Plan (Ref.11-16) for a twelve week period of public consultation. The further alterations have been prepared primarily to address key housing and employment issues emerging from an analysis of census data released since the publication of the London Plan in July 2011, and which indicate a substantial increase in the capital’s population.

11.24 These Further Alterations to the London Plan are not anticipated to have any effect on the content or recommendations of this chapter.

Local Planning Policy

London Borough of Barnet Core Strategy Development Plan Document (2012)

11.25 The LBB Core Strategy (CS) (Ref 11-17) was adopted on 11 September 2012 and the planning policies therein replaced those in the Unitary Development Plan (2006). The Core Strategy provides a shared vision of what LBB will be like in 2026; Local Development Framework policies are expected to accord with the strategic direction and key planning policies outlined in the Core Strategy. The strategy provides a basis for more detailed design guidance on suburban streets whose residential character has changed or may change in future. The Proposed Development lies within one of Barnet’s Regeneration Development areas where the Core Strategy promotes major regeneration as a key objective.

London Borough of Barnet Local Plan Development Management Policies (DMP) (2012)

11.26 The DMP document (Ref 11-18) was adopted by LBB on 11 September 2012. It is envisaged by the Council that the DPD will shape the suburb in the future and help to create attractive new buildings and neighbourhoods by providing the policy framework to restrict inappropriate increases in urbanisation.

11.27 Relevant ground conditions policies include Policy DM04: Environmental Considerations which states that:
‘Proposals on land which may be contaminated should be accompanied by an investigation to establish the level of contamination in the soil and/or groundwater/surface waters and identify appropriate mitigation. Development which could adversely affect the quality of groundwater will not be permitted’

Colindale Area Action Plan (AAP) (2010)

11.28 The LBB sets out the framework for future development and change in the AAP (2010 (Ref 11-45). The AAP identifies that the western section of the Site lies within the Colindale Avenue Corridor of Change and the eastern part of the Site lies within the Aerodrome Road Corridor of Change which identifies these areas primarily for residential-led mixed use development.

Other Relevant Policy, Standards and Guidance

11.29 The EA Pollution Prevention Guidance Notes (PPGN) provide advice on statutory responsibilities and good environmental practice. The Guidance Notes of particular relevance to the Proposed Development and ground conditions include:

- PPGN1 - General guide to the Prevention of Pollution (Ref. 11-19). This provides an introduction to the principles of pollution prevention and the EA’s pollution prevention guidance note series;

¹ PADHI – HSE’s Planning Land Use Methodology Health and Safety Executive September 2009

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- PPGN 2: Above Ground Oil Storage Tanks (Ref. 11-20) provides guidance to those responsible for the storage of oil on construction sites. The document provides guidance on location, bunding, protection and operation of stored oils in addition to maintenance and brief guidance on dealing with spills;
 - PPGN5 - Works In, Near or Liable to Affect Watercourses (Ref. 11-21). This provides guidance on general precautions to take when working in the vicinity of a watercourse, along with more specific measures to prevent contamination and to minimise any adverse impacts;
 - PPGN6 - Working at Construction or Demolition Sites (Ref. 11-22). This is a document that mirrors much of PPGN5, but with particular emphasis on the situations likely to occur at construction or demolition sites; and
 - PPGN21 - Pollution Incident Response (Ref. 11-23). This document assists those developing site specific pollution incident response plans to prevent and mitigate damage to the environment caused by accidents such as spillages and fires.
- 11.30** Other relevant legislation and guidance includes:
- Environmental Permitting (England and Wales) Regulations 2010 (Ref. 11-24);
 - The Hazardous Waste (England and Wales) Regulations 2005 (amended 2009) (Ref. 11-25);
 - Contaminated Land (England) (Amendment) Regulations 2012 (Ref. 11-26);
 - Environmental Damage (Prevention and Remediation) Regulations 2009 (Ref. 11-27);
 - The Anti-Pollution Works Regulations (1999), (Ref.11-28)
 - Contaminated Land, DEFRA Circular 01/2006 (Ref. 11-39);
 - EA Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination (Ref.11-30);
 - Human Health Toxicological Assessment of Contaminants in Soil, Science Report SC050021/SR2 (Ref. 11-31);
 - EA (2004); Model Procedures for the Management of Land Contamination, Contaminated Land Report 11 (CLR 11) (Ref. 11-32);
 - EA (2010); Guiding Principles for Land Contamination (GPLC 1, 2 and 3) (Ref. 11-33);
 - Construction Industry Research and Information Association (CIRIA) Guidance C532, 'Control of Water Pollution from Construction Sites' (Ref. 11-34);
 - The Chartered Institute of Environmental Health Local Authority Handbooks (Ref. 11-35);
 - BS 8485:2007 Code of practice for the characterization and remediation from ground gas in affected developments (Ref. 11-36); and
 - Guidance C665, 'Assessing Risks Posed by Hazardous Ground Gases to Buildings' (Ref. 11-42).
- Assessment Methodology and Effect Significance Criteria**
- 11.31** The assessment of ground conditions has involved the review and collation of information pertaining to the current condition of the soils and groundwater at the Site and the risks they pose to the environment and future site users. This information has been used to characterise baseline conditions for the Site and assess the need for mitigation to protect future users and the environment from any significant contaminant source identified. The information has been reviewed in the context of the Proposed Development to create a conceptual site model and assess the magnitude of change and significance of potential effects.
- 11.32** Examination of publicly accessible information databases and enquiries with other data suppliers have been made to determine baseline conditions on and surrounding the Site which are outlined in the following Baseline Conditions section. Publically available information was obtained from the following sources:
- Environment Agency (EA);
 - Ordnance Survey (OS);
 - British Geological Survey (BGS); and
 - Landmark Information Group Ltd (**ES Volume III: Appendix G**) (Ref. 11-1).
- 11.33** In addition, reference has been made to the following third party reports:
- GVA (July 2012). Peel Centre Site, Colindale, Environmental Impact Scoping Report (Ref. 11-2);
 - WSP (August 2012). Preliminary Geo-environmental Risk Assessment, The Peel Centre, Hendon (**ES Volume III: Appendix G**) (Ref. 11-3); and
 - Zetica, (March 2014). Sitesafe UXO Desk Study, Colindale, London Borough of Barnet (**ES Volume III: Appendix G**) (Ref. 11-4).
- 11.34** A walkover of the Site was also completed by URS on 31 March 2014 to determine any current potential ground contamination issues or likely sources of contamination.
- 11.35** No field data has been gathered or intrusive investigation undertaken during the compilation of this chapter. All data sources are referenced as relevant in the following sections.
- 11.36** This section of this ES chapter presents the following:
- Identification of the information sources that have been consulted throughout preparation this chapter;
 - Details of the consultation undertaken with respect to ground conditions;
 - The methodology behind the assessment of ground conditions effects, including the criteria for the determination of sensitivity of receptor and magnitude of change from the existing or 'baseline' condition;
 - An explanation as to how the identification and assessment of potential ground conditions effects has been reached; and
 - The significance criteria and terminology for assessment of the residual ground conditions effects.
- 11.37** It should be noted that Outline and Detailed Components of the Proposed Development have been assessed together, as they have no bearing on the assessment methodology. A robust worst case has been assumed taking into consideration the maximum parameters and the detailed layouts.
- 11.38** The Proposed Development will be carried out in three main Development Stages (with associated sub-phases) although the ES will also make reference to particular 'timeslices' during phases of the demolition and construction where parts of the Proposed Development are complete and may be occupied by future residents.
- Methodology for Determining Baseline Conditions and Sensitive Receptors*
- 11.39** The information used in the assessment for the baseline characterisation of ground conditions has been obtained from the sources detailed earlier in this chapter. A review of the baseline conditions has allowed for the identification of the potential sources of land contamination across the Site.
- 11.40** Whilst the focus of the assessment is on land contamination in terms of ground conditions, geology, hydrogeology and hydrology, other ground related aspects have been considered, including underground obstructions, the potential for Unexploded Ordnance (UXO), underground structures and utilities, and other geotechnical considerations, such as land stability.

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- 11.41 Current UK guidance advocates the use of a conceptual risk assessment model. The three conditions shown below comprise the basis of this approach in that, without each of the three elements ('source', 'pathway' and 'receptor'), there can be no contamination risk. Therefore, the presence of measurable concentrations of contaminants within the ground and subsurface environment does not automatically imply that a contamination problem exists, since the contamination must be defined in terms of pollutant linkages and unacceptable risk of harm.
- 11.42 The nature and importance of both pathways and receptors, which are relevant to a particular site, will vary according to the intended use of the Site, its characteristics, and its surroundings. The potential for harm to occur requires three conditions to be satisfied:
- The presence of substances (potential contaminants/pollutants) that may cause harm ('source' of pollution);
 - The presence of a receptor which may be harmed (e.g. the water environment or humans, buildings, fauna and flora) (the 'receptor'); and
 - The existence of a linkage between the source and the receptor (the 'pathway').
- 11.43 Receptors potentially sensitive to changes in ground conditions have been identified following the assessment of baseline conditions and the identified sources of contamination.
- 11.44 Each receptor has been assigned a level of sensitivity. The level of sensitivity is based on a variety of considerations including but not limited to, national, regional and local designations, the function of a receptor, e.g. whether an aquifer which underlies a site is used as a potable water supply or not and the end use of parts of a Proposed Development (e.g. commercial end use).
- 11.45 In terms of ground conditions, sensitive receptors are defined in Table 11-1.

Table 11-1 Criteria for Assessing Sensitivity of Contamination Receptors

Sensitivity	Definition	Future Site Users and Surrounding Land Users	Demolition and Construction Workers	Ground-water	Built Environment
Very High	Environment responds to major change(s) e.g. agricultural land use for food production, allotments.	Residential with plant uptake, and allotments	Extensive earthworks, and demolition of buildings	Principal Aquifers	Buildings, including services and foundations of historic significance
High	Environment clearly responds to effect(s) in quantifiable and / or qualifiable manner e.g. low grade agricultural land, recreational ground.	Residential without plant uptake	Limited earthworks	Secondary A Aquifers	Buildings, including services and foundations
Medium	Environment responds in a minimal way such that only minor changes are detectable e.g. landscaped areas.	Commercial landscaping or open space areas	Minimal disturbance of ground	Secondary B Aquifers	Infrastructure (roads, bridges, railways)
Low	Environment is insensitive to impact, no discernible changes e.g. soils are not in use, the land has an industrial / commercial land use and / or mainly covered by hard standing.	Industrial land covered by hard standing	No disturbance to ground	Unproductive Strata (Non-Aquifers)	Minor industrial development without subsurface services

11.46 In defining the criteria for receptor sensitivity, industry standards and best practice guidance have been taken into consideration where appropriate.

- 11.47 Following identification of the potential sources of ground contamination and having taken into consideration other ground related aspects such as the presence or absence of above and below ground storage tanks, asbestos and other sub surface utilities and structures, the likely pathways between the source of contamination or other ground related aspects and the receptor have been identified.
- 11.48 After defining the sources, the pathways and receptors, potential impacts (pre-mitigation) have been qualitatively defined.
- 11.49 Table 11-2 presents an example source-receptor-pathway interaction leading to a potential impact.

Table 11-2 Example of Source-Receptor-Pathway Interaction

Source	Receptor	Receptor Sensitivity	Pathway	Potential Impact
Hydrocarbon contamination in soil materials disturbed and volatised during earth works	Demolition and Construction Site Workers	High	E.g. Inhalation and dermal contact with hydrocarbon impacted soils and dusts.	Impact to human health.

Methodology for Determining Demolition, Construction, and Operational Effects

- 11.50 Following the determination of the baseline conditions and sensitive receptors, the methodology for identifying the potential ground conditions related effects as a result of the Proposed Development is based on the following stages:
- Preparation of a conceptual site model, identifying feasible pollution sources and pathways during the demolition and construction works and once the Proposed Development is completed and operational;
 - Determination of the magnitude of change of the potential impacts of the Proposed Development on the sensitive receptors;
 - Evaluation of the significance of the effects, relative to the receptor sensitivity; and
 - Identification of suitable and appropriate mitigation measures, for all key stages of the Proposed Development (i.e. demolition / construction and operation). An assessment is then made of the significance of any residual effects.

Significance Criteria

Magnitude of Change

11.51 The magnitude of change, or how considerable the change to the ground conditions are from the baseline conditions, as a result of an activity or action resultant from demolition, construction and operational phases of the Proposed Development, has been classified as either being: **major, moderate, minor** or **negligible**. The criteria and their respective magnitude of change classification are detailed further within Table 11-4.

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Table 11-3 Criteria for assessing magnitude of change from baseline conditions

Magnitude of Change	Receptor Description
High	Demolition and Construction works: Activities result in a major pollution release ¹ or create/remove a pollutant linkage with a substantial pollutant source . Serious risk / improvement to human health / life . Completed Operational Development: The development introduces or removes a large-scale source of potential contamination or pollutant linkage .
Medium	Demolition and Construction works: activities result in a moderate pollution release ² or create/remove a pollutant linkage with moderate pollutant source . Moderate risk / improvement to human health / life . Completed Operational Development: The development introduces or removes a relatively small-scale source of potential contamination or pollutant linkage . NB. For the purposes of this report only, URS have divided temporary changes into short-term (up to 1 month), medium term (up to 6 months) and long term (longer than 6 months).
Low	Demolition and Construction works: activities result in a minor pollution release ³ or create/remove a pollutant linkage with a minor pollutant source . Temporary pathway or receptor is introduced or removed during demolition or construction. Minor risk / improvement to human health . Completed Operational Development: The development introduces or removes a minor source of potential contamination or pollutant linkage .
Very Low	An insignificant pollution release or creation / removal of a pathway with an insignificant pollutant source . No / reversible affect to human health . No foreseeable measurable change to the existing conditions. No appreciable impacts / reversible impacts .
<p>1. A major pollution release corresponds to a Category 1 pollution incident, which is defined by the Environment Agency as having persistent and extensive effects on water, land and air quality, major damage to all ecosystems, closure of a potable abstraction, major impact on land, property, major impact on amenity value, major damage to agriculture and/ or commerce and serious impact upon man.</p> <p>2. A moderate pollution release corresponds to a Category 2 pollution incident, which is defined by the Environment Agency as having a significant effect on water, land and air quality, significant damage to all ecosystems, non-routine notification of abstractors, significant impact on land, property, reduction in amenity value, significant damage to agriculture and/ or commerce and impact on man.</p> <p>3. A minor pollution release corresponds to a Category 3 pollution incident, which is defined by the Environment Agency as having a minimal effect on water, land and air quality, minor damage to local ecosystems, marginal effect on amenity value and minimal impact to agriculture and/ or commerce.</p>	

11.52 A level of significance has been assigned to both potential effects (pre-mitigation) and residual effects (post mitigation). Essentially, the combination of the sensitivity of the receptor and the magnitude of change from the baseline condition as a result of the Proposed Development, qualitatively assess the significance of the effect. Table 11-4 presents the matrix for defining the effect significance.

11.53 Effects have the potential to be **adverse, beneficial** or **negligible**. For example, in terms of beneficial effects, the Proposed Development may remove a source of contamination or it may close a pathway that currently links a source to a receptor.

11.54 Effects also have the potential to be **temporary** (short (weeks / months), medium (years) or long (decades) term) or **permanent** and can occur at **local** (on-site or in close proximity to the area), **district** (within the LBB), **regional** (within Greater London), **national** (UK), or **international** levels.

11.55 With regards to the residual effect significance, the level of significance takes into account not only the sensitivity of the receptor and the magnitude of the change, but the mitigation measures applied to reduce the likelihood of significant effects to receptors.

Table 11-4 Criteria for assessing Effect Significance

Receptor Sensitivity	Magnitude of Change			
	Large	Medium	Small	Negligible
High	Major	Major	Moderate	Negligible
Moderate	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

11.56 The following descriptors have been used for assessing effect significance:

- **Major Adverse:** Potential serious or moderate risk to human health of Site workers or neighbouring uses, occupiers and the general public immediately adjacent to or in proximity of the Site. Major or moderate pollution release or creation of a pollutant linkage with a substantial or moderate pollutant source to Principal Chalk Aquifer and nationally designated / protected areas. Major pollution release or creation of a pollutant linkage with a substantial pollutant source to Secondary Aquifer, Secondary Undifferentiated Aquifer and regionally designated / protected areas or local areas;
- **Moderate Adverse:** Potential minor risk to human health of Site workers or neighbouring uses, occupiers and the general public immediately adjacent to or in proximity of the Site. Potential serious risk to human health of neighbouring uses, occupiers and the general public >100m from the Site. Potential serious risk to land stability. Major pollution release or creation of a pollutant linkage with a major pollutant source to Unproductive Strata. Moderate pollution release or creation of a pollutant linkage with a moderate pollutant source to Secondary Aquifer and regionally designated / protected areas or local areas. Minor pollution release or creation of a pollutant linkage with a minor pollutant source to Principal Chalk Aquifer and nationally designated / protected areas. Introduction of existing or new relatively small-scale source of potential contamination or pollutant linkage (via Existing and Proposed Development Introduced Materials, Structures and Services);
- **Minor Adverse:** Potential moderate pollution release or creation of a pollutant linkage with moderate pollutant source to Unproductive Strata. Potential moderate risk to land stability. Potential moderate risk to human health of neighbouring uses, occupiers and the general public >100m from the Site. Minor pollution release or creation of a pollutant linkage with a minor pollutant source to Secondary Aquifer, and Regionally designated / protected areas. Introduction of existing or new minor source of potential contamination or pollutant linkage (via Existing and Proposed Development Introduced Materials, Structures and Services);
- **Negligible:** Potential minor pollution release or creation of a pollutant linkage with minor pollutant source to Unproductive Strata and no / reversible effect to human health of neighbouring uses, occupiers and the general public >100m from the Site. Potential minor risk to land stability. An insignificant pollution release or creation / removal of a pathway with an insignificant pollutant source to all remaining sensitive receptors. No / reversible effect to human health of Site workers or neighbouring uses, occupiers and the general public immediately adjacent to or in proximity of the Site;
- **Minor Beneficial:** Potential removal of a pollutant linkage with moderate pollutant source to Unproductive Strata. Potential moderate improvement to human health of neighbouring uses, occupiers and the general public >100m from the Site Removal of a minor pollutant linkage with a minor pollutant source to Secondary Aquifer and regionally designated / protected areas. Removal of existing minor source of potential contamination or pollutant linkage (via Existing and Proposed Development Introduced Materials, Structures and Services);

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- **Moderate Beneficial:** Potential minor improvement to human health of Site workers or neighbouring uses, occupiers and the general public immediately adjacent to or in proximity of the Site. Potential serious improvement to human health of neighbouring uses, occupiers and the general public >100m from the Site. Potential serious improvement to land stability. Removal of major pollutant linkage with a major pollutant source to Unproductive Strata. Removal of a moderate pollutant linkage with a moderate pollutant source to Secondary Aquifer and regionally designated / protected areas or local areas. Removal of a minor pollutant linkage with a minor pollutant source to Principal Chalk Aquifer and nationally designated / protected areas. Removal of existing relatively small-scale source of potential contamination or pollutant linkage (via Existing and Proposed Development Introduced Materials, Structures and Services); and
- **Major Beneficial:** Potential serious or moderate improvement to human health of Site workers or neighbouring uses, occupiers and the general public immediately adjacent to or in proximity of the Site. Removal of a moderate pollutant linkage with a substantial or moderate pollutant source to Principal Chalk Aquifer and nationally designated / protected areas. Removal of a major pollutant linkage with a substantial pollutant source to Secondary Aquifer, Secondary Undifferentiated Aquifer and Regionally designated / protected areas or local areas.

11.57 Potential effects that are determined as being moderate or major are classed as 'significant' effects. Where an effect has been anticipated to be of negligible or minor, these are classed as 'insignificant' effects.

Consultation

11.58 URS issued an EIA Scoping Report to LBB on 24th March 2014 detailing the history of the Site, the Proposed Development and the scope and proposed content of the ES, including the Ground Conditions ES Chapter. With respect to Ground Conditions, LBB commented that due to the age of some of the existing buildings they may contain asbestos. As such the potential impact should be assessed in the ES and recommendations for any mitigation measures should be made in accordance with construction best practice. Taking this into consideration, this ES has included recommendations for a competent/licensed contractor to survey (pre site preparation survey as defined by the HSE) and remove asbestos and other materials and structures contaminated with asbestos fibres. In view of this this ES has assessed the significance of the risk.

11.59 The EA were also consulted and commented that developers should ensure that proposed piling methods do not pose a risk to controlled waters. If piling is proposed a Piling Risk Assessment will be required to demonstrate that the chosen piling method does not increase the risk of near surface pollutants migrating into deeper geological formations and aquifers. URS responded that a Piling Risk Assessment was not required during the EIA phase and was likely to form a condition attached to future planning permission. The risk assessment would be undertaken by the ground engineer/structural engineer prior to the construction phase.

Limitations and Assumptions

- 11.60 Where any data or information supplied by the Applicant or other external sources, including that from previous desk studies or reports has been used, it has been assumed that the information is correct.
- 11.61 The findings and opinions expressed are relevant to those dates of the reported enquiries and should not be relied upon to represent conditions at substantially later dates.
- 11.62 The assumptions and conclusions presented in this report are based upon information provided by the and from external third party sources (e.g. the EnviroCheck® Report, BGS maps, other consultants' desk study reports listed in the assessment methodology section above). URS have not independently verified the data included within other consultants reports.

Baseline Conditions

Site Walkover

11.63 A site walkover was undertaken by URS on 31st March 2014. Photographs taken during the walkover are presented in **ES Volume III: Appendix G**.

Onsite Operations

11.64 The Site is currently occupied by London's Metropolitan Police Service (MPS) and operated as a police training centre with open space designed for exercise and sporting activities. These facilities are reducing with the relocation/consolidation of MPS operations to the adjacent site.

11.65 The Site comprises office accommodation, residential dwellings (along Colindale Avenue and Rowan Drive) which include some campus style accommodation for those involved in Police Training activities), driver training areas, sport and athletic facilities (20.35 hectares in area), car parking spaces and an area of landscaping. Building heights on the Site currently range from one to 22 storeys (including plant) with the tall buildings located at the southern end of the Site.

Ancillary Structures

11.66 Two boiler houses were observed onsite, one near Peel House (east area of the Site) and another near Gate A, serving Simpson House (west area of the Site). Both oil and gas boilers were in use. White staining (likely to be water related) was observed on the floor beneath boilers. The boilers were bunded and on hardstanding.

11.67 Two electrical substations were observed in the Boiler House in the north-east of the Site and two within the underground tunnels beneath the Peel House tall buildings in the south-east of the Site. No access to these substations was possible during the walkover.

11.68 An electrical generator was located in the west of the Site immediately behind Simpson House to the south.

11.69 An above ground storage tank (AST) supplying the electrical standby generator was located in the south-western corner of the Site. The volume of the tank could not be ascertained during the Site walkover.

11.70 A fuel station was located within the retained area of the police training centre outside of the Application boundary adjacent north associated with a driving school. There were two petrol pumps and one diesel pump with associated underground storage fuel tanks (USTs). The station appeared to be well maintained.

Hardstanding/Landscaping

11.71 The Site comprises mostly softstanding and some landscaping (70% of the area) with the remaining areas covered by hardstanding. Vegetation appeared healthy and hardstanding was generally in good condition.

Topography

11.72 The Site is generally flat with a shallow gradient towards the Silk Stream to the south-west. The topographic survey shows that the Site slopes from 46.91m Above Ordinance Datum (AOD) in north-west to 45.71m AOD to the west, on that flank of the Site boundary. The southern Site boundary low point is approximately 42.63mAOD. The Site rises again to 52.39mAOD to the east and 47.73mAOD in the north-east corner.

Asbestos

11.73 During the Site walkover asbestos identification labels were present on a number of buildings onsite including the entrance to the Boiler House in the east of the Site.

Surrounding Land Uses

11.74 The retained area of the Metropolitan Police training centre lies immediately beyond the northern boundary of the Site. This area comprises (from west to east) a driving school with a large machine car wash, a Police

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Information Technology Organisation (PITO) building, a call centre, office building and stockpiles of demolished buildings, formerly a gym with swimming pool and other office buildings. At the time of the walkover the main reception and call centre were being demolished.

- 11.75 Beyond the retained part of the Site lies Aerodrome Road, north of which a new mixed residential and commercial development (Beaufort Park) was being constructed. The Royal Air Force museum exists beyond the new residential area.
- 11.76 The east Site boundary is adjacent to the West Coast Main Line and the M1, beyond which are residential properties.
- 11.77 Immediately south of the Site is the London Underground Northern Line and Cottenham Drive, beyond which is an area of dense vegetation then residential housing.
- 11.78 The west Site boundary is adjacent to Colindale Underground Station, beyond which there are a mixture of residential and commercial properties.

Historical Land Uses

11.79 The following history of the Site and surrounding area has been deduced from historical mapping obtained from the EnviroCheck® Report (*ES Volume III: Appendix G*).

Table 11-5 Historical Land Uses

Mapping Dates	Description
1873	Site is shown to be undeveloped open fields, with a railway line to the immediate east of the Site. Offsite a road 'Collin Deep Lane' is to the south, with a few isolated buildings along it. Watling Street (Roman Road) is shown to the south of the Site (around 750m from the boundary).
1897	Railway line immediately to the east is identified as 'Midland Railway'. A footpath crosses the south-east of the Site in a north-east to south-west direction. Silk Stream Junction is identified on the Midland Railway line, immediately east of the Site.
1920	Onsite - no significant change. Offsite, London Aerodrome is shown (approximately 100m to the north), along with the Central London Sick Asylum (approximately 100m to the west), Hangars associated with the Aerodrome are seen along the northern boundary. The British Museum has established a repository to the immediate west of the Site, beyond which rows of houses have appeared.
1936	Both onsite and offsite areas have been significantly developed. Onsite, the Metropolitan Police College has been established, which consists of a sports field and some buildings. A sign works and skid patch are both labelled in the western area. Offsite, some areas have become built up, including the establishment of part of the Metropolitan Police College. The Morden and Edgware railway line runs along the southern boundary of the Site, with Colindale station in the western corner of the Site. The Central London Sick Asylum is now called Colindale Hospital. The area north of the Site is still the aerodrome (no details shown), with a Motor Depot to the immediate North. According to RAF online historical information (www.rafmuseum.org.uk), the aerodrome was taken over by the Government in 1922 and became RAF Hendon in 1925. Car making is thought to have ceased in 1922. The area to the south of the Site has become a built up residential area with allotments, a recreation ground and a school in the vicinity. The railway line to the east has been renamed 'London Midland and Scottish Railway'. Further from the Site boundary, within 1000m, there is mixed residential and commercial land use including a Motor Body Works, Iron Foundry and Railway Sidings.

Mapping Dates	Description
1939	Onsite, as before. Offsite, the allotments to the southwest have been partly taken over by a Lacquer Works. Officers' Quarters are clearly marked immediately east of the Site. A Mineral Water factory is labelled around 900m south of the Site.
1948 – 1950 (Aerial photograph)	No significant change. The photograph is the first source to show the Aerodrome's three intersecting runways (approximately north to south, east to west and north-west to south-east. The aerodrome is now labelled as 'Hendon' (Aerodrome).
1951	No significant change
1967 – 1968	Onsite, the tennis courts in the eastern area are labelled for the first time; they have been present since the Police Training School was established. A new building appears to have been built in the north-eastern area, near Silk Stream Junction. Houses have been established in Peel Drive, in the south-eastern corner of the Site. According to RAF online, historical information (www.rafmuseum.org.uk) RAF flying transferred to Northolt in 1957, with a gliding school using the Site for a period afterwards before flying ceased altogether. The aerodrome was sold, with some land being retained in the south-east as the non-flying RAF base and Museum. Offsite, the runways are shown on the map.
1975 – 1978	Onsite, an athletics track has been built, along with new buildings to the west. Two significant buildings have also appeared in the south-eastern section. The building near Silk Stream Junction appears to have been taken down. The tennis courts are no longer shown and there has been some general rearrangement of site buildings – possibly with some pre-existing building having been modified and / or connected. These changes are consistent with the rebuilding of the training centre in 1974 reported in a GLA press release (2013). Offsite, significant change is seen on the Site of the former aerodrome north of the Site; the section sold in 1968 has been redeveloped for housing, schools, a library and car parks. The area retained by the RAF is still a base and museum.
1992 - 1993	Onsite, Peel Drive is labelled to the west of Rowan Drive (which was formerly labelled Peel Drive). Offsite, there has been little other change, though map detail is missing north of the Site. RAF Hendon is known from RAF online historical information (www.rafmuseum.org.uk) to have closed in 1988, with that site retaining the RAF museum.
2006	Onsite, no significant change. To the north, former RAF Hendon buildings south of the museum have been demolished. Only a vehicle testing centre and one unnamed building are shown where the previous RAF base buildings once stood.
2011	Onsite, no significant change. Pre-existing buildings to the south-west of the RAF Museum are clearly labelled 'Police HQ'. The area north-west of the Site has been partly redeveloped, with the area to the north-east remaining derelict.

Environmental Setting

Geology

11.80 The British Geological Survey (BGS) 1:50 000 scale geological map sheet number 256 (North London) (Ref 11-37) shows that the underlying solid geology at the Site comprises of the London Clay Formation. The map indicates an absence of superficial or drift deposits across the majority of the Site however given the history of development on the Site, it is likely that Made Ground will be present in places.

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11.81 In the vicinity of the Silk Stream offsite to the south, alluvial River Terrace Deposits comprising of sand, silt and clay are indicated.

11.82 Table 11-6 includes details of BGS boreholes in the vicinity of the Site and information from the BGS map. The boreholes reviewed as part of this assessment were TQ328NW24, TQ29SW110, TQNW124 and TQ29SW241 located approximately 10m north, 100m north, 175m south-west and 200m north of the Site boundary respectively.

Table 11-6 Geology

Stratum	Area Covered ¹	Thickness (m) ²	Typical Description ²
London Clay Formation	Entire Site	16 – 20	Firm to stiff fissured brown silty clay
Lambeth Group Formation	Entire Site	11.0	Firm to stiff fissured light blue mottled brown slightly silty clay.
White Chalk	Entire Site	Not proven	Chalk with flints

¹ From BGS Map No. 256.

² From BGS borehole logs

Hydrology and Hydrogeology

11.83 The nearest surface water receptor to the Site is the Silk Stream located approximately 75m to the south-west of the Site boundary. The EA Thames River Basin Management Plan states the Silk Stream has a current ecological water quality status of 'Moderate Potential'. This status was confirmed by consulting the latest EA river quality map.

11.84 EA mapping indicates that the Site lies entirely within Flood Zone 1 and therefore is considered to be at a low risk of fluvial flooding.

11.85 The EA website indicates that the Site overlies Unproductive Strata associated with the underlying bedrock (London Clay). Unproductive strata is described as rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. In terms of receptor sensitivity, Unproductive Strata is assessed as being of '**low sensitivity**'.

11.86 Below the Unproductive Strata is the Lambeth Group Formation, which is classed as a Secondary A Aquifer. Secondary A aquifers are described as aquifers that seldom produce large quantities of water for abstraction, but are important both for local supplies and in supplying base flow to rivers. These aquifers are assessed as being of '**medium sensitivity**'. Due to its low permeability, the London Clay would be expected to prevent significant leaching of contaminants from Made Ground to the underlying Lambeth Group aquifer.

11.87 The Upper Chalk underlies the Site at depth and is classified as a Principal Aquifer. It is abstracted for a wide range of uses within the London Basin, and as such its protection is of high importance and assessed as being of '**high sensitivity**'.

11.88 According to the EnviroCheck® Report and EA maps, the Proposed Development is not within a Source Protection Zone (SPZ) and there are no potable groundwater abstractions within 1km, which indicates that groundwater beneath the Site is unlikely to be used as a potable resource. In terms of receptor sensitivity, an groundwater as a resource is considered to be of '**low sensitivity**'.

11.89 The two closest BGS boreholes (TQ28NW24 and TQ29SW110 located adjacent north and 100m north) show standing water levels at between approximately 5.7m and 6.0m below ground level (bgl) (both measured on 10th January 1967) in stiff grey clay with layers of silty sandy clay / stiff mottled brown clay.

Geotechnical Considerations

11.90 Table 11-7 summarises the levels of potential geotechnical hazards identified at the Site as recorded in the Envirocheck® Report (Ref. 11-1).

Table 11-7 Potential Geotechnical Hazards

Hazard Type	Reported Hazard Potential
Natural Cavities	No hazard.
Coal Mining Affected Area	No hazard.
Compressible Ground Stability	Moderate to no hazard.
Ground Dissolution Stability	No hazard.
Landslide Ground Stability	Low to very low hazard.
Running Sand Ground Stability	No hazard.
Shrinking or Swelling Clay Ground Stability	Moderate hazard.
Radon Affected Areas	The property is in a lower probability radon area, as less than 1% of homes are above the action level.
Radon Protection Measures	No radon protective measures are necessary in the construction of new dwellings or extensions.

Regulatory Data

11.91 The EnviroCheck® Report lists one active discharge consent within 1km of the Site relating to a Thames Water Sewerage Pumping Station. There are two revoked discharge consents, one relating to the pumping station and the other for Fairview New Homes on the Colindale Hospital Site.

11.92 The EnviroCheck® Report lists:

- One Local Authority Pollution Prevention Controls (LAPPCs) listed within 1km of the Site which has been revoked. This relates to Theoco Aerodrome for re-spraying of road vehicles;
- 12No. recorded pollution incidents to controlled waters within 500m of the Site nine are Category 3 Minor Incidents. Three Category 2 Significant Incidents are recorded: a sewage incident in 1990 at Bunns Lane, Mill Hill 256m north-east of the Site boundary; a storm sewage incident in 1999 at an unnamed location 357m south-east of the Site boundary; and an oil-related incident in 1989 in Rushgrove Park, Colindale, 352m west of the Site boundary.
- One Substantiated Pollution Incident Register entry within 250m of the Site (146m north) from July 2006. This related to contaminated water from firefighting run-off and smoke and resulted in a Significant Air Impact and a Minor Land Impact.
- 24No. contemporary trade directory entries within 250m of the Site boundary. A summary of the onsite trades and most pertinent offsite trades is given in Table 11-8 below.

Table 11-8 Pertinent Contemporary Trades

Name	Location	Activity	Status	Distance/direction from centre of the Proposed Development
Microsystems International	Aerodrome Road, NW4 4SS2	Used Car dealers	Inactive	Adjacent North
The Automobile Centre	Aerodrome Road, NW4 4SS1	MOT Test Centre	Inactive	20m East
Adam Holmes	Aerodrome Road, NW4 4SS1	Garage Services	Inactive	20m East
Hendon Repair Centre	Aerodrome Road, NW4 4SS1	Car Body Repairs / Tuning Services	Inactive	39m East
J M Auto Engineers	Aerodrome Road, NW4 4SS1	Garage Services	Inactive	42m North-east

11.93 There are eight registered radioactive substances entries relating to the National Health Service North London Facility located 116 to 121m west of the Site. The latest permit was established on 11th June 2007, though

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entries date back to 1991. Two further entries, dated 14 July 2005, relate to The Health Protection Agency at 61 Colindale Avenue, 218m west of the Site boundary.

Waste

11.94 The EnviroCheck® Report lists:

- One licensed waste management facility is located 62m south-east of the Site. This relates to a metal recycling waste transfer site operated by Savecase Ltd. The license is listed as active.
- Two historic landfill sites within 500m of the Site boundary. A landfill 321m north from the Site is said to have accepted inert and industrial waste from 1977 to 1986. Fairview Homes also have a registered landfill site 449m south-east, without date details, accepting inert waste.
- Two Local Authority Recorded Landfill Sites (St James School, Graham Park Way and Lanacre Avenue, Quakers Course) are recorded 322m north and 493m north of the Site boundary; both are marked as 'closed'. Both sites last received waste on 31 December 1986.

Sensitive Sites

11.95 The EnviroCheck® Report indicates that the Site is not located within or in the immediate vicinity of any regulated sites of sensitive land use (e.g. areas of Green Belt, National Parks, Sites of Special Scientific Interest).

Unexploded Ordnance (UXO)

11.96 An unexploded ordnance (UXO) threat assessment has been carried out for the Site by Zetica Ltd (Ref. 11-4). The assessment concluded that there is a low risk from UXO within the Site boundary. An area of medium risk was identified offsite adjacent to the south-west corner of the Site near Colindale Tube Station.

11.97 No evidence of significant bombing or other sources of UXO was identified within the Site boundary.

11.98 In the area of medium risk offsite, there are records of two High Explosive bombs falling during a raid in World War Two. The extent of the damage caused could have masked the impact of an unexploded bomb during this or subsequent raids

Previous Site Environmental Assessments

11.99 It is understood that no intrusive ground investigations have been undertaken at the Site to date. A summary of a previous desktop study provided to URS is presented below.

WSP Preliminary Geo-environmental Risk Assessment, August 2012

11.100 In August 2012 WSP undertook a preliminary geo-environmental desk study (Ref 11-3) which covered the current Proposed Development site, and also a six hectare plot of land adjacent north which is outside the current red line Site boundary termed the 'retained site'. The Site was assessed by WSP in the context of a residential scheme with gardens.

11.101 WSP reported that the Site was within an area of low environmental sensitivity based on the Unproductive Strata underlying it and the absence of licensed groundwater abstractions within 1km of the Site.

11.102 A site walkover by WSP identified a number of potential onsite sources of contamination:

- Made Ground (uncertain nature and extent);
- Asbestos Containing Materials (ACM) in several buildings and possibly in demolition stockpiles;
- Above ground storage tanks in south-western region;
- Corrosive acids (batteries) stored on site, hazardous waste and chemical storage;

- Possible underground oil/gas supply pipeline associated with boiler houses;
- Underground storage tanks associated with the fuel station adjacent to the north in the retained part of the Site; and
- A former carwash also in the retained part of the Site.

11.103 The sources listed were described by WSP as localised and not considered to pose significant risk of widespread contamination across the Site. WSP considered that the Site represented a low to medium risk with respect to potential impacts to human health and controlled waters. WSP recommended that a ground investigation be undertaken to confirm the underlying ground conditions and to characterise the potential risks to human health and controlled waters.

Conceptual Site Model and Contaminated Land Risk Assessment

Potential Contamination Sources

11.104 Sources of potential contamination have been identified from historic maps in the EnviroCheck® Report, the WSP report (Ref. 11-3) and site walkover observations by URS. In the absence of ground investigation data a conservative approach to the land quality assessment, based on professional judgement and experience has been adopted.

11.105 From the baseline data, the potential for soil, groundwater and ground-gas contamination to be present at the Site is considered to be moderate to low and restricted to localised sources. Potential sources of contamination at the Site have been identified as:

On-Site

- Possible contamination in Made Ground including asbestos;
- Oil from tanks / boiler houses;
- Electricity substations; and
- ACM from existing or demolished buildings.

Off-Site

- Fuel station spills or possible underground storage tank / supply line leaks adjacent to the north in the retained area of the Site;
- Chemicals from the car wash adjacent to the north in the retained area of the Site;
- Hazardous materials and waste stored adjacent to the north in the retained area of the Site;
- Oil from boiler house adjacent to the north in the retained area of the Site;
- Fuel spills from former used car dealers adjacent to the north;
- Former and current railway facilities adjacent to the east and south of the Site;
- Former vehicle maintenance facilities, 20m east of the Site boundary(at its closest); and
- A former aerodrome located c. 100m north of the Site boundary.

11.106 Contamination arising from leaks or spills from the off-site sources above are likely to be localised are not expected to have significantly impacted on-site soils. Migration of contamination onsite is likely to be dependent on the presence, extent and flow direction of any shallow groundwater beneath the Site.

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Identified Receptors

11.107 The Site specific receptors were identified based on the land-use as well as the environmental setting of the Site. The identified receptors include:

- Public and nearby residents (human health receptor);
- Demolition and construction personnel (human health receptor);
- Future site users (human health receptor);
- The Secondary A aquifer of the Lambeth Group (controlled waters receptor);
- The Silk Stream (controlled waters receptor); and
- Existing and proposed new utilities and infrastructure (both on-site and in close proximity, such as foundations exposed to pyrite)

11.108 Whilst perched groundwater has been recorded in the onsite boreholes within the London Clay, this stratum is not classed as an aquifer by the EA and is not thought to be of significance as a potable resource. The considerable thickness of the London Clay Formation in this area is thought to act as a barrier to vertical migration of contaminants to the deep Chalk aquifer. Consequently the risk to the deep Chalk aquifer is considered to be very low.

11.109 Groundwater dewatering during construction can result in a reduction in moisture content of the soils which has the potential to impact land settlement. Since the Site is situated above Unproductive Strata, dewatering is not expected and associated land stability risks are considered unlikely.

11.110 The basements (maximum 6.5m deep) are proposed to terminate in the London Clay, approximately 10m above the top of the Lambeth Group (c. 16m deep at its shallowest point) which is in turn underlain by the Upper Chalk formation at depth.

11.111 The Proposed Development includes the construction of one building up to 21 storeys high and one up to 18 storeys (although predominantly between 6 and 10 storeys). These taller structures are likely to require piled foundations which will penetrate the London Clay underlying the Site and terminate in the underlying Lambeth Group (Secondary A Aquifer). As such, there is the potential for creation of preferential contaminant pathways to the deeper Secondary A Aquifer during piling works. Risks to the underlying Chalk Aquifer are expected to be low based on the clayey nature of the Lambeth Group acting as a barrier to vertical contaminant migration and, as such, are not assessed further in this chapter.

11.112 Given the nature of the underlying geology beneath the Site (London Clay), the likelihood of impacts to the Silk Stream from Site derived contamination are low. However, there is a slight risk from surface water runoff and, should perched groundwater be found to be present, there would be potential for the stream to be impacted with contaminants through the lateral migration.

11.113 London Clay and the Lambeth Group also have the potential to contain pyrite which can impact on below ground concrete structures such as foundations. Additionally some organic contaminants have the potential to permeate through service pipes (e.g. water mains).

Potential Pathways

11.114 Human health exposure pathways are dependent on the proposed end-use of the Site (mix of commercial/retail/residential without private gardens). The human health exposure pathways that are considered viable based on UK guidance (CLEA) are listed below:

- Direct ingestion of soil and dust;
- Dermal contact with soil and dust;

- Ingestion of groundwater;
- Inhalation of dust; and
- Inhalation of vapours (from soils and groundwater).

11.115 The evaluation of exposure pathways for controlled waters receptors requires an understanding of geological and hydrogeological pathways beneath the Site. The controlled waters pathways considered viable with respect to the Site are as follows:

- Lateral migration of perched water and surface runoff to the Silk Stream; and
- Vertical migration of contaminants in Made Ground to the deep Secondary A Aquifer of the Lambeth Group Formation.

Receptor Sensitivity

18.1 Potential receptors have been identified through the assessment of baseline conditions. Sensitivities have been applied as indicated in Table 11-9.

Table 11-9 Summary of Receptors Sensitivity Pre-mitigation

Receptor	Sensitivity	Comment
Public and nearby residents	High	Includes residential housing adjacent the Proposed Development.
Demolition and construction personnel	High	Construction workers involved in below ground construction will have a high sensitivity; those involved with minimal intrusion and above ground works much less.
Future Site Users	High	Includes residents, employees and visitors i.e. mixed residential / commercial / retail setting.
Groundwater	Medium	Relates to the deeper Lambeth Group (Secondary A Aquifer) which has potential to be impacted during piling
Silk Stream	Medium	The Silk Stream c. 75m south-west of the Site boundary
Existing and proposed new utilities and infrastructure	Medium	Includes the new development buildings, services, and landscaping.

Assessment of Effects and Significance

Effects during Demolition and Construction

Human Health

11.116 Following a review of baseline conditions for the Site, possible risks to the identified human health receptors may be expected from concentrations of metals, polycyclic aromatic hydrocarbons (PAHs) and hydrocarbons associated with general Made Ground, corrosive acids (batteries) stored onsite, hydrocarbons associated with the above ground fuel tanks and boiler houses onsite and the fuel station located adjacent off-site and metals associated with the metal recycling facility 62m offsite.

11.117 In addition, WSP (August 2012) (Ref 11-3) reported that asbestos was present in several buildings and possibly in demolition stockpiles. Asbestos may also be present within Made Ground beneath the Site.

Demolition and Construction Workers

11.118 It is identified that the demolition and construction phase may give rise to potential effects upon workers. Demolition and construction workers are assigned a high sensitivity. The magnitude for change is defined as medium because the construction activities will include disturbance of the ground during earthworks and installation of foundations with associated dust generation, thus a moderate risk to human health.

11.119 The potential effects upon demolition and construction workers would be limited for the duration of the construction phase activities (i.e. temporary) and occur at a local level. As such, the overall pre-mitigation

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significance of the effect upon health of demolition and construction workers during the construction phase is defined as **moderate adverse**.

Public and nearby residents

11.120 It is identified that the demolition and construction phase may give rise to potential effects to nearby visitors or residents, who are assigned a high sensitivity. The magnitude for change is defined as medium because of the moderate risk to human health through the inhalation of dust, and possible exposure to asbestos.

11.121 The potential effects upon the nearby public and residents would be temporary as limited for the duration of the construction phase activities and occur at a local level. As such, the overall pre-mitigation significance of the effect upon health of nearby public and residents during the demolition/construction phase is defined as **moderate adverse**.

Future Site Users

11.122 Due to the phased approach to construction (three Development Stages over the next 11 years) there is the potential for future site users (residents, office and retail workers, general public and maintenance workers) who are assigned a high sensitivity to be present on-site in completed stages of the development, during construction activities in other parts/phases of the Site. The magnitude for change is defined as medium because of the moderate risk to human health through the inhalation of dust, and possible exposure to asbestos.

11.123 The potential effects upon the future site users would be temporary as limited for the duration of the construction phase activities and occur at a local level. As such, the overall pre-mitigation significance of the effect upon health of future site users during the demolition/construction phase is defined as **moderate adverse**.

Controlled Waters

Secondary A Aquifer (Lambeth Group)

11.124 The Lambeth Group Aquifer is assigned a medium sensitivity due to its local importance as a groundwater source. The piled foundations for the Proposed Development are likely to extend into the Lambeth Group. The magnitude for change is defined as medium because of the moderate risk to groundwater because of the potential for creation of preferential contaminant pathways to the deeper aquifer during piling works.

11.125 The potential effects upon the Secondary A Aquifer users would be long term (temporary) as the pathway will be present for the lifetime of the piles and the effect will occur at a local level since the aquifer is not used for groundwater abstractions within 1km of the Site. As such, the overall pre-mitigation significance of the effect upon groundwater during the demolition/construction phase is defined as **moderate adverse**.

Surface Water (Silk Stream)

11.126 Potential new sources of contamination would be temporarily introduced and stored on the Site during construction and demolition giving a potential risk from surface water runoff to the Silk Stream. This stream is assigned a medium sensitivity. The magnitude for change is defined as low as the relatively flat nature of the local topography, means that accidental spillages or uncontrolled releases (e.g. drips, leaks and spills) migrating into the Silk Stream would be unlikely.

11.127 The potential effects would be temporary as limited for the duration of the construction phase activities and occur at a local level. As such, the overall pre-mitigation significance of the effect upon controlled waters (Silk stream) during the construction phase is defined as **minor adverse**.

Existing Infrastructure

11.128 It has been identified that the demolition and construction phase may give rise to potential effects upon the existing drainage and sewerage network. The existing infrastructure is assigned a Medium sensitivity. The

magnitude for change is defined as medium because the construction activities will introduce new contaminants to the Site (e.g. fuel storage for plant) and there is a potential for spills and leaks to result in the pollution of existing drainage and sewerage.

11.129 The potential effects upon existing infrastructure would be limited for the duration of the construction phase activities (i.e. long term temporary) and occur at a local level. As such, the overall pre-mitigation significance of the effect upon health of existing infrastructure during the construction phase is defined as **moderate adverse**.

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Table 11-10 Demolition and Construction - Contamination Sources, Sensitive Receptors, Pathways and Potential Effects (Pre-mitigation)

Potential Contamination Sources	Potential Sensitive Receptors	Receptor Sensitivity	Potential Pathways	Potential Impacts	Magnitude of Impact (Pre-mitigation)	Effect Significance (Pre-mitigation)
Historic and Current Land Uses						
Disturbance and volatilisation of potential contamination from historic and current on site and off site activities during earth works.	Demolition and construction workers	High	Human exposure through direct contact / inhalation / dermal uptake of associated soils, dusts, particulates and gases	Impact to human health	Medium	Moderate Adverse
	Public and nearby residents	High	Human exposure through direct contact / inhalation / dermal uptake of associated soils, dusts and particulates		Medium	Moderate Adverse
	Future site users	High	Human exposure through direct contact / inhalation / dermal uptake of associated soils dusts and particulates		Medium	Moderate Adverse
	Secondary A Aquifer (Lambeth Group)	Medium	Creation of preferential pathways	Pollution and degradation of water quality of underlying aquifers	Medium	Moderate Adverse
	Surface water (Silk Stream)	Medium	Surface runoff to the Silk Stream,	Degradation of water quality	Low	Minor Adverse
Improper use and storage of diesel, other fuels, oils, lubricants, solvents and coolants associated with demolition/ construction plant, equipment (i.e. piling rigs) and vehicles. Irregular maintenance of plant equipment and on site vehicles, and unchecked leaks and spillages of lubricants, fuels, oils solvents and coolants on site.	Construction site workers	High	Human exposure to flammables / fire and blast damage	Impact to human health	High	Major Adverse
	Construction site workers	High	Human exposure through direct contact / ingestion / inhalation / dermal uptake of associated gases / contaminants		High	Major Adverse
	Neighbouring uses, occupiers and the general public immediately adjacent to the Site	High	Human exposure through direct contact / ingestion / inhalation / dermal uptake of associated gases / contaminants		Medium	Moderate Adverse
	Surface water (Silk Stream)	Medium	Surface runoff to the Silk Stream	Degradation of streams quality	Medium	Moderate Adverse
Mobilisation and volatilisation of contaminated dust through demolition and construction activities / processes and stock piling, and Heavy Goods Vehicles (HGV) movements	Construction site workers	High	Human exposure through inhalation of and dermal contact with dust	Impact to human health	High	Moderate Adverse
	Neighbouring uses, occupiers and the general public immediately adjacent to the Site	High	Human exposure through inhalation of and dermal contact with dust		Medium	Moderate Adverse
Improper storage, handling and disposal of general waste from welfare facilities and demolition/construction activities. Hazardous waste (including potentially contaminated soils and groundwater)	Construction site workers	High	Human exposure through direct contact / inhalation / dermal uptake of associated contaminants	Impact to human health	High	Moderate Adverse
	Surface water (Silk Stream)	Medium	Surface runoff to the Silk Stream	Degradation of streams quality	Medium	Moderate Adverse
	Utilities and infrastructure	Medium	Infiltration and/or runoff into the local drainage and sewerage network	Pollution of drainage and sewerage network and nearby surface water features	Medium	Moderate Adverse
Mobilisation of contamination that would cause aggressive ground conditions as a result of demolition and construction activities and introduction of new materials / structures into the ground.	Secondary A Aquifer (Lambeth Group)	Medium	Creation of preferential pathways. Vertical and lateral migration of pollutants into local geology and hydrogeology	Contamination of natural soils, pollution and degradation of water quality of underlying Secondary A Aquifer	Medium	Moderate Adverse
	Proposed Development / introduced materials, built structures, utilities/infrastructure	Medium	Reaction between contaminant and introduced materials / structures	Deterioration and contamination of new materials and built structures, utilities and infrastructure	Medium	Moderate Adverse
Release of ground gas and volatile soil vapours through earthworks and piling activities leading to migration and accumulation.	Construction site workers	High	Human exposure to flammables / fire and blast damage	Impact to human health	High	Moderate Adverse

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Effects on Completed and Occupied Development

Human Health

Future Site Users

11.130 Future Site users are considered to have a high sensitivity due to the primarily residential end use with gardens and shared communal amenity spaces.

11.131 There has been a limited history of potentially contaminative land uses on the Site and it is considered that any potential contamination at the Site would be associated with the Made Ground and potential localised sources. The magnitude of change from baseline is considered to be very low and the effects temporary and limited to a local level.

11.132 The overall pre-mitigation significance of the effect of the complete and occupied Proposed Development on human health is defined as **negligible**.

Controlled Waters

Surface Water (Silk Stream)

11.133 The Silk Stream is assigned a **medium** sensitivity. During construction phase any potential residual contamination in Made Ground or perched water will likely be improved, removed, or contained. As such the magnitude of change due to the operation of the Proposed Development on the Silk Stream is low, and the effects temporary and occurring at a local level. As such, the overall pre-mitigation significance of the effect upon the Silk Stream from the completed development is defined as **minor adverse**. The new residential dwellings may have a **minor, positive, long-term overall effect** on controlled waters receptors by reducing surface water runoff with the introduction of more soft landscaping areas.

Risk to New Built Environment

11.134 Certain contaminants in soil or groundwater (hydrocarbons, solvents, ammoniacal nitrogen) can permeate through / corrode pipe work and possibly contaminate water supplies; and plastic water supply pipes can be at risk of attack from oils and phenols. Additionally, concrete infrastructure can be subject to attack from acids and high sulphate concentrations in soils.

11.135 The Proposed Development/ utilities/ infrastructure are assigned a **medium** sensitivity. The magnitude for change is defined as medium, and the effects could be long term temporary occurring at a local level.

11.136 As such, the overall pre-mitigation significance of the effect upon the new built environment from the completed development is defined as **moderate adverse**.

Table 11-11 Operational Development – Potential Effects (Pre-mitigation)

Potential Contamination Sources or Geotechnical Consideration	Potential Sensitive Receptors	Receptor Sensitivity	Potential Pathways	Potential Impacts	Magnitude of Impact (Pre-Mitigation)	Effect Significance (Pre-Mitigation)
Land contamination due to new activities on site: spillages of fuels in car parks; leakage from chemical storage spillages of waste / oils from new land uses	Neighbouring uses, occupiers and the general public immediately adjacent to the Site	High	Human exposure through direct contact / ingestion / inhalation / dermal uptake of associated soils, dusts, particulates and gases	Impact to human health	Very Low	Negligible
	Proposed Development End Users	High			Very Low	Negligible

Potential Contamination Sources or Geotechnical Consideration	Potential Sensitive Receptors	Receptor Sensitivity	Potential Pathways	Potential Impacts	Magnitude of Impact (Pre-Mitigation)	Effect Significance (Pre-Mitigation)
	Surface water (Silk Stream)	Medium	Surface runoff to the Silk Stream	Impact to water quality	Very Low	Negligible
Potential contaminants in Made Ground and potential pyritic conditions in London Clay (Unproductive Strata) and Lambeth Group (Secondary A Aquifer)	New Built Environment	Medium	Direct contact of underground services and concrete foundations with hydrocarbon impacted soils and attack from acids and high sulphate concentrations in soil	Permeation of contaminants through plastic water pipes and impact on water quality Concrete degradation	Medium	Moderate Adverse

Additional Mitigation

Additional Mitigation during Demolition and Construction

General

11.137 Mitigation can be carried out through design or management, and the strategy should be informed by the following hierarchy of options:

- Avoidance;
- Reduction;
- Compensation;
- Remediation; or
- Enhancement.

11.138 An Construction Environmental Management Plan (CEMP) will be prepared prior to commencement of any works, setting out the management, monitoring, auditing and training procedures, and all mitigation measures that will be put in place during demolition and construction, to ensure compliance with the applicable regulations. In order to prevent contamination and protect human health and controlled waters from effects related to ground conditions, the CEMP will include mitigation measures such as those presented below and in Table 11-12.

Hazardous Materials and Ground Contamination – Human Health

11.139 A number of mitigation measures will be employed during the demolition and construction phase to minimise impacts to human health. These include, but are not limited to, the following:

- Keeping the length of time materials will be stockpiled on-site before materials are removed for re-use, recycling or disposal to a minimum;
- Locating stockpiles as far from sensitive receptors as possible;
- Regularly dampening stockpiles to reduce dust generation;
- Covering stockpiles with tarpaulins prior to disposal;
- Ensure all vehicles are well maintained to prevent accidental pollution from leaks;

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- Use of wheel washing facilities at all Site access and egress points;
- The use of personal protective equipment (PPE) and implementation of Health and Safety Protocols, Plan and Procedures for all demolition and construction workers;
- Undertaking Site Investigations (SI) and preparing a remediation framework for the identification, assessment, and mitigation of contamination risks associated with in-situ soils and re-use of excavated materials. The remediation framework will identify remediation requirement for protection of human health and controlled waters, as well as identifying any areas that require remediation to be undertaken. It is understood that soils are to be retained and redistributed across the Site, it is expected that the majority will be suitable for reuse based on the desk study findings however a SI will confirm this; and
- Disposal of any contaminated soil off-site, to a landfill appropriate to the level of contamination present and the waste classification determined from the chemical analysis or Waste Acceptance Criteria testing as necessary.

Hazardous Materials and Ground Contamination – Controlled Waters

11.140 A number of mitigation measures will be employed during the demolition and construction phases to minimise impacts to controlled waters. These include those listed above, as well as the following.

11.141 A Pollution Response Plan will be drafted prior to the commencement of works on-site. The plan will outline key pollution mitigation measures including a Control of Substances Hazardous to Health (COSHH) / fuel inventory and key contacts to be notified in the event of a significant pollution incident, which may subsequently lead to the contamination of controlled waters.

11.142 All directly and indirectly purchased bulk fuel and COSHH items will be stored in accordance with the relevant Environment Agency Pollution Prevention Guidance notes and tanks will be locked when not in use, in order to prevent unauthorised access. Periodic toolbox talks on spill prevention will be provided and the correct storage and disposal of COSHH items will be covered in the Site induction.

Land Stability and Proposed Structures / Surrounding Properties

11.143 The Proposed Development will be designed with a suitable basement and piled foundations to ensure that long-term settlement of the Proposed Development will occur within acceptable limits. Appropriate foundations will be designed using information collected during intrusive investigations and following appropriate pile testing, if necessary.

11.144 Specification of concrete used in foundations and building structures will be selected based on the results of soil and groundwater sulphate analyses. Guidance is provided by the Building Research Establishment (BRE) series 'Concrete in Aggressive Ground' (Ref. 11-38).

11.145 As part of the excavation works for basement development, temporary works will be required to shore the basements. Retaining measures and temporary works will be designed by contractors to allow for earth pressures and water control issues. Retaining measures will be designed for groundwater and surface water cut-off. A specialist contractor will carry out final detailed retaining, according to the proposed excavation sequence.

Utilities

11.146 A review of historical land use identified a potential to encounter localised hydrocarbon impacted soils and shallow groundwater, therefore consideration must be given to increased potable water pipe specification. Risks to the Proposed Development will be adequately mitigated through guidance provided in the UK Water Industries Research document (10/W/M/03/21 January 2011) which provides guidance on potential requirements for protection measures in the selection of water supply pipes (Ref. 11-39)

UXO

11.147 In relation to the low UXO hazard identified onsite, Zetica Ltd recommend that site specific ordnance safety and awareness briefings to be given to all persons conducting intrusive works.

Table 11-12 Mitigation Measures

Potential Impact	Mitigation Measures
Impact to human health - Human exposure through direct contact / inhalation / dermal uptake of contaminants	<p>All works will be carried out in accordance with relevant Construction Design Management (CDM) Regulations (Ref. 11-40).</p> <p>Details of the above measures will be presented within the H&SP, and the EMP.</p> <p>A competent/licensed contractor will survey (pre site preparation survey as defined by the HSE) and remove asbestos and other materials and structures contaminated with asbestos fibres.</p> <p>All other materials will be disposed of by the contractor/s to appropriate recycling facilities or appropriately licensed landfills, in line with the Site Waste Management Plan (SWMP).</p> <p>Any waste effluent will be tested and where necessary, disposed of at the correctly licensed facility by a licensed specialist contractor/s.</p> <p>After removal of any fuel tanks, samples of soil and groundwater (if present) will be taken from beneath the tanks' location to check for possible contamination. Where contamination is found, the ground will be selectively excavated for disposal off-site or remediated.</p> <p>Oils and hydrocarbons will be stored in designated locations with specific measures to prevent leakage and release of their contents, include the siting of storage area away from surface water drains, on an impermeable base with an impermeable bund that has no outflow and is of adequate capacity to contain 110% of the contents. Valves and trigger guns will be protected from vandalism and kept locked up when not in use. Details of appropriate storage and handling measures will be presented within the Detailed Construction Environmental Management Plan (DCEMP). Wherever possible, plant and machinery will have drip trays beneath oil tanks/engines/gearboxes/hydraulics, which will be checked and emptied regularly via a licensed waste disposal operator.</p> <p>The appropriate utility company will be consulted on the potential requirement for an oil interceptor at the point where site surface water runoff enters the sewerage network.</p> <p>A spillage Emergency Response Plan (ERP) will be produced, which site staff will be required to have read and understood. On-site provisions will be made to contain a serious spill or leak through the use of booms, bunding and absorbent material.</p> <p>Appropriate handling and disposal of pile arisings, concrete, pastes and/or grouts during the laying of foundations.</p> <p>During both the demolition and construction stages of work, the contractor/s will employ dust suppression measures when necessary to prevent the potential mobilisation of contaminated dust particles and their migration off site.</p> <p>Stockpiles and material handling areas will be kept as clean as practicable to avoid nuisance from dust. Dusty materials will be dampened down using water sprays in dry weather.</p> <p>Access roads will be regularly cleaned and damped down with water.</p> <p>All vehicles entering and leaving the Site during the demolition and construction period will pass through a wheel washing facility. Vehicles used to transport materials and aggregates will be enclosed or covered in a tarpaulin. Vehicle movements will be kept to a minimum and vehicle speeds within the Site will be limited.</p> <p>Dust generating equipment e.g. mobile crushing and screening equipment will be located to minimise potential nuisance impacts to receptors, as far as practicable.</p> <p>Complaints about dust will be investigated at the earliest opportunity and appropriate action taken to control the source or remedy the impact as appropriate.</p> <p>Removal of potentially contaminated Made Ground from basement excavations. A full, double basement will be excavated to a maximum depth of 9.5m, removing all existing Made Ground across approximately 60% of the Site area.</p> <p>Appropriate use of Personal Protective Equipment (PPE) and implementation and adherence to Health and Safety Protocols, Plans and Procedures. Demolition and construction workers will remain vigilant of ground conditions at all times and will report to the Principal Contractor, any suspect areas of potential contamination.</p>
	Impact to human life – Inhalation of ground-gases and volatile vapours
Lowering of the groundwater / water table – settlement / consolidation of land,	<p>Selection of appropriate methods to dewater excavations, for example, prior to dewatering the perimeter of the excavation could be enclosed with either secant-pile or diaphragm wall. Piezometers (standpipes) could then be placed outside the secant pile wall to monitor groundwater levels to ensure levels do not drop below</p>

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Potential Impact	Mitigation Measures
subsidence, land instability, property damage	the critical level. Seepage analysis and groundwater level monitoring will be carried out as appropriate to assess deformation and stability of surrounding structures, including neighbouring property, as considered necessary.
Creation of preferential pathways and mobilisation of contamination. Contamination of natural soils, driving of contamination into an aquifer, contamination of groundwater with concrete, paste or grout, pollution and degradation of water quality of underlying Secondary and Principal aquifers	Ground investigations will be undertaken prior to the commencement of works on the Site and will inform the Foundation / Piling Works Risk Assessment which will define the appropriate piling methods and foundation design to mitigate risk. All piling works will be carried out in accordance with EA Guidance Note on Piling / Penetrative Ground Improvement Methods on Land Affected by Contamination (Ref. 11-41). The contractor will implement control measures during piling (such as dewatering of potentially contaminated groundwater from the Secondary Aquifer prior to piling). Groundwater quality monitoring will be undertaken as necessary.
Infiltration and / or run off into the local drainage / sewerage network - pollution of drainage and sewerage network and adjacent surface water features. Run off and infiltration of contaminants from material stockpiles. Contamination of drainage and sewerage network and / or groundwater	Any waste effluent will be tested and where necessary, disposed of at the correctly licensed facility by a licensed specialist contractor/s (see above for further details). Oils and hydrocarbons will be stored in designated locations with specific measures to prevent leakage and release of their contents (see above for further details). The appropriate utility company will be consulted on the potential requirement for an oil interceptor and sediment trap at the point where site surface water runoff enters the sewerage network. Wherever possible, plant and machinery will have drip trays beneath oil tanks/engines/gearboxes/hydraulics, which will be checked and emptied regularly via a licensed waste disposal operator. A spillage ERP will be produced, which site staff will be required to have read and understood. On-site provisions will be made to contain a serious spill or leak through the use of booms, bunding and absorbent material. Intrusive / Phase II site investigation work will be undertaken, where required, to identify significant areas of contamination. Disposal of surplus soils arising from the excavations will be undertaken in accordance with the SWMP / Materials Management Plan (MMP), current waste management regulations and guidance.
Deterioration and contamination of new materials and built structures, utilities and infrastructure	Geotechnical ground investigations will be undertaken across the Site. An assessment of the potential for aggressive ground will be undertaken, with the results of the geotechnical analysis and further ground / site investigation being used to fully assess the risks to materials and services. The information obtained will enable the correct specification of materials (if appropriate) and the selection of materials for services (including potable water supply).

Additional Mitigation Once the Proposed Development is Completed and Occupied

11.148 No contamination specific mitigation measures are considered necessary during the operational phase of the Proposed Development beyond regular inspection and maintenance of infrastructure to ensure that no contamination pathways to underlying soil or groundwater occur as a result of disrepair.

Residual Effects and Conclusions

Overall Hybrid Planning Application Residual Effects Summary and Conclusions

11.149 Following the implementation of mitigation measures, it is anticipated that all demolition and construction and effects will be reduced to residual effects of **negligible** significance. Therefore, no significant effects to ground conditions are expected through the demolition, construction and refurbishment works associated with the Proposed Development.

11.150 As the effects to ground conditions resulting from the operation of the Proposed Development were considered to be negligible pre-mitigation, the residual effects associated with the completed and operational Proposed Development are also anticipated to be of **negligible** significance. Therefore, no significant effects to ground conditions are expected once the Proposed Development is completed and occupied.

11.151 Table 11-13 summarises the residual effects on ground conditions.

Table 11-13 Summary of Residual Effects

Description of Effect	Residual Effect Significance	Nature of Effect	Geographic Scale
Demolition and Construction			
Effect of Contaminated Soils, Groundwater and Ground Gas to construction workers and future residents occupying initial completed blocks	Negligible	n/a	n/a
Effect of Contaminated Soils, Groundwater and Ground Gas on controlled waters.	Negligible	n/a	n/a
Effects of Excavation – Land Stability and Proposed Structures / Surrounding Properties	Negligible	n/a	n/a
Completed and Occupied Development			
Effect from soil and groundwater contamination on human health and controlled waters	Negligible	n/a	n/a
Effects of Excavation – Land Stability and Proposed Structures / Surrounding Properties	Negligible	n/a	n/a

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