

North London Waste Authority
**North London Heat and Power
Project**

Preliminary Environmental
Information Report
Volume 2 Appendix 6.1 Ground
Conditions and Contamination
Assessment Methodology

Issue for Consultation

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Arup

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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1 Ground Conditions and Contamination Assessment Methodology

1.1 Introduction

1.1.1 This appendix sets out the methodology for assessing the likely significant effects of the Project on ground conditions and contamination.

1.1.2 This section is divided into the following parts:

- engagement - describing a summary of comments included in the Scoping Opinion and how these comments have been addressed;
- legislation and guidance - detailing requirements of the relevant National Policy Statements (NPS), how these have been addressed and additional guidance relevant to the assessment;
- methodology for establishing baseline conditions; and
- methodology for the assessment of construction, operation, decommissioning and cumulative effects.

1.2 Engagement

1.2.1 Engagement was key to development of the Application Site design and environmental assessment. Vol 2 Appendix 6.1 Table 1.1 details the stakeholders contacted, a summary of key issues raised and how these have been addressed in the assessment. Engagement commenced during the initial site investigation stages, continued throughout site design stage and scoping, and is ongoing for the risk assessments undertaken in 2015. All site investigation and site assessment reports relevant to the Project were issued to the Environment Agency (EA) for comment.

1.2.2 A summary of the comments on reports issued to the stakeholders, stakeholder consultation meetings and response to the Scoping Opinion relevant to ground conditions and contamination is detailed below. Full details of all the topic-specific comments received during scoping and subsequent technical stakeholder engagement and responses are provided in Vol 1 Appendix 6.1 Table 1.1.

1.2.3 Discussions have taken place with the EA on the management of potential impacts on groundwater, in particular the Chalk aquifer.

Vol 2 Appendix 6.1 Table 1.1 Ground conditions and contamination engagement responses

| Organisation and date | Comment | Response |
|---------------------------------------|--|---|
| LB Enfield & Environment Agency, 2011 | Meeting to discuss AMEC ¹ site investigation and human health generic risk assessment which concluded that there was low risk to human health at the Application Site. LB Enfield was satisfied with the content of the report, but stated that additional assessment may be needed depending upon the future use of the Application Site ² (i.e. the future land use scenario). EA commented that the 2011 site investigation report adequately characterised the environmental risk posed by the Application Site. | Further site investigations were undertaken to better characterise the Application Site for the proposed Project design and are considered in the assessment. Human Health Risk was scoped out of the assessment. |
| Environment Agency, 2012 | The EA issued a response ³ to the AMEC 2012 Source Protection Zone (SPZ) assessment and AMEC 2012 site investigation. The EA confirmed that they were satisfied with the contents of the 2012 SPZ assessment and that the 2012 site investigation provided useful information on the thickness of the London Clay across the Application Site. | As no unacceptable risks to groundwater receptors were identified, the design of the Project at the Application Site was progressed. A summary of all information relevant to the Project from the Application Site investigation reports and SPZ assessment report are included in Vol 2 Section 6.5 and a summary of all data from the reports are provided in the Hydrogeological Risk Assessment provided as Vol 2 Appendix 6.2. |
| Environment Agency, 2013 | The EA recommended that a thickness of 5 to 8m of London Clay should be retained below any waste-related development on the Application Site. | AMEC was commissioned to undertake further site investigation in 2014 to confirm the geological thicknesses and the data from this investigation are included in the Vol 2 Section 6.5. As a result of these additional geological data, the ERF bunker was designed in north-east of the Application Site where the London Clay is thickest. |
| Environment Agency, 2014 | On the 2014 Site Investigation, the EA commented that further information regarding the permeability of the London Clay/Lambeth Clay at depth was required to better identify the risk to the underlying aquifer. | Laboratory permeability testing was undertaken on the drilling samples of London Clay and Lambeth Group. The results are summarised in the Vol 2 Section 6.5 and further details available in the Hydrogeological Risk Assessment provided as Vol 2 Appendix 6.2. |

¹ Note: Prior to 2015, Amec Foster Wheeler company name was AMEC

² Letter dated 3/10/11, from LB Enfield to AMEC, re: Edmonton SI Report

³ Letter dated 29/03/12, from Environment Agency to AMEC, re: Enquiry regarding dry Anaerobic Digestion (AD) Plant at Edmonton EcoPark in SPZ1 as part of NLWA Waste Services Procurement Process. Ref: NE/2012/114412/01-L01

| Organisation and date | Comment | Response |
|--|--|---|
| Environment Agency, 27 March 2014 | <p>During consultation on the Project design stage, the following aspects of the scheme were identified by the EA as requiring further assessment:</p> <ul style="list-style-type: none"> • Disturbance of groundwater flow in the Kempton Park Gravels as a result of the construction of the underground waste bunker which would fully penetrate this aquifer unit; • A groundwater risk assessment and a hydrogeological assessment of groundwater flow; • The need to maintain a minimum thickness of London Clay of 5 to 8m beneath the waste bunker and any other deep structures, to maintain a degree of protection to underlying aquifer units; and • The potential for foundation piles to create pathways for migration of contaminants into aquifer units underlying the London Clay. | <p>A Hydrogeological Risk Assessment (Vol 2 Appendix 6.2) has been undertaken incorporating the aspects noted by the EA including requirements for a risk assessment set out in the EA's Groundwater Protection: Principles and practice GP3⁴.</p> <p>Numerical modelling was undertaken to investigate the potential change to groundwater levels in the Kempton Park Gravels as a result of the proposed construction of the underground waste bunker as part of ERF.</p> <p>These assessments are all incorporated in Vol 2 Section 6.5 (baseline).</p> <p>The structures and buildings with deepest basements would be located in north-east of the Application Site where the London Clay is thickest to maintain a minimum of 5m London Clay beneath the waste bunker.</p> <p>A piling works risk assessment will be undertaken as part of the detailed design process to select the piling technique. The groundwater protection measures within the design will be agreed with the EA.</p> |
| Scoping Response: Secretary of State – November 2014 | <p>“In view of the current and previous uses of the Application Site the Secretary of State welcomes the proposed assessment of effects on ground conditions and contamination risks. The baseline for the ES should explain in detail the extent of the study area, ensuring that the impacts are considered over a sufficiently wide area and provide the reasons to justify this.”</p> | <p>The baseline for the assessment includes the detail noted by the Secretary of State and effects have been assessed inside and outside of the Application Site boundary where potentially significant effects have been identified.</p> |
| Scoping Response: Secretary of State – November 2014 | <p>“The Secretary of State notes Table 8.2 which summarises the baseline scoping studies completed to date and which have helped to refine the scope of the assessment. Copies of these documents should be included with the ES if they are relied upon to support the scope and/or the conclusions of the assessment.”</p> | <p>The Hydrogeological Risk Assessment summarises all data from previous investigations which is relevant to this assessment and is included as Vol 2 Appendix 6.2 to this PEIR and will be included in the ES.</p> |

⁴ Environment Agency (2013) Groundwater Protection: Principles and Practice Pollution GP3 August 2013 Version 1.1

| Organisation and date | Comment | Response |
|--|--|--|
| Scoping Response: Secretary of State – November 2014 | “Paragraph 8.3.7 states that the assessment will focus on significant effects to receptors within the Application Site boundary. It is argued that pathways for contaminant migration to offsite receptors require contaminants entering underlying groundwater or existing contaminants in the soil/groundwater being disturbed and migrating elsewhere. The Report states that mitigation measures will prevent this from happening. These measures should be fully described in the ES; including how and why they mitigate all potentially significant adverse effects. It should also be clear how their delivery would be secured through the DCO. The potential of the measures to fail and/or not mitigate all potentially significant adverse effects (e.g. due to accidents or spillages/leakages of contaminants) should be addressed.” | The assessment takes these comments into account. The pollution prevention measures are set out in Vol 2 Section 6. The measures have been and will be discussed further with the LB Enfield and the EA through ongoing engagement. |
| Scoping Response: Secretary of State – November 2014 | “Paragraph 8.3.27 explains that the hydrogeological conceptual site model (CSM) to be produced will identify the mitigation measures proposed. The characteristics and likely effectiveness of these measures should be discussed and agreed with the Environment Agency and the outcomes of this process should be explained in the ES.” | The CSM is included in the assessment presented in Vol 2 Appendix 6.2. The CSM was developed as part of the Hydrogeological Risk Assessment and mitigation measures have been identified. The likely effectiveness of these mitigation measures has also been assessed. Discussions are ongoing with the EA regarding the effectiveness of the measures. |
| Scoping Response: Environment Agency – November 2014 | “We are pleased to see that ground conditions and contamination have been considered within section 8 of the scoping document. Rather than focusing on human health implications which can be managed (e.g. capping or importing clean soils), it looks at the risks to the groundwater as a receptor.” | Groundwater is considered as a receptor in Vol 2 Section 6 (Ground Conditions and Contamination). |
| Scoping Response: Environment Agency – November 2014 | “As identified, the detailed Hydrogeological Assessment of the Application Site should identify controls which will be in place to break any Source Pathway Receptor (SPR) linkages during the construction and operational phases. This document does not go into as much detail for the operation phase controls as will be identified for the | A SPR conceptual model has been developed and is described in the Hydrogeological Risk Assessment provided as Vol 2 Appendix 6.2 to this PEIR. For each risk identified in operational phase, associated environmental control measures and mitigation have been identified. |

| Organisation and date | Comment | Response |
|---|--|--|
| | construction phase, we would suggest this is considered in more detail and how this can be expanded upon. There will be a degree of overlap with any environmental permit requirements, but it is critical to get the appropriate infrastructure in place as it will be difficult and costly to retrofit controls once the Application Site has been developed”. | |
| Environment Agency, 13 February 2015 and 18 February 2015 | “Based on the analysis of advantages and disadvantages, we would also prefer to see the bunker removed as it leaves the land in a better position for redevelopment and less of a risk to the environment”. | The assessment now considers that during demolition of EfW facility the EfW bunker would be removed. |
| Environment Agency, 6 March 2015 | Awaiting comment on the Hydrogeological Risk Assessment Report. | |

1.3 Legislation and guidance

National policy

1.3.1 National policy requirements relevant to ground conditions and contamination assessment from EN-1: Overarching National Policy Statement for Energy and EN-3: National Policy Statement for Renewable Energy Infrastructure are listed in Vol 2 Appendix 6.1 Table 1.2 and Vol 2 Appendix 6.1 Table 1.3.

Vol 2 Appendix 6.1 Table 1.2: EN-1: Overarching National Policy Statement for Energy

| Requirements of NPS EN-1 | How the requirement is addressed | Location of where to find further detail |
|---|---|--|
| Para 5.15.4 notes that ‘activities that discharge to the water environment are subject to pollution control. The considerations set out in Section 4.10 of this NPS and detailed below on the interface between planning and pollution control therefore apply, and should be considered. These considerations will also apply in an analogous way to the abstraction licensing regime regulating activities that take water from the water environment, and to the control of regimes relating to works to, and structures in, on, or under a controlled water.’ | | |
| Para 4.10.2 – ‘Pollution control is concerned with preventing pollution through the use of measures to prohibit or limit the releases of substances to the environments from different sources to the lowest practicable levels. It also ensures that water quality meet standards that guard against impacts to the environment or human health.’ | Pollution control included in design and detailed in Interim CoCP. Pollution control risk assessed and impacts noted as part of ground conditions and contamination assessment. | Interim CoCP (Vol 1 Appendix 3.1) |

| Requirements of NPS EN-1 | How the requirement is addressed | Location of where to find further detail |
|--|---|--|
| <p>Para 4.10.6 – ‘Applicants are advised to make early contact with relevant regulators including the EA, to discuss their requirements for environmental permits and other consents. This will help ensure count of all relevant environmental considerations and that the relevant regulators are able to provide timely advice and assurance to the IPC. Whenever possible, applicants are encouraged to submit applications for Environmental Permits and other necessary consents at the same time as applying to the IPC for development consent.’</p> | <p>EA and LB Enfield consulted and informed throughout the development of the Application Site plan.</p> | <p>Vol 2 Section 6.2 (Engagement)</p> |
| <p>Para 4.10.8 – ‘The relevant pollution control authority is satisfied that potential releases can be adequately regulated under the pollution control framework; the effects of existing sources of pollution in and around the Application Site are not such that the cumulative effects of pollution when the proposed development is added would make that development unacceptable, particularly in relation to statutory environmental limits.’</p> | <p>Cumulative impacts considered as part of ground conditions and contamination assessment.</p> | <p>Vol 2 Section 6.12 (Cumulative effects)</p> |
| <p>Para 5.15.7 – It should be considered ‘whether appropriate requirements should be attached to any development consent and/or planning obligations entered into to mitigate adverse effects on the water environment.’</p> | <p>Flood risk assessment (FRA) and hydrogeological risk assessment) undertaken. Potential impacts considered as part of ground conditions and contamination assessment.</p> | <p>FRA (Vol 2 Appendix 10.2), hydrogeological risk assessment (Vol 2 Appendix 6.2), Water Resources and Flood Risk (Vol 2 Section 10) and Ground Conditions and Contamination (Vol 2 Section 6).</p> |
| <p>Para 5.15.8 – It should be considered ‘whether mitigation measures are needed over and above any which may form part of the Project application. A construction management plan may help codify mitigation at that stage.’</p> | <p>Potential impacts considered as part of ground conditions and contamination assessment and managed by the Interim CoCP.</p> | <p>Interim CoCP (Vol 1 Appendix 3.1) and ground conditions and contamination assessment (Vol 2 Section 6)</p> |
| <p>Para 5.15.9 – ‘The risk of impacts on the water environment can be reduced through careful design to facilitate adherence to good pollution control practice. For example, designated areas for storage and unloading, with appropriate drainage facilities, should be clearly marked.’</p> | <p>Water environment considered within the design and Interim CoCP and potential impacts considered as part of ground conditions and contamination assessment.</p> | <p>Interim CoCP (Vol 1 Appendix 3.1)</p> |

| Requirements of NPS EN-1 | How the requirement is addressed | Location of where to find further detail |
|--|--|--|
| Para 5.10.5 – ‘The ES should identify existing and proposed land uses near the Project, any effects of replacing an existing development or use of the Application Site with the proposed Project or preventing a development or use on a neighbouring site from continuing. Applicants should also assess any effects of precluding a new development or use proposed in the development plan.’ | Cumulative impacts of neighbouring developments considered as part of ground conditions and contamination assessment. | Vol 2 Section 6.12 (Cumulative effects) |
| Para 5.10.8 – ‘Applicants should also identify any effects and seek to minimise impacts on soil quality taking into account any mitigation measures proposed. For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination.’ | Potential effects and impacts considered in hydrogeological risk assessment and as part of ground conditions and contamination assessment. | Hydrogeological Risk Assessment, (Vol 2 Appendix 6.2), Water Resources and Flood Risk (Vol 2 Section 10) and Ground Conditions and Contamination (Vol 2 Section 6) |
| Para 5.15.2 – ‘Where the Project is likely to have effects on the water environment, the Applicant should undertake an assessment of the existing status of, and impact of the proposed Project on, water quality, water resources and physical characteristics of the water environment as part of the ES.’ | Assessed under Water resources, which provides baseline for this assessment. | Water Resources and Flood Risk (Vol 2 Section 10) |
| Para 5.15.3 of this NPS notes that the Applicant should include the following in the ES. | | |
| ‘the existing quality of waters affected by the proposed Project and the impacts of the proposed Project on water quality’ | Assessed in ground conditions and contamination assessment. | Ground Conditions and Contamination (Vol 2 Section 6) |
| ‘existing water resources affected by the proposed Project and the impacts of the proposed Project on water resources’ | Assessed under water resources which provides baseline for this assessment. | Water Resources and Flood Risk (Vol 2 Section 10) |
| ‘any impacts of the proposed Project on water bodies or protected areas under the Water Framework Directive and source protection zones (SPZs) around potable groundwater abstractions.’ | Assessed underground conditions and contamination assessment and water resources, which provides baseline for this assessment. | Ground Conditions and Contamination (Vol 2 Section 6) and Water Resources and Flood Risk (Vol 2 Section 10) |

Vol 2 Appendix 6.1 Table 1.3: EN-3: National Policy Statement for Renewable Energy Infrastructure

| Requirements of NPS EN-3 | How the requirement is addressed | Location of where to find further detail |
|---|---|---|
| Para 2.5.86 – The Applicant should have ‘demonstrated measures to minimise adverse impacts on water quality and resources as described in EN-1 and EN-3.’ | Potential impacts considered as part of ground conditions and contamination assessment. | Ground Conditions and Contamination (Vol 2 Section 6) |

Legislation, guidance and local policy

1.3.2 The basis for the assessment of contamination land is founded in the legalisation, policy and guidance listed below. These documents define how contaminated land is identified, how contaminated land should be assessed, the requirement to identify and protect receptors, and the use of a conceptual model identifying source-pathway-receptors as an assessment methodology. These documents have therefore define the methodology of the assessment and give guidance on the assessment outcome. A summary of some of the most pertinent paragraphs and/ or summaries of the relevant sections from these documents have been detailed below. As these documents are applicable to the development of the methodology, they have not been referenced individually in the Assessment.

- National Planning Policy Framework ;
- The Groundwater (England & Wales) Regulations (2009);
- Part 2A of the Environment Protection Act 1990 (EPA 1990);
- Department of Environment, Food and Rural Affairs (Defra) Contaminated Land Statutory Guidance (2012);
- Defra SP1010: Development of Category 4 Screening Levels for Assessment of Land affected by Contamination – Policy Companion Document, March 2014; Risk assessment guidance; and
- CLR11.

1.3.3 Paragraph 109 of the National Planning Policy Framework indicates that the planning system should contribute to and enhance the natural and local environment by:

“remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.”

1.3.4 In this assessment the identification of any land which has potentially polluting substances has been assessed to determine if mitigation will be required as part of the Project. Paragraph 121 states that:

“Planning policies and decisions should also ensure that:

- *the Application 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.

- *adequate site investigation information, prepared by a competent person, is presented.”*

- 1.3.5 Several site investigations have been undertaken at the main operational site which included soil, gas and water sampling and monitoring and provide the baseline to this assessment.
- 1.3.6 The Groundwater (England & Wales) Regulations (2009) defines hazardous and non-hazardous substances, and makes it an offence to cause or knowingly permit the discharge of hazardous or non-hazardous substances into groundwater unless it is carried out under and in accordance with a permit granted by the EA. This definition is included as one of the assessment criteria.
- 1.3.7 The principal legislation governing the identification and remediation of contaminated land is Part 2A of the Environment Protection Act 1990 (EPA 1990), which was implemented in April 2000. The legislation is supported by the Contaminated Land (England) Regulations (2000), amended in 2006 and 2012, and Statutory Guidance (Defra Circular 01/2006), subsequently updated in April 2012. Together this provides the regulatory regime which sets out the nature of liabilities that can be incurred by owners of contaminated land and groundwater.
- 1.3.8 Part 2A provides a statutory definition of contaminated land and sets out the nature of liabilities that can be incurred by owners of contaminated land and groundwater and these definitions have been applied in this assessment. According to the Act, contaminated land is defined as:
- *"any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substance in, on, or under that land, that:*
 - *Significant harm is being caused, or there is significant possibility of such harm being caused; or*
 - *Significant pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused”*
- 1.3.9 Central to the regulatory system is a rigorous procedure of risk assessment which is used to determine the existence of ‘contaminated land’ according to the definition. The approach to undertaking a risk assessment should be in line with the regulations and be based on a tiered framework in accordance with risk assessment guidance⁵ and CLR11⁶. This approach was used in this assessment and in the Hydrogeological Risk Assessment which supports the assessment (Vol 2 Appendix 6.2).

⁵ Department for Environment, Transport and the Regions, Environment Agency and Institute for Environment and Health. Guidelines for Environmental Risk Assessment and Management. July 2000.

⁶ Department for the Environment, Food and Rural Affairs and the Environment Agency. Model Procedures for the Management of Land Contamination. Contaminated Land Report CLR 11. September 2004.

- 1.3.10 Following the guidance, a conceptual model has been developed at the preliminary risk assessment (tier 1) stage. The conceptual model represents the characteristics of the Application Site and indicates the possible relations between contaminants, pathways and receptors
- 1.3.11 For a potential risk to exist at a site all three of the above elements must be present, and linked together so that a contaminant has been identified, a receptor is located on the Application Site and there is an exposure pathway that links the contaminant to the receptor. The term pollutant linkage is used to describe a particular combination of contaminant-pathway-receptor relationship.
- 1.3.12 For each receptor, a description of the harm that is to be regarded as significant harm for the purposes of the regime is contained in the statutory guidance and has been followed in this assessment. Receptors include human beings, ecological systems in certain protected locations (e.g. sites of special scientific interest), property such as crops, livestock, domesticated animals, animals maintained for sporting purposes, buildings and their services. Significant harm includes in appropriate cases death, disease, serious injury, specified ecological system effects, substantial diminution of crop yield and structural building failure. Pollution of controlled waters arising from the contaminated condition of land is also included in the regime.
- 1.3.13 Other guidelines and standards have been taken into account during the preparation of this assessment, in addition to those named above and include:

Controlled waters

- Defra, Environment Agency Water Framework Directive (WFD) Thames River Basin Management Plan (2009)

Baseline data for the assessment:

- British Standards Institute (BSI) BS10175:2011+A1:2013 Investigation of Potentially Contaminated Sites – Code of Practice was used to for site investigations which are included in the baseline of the assessment.
- BSI BS5030:1999+A2:2010 Code of practice for Site Investigations was used to for site investigations which are included in the baseline of the assessment.
- EA Pollution Prevention Guidelines (PPG) (notably PPG1 – Guide to Preventing Pollution, PPG2 – Above Ground Oil Storage Tanks, PPG5 – Works in or Near Water, PPG6 – Working at Construction and Demolition Sites, PPG7 – Refuelling Facilities Good Practice Guidelines, PPG21 – Pollution Incident Response Planning, PPG22 – Dealing with Spills)

Piling design:

- Environment Agency (2001) Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention. NC/99/73

- Environment Agency (2002) Piling into contaminated sites

Groundwater risk assessment and assessment methodology

- EA Groundwater Protection: Principles and Practice Pollution GP3

1.3.14 Other guidelines, policies and plans have been consulted during the preparation of this assessment to ensure all applicable regional and local planning policies have been considered. The policies reference the use of the guidance and legislation which were already considered within the assessment as detailed in paragraphs 1.3.12 and 1.3.13. Policies considered comprise:

- London Plan (2011)⁷ Policy 5.14 Water quality and waste water infrastructure. It indicates that future developments in London will 'protect and improve water quality having regard to the Thames River Basin Management Plan'.
- Enfield Council Core Strategy 2010-2025 Section 8⁸ details the core policies for the Environment Protection for future developments in LB Enfield and are consistent with the national policy.
- Enfield Council Development Management Document (2014) Section 11, details policy on Environmental Protection for future developments in the borough, and also provides guidance on the policies. The document details that contaminated land will be sufficiently assessed to determine that no harm will be caused for use of the Application Site. It also details that risk assessment of all potential effects, the application of suitable safeguards and consultation with the EA or other suitable regulators needs to occur. This document was consistent with the national policy and CLR11 guidance methodology considered in the assessment.
- Enfield Council Unitary Development Plan (1994) contains the policy on Environmental Protection (G1) which is consistent to the national policy considered in the assessment.
- The London Borough Councils and EA have developed a contaminated land strategy in accordance with Part 2A and produced a document 'Contaminated Land a guide to help developers meet planning requirements' dated January 2004 which details the risk assessment methodology for contaminated land for new developments which is considered in the methodology for this assessment. This is consistent with the approach detailed in Part 2A which is used in this assessment.

⁷ London Plan (2011) <https://www.london.gov.uk/priorities/planning/publications/the-london-plan> (Accessed March 2015)

⁸ http://www.enfield.gov.uk/info/200057/planning_policy/1047/core_strategy_2010 (Accessed March 2015)

1.4 Baseline conditions

Current baseline

1.4.1 Extensive work has been undertaken in relation to ground conditions and contamination at the Application Site. This work is summarised in Vol 2 Appendix 6.1 Table 1.4. The table additionally describes the purpose of each assessment or investigation. A map of the current site groundwater monitoring network and further details of each of the Application Site investigations and assessments are detailed in Vol 2 Appendix 6.2 Hydrogeological Risk Assessment.

Vol 2 Appendix 6.1 Table 1.4: Baseline data

| Year | Relevant baseline data | Purpose |
|------|--|---|
| 2011 | Review of historical information and geological and groundwater vulnerability mapping | To determine the historical and current site conditions from the available literature and location mapping. |
| 2011 | Soils data from 56 intrusive locations | To develop geological mapping of the Application Site and soil quality |
| 2011 | Two groundwater and six ground gas monitoring rounds | To determine the baseline groundwater and ground gas concentrations |
| 2011 | Three ground gas monitoring rounds and risk classification | To establish the potential risk to human health and to the environment. |
| 2012 | A screening assessment for the SPZ for nearby public water supply boreholes was undertaken. This study included a conceptual site model and preliminary risk categorisation for the proposed anaerobic digestion plant | To establish a conceptual site model and preliminary risk categorisation. |
| 2013 | Soils data from four additional boreholes installed into the London Clay and Lambeth Group | To develop geological mapping of the Application Site and groundwater quality in the Lambeth Group. |
| 2013 | Additional investigation of groundwater quality, following feedback from the Environment Agency. | To confirm the water quality in the Lambeth Group by analysing with lower analytical minimum detection limits. |
| 2014 | Soils and geotechnical data from 13 boreholes installed into the London Clay and Lambeth Group | To further develop geological mapping of the Application Site and determine the thickness of London Clay in the north of the Application Site. Geotechnical testing for informing building and foundation design. |
| 2014 | Soils analysis from four boreholes installed into the London Clay and Lambeth Group | To further develop geological mapping of the Application Site and determine the land quality. |
| 2015 | Ten rounds of groundwater monitoring data from 19 boreholes, collected 2012-14. | Determine the baseline groundwater quality on the Application Site and |

| Year | Relevant baseline data | Purpose |
|------|--|---|
| | | monitoring for the Application Site Protection Monitoring Plan. |
| 2015 | Hydrogeological Risk Assessment for the Application Site and proposed ERF. | Establish the hydrogeological risks for the Application Site. |

Receptor identification and sensitivity

- 1.4.2 The varying effects of a contaminant on individual receptors depend largely on the sensitivity of the receptor. Receptors include any people, animal or plant populations, or natural or economic resources within the range of the contaminant source which are connected to the source by the transport pathway, although in this instance the assessment is concerned primarily with soils and groundwater.
- 1.4.3 The receptors for current site activities are identified as part of the ground condition and contamination assessment in the conceptual site model. The sensitivity of each of the receptors has been identified as part of the assessment methodology. Baseline soil and groundwater sampling has been undertaken within the operational area of the Application Site and the boreholes and monitoring network put in place to establish baseline ground, surface water and groundwater quality is shown in Vol 2 Figure 6.1.
- 1.4.4 Receptors outside the Application Site boundary are also considered as receptors from onsite sources identified. The groundwater in the aquifers underlying the Application Site are sensitive receptors, and the public and private abstractions from these aquifers are sensitive receptors. The Salmon's Brook which is hydraulic connection with the Application Site groundwater aquifers is also considered a receptor for this assessment.
- 1.4.5 Off-site surface water bodies which have been identified as potential receptors have been assessed and their water quality considered within the Thames River Basin Management Plan (2009) context with reference to improving water quality.

Future baseline

- 1.4.6 The future baseline of the Application Site considers changes to the baseline due to planned developments in the vicinity of the Application Site which need to be taken into account in the assessment.

1.5 Construction

- 1.5.1 The methodology has been developed using expert judgement in conjunction with the guidance identified in Section 1.3.

Assessment area

- 1.5.2 The assessment area encompasses the Application Site and considers offsite Principal and Secondary aquifers, and public and private groundwater abstractions which could be impacted by onsite sources. The

surface water body, the Salmon's Brook is considered as it is in hydraulic connectivity with the onsite aquifers.

Assessment method and significance criteria

1.5.3 The significance of any impacts caused by the Project on baseline conditions has been assessed qualitatively based on professional judgement and relevant guidance (as detailed in Section 1.3) for contaminated land and water resources. The magnitude of the impact is determined by assessed the severity and likelihood. The sensitivity of the receptor, which is a combination of its relative importance and the degree of anticipated environmental response of the receptor, and the magnitude of any potential impact combine to determine the significance of the impact. Magnitude, severity, sensitivity and significance criteria were developed and are detailed below.

Severity

Severity of the impact, is the scale of impact on a receptor, i.e. size, duration, timing or frequency, as defined in Vol 2 Appendix 6.1 Table 1.5. The likelihood of the impact is detailed in Vol 2 Appendix 6.1 Table 1.6. The severity of impact is combined with the likelihood of occurrence to give the magnitude of impact as detailed in Vol 2 Appendix 6.1 Table 1.7.

Vol 2 Appendix 6.1 Table 1.5: Severity of impact

| Severity | Criteria (impact size, duration, timing or frequency) |
|------------|--|
| Major | Major change to soil or groundwater conditions (including deterioration in soil or groundwater quality) resulting in temporary or permanent changes (e.g. major spillage resulting in levels of contamination which would cause significant harm to a receptor). |
| Moderate | Detectable change to soil or groundwater conditions resulting in non-fundamental temporary or permanent changes. Some deterioration in soil quality likely to temporarily affect sensitive receptors. |
| Minor | Detectable but minor change to soil or groundwater conditions. Soil quality standards less than threshold and unlikely to affect sensitive receptors (e.g. a minor spillage). |
| Negligible | Unquantifiable change in soil or groundwater conditions. |

Vol 2 Appendix 6.1 Table 1.6 Likelihood of impact

| Impact | Definition |
|-------------------|---|
| Unlikely | An impact which whilst theoretically possible will probably never be realised. |
| Low likelihood | An impact that is considered possible when considered over the development lifetime. |
| Likely inevitable | An impact which is considered likely when considered over the development lifetime, but not inevitable. |
| High likelihood | An impact that is considered to be a direct and inevitable consequence of the Project or which is considered to be probable even when considered in the short term. |

Vol 2 Appendix 6.1 Table 1.7 Magnitude of impact

| | | Likelihood | | | |
|----------|------------|------------|----------------|-------------------|-----------------|
| | | Unlikely | Low likelihood | Likely inevitable | High likelihood |
| Severity | Major | Minor | Moderate | Major | Major |
| | Moderate | Negligible | Minor | Moderate | Moderate |
| | Minor | Negligible | Negligible | Minor | Minor |
| | Negligible | Negligible | Negligible | Negligible | Negligible |

Sensitivity

- 1.5.4 Vol 2 Appendix 6.1 Table 1.8 provides the sensitivity criteria for receptors, which is a combination of their relative importance and the degree of anticipated environmental response.

Vol 2 Appendix 6.1 Table 1.8: Criteria for sensitivity of receptor

| Sensitivity | Criteria |
|--------------------|--|
| Very High | Environment responds to major change(s) e.g. substantial change to groundwater quality in an aquifer used as potable drinking water supply. Potential to cease drinking water supply on long term. |
| High | Environment clearly responds to effect(s) in quantifiable and/or quantifiable manner e.g. change in groundwater quality in an aquifer causing identifiable deterioration in water quality. Potential to cease drinking water supply on medium or short term. |
| Medium | Environment responds in a minimal way such that only minor changes are detectable e.g. groundwater quality show only minor changes. |
| Negligible | Environment is insensitive to impact, no discernible changes e.g. No significant change in water quality detected, or receptor not sensitive to change. |

Significance criteria

- 1.5.5 Magnitude of impact and sensitivity have been combined to provide the significance of impacts on receptors as detailed in Vol 2 Appendix 6.1 Table 1.9.
- 1.5.6 The significance assessment is the process of collating known information on a hazard or set of hazards in order to estimate actual or potential impact on receptors. Receptors are connected with the hazard under consideration via one or several exposure pathways Risks are generally managed by isolating or removing the hazard, isolating the receptor, or by intercepting the exposure pathway. Without the three essential components of a source, pathway and receptor, there can be no effect on the receptor. Thus, the mere presence of a hazard at a site does not mean that there will necessarily be attendant risks.
- 1.5.7 In this assessment the source, pathway and receptor linkage is identified within the conceptual site model. The assessment is made for each contaminant on a receptor by receptor basis with reference to the significance and degree of the risk. In assessing this information, a measure is made of whether the source contamination can reach a receptor, determining whether it is of significance or not.

Vol 2 Appendix 6.1 Table 1.9 Significance of the impact

| | | Sensitivity of Receptor | | | |
|---------------------|------------|-------------------------|-----------------------|------------------------|------------------|
| | | Very high | High | Medium | Low |
| Magnitude of Impact | Major | Very Substantial | Substantial | Substantial /Moderate | Moderate |
| | Moderate | Substantial | Substantial /Moderate | Moderate | Moderate/ Slight |
| | Minor | Substantial /Moderate | Moderate | Moderate/ Slight | Slight |
| | Negligible | Negligible | Negligible | Negligible | Negligible |
| | | | | | |
| | Key: | Significant Impact | | Not Significant Impact | |

Vol 2 Appendix 6.1 Table 1.10 Definition of significance of impacts

| | Significance | Definition |
|------------------------|------------------|---|
| Not significant impact | Negligible | The presence of an identified hazard does not give rise to the potential to cause significant harm to a receptor. |
| | Slight/Moderate | It is possible that harm could arise to a receptor from an identified hazard but it is likely that, at worst, this harm, if realised, would normally be minor. |
| Significant impact | Substantial | It is possible that, without appropriate remedial action, harm could arise to a receptor. It is relatively unlikely that any harm would be high, and if any harm were to occur it is more likely that such harm would be minor. |
| | Very Substantial | Harm is likely to arise to a receptor from an identified hazard at the Application Site without appropriate remedial action. |

1.5.8 Where the risk of significant impact is assessed to be substantial or above, mitigation/management will normally be required to reduce the level of risk to slight or negligible levels. In any situations where it is not possible, or reasonable, to mitigate the impacts down to this level, these residual risks have then been assessed. The summary for each significance category is detailed in Vol 2 Appendix 6.1 Table 1.10.

1.6 Operational

1.6.1 The assessment method is the same as that applied for the construction assessment and described in Section 1.5.

1.7 Decommissioning effects

1.7.1 The assessment method is the same as that applied for the construction assessment and described in Section 1.5.

1.8 Cumulative effects

1.8.1 Cumulative effects of other developments within the local area are identified below, and their effect are considered qualitatively during the different phases of the Project.

1.8.2 The potential effects for the construction and operational phases of each of the developments are identified and these effects are considered in addition to the potential effects from the Project. The cumulative effects of the developments are assessed to indicate if there are any likely significant impact.

- The North London (Electricity Line) Reinforcement (DCO) Project is located approximately 60m from the Application Site and extends along the north-east, east, south-east and south of the Application Site. Upgrade work to an existing overhead line between Waltham Cross and Tottenham Substations, and its operation at a higher voltage. The upgrading will involve works at each substation along the route. This includes a substation located partially within the Application Site boundary. No information is available regarding the nature of the upgrade work however any construction required has the potential to increase hardstanding within that area.
- Meridian Water, approximately 300m south of the Application Site. It is anticipated that these works will include excavations, piles and dewatering and therefore may have effect on the flow and water quality in the underlying aquifers. Any change of use to residential is likely to extend the amount of soft landscaping and hence would influence infiltration rates at that site.