

## 15. Ground Contamination

### 15.1 Introduction

- 15.1.1 This Chapter, which has been prepared by Waterman, provides a statement of conformity with regard to the potential ground contamination impacts arising from the Scheme with Phase 1B (North) in place (and having regard also to the detailed design previously approved in relation to Phase 1A (North)). This statement of conformity is provided pursuant to the s73 ES and other EIA Documentation (as defined in **Chapter 4: Approach to the ES Further Information Report**) in light of the further detailed design information now available in respect of Phase 1B (North) and confirms whether the findings of the s73 ES and other EIA Documentation with respect to the likely significant effects, mitigation and residual impacts in relation to ground contamination remain valid.
- 15.1.2 A review of relevant policy, legislation and guidance published since preparation of the s73 ES and other EIA Documentation has been carried out. A review of the detailed design for Phase 1B (North), as defined in **Chapter 2: Description of Phase 1B (North) RMA**, has then been undertaken, to identify elements of the Phase 1B (North) RMA of relevance to the ground contamination assessment.
- 15.1.3 The approach to the statement of conformity is set out and a summary of relevant consultation is provided. A review of the baseline information presented in the s73 ES and other EIA Documentation has been undertaken and updates are presented where relevant. Commentary is then provided which confirms whether any new or different potential significant ground contamination impacts arising from the Development (comprising the Scheme with the detailed design for both Phase 1A (North) and Phase 1B (North) in place) from those identified in the s73 ES and other EIA Documentation are likely. Likewise, any new or different mitigation measures from those identified in the s73 ES and other EIA Documentation are presented where considered necessary, and residual impacts following the application of mitigation are described.
- 15.1.4 The Chapter is supported by **Appendix 15.1: Remediation Strategy for Phase 1B (North)** and **Appendix 15.2: Generic Quantitative Geo-Environmental Risk Assessment: Phase 1B (North) Brent Cross**.

### Policy, Legislation and Guidance

- 15.1.5 There have been no significant changes to legislation, policy or guidance since the s73 ES and other EIA Documentation were prepared which have a material effect on the approach to or findings of the ground contamination assessments previously presented.

### 15.2 Relevant Phase 1B (North) RMA Details

- 15.2.1 The detailed design proposals for the Phase 1B (North) RMA of relevance to ground contamination have been reviewed and are listed below:
- Plot 113: Residential development will be located on Plot 113;

- **Development Plots:** those development plots to the south, west and east of the existing Brent Cross Shopping Centre, around High Street North and Brent Cross Main Square, comprising a mix of uses including retail, leisure, food and beverage, hotel, and community floorspace, in addition to an energy centre, multi-storey car parks and an enhanced replacement bus station. Refurbishment works are also proposed within existing Brent Cross Shopping Centre, such as reconfiguring existing retail units, removal of the existing mall roof lights and replacement with new features, renewal and replacement of mall floor finishes, increasing the height of existing shopfronts and external alterations to the exterior of the shopping centre where it meets the new plots.
- **Public Realm and Open Spaces:** including Brent Cross Main Square and the Threshold Spaces including - Fenwick Place, Tempelhof Circus and Layfield Place.
- **Sturgess Park improvements:** the existing Sturgess Park to the north west of the Shopping Centre is to be retained and enhanced including new formal play facilities, seating areas, gardens, informal sports provision and nature areas
- **Riverside Park (Reaches 1 and 3):** The Eastern Brent Riverside Park and Western Brent Riverside Park to be provided adjacent to the realigned River Brent and including a riverside walkway and River Brent Nature Park to be provided alongside the River Brent.

### **15.3 Assessment Methodology**

- 15.3.1 There have been no significant changes to planning policy, legislation or guidance which materially affect the approach to the ground contamination assessment presented in the s73 ES and other EIA Documentation. The methodology and significance criteria previously presented therefore remain valid for the purposes of assessing the Phase 1B (North) RMA.
- 15.3.2 The baseline ground conditions information presented in the s73 ES and other EIA Documentation has been reviewed by Waterman in light of further ground investigation work undertaken from October 2016 to March 2017 for Phase 1B (North) (which is reported in the Generic Quantitative Geo-Environmental Risk Assessment (GQRA), to determine whether the updated baseline information could affect the previous findings of the s73 ES and other EIA Documentation.
- 15.3.3 In considering the Phase 1B (North) RMA proposals, an assessment based on the methodology applied in the s73 ES and other EIA Documentation has been applied to consider the potential impact of any changes from the 2014 Permission and the specific design details of Phase 1B (North).
- 15.3.4 This approach has enabled Waterman to identify whether the ground condition impacts presented in the s73 ES and the other EIA Documentation remain valid. The likely significant ground condition impacts arising from the Development with Phase 1B (North) RMA in place have been reviewed with reference to the updated baseline information.

#### **Limitations or Constraints**

- 15.3.5 No limitations or constraints were identified within the assessment.

## 15.4 Consultation

- 15.4.1 The approach to the ground contamination Statement of Conformity was set out in the EIA Scoping Report (**Appendix 4.1**). This approach to the assessment was considered acceptable by LBB (see **Appendix 4.2**).
- 15.4.2 Any comments in relation to ground contamination received from LBB or consultees have been addressed where relevant in this Chapter.

## Baseline Conditions

- 15.5.1 The baseline information presented in the s73 ES and other EIA Documentation has been reviewed, taking into account the results of the 2016/17 ground investigation and detailed design information for the Phase 1B (North) RMA. An overview of the baseline information now available as a result of the 2016/17 ground investigation is provided below; full details can be found in **Appendix 15.2**.
- 15.5.2 During the period September 2016 to February 2017, further ground investigations were conducted on the Site by Waterman. These investigations covered four areas within Phase 1B (North): Plot 113; the plots within Brent Cross East Development Zone around the existing shopping centre; Sturgess Park Improvements and River Brent Infilling Works (this comprises an area of approximately 450m which will be infilled following the River Brent diversion works (the realignment of the river was assessed as part of the Phase 1A (North) FIR)). The investigations covered both geotechnical and contamination aspects. The detailed scope of the ground investigation is set out in **Appendix 15.2** and included:
- 13 Cable Percussion Only Boreholes;
  - 2 Rotary Only Borehole; and
  - 6 Windowless Sample Boreholes.
- 15.5.3 Borehole locations are shown on **Figures 15.1 to 15.3**.
- 15.5.4 The 2016/17 ground investigation results revealed ground, groundwater and contamination conditions generally consistent with those identified during previous investigations reported in the s73 ES and other EIA Documentation. Any additional baseline information to that identified in the s73 ES and other EIA Documentation is summarised below and detailed in **Appendix 15.2**.

## Source Areas Identified – Additional Supporting Site Investigation data (Soils)

### Plot 113

- 15.5.5 Based on the results of analysis undertaken, there was a single exceedance of lead contamination, and an exceedance of benzo(a,h.)anthracene.
- 15.5.6 Asbestos was detected in a single sample. Asbestos Containing Material (ACM) was detailed as Chrysotile loose fibres.

### Plots around the existing Shopping Centre, within Brent Cross East Development Zone (BXE)

- 15.5.7 No contamination was identified within the shallow natural soils identified. Minor elevations of three polyaromatic hydrocarbons, benzo (b.) fluoranthene, benzo (a.) pyrene and dibenzo (a.h.) anthracene, were recorded in six locations in the southern section of the BXE area within Phase 1B (North). Three exceedances of a fourth polyaromatic hydrocarbon, naphthalene, and three exceedances of lead were also recorded across the extent of the total BXE area. The remainder of the soil results did not highlight any elevated contaminant levels above the commercial assessment criteria.
- 15.5.8 Asbestos was identified in Made Ground samples across the BXE area within Phase 1B (North), with no particular concentrations in one area. When quantified, the asbestos was found to comprise less than 1% of the dry weight of any soil samples. Ground investigations found that Made Ground across this area contained evidence of demolition material such as brick, concrete rubble, glass and wood, which is likely also to have been the source of the asbestos identified.

#### Sturgess Park Improvements

- 15.5.9 There were no exceedances for any organic or inorganic contaminants in any of the samples within this 'remediation zone'. Asbestos was also not detected in any of the samples.

#### River Brent Infilling Works

- 15.5.10 Made Ground was found to contain some elevated levels of polyaromatic hydrocarbons and metals. Beneath the Made Ground, no elevated levels of contamination were identified in the natural material. Asbestos was identified in numerous samples and therefore will require further consideration in the site specific remediation strategy for this area.

#### Source Area Identified – Supporting Site Investigation data (Controlled Waters)

- 15.5.11 Groundwater monitoring undertaken between October and December 2016 recorded groundwater levels in the shallow geology (Made Ground, Alluvium and Taplow Gravel) of between 38 to 45m Ordnance Datum (OD). Shallow groundwater levels in the northeast of Phase 1B (North) were found to be 5m to 6.5m higher than in the remainder of the area, correlating with the topographic profile of the Site. Deep groundwater levels were recorded in the Lambeth Group Secondary A Aquifer, beneath the London Clay Formation at +39m OD.
- 15.5.12 The site investigation (SI) results indicated that shallow groundwater above the London Clay Formation generally flows in a southern direction. Contamination within this groundwater could potentially migrate off-Site via this flow, and affect the Taplow Gravel Secondary A aquifer. The Secondary A aquifer groundwater bodies within the Lambeth Group and Thanet Formation, and the Principal Aquifer in the Chalk Group, may also be receptors for potential contamination in the shallow groundwater. These aquifers are present in the geology underlying Phase 1B (North).
- 15.5.13 Shallow groundwater samples were tested for a range of organic and inorganic contaminants as well as semi-volatile organic compounds (SVOCs). Assessment of the results identified nine exceedances of metals, and a single elevation of naphthalene above the assessment criteria. These exceedances were broadly constrained to the south of the Phase 1B (North) SI study area, and were spread across a wide area with no hotspots found. Where instances of contamination were identified, the elevated level was only slightly above the assessment criteria which suggests

the overall groundwater body within Phase 1B (North) has not been significantly impacted by ground contamination.

### Source Area Identified – Supporting Site Investigation data (Ground Gas Conditions)

- 15.5.14 Ground gas and vapour monitoring at the wells installed in eleven of the investigation locations has been completed (gas monitoring is ongoing at the time of writing this chapter). A consistently elevated presence of methane was detected at a single Waterman investigation location, WS801 (shown in **Figure 15.1**), located in the northwest of the Phase 1B (North) SI study area. Carbon dioxide levels were recorded above the limit of detection while depleted oxygen levels were also found in some of the boreholes.
- 15.5.15 Although a high methane concentration was encountered in a single monitoring location, samples from nearby monitoring wells did not record elevated methane levels. This suggests that the ground gas source was localised within the Made Ground in this area, rather than representative of the overall Phase 1B (North) SI study area. The elevated methane reading from WS801 is therefore discounted in the overall gas assessment for the Phase 1B (North) SI study area.
- 15.5.16 The 2016/17 ground investigation results (**Appendix 15.2**) provide additional baseline information to that identified in the s73 ES and other EIA Documentation. The ground investigation in 2016/2017 has indicated that there is some contamination present at the Made Ground within Phase 1B (North) and some elevated methane levels. Overall, the results revealed ground, groundwater and contamination conditions are generally consistent with those identified during previous investigations reported in the s73 ES and other EIA Documentation.

### Summary

- 15.5.17 As identified above, the 2016/17 ground investigation (**Appendix 15.2**) indicates that there are potential sources of contamination present in the Made Ground within the areas where the SI was carried out within Phase 1B (North). The ground investigations identified hotspots of metals and PAH within shallow soils, along with minor metals and PAH contamination within shallow groundwater. Asbestos was also detected in low amounts.
- 15.5.18 The findings of ground gas monitoring indicate the overall Site, using the CIRIA C716 classification guidance<sup>i</sup>, is Characteristic Situation 1 (very low risk). However, consistently elevated methane levels have been found in the south of the Phase 1B (North) SI study area, which raise the Characteristic Situation to Characteristic Situation 2 (low risk).
- 15.5.19 The baseline data as previously reported, which for the purposes of Phase 1B (North) was the baseline information provided in the s73 ES, was split into 6 divisions, of which Brent Cross was one of these divisions. The Brent Cross division comprised all land east of the Midline Mainline Railway and north of the A406, including the existing Brent Cross shopping centre and associated car parking areas (see s73 ES for more detail). The findings of the 2016/17 SI are broadly in keeping with those of the previous SI in that area, however more specific and detailed information on the locations and extent of the contamination has been provided as a result. In addition, the SI confirmed the presence of asbestos in the Made Ground.

## 15.5 Assessment and Mitigation

### Construction

#### Potential Impacts

- 15.6.1 Elements of the Construction Impact Assessment (CIA) and Indicative Construction Programme (ICP) have been updated since the preparation of the s73 Application and other EIA Documentation (**Appendix 2.1**), including updating the sequence and timing of the construction activities for Phase 1B (North). However, even though the timing and order of the construction activities provided within the s73 ES and other EIA Documentation have changed, the construction activities themselves have not changed and therefore do not change the potential impacts previously reported in relation to ground contamination.
- 15.6.2 There have been no significant changes to legislation, policy and guidance which have led to a need for the re-assessment of baseline data since the s73 ES and other EIA Documentation was prepared; whilst additionally the construction activities presented in the ICP remain unchanged. The results of the GQRA outlined above accord with the assumptions made in the assessment of the ground contamination impacts of the Scheme undertaken at outline stage and presented in the s73 ES.
- 15.6.3 The updated baseline data available following the 2016/17 ground investigation (**Appendix 15.2**) indicated that there are no new or different potential impacts to those identified in the s73 ES and other EIA Documentation.
- 15.6.4 A series of Site Specific Remediation Strategies (SSRS) will be developed for each area within Phase 1B (North) prior to commencement of construction. It is considered that the measures included within these remediation strategies, which may include such measures as gas protection, on-Site monitoring and classification of waste and appropriate removal and disposal, will form inherent mitigation, in addition to adherence to the relevant measures contained in the Code of Construction (CoCP) and Construction Environmental Management Plan (CEMP) for Phase 1B (North), as these are required through pre-commencement conditions attached to the 2014 Permission.
- 15.6.5 The potential construction impacts identified in the s73 ES and other EIA Documentation included disturbance of contaminated land resulting in damage to watercourses, human health or the environment, unidentified contamination and safety of the workforce. Due to the further refinement of the detailed design proposals and the additional information gained from the 2016/17 investigations, it is considered that the potential construction impacts with the inherent mitigation considered will be **negligible**. This is consistent with the reported potential construction / short term impacts of the s73 ES and other EIA Documentation.
- 15.6.6 Following the application of the inherent mitigation that will be set out in the SSRSs and the CEMP and CoCP for Phase 1B (North), it is considered that no new or different impacts are likely to arise for ground contamination during construction of Phase 1B (North).
- 15.6.7 It is therefore confirmed that the assessment of construction impacts in relation to ground contamination presented in the s73 ES and other EIA Documentation remain valid.

## Mitigation

- 15.6.8 The s73 ES and other EIA Documentation identified a range of mitigation measures and noted that, in order to define the exact extent and scope of mitigation, further ground investigation work would be required during the detailed design stage of the project. In view of the new 2016/17 ground investigation data and the subsequent risk assessment, mitigation measures have been identified for the Phase 1B (North) area (refer to **Appendix 15.2**), which are in keeping with the mitigation measures identified in the s73 ES and other EIA Documentation.
- 15.6.9 All relevant mitigation measures from the s73 ES and other EIA Documentation will be incorporated into the SSRSs for Phase 1B (North) of the Site. As such, these measures will form part of the detailed design of the Development, secured via planning conditions of the 2014 Permission and are considered to be inherent to the Development.

## Residual Impacts

- 15.6.10 No new or different impacts were identified compared with those previously reported in the s73 ES and other EIA Documentation and therefore the residual impacts as reported previously, i.e. **negligible**, remain valid.

## Operation

### Potential Impacts

- 15.6.11 As highlighted above, the 2016/17 ground investigation (**Appendix 15.2**), has provided more detail on areas of contamination within Phase 1B (North). Potential sources include contamination and asbestos in Made Ground, shallow soils and shallow groundwater and ground gas arising from Made Ground and Alluvium. However, in terms of the potential risk to future site users, the detailed design proposals involve hardstanding and buildings covering a large area of Phase 1B (North). This, alongside the use of an appropriate thickness of certified clean, uncontaminated topsoil in soft landscaped areas, will prevent future users of Phase 1B (North) coming into contact with ground contamination.
- 15.6.12 In terms of the elevated ground gas monitoring results, the monitoring well where an elevated recording is reported is within a section of the Phase 1B (North) area where basement excavation is planned. This will remove all Made Ground and Alluvium from the area, likely removing the source material for the elevated gas readings. However, gas protection measures will still be considered in buildings in this area of Phase 1B (North), in order to fully reduce the risk to future users of Phase 1B (North) to low.
- 15.6.13 The remediation strategies, as outlined in **Appendix 15.2**, will be considered as inherent mitigation in the detailed design of Phase 1B (North). In view of this, it is deemed that the potential operational impacts from the detailed design in terms of contamination risks are **negligible**. This is consistent with the s73 ES and other EIA Documentation.

## Mitigation

- 15.6.14 No new or different mitigation was identified in the GQRA (**Appendix 15.2**) compared with the s73 ES and other EIA Documentation. A series of SSRS will be developed for various elements of Phase 1B (North) as outlined above. Therefore, the operational mitigation measures contained within the s73 ES and other EIA Documentation remain valid.

## Residual Impacts

- 15.6.15 No new or different impacts were identified than those reported in the s73 ES and other EIA Documentation, and therefore the residual impacts previously reported remain valid.
- 15.6.16 A summary of the residual impacts associated with ground contamination is included within **Chapter 22: Summary of Residuals Impacts and Mitigation**.

## References

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<sup>i</sup> CIRIA C716, London 2012, Remediating and mitigating risks from volatile organic compound (VOC) vapours from land affected by contamination