



Industrial Property Investment Fund (IPIF)

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# UNIT 5 BARTON PARK INDUSTRIAL ESTATE

Remediation Strategy





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## Remediation Strategy

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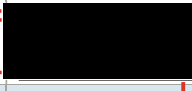
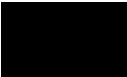
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# 1 INTRODUCTION

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## 1.1 AUTHORISATION AND PURPOSE OF THE ASSESSMENT

WSP UK Limited (WSP) was commissioned by Industrial Investment Property Fund (IPIF) (the 'Client') to prepare a Remediation Strategy for the yard at Unit 5, Barton Park Industrial Estate, Chickenhall Lane, Eastleigh, SO50 6RR ('the Site').

A Ground Contamination Liabilities Technical Summary Report was prepared by WSP in April 2021 (Ref No.: 70080743) (herein referred to as 'TSR, 2021'), which presented the finding from a ground investigation completed in March 2021 and outlined the identified contamination and associated liabilities requiring remedial measures.

This Remediation Strategy has been prepared following a request from the regulators to support the planning application for the Site by the Client. It has been prepared in general accordance with current good practice, including that detailed in the Environment Agency (EA) document Land Contamination Risk Management (LCRM) (2021). It should be noted that a Preliminary Risk Assessment (PRA) and Generic Quantitative Risk Assessment (GQRA) were not produced for the Site in line with LCRM.

A Site Location Plan and Site Boundary Plan are shown as **Figure 1** and **Figure 2** included in **Appendix A**.

## 1.2 PROPOSED DEVELOPMENT

The Client has confirmed that they are intending to resurface the whole footprint of the Site with new concrete hardstanding. The resurfacing works will be completed under planning, of which this Remediation Strategy will form part of the application. The Site will be used for commercial use following the resurfacing.

The Client has appointed Hurst Pierce & Mancolm LLP to complete the design for the new concrete hardstanding resurfacing of the Site, final plans are not yet available. WSP have been informed that the resurfacing will likely comprise 200mm thick reinforced concrete over 150mm layer of type 1 sub-base, which will include new surface drainage, flowing into new and existing below ground drainage. WSP understand that a new pump chamber and separator will be installed below ground as part of the resurfacing works, but this is yet to be confirmed. Final formation levels have not yet been confirmed.

## 1.3 OBJECTIVES

Based on the findings of the TSR, 2021, the objectives of these works were to prepare a Remediation Strategy in general accordance with LCRM, to address the pollutant linkages identified across the Site. This will include the following:

- Review of background information;
- Summary of relevant pollutant linkages as identified through development of a Conceptual Site Model (CSM) and generic quantitative risk assessment (GQRA);
- Remediation Objectives and Requirements;
- Options Appraisal;
- Remedial Strategy; and,
- Remediation Validation Plan.

## 1.4 SOURCES OF INFORMATION

The following contamination assessment reports and public information have been referred to in the design and preparation of this Remediation Strategy:

- WSP, Technical Summary Report, Unit 5, Barton Park Industrial Estate – Ground Contamination Liabilities Summary, Dated April 2021; Ref: 70080743 (TSR, 2021);
- British Geological Survey (BGS) Geological Map Sheet 315, Southampton, scale 1:50,000, Drift edition (2010)
- BGS 'Geology of Britain' online viewer (<http://mapapps.bgs.ac.uk/geologyofbritain/home.html>), accessed on 13 July 2021.
- Defra's Magic Map website (<https://magic.defra.gov.uk/MagicMap.aspx>), accessed on 13 July 2021.

## 1.5 CONFIDENTIALITY & LIMITATIONS

This report is addressed to and may be relied upon by Industrial Investment Property Fund.

This assessment has been prepared for the sole use and reliance of the above-named parties. This report has been prepared in line with the WSP proposal and associated notes. This report shall not be relied upon or transferred to any other parties without the express written authorisation of WSP. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party.

This report needs to be read and used in full. General limitations of the assessment are included in **Appendix B**.

## 2 SUMMARY OF SITE INFORMATION

### 2.1 SITE LOCATION & SITE DESCRIPTION

A Site Location Plan and Site Boundary Plan are provided as **Figure 1** and **Figure 2** included in **Appendix A**.

**Table 2-1** provides details of the Site which have been obtained from the TSN, 2021, which summaries key observations made during the ground investigation undertaken in March 2021.

**Table 2-1 - Site Information**

| Details                                           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Site Address                                      | Unit 5, Barton Park Industrial Estate, Chickenhall Lane, Eastleigh SO50 6RR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Grid Reference                                    | Approximate NGR – 445869, 118936                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Site Description                                  | <p>The Site is irregular in shape and comprises a yard associated with a single storey warehouse building located offsite immediately to the east. The Site is located within Barton Park Industrial Estate in Eastleigh, approximately 65 metres (m) east of Eastleigh train station.</p> <p>During the 2021 ground investigation, it was noted there was an electrical substation, propane tanks, and drums of lubricant and possible fuel present on Site.</p> <p>Publicly available aerial photos accessed in 2022 show the Site to be vacant, no longer storing shipping containers and telehandler observed in 2021.</p> |
| Site Surrounding Area                             | The surrounding area comprised railway sidings and the mainline railway to the west and Barton Park Industrial Estate to the north, south and east.                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Ground Cover, Surface Observations and Topography | The ground cover is a mix of hardstanding and rough broken ground, with at least one set of railway tracks visible cutting through the Site north to south. It is relatively flat across the Site, sloping slightly towards the east. Site elevation ranges from ~13.46 m above ordnance datum (AOD) in the east to 14.75 m AOD in the west.                                                                                                                                                                                                                                                                                   |

### 2.2 SITE HISTORY

#### 2.2.1 ON-SITE

Historically, the Site comprised a locomotive, carriage and wagon works from the 1890s until the Site was redeveloped into Barton Park Industrial Estate in the late 20th Century. Publicly available information appears to show that the former locomotive, carriage and wagon works buildings remain on the eastern boundary, but the railway infrastructure have been removed.

In recent years the Site has been used for container and wagon storage and is now understood to be vacant.

#### 2.2.2 OFF-SITE

Surrounding land uses have historically included gas works, sidings, warehouses, rail depot, refuse destructor and allotments; all of which represent potential sources of contamination. The current surrounding land uses include a mix of commercial, infrastructure and light industrial. Immediately to

the west of Site are multiple railway lines and an aggregates storage area relating to rail activities. The Site is bounded to the north, east and south by commercial or light industrial activities.

## 2.3 GROUND INVESTIGATION

A phase of ground investigation was undertaken on 16 March 2021. The geo-environmental investigations comprised the following:

- Four window sample boreholes (WS05 to WS08); and
- Eight dynamic cone penetrometer (DCP) locations (DCP09 to DCP16).

The exploratory hole locations from this investigation are presented on **Figure 3** included in **Appendix A**. A summary of the locations installed with monitoring wells are presented in **Table 2-2** below:

**Table 2-2 – Summary of Installed Monitoring Wells**

| Location | Response Zone (m bgl) | Stratum                            |
|----------|-----------------------|------------------------------------|
| WS05     | 1.00 – 2.30           | River Terrace Deposits             |
| WS06     | 1.00 – 2.50           | Made Ground/River Terrace Deposits |
| WS07     | 1.50 – 5.00           | Wittering Formation                |
| WS08     | 0.80 – 1.20           | River Terrace Deposits             |

Selected soil and groundwater samples were collected from the intrusive locations and submitted for chemical analysis. Following installation of the monitoring wells, groundwater level monitoring and ground gas monitoring was undertaken on two occasions.

The findings of the ground investigation works were used to complete a Ground Contamination Liabilities Summary Technical Note (dated April 2021), details of which are discussed further in **Section 3**.

## 2.4 GEOLOGY

Information collated from the exploratory hole logs from the ground investigation undertaken in March 2021 have been used to summarise the geology at the Site, which are generally in agreement with British Geological Survey (BGS) geological records, presented in **Table 2-3**.

**Table 2-3 – Summary of Ground Conditions**

| Stratum                   | Range of Depth to Base of Strata (m bgl) | Elevation to Base of Strata (m AOD) | Range of Thickness (m) |
|---------------------------|------------------------------------------|-------------------------------------|------------------------|
| Surfacing (where present) | 0.10 to 0.22                             | 14.52 to 13.39                      | 0.10 to 0.22           |
| Made Ground               | 0.55 to 2.30                             | 13.80 to 12.40                      | 0.38 to 2.08           |

| Stratum                | Range of Depth to Base of Strata (m bgl) | Elevation to Base of Strata (m AOD) | Range of Thickness (m) |
|------------------------|------------------------------------------|-------------------------------------|------------------------|
| River Terrace Deposits | 1.15 to 3.00 (base not proven)           | 13.40 to 11.56 (base not proven)    | 0.35 to 2.20           |
| Wittering Formation    | 5.00 (Base not proven)                   | 8.56 (Base not proven)              | 3.85 (Base not proven) |

## 2.5 VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

Visual/ olfactory observations of contamination were limited to two locations in the northern part of the Site during the ground investigation in March 2021. The observations presented in **Table 2-4**.

**Table 2-4 – Visual and Olfactory Evidence of Contamination**

| Exploratory Hole ID | Depth of Observation (m bgl) | Strata of Observation  | Description of Visual/ Olfactory Contamination                                  |
|---------------------|------------------------------|------------------------|---------------------------------------------------------------------------------|
| WS05                | 1.95                         | River Terrace Deposits | PID reading of 22ppm. Smear area with dark grey staining with hydrocarbon odour |
| WS05                | 2.00                         | River Terrace Deposits | Slight oily residue on recovered gravels with hydrocarbon odour                 |
| WS06                | 2.10                         | Made Ground            | Oily residue at base of strata and hydrocarbon odour                            |
| WS06                | 2.30                         | River Terrace Deposits | Hydrocarbon odour                                                               |
| WS06                | 3.00                         | Wittering Formation    | Solvent/ possible creosote odour                                                |

## 2.6 HYDROGEOLOGY AND HYDROLOGY

The superficial deposits, observed at the Site to be River Terrace Deposits is designated as Secondary A (Undifferentiated) Aquifer and the bedrock of the Wittering Formation is designated as a Secondary A Aquifer.

The Site is not within a Groundwater Source Protection Zone (SPZ) for public water supply.

Groundwater has been identified as being present within the River Terrace Deposits during monitoring at depths ranging between 2.02 m and 2.23 m bgl (12.54 m to 12.46 m AOD). Groundwater was also recorded within the Made Ground at WS06, however the installation was within an area of particularly deep Made Ground, where River Terrace Deposits were thinner than the rest of the Site, suggesting the superficial deposits have been removed previously and replaced with Made Ground. This indicates continuity between the Made Ground and River Terrace Deposits.

Groundwater was recorded within the Wittering Formation in one well during monitoring ranging from 1.25 m to 1.90 m bgl (12.31 m to 11.66 m AOD). However, given that this unit encountered was

observed to be generally cohesive within the ground investigation and slow to recharge during well development, it is considered that the groundwater is perched within isolated sand lenses.

Visual and olfactory contamination, in addition to elevated PID readings were observed primarily within the River Terrace Deposits (WS05 and WS06). The River Terrace Deposits were unproven in WS05 but in WS06, the contamination was observed to sit at the base of the River Terrace Deposits, on top of the Wittering Formation, described in all locations as a silty Clay. It is therefore considered that the cohesive Wittering Formation acts as an aquitard to the vertical migration of contamination.

Groundwater flow direction is likely to be towards the northeast, in the direction of the River Itchen, located 300 m northeast, at its closest point.

### 3 RISK ASSESSMENTS

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A summary of the risk assessment undertaken within the TSR, 2021 is outlined below. This summary should be read in conjunction with the full risk assessments included within the TSR, 2021.

#### 3.1 HUMAN HEALTH RISK ASSESSMENT FROM SOILS

The human health risk assessment from soils was undertaken based on the understanding that the Site was to be leased again to commercial operations in the future. Therefore, soil analytical results were screened against selected commercial land use generic assessment criteria (GAC).

Soil organic matter (SOM) content of the soil samples obtained from across the Site were highly variable, ranging between 0.741% to 30%, with an average of 8.18%. However, given the high level of variability across the Site, a SOM value of 1% was utilised to generate conservative screening criteria.

To assess the risk to human health from vapours derived from groundwater, a commercial land use scenario and a sand soil type were assumed to generate conservative GAC.

It should be noted that any changes to the proposed end use scenario or hard surfacing design may require a re-assessment of the data and the associated risks.

The following key points were identified:

- Although there were elevated concentrations of total petroleum hydrocarbons (TPH) within soil samples (WS06 and WS07), there were no exceedances of GAC for a commercial land use;
- Visual and olfactory evidence of contamination was identified within WS05 and WS06 as presented in **Table 2-4**. In addition, anthropogenic inclusions such as clinker, were noted in the Made Ground;
- There was one soil sample (WS05 at 0.30 m bgl) which had asbestos containing material positively identified and submitted for quantification. Loose fibres of asbestos were detected with a quantification value of 0.966%;
- Groundwater samples collected were compared against the commercial sand soil type groundwater vapour GAC, with no exceedances recorded;
- Based on the findings and the future site use to comprise a commercial scenario, the risk to future site users within areas of hardstanding and buildings is unlikely to present a risk to human health but may present a risk if areas of soft landscaping are included as part of the future resurfacing design;

Asbestos containing materials were identified within one sample from the Made Ground. The presence of asbestos within other areas of the Site cannot be discounted. There is considered to be a **Moderate** risk to current site users and third-party neighbours during the proposed earthworks and construction works for the resurfacing. Subsequent to resurfacing, the risks will be considered **Low**.

The risk to construction / maintenance workers and third-party neighbours during earthworks and construction require management through appropriate risk assessment and control measures, managed under the Construction (Design and Management) (CDM) Regulations 2015 (CDM, 2015).

There were no exceedances of GAC within the soil samples tested, though elevated concentrations elsewhere on the Site cannot be discounted given the Sites history. The risk to future construction /

maintenance workers, site users and third-party neighbours from contaminants in soils is considered to be **Negligible**. This is because the proposed concrete resurfacing will break any potential contaminant linkage between the contaminant and the receptors. Based on this, the risk to human health from contaminants in soil was not considered further.

## 3.2 CONTROLLED WATERS RISK ASSESSMENT

Soil leachate and groundwater samples were compared against Environmental Quality Standard (EQS) to assess the risk to the River Itchen. Soil leachate and groundwater samples were compared against Drinking Water Standards (DWS) to assess the risk to the Secondary A (Undifferentiated) Aquifer within the River Terrace Deposits and the Secondary A Aquifer in the Wittering Formation.

The TSR, 2021 identified the following:

- Two samples from WS06 (2.10 m - 2.30 m bgl (Made Ground) and 3.50 m - 4.00 m bgl (Wittering Formation)) were submitted for leachate analysis. When compared against the groundwater GACs, there were no exceedances.
- Groundwater was obtained from three of the four monitoring wells following the ground investigation (WS05, WS06 and WS07). Monitoring well WS08 was dry during all monitoring visits, likely due to its shallow installation.
- Visual and olfactory contamination as oily residue in unsaturated and saturated River Terrace Gravels observed in WS05 and WS06. Possibility for further hotspots on Site.
- Exceedances of the EQS and DWS criteria were encountered in groundwater samples with respect to metals, PAHs and TPHs. The TPH exceedances were observed in WS05 and WS06 only, where visual oily residue was also observed within the River Terrace Deposits.
- The exceedances were recorded within all three samples and therefore contamination is assumed to be widespread within the groundwater across the Site.

Although there were no exceedances from leachable contaminants from the soil samples tested, visual and olfactory evidence of contamination as oily residues were present in River Terrace Deposits with a risk of further leaching to groundwater increased with infiltration. The risk from leachable contaminants to groundwater is considered to be **Low to Moderate**.

Given that groundwater underlying the Site has been inferred as flowing towards the northeast, the exceedances of the EQS criteria in groundwater samples indicate that groundwater underlying the Site has the potential to impact the River Itchen, to the east of the Industrial Park. However, given the Site's location within an industrial area and with extensive railways siding to the west, the exceedances in the groundwater may be attributed to the surrounding area and from offsite. The risk to the River Itchen is considered to be **Moderate**.

Exceedances of the DWS criteria in groundwater samples underlying the Site represent a theoretical risk to groundwater within the Secondary Undifferentiated Aquifer of the River Terrace Deposits. However, given the historical and current use of the Site and surrounding area, it is considered that the groundwater underlying the Site is unlikely to be utilised as a drinking water resource in the future. Therefore, based on the available information, the risk from contaminants underlying the Site to groundwater within the Secondary Undifferentiated Aquifer of the River Terrace Deposits, is considered to be **Low to Moderate**.

Although the Wittering Formation is classified as a Secondary A Aquifer, due to the cohesive nature of the deposit at the Site, the stratum is considered to act as an aquitard. Therefore, the risk is considered to be **Low**.

### 3.3 GROUND GAS RISK ASSESSMENT

Ground gas monitoring was undertaken on two occasions following the ground investigation. The monitoring rounds were completed on the 24 and 31 March 2021. Falling atmospheric pressures were recorded during both rounds of monitoring with the following findings:

- Hydrogen sulphide and carbon monoxide did not rise above 0.1 ppm during the two monitoring visits.
- Minor elevated volatile organic compound (VOC) readings using a PID were recorded at all four monitoring wells, ranging between <0.1 ppm and 0.4 ppm.
- Depleted oxygen concentrations were recorded at WS06 and WS08, with values ranging between 13.50 and 15.20 %v/v.

Based on the monitoring data and in accordance with CIRIA C665 guidance, a maximum gas screening value (GSV) of 0.0001 l/hr was calculated for methane, and a maximum GSV of 0.0041 l/hr was calculated for carbon dioxide. The ground gas characterisation of the Site was determined to be CS1, considered to be **Very Low** risk.

The depleted oxygen concentrations are considered to present a risk to below ground construction workers and maintenance workers, rated as **Moderate**. This risk would need to be addressed through appropriate risk assessments and control measures, managed under CDM 2015.

Offsite migration of gasses and vapours is considered to present a **Very Low** risk given the negligible flow rates observed. In future, should the land use change, further ground gas monitoring and assessment would be required in line with good working practises as presented within industry guidance CIRIA C665 and BS8484:2015+A1:2019.

The monitoring strategy was designed to provide an initial indication of whether ground gas may represent a potential risk to the future end-users. Although the number of monitoring visits and monitoring period durations were not compliant with the typical/idealised frequency recommended in CIRIA C665, ground gas was not identified as a significant potential risk on Site and two monitoring rounds are considered to be sufficient to form an initial baseline site characterisation.

## 4 CONCEPTUAL SITE MODEL

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### 4.1 INTRODUCTION

The conceptual site model (CSM) is taken from the TSR, 2021 and presents the key receptors at the Site and provides plausible linkages identified from the generic risk assessment in **Section 3**.

### 4.2 POTENTIAL CONTAMINATION SOURCES

Based on the Site conditions and potential contaminant linkages, potential sources of contamination that may affect the future commercial development and end use have been identified as follows:

- Asbestos within Made Ground soils;
- Dissolved metals, PAHs and TPHs in groundwater; and,
- Ground gases.

### 4.3 POTENTIAL RECEPTORS

Relevant potential receptors are considered to include the following in the context of the proposed concrete hardstanding resurfacing:

#### Human Health

- Current and future site users, site workers and visitors;
- Construction and maintenance workers; and,
- Third party neighbours.

#### Controlled Waters

- River Terrace Deposits (Secondary Undifferentiated Aquifer);
- Wittering Formation (Secondary A Aquifer); and
- River Itchen (300m northeast of the Site).

### 4.4 RELEVANT CONTAMINANT LINKAGES

**Table 4-1** presents the contaminant linkages that were considered to be plausible following the ground investigation, based on an evaluation of the potential sources and future receptors and the current hydrogeological model.

**Table 4-1 – Relevant Contaminant Linkages**

| Plausible Contaminant Linkage (PCL) | Source                                | Pathway                                                                                                                                                                  | Receptor                                                                          | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PCL 1</b>                        | Asbestos                              | Inhalation of fibres and windblown to adjacent properties                                                                                                                | Future site users<br>Construction / maintenance workers<br>Third party neighbours | Asbestos containing materials was identified within one sample tested from the Made Ground. The presence of asbestos within other areas of the Site cannot be discounted. There is considered to be a <b>Moderate</b> risk to current site users and third-party neighbours when construction works for the resurfacing works take place.<br><br>Consideration of further risk assessment and appropriate control measures must be undertaken if this material is to be re-used on site or disposed off-site to a suitably licenced facility.                                                                               |
| <b>CL 2</b>                         | Contaminants in soils                 | Dermal contact<br><br>Ingestion of impacted soil particles on-site, and windblown to adjacent properties<br><br>Inhalation of dust, and windblown to adjacent properties | Future site users<br>Construction / maintenance workers<br>Third party neighbours | There were no exceedances of GAC within the soil samples tested, given the Sites history, they may be present elsewhere on the Site.<br><br>The risk to future maintenance workers, site users and third-party neighbours from contaminants in soils is <b>Negligible</b> as the proposed concrete surfacing will break any potential contaminant linkage between the contaminant and the receptors.<br><br>There is a potential risk to construction workers and third party neighbours during the construction of the concrete surfacing which should be mitigated through risk assessment and management under CDM 2015. |
| <b>CL 3</b>                         | Dissolved contaminants in groundwater | Inhalation of vapours<br><br>Direct contact                                                                                                                              | Future Site users<br>Construction / maintenance workers<br>Third party neighbours | No groundwater samples exceeded the commercial vapour GAC indicating a <b>Very Low</b> risk to future Site users and third-party neighbours from groundwater derived vapours.<br><br>The risk to construction / maintenance workers during construction phases of the concrete resurfacing from direct contact with contaminants in shallow groundwater is considered to be <b>Moderate</b> and requires management through appropriate risk assessment and control measures under CDM 2015.                                                                                                                                |
| <b>CL 4</b>                         | Leachable contaminants in soils       | Vertical and lateral leaching form impacted soils.                                                                                                                       | River Terrace Deposits (Secondary)                                                | Hydrocarbon hotspots as oily residue were noted in WS05 and cannot be discounted from being present in other isolated areas on Site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

| Plausible Contaminant Linkage (PCL) | Source                                         | Pathway                                           | Receptor                                                                                                                         | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------|------------------------------------------------|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                     |                                                |                                                   | Undifferentiated Aquifer)<br>Wittering Formation (Secondary A Aquifer)<br>River Itchen 300m NE                                   | No leachable contaminants were identified in the soil samples tested.<br><br>There is a <b>Low to Moderate</b> risk to controlled waters from leaching of impacted soils from oily residues, although no exceedances were identified in the analysis. The resurfacing of the hardstanding will limit rainfall infiltration to the subsurface and therefore restricting the leaching of contaminants from shallow soils into the underlying groundwater.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| CL 5                                | Dissolved metals, PAHs and TPHs in groundwater | Vertical and lateral migration within groundwater | River Terrace Deposits (Secondary Undifferentiated Aquifer)<br>Wittering Formation (Secondary A Aquifer)<br>River Itchen 300m NE | Exceedances of the DWS criteria in groundwater samples underlying the Site represent a theoretical risk to groundwater within the Secondary Undifferentiated Aquifer within the River Terrace Deposits. However, given the historical and current use of the Site and surrounding area, it is considered that the groundwater underlying the Site is unlikely to be utilised as a drinking water resource in the future. Therefore, based on the available information, the risk from contaminants underlying the Site to groundwater within the Secondary Undifferentiated Aquifer within the River Terrace Deposits, is considered to be <b>Low to Moderate</b> .<br><br>Although the Wittering Formation is classified as a Secondary A Aquifer, due to the cohesive nature of the deposit at the Site, the stratum is considered to act as an aquitard. Therefore, the risk is considered to be <b>Low</b> .<br><br>Given that groundwater underlying the Site has been inferred as flowing towards the east, the exceedances of the EQS criteria in groundwater samples indicate that groundwater underlying the Site has the potential to impact the River Itchen, adjacent to the east. The risk to the River Itchen is considered to be <b>Moderate</b> . |

| Plausible Contaminant Linkage (PCL) | Source                                                | Pathway                                       | Receptor                                                                                                          | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------|-------------------------------------------------------|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CL 6                                | Aggressive compounds (i.e. sulphate and hydrocarbons) | Direct contact with impacted soils            | Future below ground services (e.g. potable water supply pipes)<br>Future building structures                      | Based on the available data and the preliminary assessment, barrier pipes are considered to be required if pipes are to be installed where identified elevated hydrocarbons contamination is present. However, it should be noted that the assessment was preliminary, and any pipe design should be subject to the appropriate testing in service trenches and agreed with the relevant statutory authority.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| CL 7                                | Made Ground and hydrocarbons                          | Migration of ground gas and volatile vapours. | Future Site users<br>Construction / maintenance workers<br>Third party neighbours<br>Adjacent building structures | <p>The Site has been classified as being Characteristic Situation 1 (<b>Very Low</b> risk) with respect to ground gases. This indicates that ground gas protection measures are not required to mitigate the gas risk. Although the number of visits and monitoring period duration are not compliant with the typical/idealised frequency and monitoring periods recommended in CIRIA C665, ground gas was not identified as a significant potential risk on Site and two monitoring rounds are considered to be sufficient to provide an initial baseline site characterisation.</p> <p>The depleted oxygen concentrations, readings of carbon monoxide, and visual / olfactory evidence of contamination and elevated PID concentrations recorded during the intrusive investigation indicate that there is a potential ground gas and vapour risk to below ground construction and maintenance workers. This is therefore considered to be a <b>Moderate</b> risk at the Site which would need to be addressed through appropriate risk assessments and control measures.</p> |

Risks associated with potable water supply have not been assessed within this report. The suitability of materials surrounding potable water supplies in any remaining ground should be assessed and confirmed with the water supply company when the design plans are finalised.

## 5 REMEDIATION OBJECTIVES, CONSTRAINTS AND OPTIONS APPRAISAL

This section defines the remediation objectives and constraints and sets out the basis for selecting the most appropriate overall remediation option for the Site.

### 5.1 REMEDIATION OBJECTIVES

The remediation objectives of this strategy are set out below and have been developed to address the potential risks to human health, controlled waters, services and buildings for the future development.

The remediation objectives of the future development are as follows:

- Protection of human health and the environment;
- To provide a site suitable for the proposed end-use;
- Contributing to a sustainable development;
- Minimising adverse environmental impact offsite; and,
- Best practical remediation measures.

The protection of human health and the environment from soil contamination will need to address;

- Unacceptable risks to human health; and,
- Release of contaminants to groundwater.

From the plausible contaminant linkages listed in **Table 4-1**, the relevant contaminant linkages (RCLs) with a risk of Moderate or higher have been brought forward for remediation as presented in **Table 5-1**.

**Table 5-1 – Relevant Contaminant Linkages**

| RELEVANT CONTAMINANT LINKAGE (RCL) | SOURCE                          | PATHWAY                                                   | RECEPTOR                                                                          | COMMENTS                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------|---------------------------------|-----------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RCL 1                              | Asbestos                        | Inhalation of fibres and windblown to adjacent properties | Future site users<br>Construction / maintenance workers<br>Third party neighbours | Control measures during excavation works associated. Source removal of arisings generated.<br><br>During groundworks appropriate asbestos controls are recommended to mitigate the risk against the release of airborne asbestos fibres (including air monitoring) are recommended.<br><br>Provision of a pathway break in soft landscaped areas. |
| RCL2                               | Leachable contaminants in soils | Vertical and lateral leaching from impacted soils.        | River Terrace Deposits (Secondary Undifferentiated Aquifer)                       | Hydrocarbon hotspots as oily residue were noted in WS05 and cannot be discounted from being present in other isolated areas on Site.                                                                                                                                                                                                              |

| RELEVANT CONTAMINANT LINKAGE (RCL) | SOURCE                                         | PATHWAY                                           | RECEPTOR                                                                            | COMMENTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------|------------------------------------------------|---------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                    |                                                |                                                   | Wittering Formation (Secondary A Aquifer)<br>River Itchen 300m NE                   | Consideration for the use of hotspot removal / localised groundwater treatment if oily residue encountered in the groundwater within excavations.                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>RCL 3</b>                       | Dissolved contaminants in groundwater          | Inhalation of vapours<br>Direct contact           | Construction / maintenance workers                                                  | Control measures in line with CDM Regulations during excavation works such as the installation of infrastructure.<br><br>Provision of a pathway break to mitigate the risk to human health.<br><br>Consideration of localised water treatment to reduce the mass of dissolved phase contaminants in the groundwater.                                                                                                                                                                                                                                                                           |
| <b>RCL 4</b>                       | Dissolved metals, PAHs and TPHs in groundwater | Vertical and lateral migration within groundwater | River Terrace Deposits (Secondary Undifferentiated Aquifer)<br>River Itchen 300m NE | Hydrocarbon hotspots as oily residue were noted in WS05 and cannot be discounted from being present in other isolated areas on Site. With the removal of hotspots encountered during construction works and the application of concrete hardstanding, this will prevent rainwater infiltration and reduce leaching potential to groundwater,<br><br>Control measures in line with CDM Regulations during excavation works such as the installation of infrastructure.<br><br>Consideration of localised water treatment to reduce the mass of dissolved phase contaminants in the groundwater. |
| <b>RCL 5</b>                       | Made Ground and hydrocarbons                   | Migration of ground gas and volatile vapours.     | Construction / maintenance workers                                                  | Control measures in line with CDM Regulations during excavation works such as the installation of infrastructure.<br><br>No requirement for ground gas / vapour protection measures based on the nature of the proposed end-use however active monitoring should be considered in excavations during construction.                                                                                                                                                                                                                                                                             |

## 5.2 CONSTRAINTS

Prior to the assessment of potential remediation techniques, site-specific characteristics and constraints that could affect the selection of feasible options has been considered. These are identified in **Table 5-2**.

**Table 5-2 –Potential Remediation Constraints**

| Characteristic or Constraint | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Proposed Development         | Resurfacing of the whole footprint of the Site with reinforced concrete, including above and below ground drainage and a below ground interceptor.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Site use and condition       | The Site is currently vacant with former containers and equipment being stored at the Site no longer present.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Working area                 | The Site is relatively small and may require a strategy to manage vehicles associated with the proposed earthworks and resurfacing of the Site. Material deemed unsuitable should be removed from the Site as soon as practicable. Stockpiles should be away from the boundary with the railway lines and no higher than 2m.                                                                                                                                                                                                                                                                                                                                                                                                        |
| Site access                  | Access to the Site is via a set of double gates on the northern boundary or the southern boundary.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Security                     | The Site is fully fenced with lockable gates on the northern and southern boundary. The fencing comprises 2.4m high palisade. There appears to be an electric fence around the perimeter of the Site, although its condition is unknown.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Surface water and flooding   | There is no known surface water flooding at the Site, which is set within an Industrial Estate. The nearest surface water is the River Itchen, 300 m to the northeast.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Ecology                      | There are no known ecological constraints present on Site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Tree preservation order      | There are no known Tree Preservation Orders (TPOs) pertaining to the Site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Heritage                     | There are no known relevant heritage interests pertaining to the Site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Unexploded ordnance          | An unexploded ordnance (UXO) preliminary assessment has been undertaken which indicates that the Site is within an area of Moderate UXO hazard level. Some level of monitoring may be required during earthworks excavations to prepare site levels for the resurfacing.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Services                     | <p>There is an electrical substation located in the northeast of the Site, managed by Scottish and Southern Electricity Networks. A low voltage cable extends around the perimeter fencing, suggesting it is an electric fence, but its condition cannot be confirmed.</p> <p>Below ground water, foul water, surface water and high voltage electric extend along the eastern boundary, parallel to the adjacent building. A BT cable is also noted to extend along the building.</p> <p>Foul water from the building flows offsite in a southerly direction. Foul water in the north, including surface water flows offsite site to the north.</p> <p>Utility information and 2021 survey are presented in <b>Appendix C</b>.</p> |
| Railway                      | The western boundary is constrained by multiple railway lines and an aggregates storage area relating to rail activities. Agreement on methods for the resurfacing may require agreement from Network Rail.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

### 5.3 REMEDIATION OPTIONS APPRAISAL

An appraisal has been undertaken taking into consideration technical, logistical and financial aspects of the remediation technology/options and incorporates the staged approach as defined in LCRM.

The remedial options available to manage unacceptable risks will either:

- Manage (remove, destroy, modify or immobilise) the source;
- Interrupt the pathway; or,
- Modify the receptor or the behaviour of the receptor.

The proposed options are designed to manage the source of contamination or interrupt the pathway. Modifying receptor or receptor behaviour has not been considered in this instance. Source management may involve the removal, destruction, stabilisation, or transformation of the source. Pathway interruption may involve either the blocking of the pathway or the destruction or removal of contaminants moving along a pathway.

## 5.4 FEASIBLE REMEDIATION OPTIONS

Feasible remedial techniques for the Site for the RCLs identified are provided in **Table 5-3**, which include in-situ and ex-situ civil engineering based and process-based solutions. Due to the limited contamination risks and resurfacing proposed for the Site, a full list and then short list of remediation options has not been considered necessary for this project. **Section 5.5** presents the preferred option for remediation from the table.

RC2 and RC4 have been excluded from the long list remediation **Table 5-3** as the Moderate risk rating was for construction workers/ maintenance workers only, which is mitigated through construction risk assessment and management in line with CDM 2015 and not through remediation.

**Table 5-3 – Feasible Remediation Options**

| RCL  | Details                                                                                              | Remediation Method               | Remediation Option                 | Applicable/ Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------|------------------------------------------------------------------------------------------------------|----------------------------------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RCL1 | Asbestos fibres in Made Ground with a risk of inhalation for site workers and third party neighbours | Civil Engineering                | Containment – cover system         | A containment option involves the full or partial containment of the contamination to remove the exposure pathway to the receptor. In the instance of asbestos fibres within the Made Ground, a partial containment as a cover system would be suitable to remove the exposure pathway. This is a cheaper option in relation to other options. The disadvantages is that the asbestos fibres are still present onsite below the containment system and should the site situation change/ the barrier is broken, the containment suitability should be reassessed.                          |
|      |                                                                                                      | Civil Engineering                | Excavation and disposal            | Involves excavation of affected soils and disposal offsite. It has the advantage of complete removal of the contaminant from the site. The disadvantage is with the associated disposal costs for asbestos impacted soils and is seen as an environmentally unsuitable solution. Excavated impacted material to be sent to a suitably licensed waste facility or landfill. Further material would then be required for import to replace excavated soils. Any excavation should be undertaken in line with materials management of the soils in accordance with waste management guidance. |
|      |                                                                                                      | Stabilisation and Solidification | Hydraulic binders (such as cement) | The option of stabilisation and solidification uses binders to lock the asbestos fibres into the Made Ground matrix to reduce the ability of the fibres to be released. The disadvantage is the cost in addition to the risk of releasing fibres should the stabilised surface be damages.                                                                                                                                                                                                                                                                                                 |
|      |                                                                                                      | Thermal                          | Incineration                       | Thermal is an uncommon treatment option for asbestos and requires extremely high temperatures to enable the asbestos to be chemically altered to no longer present a risk to human health. This option requires the excavation and removal of the impacted soils and replacement with suitable imported materials. The disadvantage of this option is the very high treatment costs for such a small site.                                                                                                                                                                                 |
| RCL2 | Oily residue in soils with risk of leaching to River Terrace                                         | Civil Engineering                | Containment – hydraulic barrier    | A containment option involves the full or partial containment of the contamination to remove the exposure pathway to the receptor. In the instance the oily residue contaminants within the soils, leaching                                                                                                                                                                                                                                                                                                                                                                                |

| RCL  | Details                                                                                                                                  | Remediation Method               | Remediation Option                 | Applicable/ Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | Deposits (Secondary Undifferentiated Aquifer)                                                                                            |                                  |                                    | to groundwater. A partial containment, in this instance a hardcover would be suitable to remove the pathway by removing rainwater infiltration and thus reducing further leaching and mobility of contaminants. This is a cheaper option in relation to other options. The disadvantages is that the oily residues are still present onsite below the containment system, although natural attenuation will likely occur. All oily residue encountered during the works to be removed and disposed offsite.                                              |
|      |                                                                                                                                          | Civil Engineering                | Excavation and disposal            | This would require the excavation and removal of the oily residues from the Site. Given the Low to Moderate risk, the cost of removing the limited oily residue is not considered necessary, particularly with the installation of the concrete surfacing, removing rainwater infiltration and leaching.                                                                                                                                                                                                                                                 |
|      |                                                                                                                                          | Biological                       | Boipiles, windrow turning,         | These biological treatment options will require excavation to enable treatment of the soils and given the limited observed oily residues on site, is cost prohibitive for the size of the works. The concrete surfacing will removing rainwater infiltration and leaching.                                                                                                                                                                                                                                                                               |
|      |                                                                                                                                          | Physical                         | Soil Vapour Extraction (SVE)       | The oily residues are likely to be from the heavy end TPH contamination identified in the groundwater and not easily treated with SVE.                                                                                                                                                                                                                                                                                                                                                                                                                   |
|      |                                                                                                                                          | Stabilisation and Solidification | Hydraulic binders (such as cement) | The option of stabilisation and solidification uses binders to lock the asbestos fibres into the Made Ground matrix to reduce the ability of the fibres to be released. The disadvantage is the cost in addition to the risk of releasing fibres should the stabilised surface be damages.                                                                                                                                                                                                                                                               |
| RCL4 | Dissolved metals, PAHs and TPHs in groundwater with a risk to the underlying River Terrace Deposits (Secondary Undifferentiated Aquifer) | Civil Engineering                | Containment – hydraulic barrier    | A containment option involves the full or partial containment of the contamination to remove the exposure pathway to the receptor. In the instance of the dissolved phase contaminants within the groundwater to the wider aquifer. A partial containment, in this instance a cover system would be suitable to remove the pathway by reducing rainwater infiltration and thus reducing further leaching and mobility of contaminants. This is a cheaper option in relation to other options. The disadvantages is that the dissolved phase contaminants |



| RCL | Details | Remediation Method | Remediation Option               | Applicable/ Comment                                                                                                                                                                                                                                                                                                         |
|-----|---------|--------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |         |                    |                                  | are still present onsite below the containment system, although natural attenuation will likely occur.                                                                                                                                                                                                                      |
|     |         | Biological         | Natural Attenuation              | Natural attenuation allows the dissolved phase contaminants to be broken down naturally over time by naturally occurring bacteria in the ground and groundwater. The advantage of this option is that it has very low costs. The disadvantage of this option is the very long timeframe to remove contaminants.             |
|     |         | Physical           | Permeable Reactive Barrier (PRB) | The permeable reactive barrier option comes with a very high installation, operational and maintenance cost. The cost of a PRB would be excessive for the low-level exceedances recorded at the Site. The advantage of a PRB is the success at treating contaminated groundwater prior to discharge down gradient/ offsite. |

## 5.5 REMEDIATION SHORT LIST AND PREFERRED REMEDIATION OPTIONS

### 5.5.1 RCL1 ASBESTOS FIBRES IN MADE GROUND

**Table 5-3** presented four options to mitigate the risk of asbestos and asbestos fibres to human health at the Site. Excavation & disposal and thermal treatment were ruled out due to the high cost of progressing with these options. Given the small size of the Site and the proposal already in place to complete concrete resurfacing, the option to stabilised & solidified material was discounted. The preferred remediation option was containment comprising a cover system, which is completed as the new site wide concrete resurfacing.

### 5.5.2 RCL3 OILY RESIDUE IN SOILS

Table 5-3 provided a range of option to treat the oily residue observed within exploratory location WS05 and likelihood of further isolated hotspots. Given the limited oily residue observed, the most appropriate option for the context of the Site was containment through the installation of the concrete surfacing across the Site. In addition, any oily residues encountered during the earthworks and preparation for the concrete should be excavated and removed from Site for disposal.

### 5.5.3 RCL3 DISSOLVED CONTAMINANTS IN GROUNDWATER

This risk of inhalation of vapours from volatile contaminants in the groundwater was determined to be a moderate risk to construction workers during the preparation of the ground ahead of resurfacing. Risks present during construction works shall be mitigated through risk assessment, management and safe systems of work as required through The Construction (Design & Management) Regulations 2015.

The control measures could include vapour monitoring during excavation using a photo-ionisation device (PID) to continuously monitor the volatile vapours and exposure to the construction staff.

### 5.5.4 RCL4 DISSOLVED CONTAMINANTS IN GROUNDWATER

**Table 5-3** assessed three options for the remediation of dissolved contaminants within the groundwater with a potential risk to the River Terrace Deposits, assigned as a Secondary (undifferentiated) Aquifer by the EA. A permeable reactive barrier was excluded due to the very high installation cost, in addition to ongoing operation and maintenance costs given the low groundwater sensitivity of the Site considering its historic uses and current industrial estate.

Both containment and natural attenuation were viable options, with the preferred option being containment as part of the proposed concrete resurfacing. Initially the containment system, as a hardstanding concrete cover would prevent rainwater infiltration of the soils and reduce mobility of the contaminants, allowing natural attenuation to occur on its own.

### 5.5.5 RCL5 GROUND GAS AND VOLATILE VAPOURS

This risk of asphyxiation from depleted oxygen within below ground excavations and works was determined to be a moderate risk to construction workers during the preparation of the ground ahead of resurfacing. Risks present during construction works shall be mitigated through risk assessment, management and safe systems of work as required through CDM 2015.



Control measures could include gas, vapour and oxygen monitoring during below ground works and having a safe egress from all below ground and confined space works. This would be particularly relevant during deeper excavation into groundwater during the installation of the interceptor.

## 6 REMEDIATION STRATEGY

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### 6.1 OUTLINE STRATEGY

The Remediation Strategy is intended to define the preferred option to remediate the Site in accordance with industry best practice considering the site-specific information collected during the ground investigation and GQRA. The Remediation Strategy must enable the completion of the remediation objectives outlined in **Section 5.1**. The outline strategy proposed is as follows:

- Breakout existing hard surfacing;
- Earthworks and preparation of sub-surface;
- Removal of oily residues or contamination (if encountered); and
- Installation of hardstanding surfacing across the Site (concrete).

### 6.2 EXISTING HARDSTANDING REMOVAL

#### 6.2.1 HARDSTANDING & SUB-BASE

It is envisaged that breakout of existing hardstanding will be required to progress the proposed resurfacing. When breaking out hardstanding, these materials should be segregated and records kept of the volumes of recycled material, including volumes of concrete generated. Tarmacadam broken out should be stockpiled and removed offsite for recycling at a licensed facility.

Locations of material stockpiles shall be recorded on a live material tracking plan, which will be revised during the course of the works in line with Material Management requirements covered in **Section 6.2.4**. Reinforcing bar and other recovered metals shall also be logged prior to being transported to a licenced metal recycling facility.

As part of the hardstanding removal, sub-base materials, where present, will be stockpiled for verification testing and potential reuse.

#### 6.2.2 EXCAVATION TO PREPARE LEVELS

Although final levels have not yet been provided, it is likely some excavation will be required to prepare the platforms ahead of sub-base and concrete surfacing installation. The final surfacing design is likely to contain surface and below ground drainage, including a new below ground interceptor, tying into existing drainage.

A watching brief for contaminated material and free phase oil shall be carried out during excavation works as detailed in **Section 6.3**. Grossly impacted material within the unsaturated zone shall be removed from the Site under Duty of Care to a licenced waste facility or landfill. General excavated material will be stockpiled for processing and testing for suitability for reuse. All excess material are to be removed from the Site. Locations of material stockpiles shall be recorded on a live material tracking plan, which will be revised during the course of the works in line with Material Management requirements covered in **Section 6.2.4**.

Asbestos is known to be present within the Made Ground with control measures detailed within **Section 6.8.1**.

### 6.2.3 CRUSHING/ PROCESSING

Excavated hardstanding that is determined to be potentially suitable for reuse (free of visual or olfactory signs of contamination) shall be transferred to designated crushing areas onsite. Steel reinforcement bar liberated during crushing shall be stockpiled separately prior to offsite disposal.

All crushed material will be sampled at the specified frequency outlined in **Section 6.6** and given a unique sample reference, linking them to a specific stockpile.

Areas designated for crushing shall be segregated and subject to environmental compliance monitoring in accordance with the Mobile Plant Environmental Permit. Methods including damping materials prior to crushing should be employed.

### 6.2.4 MANAGEMENT OF ARISING

The earthworks associated with the resurfacing works could generate a small volume of construction arisings as part of the levelling for the new surfacing. In order to ensure that the remediation strategy is adhered to, it will be necessary firstly to confirm whether these materials are required for reuse on the Site. If required, these would need to be tested for chemical suitability in line with the frequency sent out in **Section 6.6** and the assessment criteria outlined within **Tables 6-2** and **6-3**. They should also be tested for geotechnical suitability for reuse. Should materials fail the reuse criteria, they should be removed from the Site under Duty of Care and sent to a suitably licensed waste facility.

To control the reuse of soils during the levelling works, a Materials Management Plan (MMP) for the Site in accordance with the Definition of Waste Development Industry Code of Practice, CLAIRE should be prepared. This will set out how the movement of materials will be tracked and verified and demonstrate that the soils used during the earthworks are all recovered for an intended purpose and suitable for the end use. A 'Qualified Person' as defined under the Codes of Practice (CoP) will review the development of the Materials Management Plan, Risk Assessments and Remediation Strategy/Design Statement together with documentation relating to Planning and Regulatory issues will sign a Declaration which is forwarded to the Environment Agency and which confirms compliance with the CoP.

The movement and reuse of material during the levelling and potential reuse of existing material at surface will be recorded by the Contractor and independently verified by on site testing by an independent consultant to fulfil the requirements of the Material Management Plan (MMP) and this Remediation Strategy (RS).

## 6.3 VISUAL INSPECTIONS AND WATCHING BRIEF

It is proposed that a system of appropriate inspection and assessment is implemented during the excavation and levelling of the Site prior to the resurfacing as part of the planned works. This role will be performed by a suitably experienced Engineer who is able to provide an appropriate level of specialist technical advice in relation to the presence of contamination or otherwise.

The Engineer shall ensure that all material is correctly inspected, stockpiled, tested and classified. The Engineer will have primary responsibility for the inspection of arisings and excavation of any suspected contaminated material.

The Engineer will direct the contractor as to how arisings are to be managed, including the requirements for the segregation, stockpiling and subsequent testing.

In addition, during the material excavation and levelling works, the Contractor should maintain the services of an asbestos consultant to provide guidance on works, particularly if further asbestos is encountered. The asbestos consultant should provide advice, methodologies for mitigating fibre release, providing tool box talks to staff and undertaking personnel and verification monitoring.

In order to maximise the quantity of material that can be retained on Site for reuse, the segregation of different material types should be completed in accordance with the Materials Management Plan (MMP). For example, concrete, tarmacadam and Made Ground soil deposits should be excavated separately and segregated at the point of excavation.

## **6.4 OILY RESIDUE REMOVAL/ GROUNDWATER MANAGEMENT**

It is likely that oily residues within the soils may be encountered during the earthworks and levelling required ahead of concrete resurfacing. It was observed within WS05 in the north of the Site. As described in Section 6.3, all excavations should be supervised by an experienced Environmental Consultant to watch for signs of contamination.

If oily residues are encountered, they should be removed from the excavation and segregated in an isolated stockpile for offsite disposal. The stockpile should be located on an impermeable surface and covered to prevent contaminated material runoff. After the removal of the oily residues, the excavation should be visually verified that it is free from contamination and photographed for validation records. A record of location and volume of excavated material should be kept along with disposal waste transfer notes/ consignment notes for the completion report.

It is possible oily water or free phase product may be encountered in some excavations, particularly deeper excavations associated with the potential new interceptor where they extend into groundwater. If oily water or free phase product is encountered, this must be removed and best efforts made to ensure all oil is removed by allowing a recharge period. Removal could be by pumping to a suitable temporary water treatment system or by vacuum tanker to a suitable licensed waste facility.

## **6.5 WASTE MANAGEMENT**

It is considered likely that some material will be generated during the excavation and levelling works and where suitable, materials are to be reused on Site in order to minimise the cost of offsite disposal. The crushed concrete could be used as a sub-base under the proposed concrete surfacing.

Any need for the disposal of material offsite will require appropriate pre-classification and pre-treatment by the Contractor to minimise the waste volume.

The Contractor should provide a works materials management statement that sets out the circumstances and criteria for which materials are to be classified as waste or non-wastes.

The Contractor is required to provide method statements illustrating how compliance with waste management legislation is to be achieved for those materials classified as waste, to include but not limited to:

- Use of imported material;
- Criteria for assessing of the suitability of imported materials;
- Management of material that arises during the works and is classified as waste;
- Waste streams are appropriately classified prior to offsite disposal;

- Audit process for the selection of waste management contractors to include the collection and assessment of licences, permits and registrations; and,
- Audit process and record keeping.

## 6.6 SAMPLING AND TESTING FOR SUITABILITY OF USE

Sampling and testing of any materials reused will be required in order to demonstrate suitability of use. A sampling frequency and strategy is detailed below. The Contractor should confirm material reused are geotechnically suitable.

**Table 6-1 - Proposed Sampling Strategy**

| ACTIVITY                                                              | TESTING FREQUENCY                                                            | TESTING SUITE                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------|------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Stockpiled materials for disposal                                     | Testing frequency as required by the receiver of the waste                   | Waste acceptable criteria (WAC) analysis if being taken to a landfill or a full testing suite for metals, inorganics and organics if being taken to another site or a Soil Treatment Facility (subject to the requirements of the receiver site). |
| Site won crushed concrete used to create site levels and infill voids | One sample will be analysed per 50 m <sup>3</sup> of material                | Asbestos and TPH-CWG                                                                                                                                                                                                                              |
| Site won soils used to create site levels and infill voids            | One Sample will be analysed per 50 m <sup>3</sup> of material                | Suite including TPH-CWG, asbestos, metals and PAHs.                                                                                                                                                                                               |
| Imported material and/ or subbase for proposed resurfacing            | One sample every 50 m <sup>3</sup> . With a minimum of 3 samples per source. | Suite including TPH-CWG, asbestos, metals and PAHs.                                                                                                                                                                                               |

The materials being used for backfill below the proposed new hardstanding will be assessed for suitability by comparison to the generic screening criteria (GACs) for commercial scenario using 1% soil organic matter (SOM) as presented within the table below. This screening criteria has been used as conservative assessment for the Site as outlined within the Generic Quantitative Risk Assessment for the Site. Any exceedances would then require assessment on an individual basis in order to confirm suitability of use. Grossly contaminated soils (i.e. oily) should not be reused even if these are less than the criteria outlined below. Grossly contaminated soils, including visually contaminated soils should be taken offsite for disposal or treatment.

**Table 6-2 - GACs for Commercial**

| ANALYTE  | GAC         | UNITS | ANALYTE               | GAC   | UNITS |
|----------|-------------|-------|-----------------------|-------|-------|
| Asbestos | <0.1% (w/w) | %     | TPH Aliphatic C35-C44 | 5,000 | mg/kg |
| Arsenic  | 635         | mg/kg | TPH Aromatic C7-C8    | 5000  | mg/kg |
| Cadmium  | 223         | mg/kg | TPH Aromatic C8-C10   | 3460  | mg/kg |

| ANALYTE                | GAC          | UNITS | ANALYTE              | GAC          | UNITS |
|------------------------|--------------|-------|----------------------|--------------|-------|
| Chromium III           | 9,950        | mg/kg | TPH Aromatic C10-C12 | <b>5,000</b> | mg/kg |
| Copper                 | 69,800       | mg/kg | TPH Aromatic C12-C16 | <b>5,000</b> | mg/kg |
| Lead                   | 1,390        | mg/kg | TPH Aromatic C16-C21 | <b>5,000</b> | mg/kg |
| Mercury                | 1,110        | mg/kg | TPH Aromatic C21-C35 | <b>5,000</b> | mg/kg |
| Nickel                 | 3,060        | mg/kg | TPH Aromatic C35-C44 | <b>5,000</b> | mg/kg |
| Selenium               | 12,300       | mg/kg | Benzo (a) pyrene     | 38           | mg/kg |
| Zinc                   | N/A          | mg/kg | Naphthalene          | 193          | mg/kg |
| TPH Aliphatics C5-C6   | <b>5,000</b> | mg/kg | Benzene              | 27           | mg/kg |
| TPH Aliphatics C6-C8   | <b>5,000</b> | mg/kg | Ethylbenzene         | <b>5,000</b> | mg/kg |
| TPH Aliphatics C8-C10  | <b>5,000</b> | mg/kg | Toluene              | <b>5,000</b> | mg/kg |
| TPH Aliphatics C10-C12 | <b>5,000</b> | mg/kg | Xylene M & O         | <b>5,000</b> | mg/kg |
| TPH Aliphatics C12-C16 | <b>5,000</b> | mg/kg |                      |              |       |
| TPH Aliphatic C16-C35  | <b>5,000</b> | mg/kg |                      |              |       |

NOTE: Values in bold have been reduced to 5000 mg/kg as a proxy value. The actual values for hydrocarbons beneath commercial sites are considered to be too high for placement and could potentially affect local infrastructure.

## 6.7 PLACEMENT OF PROPOSED SUB-BASE AND HARDSTANDING

The resurfacing of the Site is likely to comprise 150mm type 1 sub-base and 200mm reinforced concrete; the design is to be confirmed. The installation of the sub-base layer will need to be independently verified to ensure imported subbase materials meet the required standard in accordance with the requirements set out in **Table 6-3**.

**Table 6-3 – Material Import Criteria**

| ANALYTE      | GAC    | UNITS | ANALYTE          | GAC   | UNITS |
|--------------|--------|-------|------------------|-------|-------|
| Asbestos     | NIL    | %     | Total TPH        | 899*  | mg/kg |
| Arsenic      | 635    | mg/kg | Benzo (a) pyrene | 38.2  | mg/kg |
| Cadmium      | 223    | mg/kg | Naphthalene      | 193   | mg/kg |
| Chromium III | 1,539* | mg/kg | Benzene          | 26.6  | mg/kg |
| Copper       | 1,998* | mg/kg | Ethylbenzene     | 508** | mg/kg |
| Lead         | 899*   | mg/kg | Toluene          | 835** | mg/kg |

| ANALYTE  | GAC   | UNITS | ANALYTE      | GAC   | UNITS |
|----------|-------|-------|--------------|-------|-------|
| Mercury  | 1,114 | mg/kg | Xylene M & O | 467** | mg/kg |
| Nickel   | 305*  | mg/kg |              |       |       |
| Selenium | 881*  | mg/kg |              |       |       |
| Zinc     | 324*  | mg/kg |              |       |       |

\* Hazardous Waste threshold, with safety factor for additive compounds used.

\*\* based on soil saturation limit

## 6.8 OTHER CONSIDERATIONS

### 6.8.1 MANAGEMENT OF ASBESTOS

Further assessment of risks associated with the presence of asbestos containing materials within the Made Ground would need to be considered as a part of the proposed resurfacing when looking at risks to construction workers/ maintenance workers. Based on the historical development of the site and the findings during the ground investigation and assessments, the presence of asbestos within the ground cannot be dismissed and should be considered as a part of the proposed development. Consideration of risk from asbestos exposure during the resurfacing works should be included in the Contractors risk assessments and managed under CDM 2015.

If asbestos is identified during the excavations on the Site, this material will require careful management in accordance with Control of Asbestos Regulations 2012. Asbestos exposure risk assessment, mitigation such as dust suppression and air monitoring may be required.

It is considered that based upon the proposed resurfacing, the placement of hardstanding across most of the Site will remove the pathway for exposure.

Any bound asbestos encountered during excavations are likely to require disposal offsite.

### 6.8.2 MANAGING UNEXPECTED CONTAMINATION

Excavation and earthworks ahead of resurfacing should be undertaken with an appropriately skilled Engineer overseeing works. The Engineer should be aware of the different types of material 'expected' and 'not expected' on this Site. It is likely that oily residues will be encountered during excavation and earthworks and management should be in line with **Section 6.4**. In the event that unexpected contamination is encountered then the following actions are proposed:

Immediately stop excavations to assess the immediate risks to the environment to include:

- Inhalation of hazardous dust such as asbestos;
- Inhalation of vapour or gas; and,
- Spread of liquid contamination such as liquids / oils leaking from pipes or tanks.

If there is an immediate risk to human health and construction workers, then evacuate to a safe distance and follow site emergency procedures.

If no immediate risk to human health, then undertake an assessment to determine:

- The source of contamination; and,

- Appropriate method of containment.

A specialist Environmental Consultant must be appointed to further assess the risks and develop an appropriate remediation strategy which would need to be agreed with the Local Authority. With assistance from the Environmental Consultant, a risk based assessment and strategy will be developed to assess the potential source / pathway / receptor contaminant linkages. If a significant contaminant linkage that requires supplementary remediation works is identified, then notification will be made to the Local Authority along with the mitigation approach for managing the identified contamination risk.

In addition to the above, it is recommended that a watching brief by a suitably qualified person be carried out during all major earthworks including excavations and hard surfacing removal. All site personnel will be briefed on the potential areas of concern, contamination risks and observations to be made during the works. The engineer shall ensure:

- Observations of all excavations during the works and any potential contamination is noted and addressed in accordance with **Table 6-5**;
- A photographic record is kept during the key stages of the development and key occurrences of the works;
- All contamination observations are addressed in accordance with this Remediation Action Plan; and,
- All of the findings will be reported within the Verification Report.

The procedure for assessing unexpected contamination will be a risk based assessment and will follow the following the procedure outlined in **Table 6-5**. The level of risk assessment will dependant on the identified pollutant linkage and the severity of the unexpected contamination.

**Table 6-4 - Flow Chart Showing Procedures for Assessing and Managing Unexpected Contamination**

| STEP                             | ACTIONS                                                                                                                                                         |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identify Pollutant Linkage       | Review the Conceptual Site Model to identify any relevant pollutant linkages.                                                                                   |
| Conduct Risk Assessment          | Undertake a Quantitative Risk Assessment to determine if the level of risk is acceptable.                                                                       |
| Remediation Options Appraisal    | If the level of risk is not acceptable, then review the options to select the most cost-effective option to either break or remove the pollutant linkage.       |
| Determine Remediation Strategy   | Finalise and present the strategy for regulatory approval.                                                                                                      |
| Submit to Regulator for approval | In the event that regulatory approval is not obtained, then revisit the Remediation Options Appraisal and Remediation Strategy to meet regulatory requirements. |
| Implement Strategy               | Implement remediation in accordance with the agreed strategy.                                                                                                   |
| Verification                     | Undertake verification works and report in a final Validation Report.                                                                                           |

### **6.8.3 BOREHOLE DECOMMISSIONING**

The existing monitoring wells at the Site as presented in Table 2-2, will be decommissioned by the Contractor prior to resurfacing works to prevent leaving a pathway to the aquifer at the Site. Decommissioning should be in line with industry guidance and the Contractor should include decommissioning record in the validation report.

## 7 ENVIRONMENTAL MONITORING AND CONTROL MEASURES

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As part of construction works at the site there will be a requirement for environmental controls and monitoring.

Typical considerations will focus on perched groundwater, air, noise and vibration and odour. The requirement for detailed information on the methodologies and controls will be detailed in a Construction Environmental Management Plan or Construction Code of Practice document, prepared by the Contractor and agreed with the Local Authority prior to commencing works.

### 7.1 DUST AND PARTICULATES

Dust and particulates can potentially be generated during excavation and haulage activities. The haulage requirements should be minimised and haulage routes kept free from mud where possible and sufficiently dampened down to minimise dust generation.

It is recommended that dust generation should be monitored on a visual basis and potential dust and asbestos fibres should also be monitored via frisbee gauges on the boundary of the site at agreed locations. Damping down is recommended to be undertaken where any excessive dust was observed or where monitored dust levels exceed a value of 200 mg/m<sup>3</sup> (to be agreed with the Local Authority). The covering of stockpiles should be undertaken and a wheel washing facility should be installed for any vehicle movements off-site. This should be agreed with the Local Authority prior to commencing works.

An Asbestos Management Plan should be produced due to the known asbestos fibres within the Made Ground on site, which is discussed further in **Section 6.8.1**.

### 7.2 VAPOURS AND ODOURS

The works should be monitored constantly by the Environmental Specialist with the aid of a portable photo-ionisation detector (PID). If vapours are identified, it is anticipated that they will rapidly disperse and that measurable concentrations will not extend beyond the excavation boundary. Should measurable concentrations (>1 ppm total VOCs) be found outside the excavation area limits, it is recommended that works should cease pending assessment.

Should organic vapours be detected using a PID during excavation for resurfacing, respiratory protection for organic vapours that conforms to the European Product Directive (CE) should be available for personnel exposed to vapours.

If vapours are detected, a specific site risk assessment shall be undertaken to define trigger vapour concentrations warranting cessation of the works. The type of respiratory protection required may be determined based on observed site conditions.

Whilst the site is not currently operational or occupied by other users, on-going monitoring within and at the site boundary on the basis of proximate commercial properties, together with along on-site transport routes shall be undertaken, both of recordable vapours and odour. Should excessive vapours or odours be generated, the works shall be temporarily suspended and reassessed. The findings of all monitoring will be clearly communicated to other site users.

### **7.3 WATER INGRESS AND CONTROL**

It is not anticipated that groundwater will be encountered during the shallow excavations to progress the resurfacing. Should groundwater or perched water be encountered, it has the potential to be contaminated and will require management through either dewatering and/or disposal under Duty of Care or discharge via consent to foul sewer. Similarly, buried pipelines or underground structures may contain contaminated liquids. Measures should be taken to ensure that when emptying and / or excavating such structures, contaminated liquids do not contaminate the surrounding soil or other materials, or enter groundwater or any surface water feature.

## 8 HEALTH, SAFETY AND ENVIRONMENTAL CONSIDERATIONS

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The health and safety management scheme operated during remediation, earthworks and validation operations should consider all relevant health and safety documentation, policy and methodology applicable to such works. The works should also comply with the Construction Design Management Regulations (CDM) 2015.

### 8.1 CONTAMINATION

Construction workers or maintenance staff involved in excavations at the Site could be exposed to concentrations of contamination in soils that are likely to present a low to moderate risk to human health. It will be necessary to ensure that construction workers are adequately protected and that a suitable health and safety management scheme is operated during construction and remediation activities.

As a minimum, the health and safety plan should address the following potential health and safety issues:

- Potential for vapours or depleted oxygen in excavations;
- Dermal contact;
- Ingestion; and,
- Dust and (asbestos) fibre inhalation.

Asbestos was identified in one sample in the shallow Made Ground at the Site. Earthworks and construction contractors should be aware of the potential for asbestos containing materials in soils and be vigilant to its presence. If potential asbestos containing materials are identified during redevelopment, professional advice should be sought.

### 8.2 ENVIRONMENTAL CONTROLS

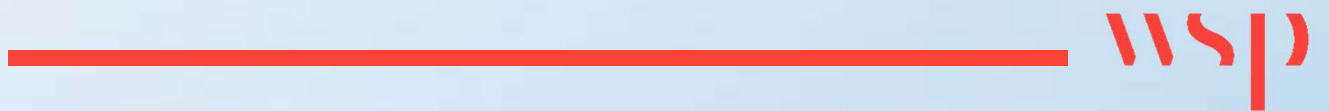
The Contractor should be responsible for the provision of all necessary environmental controls during the remediation works. These measures will include:

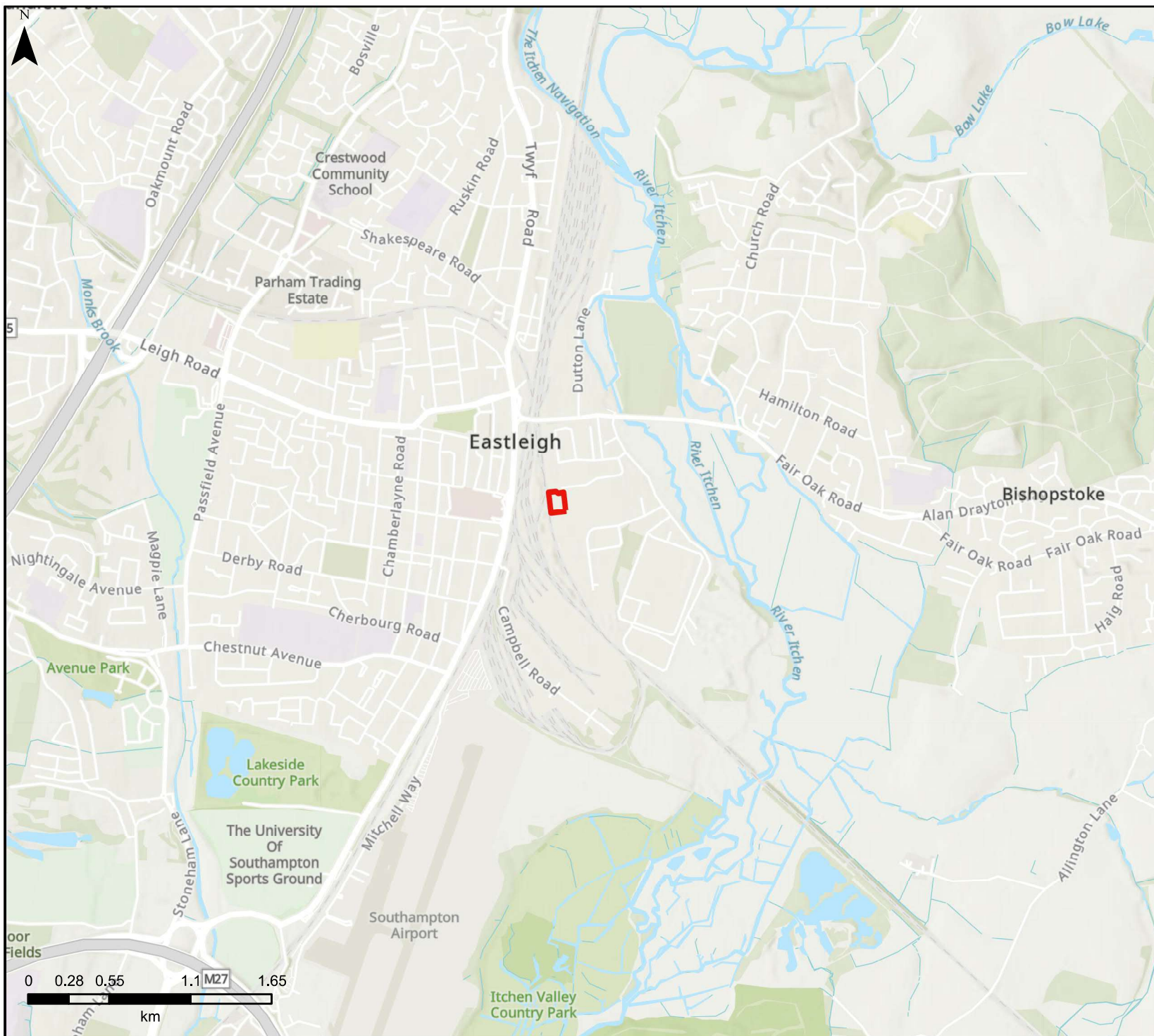
- Protection of surface water drains and catchments of surface run-off to reduce the risk of contaminated run-off and high-suspended solids moving off-site;
- Management of stockpiles of recycled (crushed) construction aggregates and contaminated soils awaiting off-site disposal and/or on-site treatment to minimise the potential for generation of contaminated run-off and dust;
- Use of dust and odour suppression techniques during development to minimise off-site impacts; and,
- Storage of all fuels, oils and chemicals will be stored in appropriate containers within bunded compounds.

Guidelines presented within the Environment Agency document, "Pollution Prevention Guidance 6 – Working at Construction and Demolition Sites" should be adhered to and all relevant licences obtained.

# Appendix A

## FIGURES





DO NOT SCALE

Information Classification:

INTERNAL

Information that is only intended for internal distribution among WSP employees, independent consultants, contractors, sub-contractors, clients and authorised third parties.

Legend :

— Site boundary

FIGURE 1

Title : Site Location Plan

Author : ArcGIS Web AppBuilder

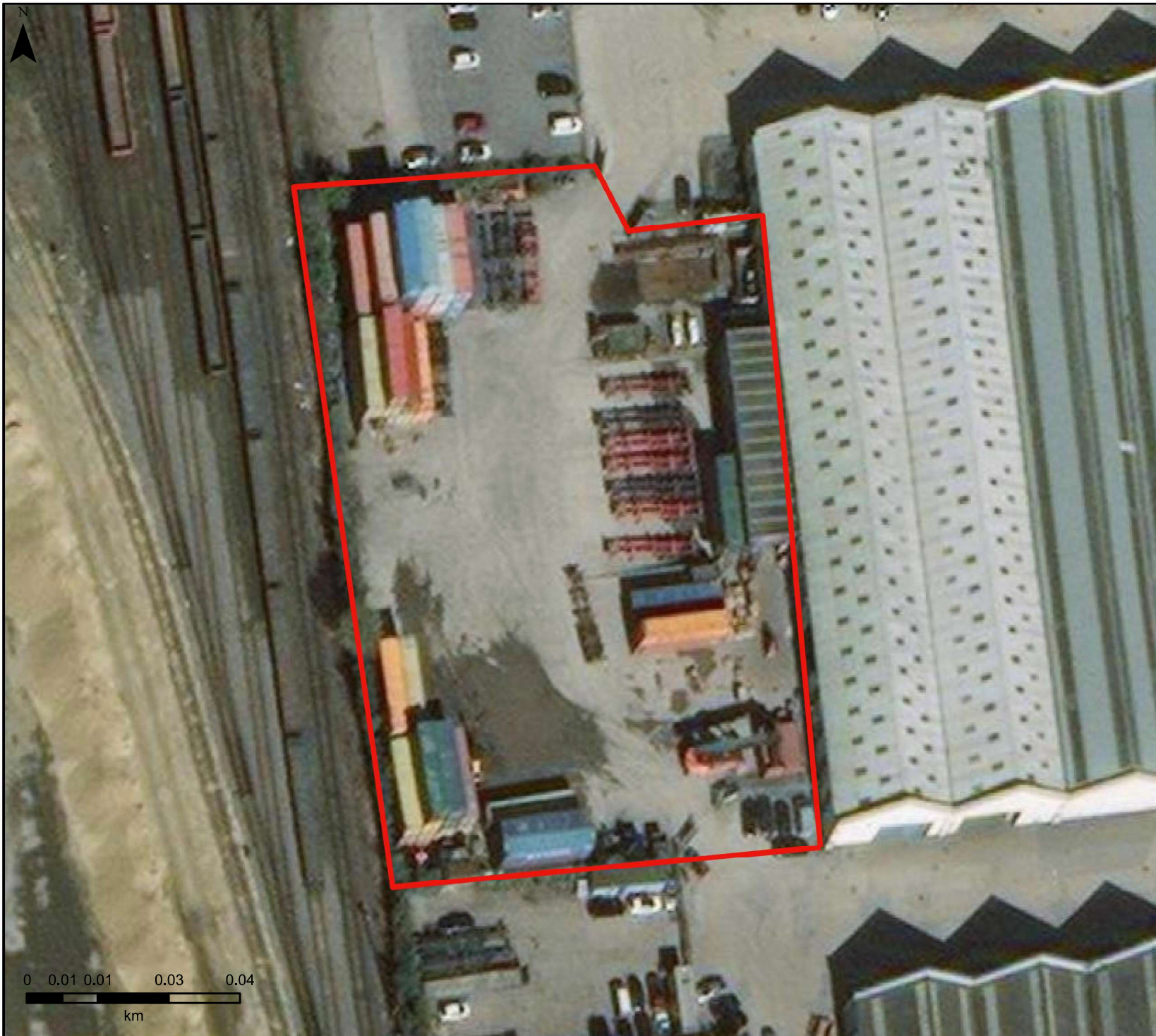
Scale : 1:36,112

Layout : WSP A4 Landscape

Current Time : 05/04/2022 14:53



© WSP UK Ltd



DO NOT SCALE

Information Classification:

INTERNAL

Information that is only intended for internal distribution among WSP employees, independent consultants, contractors, sub-contractors, clients and authorised third parties.

Legend :

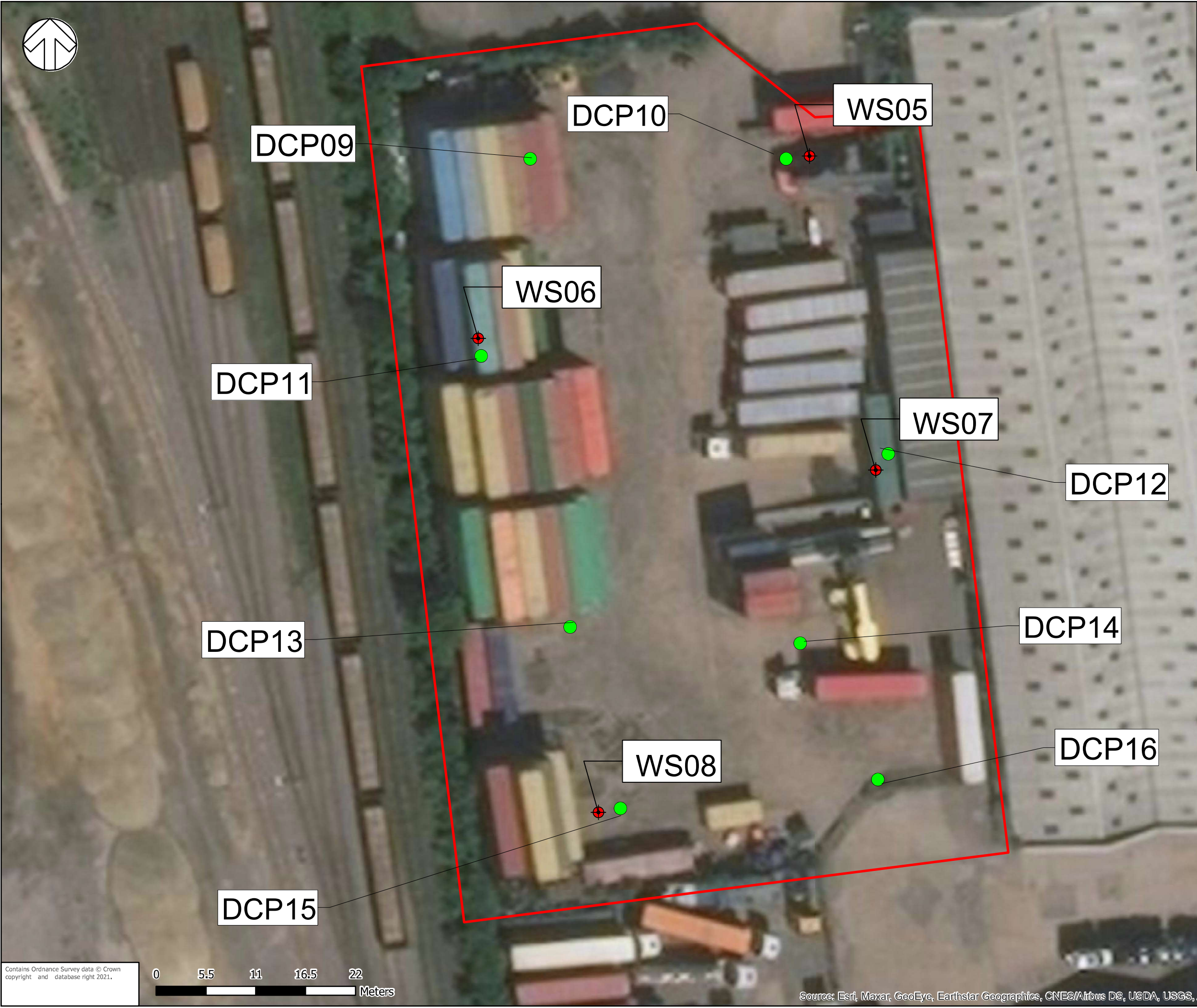
— Site boundary

FIGURE 2

Title : Site Layout Plan  
Author : ArcGIS Web AppBuilder  
Scale : 1:1,128  
Layout : WSP A4 Landscape  
Current Time : 05/04/2022 17:08



© WSP UK Ltd



Legend

- Site Boundary
- DCP Points
- Exploratory Holes
- WS Locations

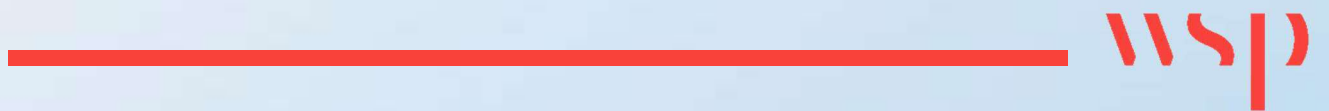
**wsp**

TITLE:  
Unit 5 Barton Park, Eastleigh  
Exploratory Hole Plan

FIGURE No:  
**Figure 3**

# Appendix B

## **LIMITATIONS**



## REPORT LIMITATIONS - GROUND RISK AND REMEDIATION

### GENERAL

1. WSP UK Limited has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed and outlined in the body of the report.
2. Unless explicitly agreed otherwise, in writing, this report has been prepared under WSP UK Limited standard Terms and Conditions as included within our proposal to the Client.
3. Project specific appointment documents may be agreed at our discretion and a charge may be levied for both the time to review and finalise appointments documents and also for associated changes to the appointment terms. WSP UK Limited reserves the right to amend the fee should any changes to the appointment terms create an increase risk to WSP UK Limited.
4. The report needs to be considered in the light of the WSP UK Limited proposal and associated limitations of scope. The report needs to be read in full and isolated sections cannot be used without full reference to other elements of the report and any previous works referenced within the report.

### PHASE 1 GEO ENVIRONMENTAL AND PRELIMINARY RISK ASSESSMENTS

**Coverage:** *This section covers reports with the following titles or combination of titles: phase 1; desk top study; geo environmental assessment; development appraisal; preliminary environmental risk assessment; constraints report; due diligence report; geotechnical development review; environmental statement; environmental chapter; project scope summary report (PSSR), program environmental impact report (PEIR), geotechnical development risk register; and, baseline environmental assessment.*

5. The works undertaken to prepare this report comprised a study of available and easily documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the Site and correspondence with relevant authorities and other interested parties. Due to the short timescales associated with these projects responses may not have been received from all parties. WSP UK Limited cannot be held responsible for any disclosures that are provided post production of our report and will not automatically update our report.
6. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only for the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, WSP UK Limited reserves the right to review such information and, if warranted, to modify the opinions accordingly.
7. It should be noted that any risks identified in this report are perceived risks based on the information reviewed. Actual risks can only be assessed following intrusive investigations of the site.
8. WSP UK Limited does not warrant work / data undertaken / provided by others.

## REPORT LIMITATIONS - GROUND RISK AND REMEDIATION

### INTRUSIVE INVESTIGATION REPORTS

**Coverage:** *The following report titles (or combination) may cover this category of work: geo environmental site investigation; geotechnical assessment; GIR (Ground Investigation reports); preliminary environmental and geotechnical risk assessment; and, geotechnical risk register.*

9. The investigation has been undertaken to provide information concerning either:
  - i. The type and degree of contamination present at the site in order to allow a generic quantitative risk assessment to be undertaken; or
  - ii. Information on the soil properties present at the site to allow for geotechnical development constraints to be considered.
10. The scope of the investigation was selected on the basis of the specific development and land use scenario proposed by the Client and may be inappropriate to another form of development or scheme. If the development layout was not known at the time of the investigation the report findings may need revisiting once the development layout is confirmed.
11. For contamination purposes, the objectives of the investigation are limited to establishing the risks associated with potential contamination sources with the potential to cause harm to human health, building materials, the environment (including adjacent land), or controlled waters.
12. For geotechnical investigations the purpose is to broadly consider potential development constraints associated with the physical property of the soils underlying the site within the context of the proposed future or continued use of the site, as stated within the report.
13. The amount of exploratory work, soil property testing and chemical testing undertaken has necessarily been restricted by various factors which may include accessibility, the presence of services; existing buildings; current site usage or short timescales. The exploratory holes completed assess only a small percentage of the area in relation to the overall size of the Site, and as such can only provide a general indication of conditions.
14. The number of sampling points and the methods of sampling and testing do not preclude the possible existence of contamination where concentrations may be significantly higher than those actually encountered or ground conditions that vary from those identified. In addition, there may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.
15. The inspection, testing and monitoring records relate specifically to the investigation points and the timeframe that the works were undertaken. They will also be limited by the techniques employed. As part of this assessment, WSP UK Limited has used reasonable skill and care to extrapolate conditions between these points based upon assumptions to develop our interpretation and conclusions. The assumption made in forming our conclusions is that the ground and groundwater conditions (both chemically and physically) are the same as have been encountered during the works undertaken at the specific points of investigation. Conditions can change between investigation points and these interpretations should be considered indicative.
16. The risk assessment and opinions provided are based on currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values. Specific assumptions associated

## REPORT LIMITATIONS - GROUND RISK AND REMEDIATION

with the WSP UK Limited risk assessment process have been outlined within the body or associated appendix of the report.

17. Additional investigations may be required in order to satisfy relevant planning conditions or to resolve any engineering and environmental issues.
18. Where soil contamination concentrations recorded as part of this investigation are used for commentary on potential waste classification of soils for disposal purposes, these should be classed as indicative only. Due consideration should be given to the variability of contaminant concentrations taken from targeted samples versus bulk excavated soils and the potential variability of contaminant concentrations between sampling locations. Where major waste disposal operations are considered, targeted waste classification investigations should be designed.
19. The results of the asbestos testing are factually reported and interpretation given as to how this relates to the previous use of the site, the types of ground encountered and site conceptualisation. This does not however constitute a formal asbestos assessment. These results should be treated cautiously and should not be relied upon to provide detailed and representative information on the delineation, type and extent of bulk ACMs and / or trace loose asbestos fibres within the soil matrix at the site.
20. If costs have been included in relation to additional site works, and / or site remediation works these must be considered as indicative only and must be confirmed by a qualified quantity surveyor.

## EUROCODE 7: GEOTECHNICAL DESIGN

21. On 1st April 2010, BS EN 1997-1:2004 (Eurocode 7: Geotechnical Design – Part 1) became the mandatory baseline standard for geotechnical ground investigations.
22. In terms of geotechnical design for foundations, slopes, retaining walls and earthworks, EC7 sets guidance on design procedures including specific guidance on the numbers and spacings of boreholes for geotechnical design, there are limits to methods of ground investigation and the quality of data obtained and there are also prescriptive methods of assessing soil strengths and methods of design. Unless otherwise explicitly stated, the work has not been undertaken in accordance with EC7. A standard geotechnical interpretative report will not meet the requirements of the Geotechnical Design Report (GDR) under Eurocode 7. The GDR can only be prepared following confirmation of all structural loads and serviceability requirements. The report is likely to represent a Ground Investigation Report (GIR) under the Eurocode 7 guidance.

## DETAILED QUANTITATIVE RISK ASSESSMENTS AND REMEDIAL STRATEGY REPORTS

23. These reports build upon previous report versions and associated notes. The scope of the investigation, further testing and monitoring and associated risk assessments were selected on the basis of the specific development and land use scenario proposed by the Client and may not be appropriate to another form of development or scheme layout. The risk assessment and opinions provided are based on currently available approaches in the generation of Site Specific Assessment Criteria relating to contamination concentrations and are not considered to represent a risk in a specific land use scenario to a specific receptor. No liability can be accepted for the retrospective effects of any future changes or amendments to these values, associated models or associated guidance.



## REPORT LIMITATIONS - GROUND RISK AND REMEDIATION

- 24. The outputs of the Detailed Quantitative Risk Assessments are based upon WSP UK Limited manipulation of standard risk assessment models. These are our interpretation of the risk assessment criteria.
- 25. Prior to adoption on site they will need discussing and agreeing with the Regulatory Authorities prior to adoption on site. The regulatory discussion and engagement process may result in an alternative interpretation being determined and agreed. The process and timescales associated with the Regulatory Authority engagement are not within the control of WSP UK Limited. All costs and programmes presented as a result of this process should be validated by a quantity surveyor and should be presumed to be indicative.

### GEOTECHNICAL DESIGN REPORT (GDR)

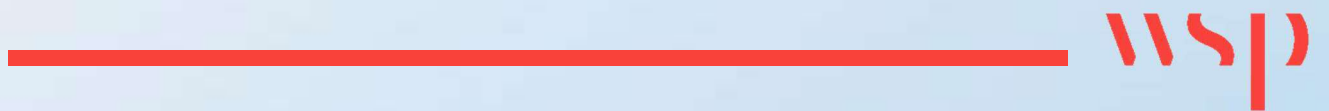
- 26. The GDR can only be prepared following confirmation of all structural loads and serviceability requirements. All the relevant information needs to be provided to allow for a GDR to be produced.

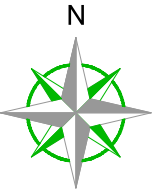
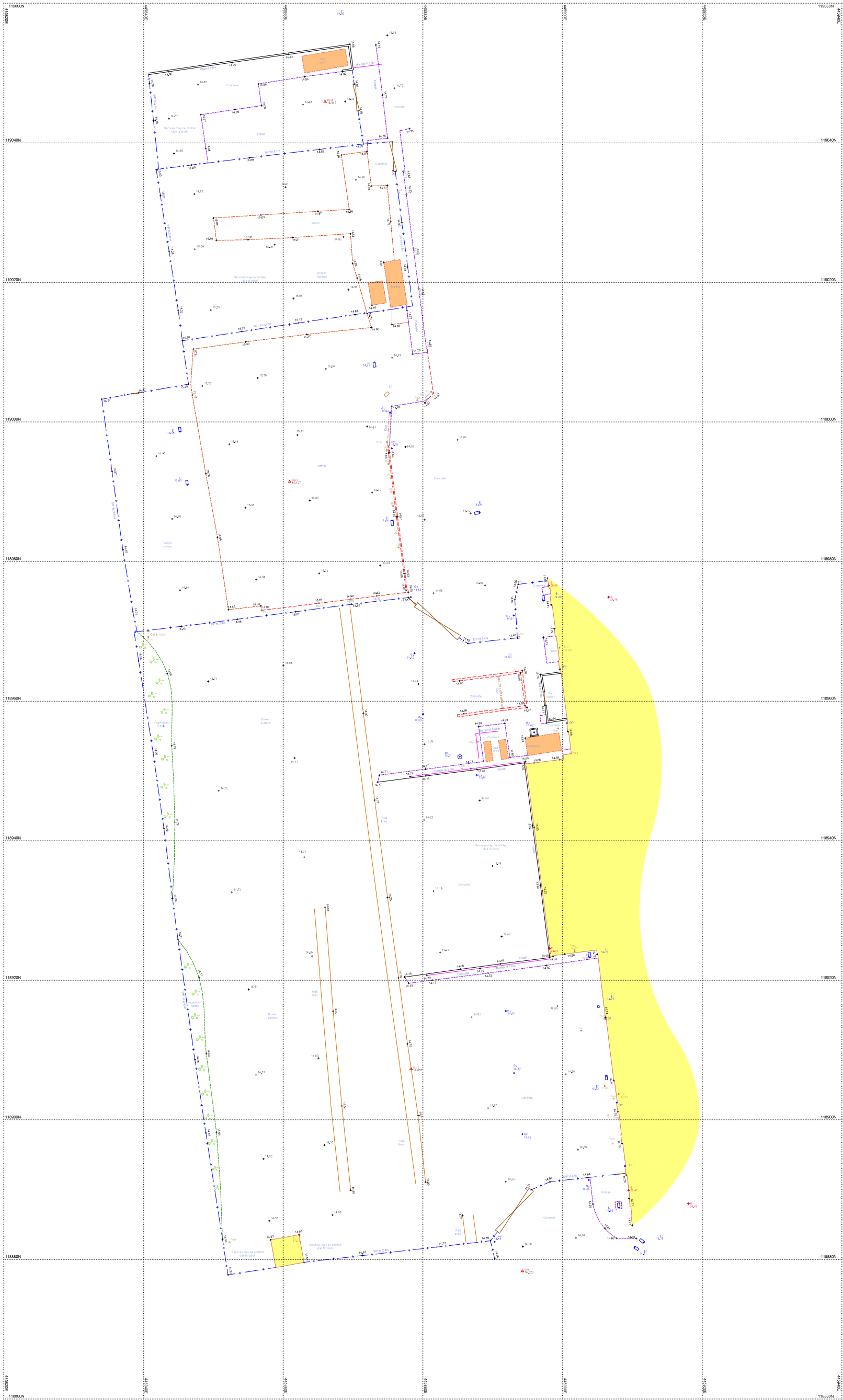
### MONITORING (INCLUDING REMEDIATION MONITORING REPORTS)

- 27. These reports are factual in nature and comprise monitoring, normally groundwater and ground gas and data provided by contractors as part of an earthworks or remedial works.
- 28. The data is presented and will be compared with assessment criteria.

# Appendix C

## **SERVICE INFORMATION**





Station Information:

| Station | Easting (m) | Northing (m) | Level (m) |
|---------|-------------|--------------|-----------|
| GH1     | 445894,284  | 118978,323   | 14,623    |
| GH2     | 445878,346  | 118907,282   | 14,655    |
| GH3     | 445860,957  | 118991,456   | 15,127    |
| GH4     | 445866,022  | 119045,803   | 14,945    |

OS Note:

This survey has been oriented to the Ordnance Survey (O.S.) National Grid (OSGB36) via Global Navigation Satellite Systems (GNSS) and the O.S. Active Network (OS Net). A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSGB36 to OSN2000 transformation model. The survey has been correlated to this point and a further one or more OSGB36 (15) points established to create a true O.S. bearing for angle orientation. No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied. Please refer to Survey Station Table to enable establishment of the on-site grid and datum.

Some services may have been omitted due to ground obstructions.

| Legend: |              |  |              |
|---------|--------------|--|--------------|
|         | Building     |  | Boundary     |
|         | Road         |  | Drainage     |
|         | Fence        |  | Tree         |
|         | Water        |  | Spot height  |
|         | Contour      |  | Level point  |
|         | Survey point |  | Benchmark    |
|         | Obstacle     |  | Electricity  |
|         | Telephone    |  | Gas          |
|         | Water main   |  | Sewer        |
|         | Drainage     |  | Manhole      |
|         | Boundary     |  | Survey point |
|         | Level point  |  | Benchmark    |
|         | Spot height  |  | Tree         |
|         | Drainage     |  | Obstacle     |
|         | Electricity  |  | Gas          |
|         | Water main   |  | Sewer        |
|         | Drainage     |  | Manhole      |
|         | Boundary     |  | Survey point |
|         | Level point  |  | Benchmark    |
|         | Spot height  |  | Tree         |
|         | Drainage     |  | Obstacle     |
|         | Electricity  |  | Gas          |
|         | Water main   |  | Sewer        |
|         | Drainage     |  | Manhole      |
|         | Boundary     |  | Survey point |
|         | Level point  |  | Benchmark    |
|         | Spot height  |  | Tree         |
|         | Drainage     |  | Obstacle     |
|         | Electricity  |  | Gas          |
|         | Water main   |  | Sewer        |
|         | Drainage     |  | Manhole      |
|         | Boundary     |  | Survey point |
|         | Level point  |  | Benchmark    |
|         | Spot height  |  | Tree         |
|         | Drainage     |  | Obstacle     |
|         | Electricity  |  | Gas          |
|         | Water main   |  | Sewer        |
|         | Drainage     |  | Manhole      |
|         | Boundary     |  | Survey point |
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|         | Spot height  |  | Tree         |
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|         | Drainage     |  | Manhole      |
|         | Boundary     |  | Survey point |
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|         | Electricity  |  | Gas          |
|         | Water main   |  | Sewer        |
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|         | Drainage     |  | Manhole      |
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|         | Spot height  |  | Tree         |
|         | Drainage     |  | Obstacle     |
|         | Electricity  |  | Gas          |
|         | Water main   |  | Sewer        |
|         | Drainage     |  | Manhole      |
|         | Boundary     |  | Survey point |
|         | Level point  |  | B            |





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