



14 Ground Conditions, Hydrogeology & Contamination

14.1 INTRODUCTION

14.1.1 This chapter assesses the impact of the Proposed Development on soil and groundwater. In particular it considers the potential impacts of localised areas of ground contamination from potentially contaminative uses (existing and historical) at the site or within its immediate vicinity.

14.1.2 This chapter (and its associated figures and appendices) is not intended to be read as a stand alone assessment and reference should be made to the Front End of this ES (Chapters 1 – 5), as well as **Chapter 15 - Cumulative Effects**.

14.1.3 This chapter is supported by a Phase I Geo-Environmental Assessment for the Site undertaken by WSP in October 2009, which is attached as **Appendix 14.1**.

14.2 LEGISLATION, POLICY AND GUIDANCE

Legislative Framework

14.2.1 The applicable legislative framework is summarised as follows:

- Part IIA of the Environmental Protection Act 1990 (Ref. 14.1) - Part IIA of the Environmental Protection Act 1990 describes a regulatory role for Local Authorities in dealing with contaminated land. Contaminated land is defined as 'land which appears to the local authority to be in such a condition, by reason of the presence in, on or under the land, of polluting substances';
- Environment Act 1995 (Ref. 14.2) - The Environment Act 1995 creates a system whereby local authorities must identify, and if necessary, arrange for the remediation of contaminated sites;
- Anti-Pollution Works Regulations 1999 (Ref. 14.3) - Sets out the contents of anti-pollution works notices, how to appeal against such notices, and how to claim compensation for access rights in connection with anti-pollution works;
- Circular 01/2006, Contaminated Land (Ref. 14.4) - Sets out additional provisions under Part IIA for dealing with radioactive contaminated land and arrangements for appeals against remediation notices served by local authorities;
- Construction (Design & Management) Regulations 2007 (Ref. 14.5) - These regulations are to make explicit duties that exist under the Health and Safety at Work Act 1974 and the Management of Health and Safety at Work Regulations 1999. This requires clients to use their influence to ensure that the arrangements other duty holders have made are sufficient to ensure health and safety of those working or those affected by that work; and
- Controls of Asbestos Regulations 2006 (Ref. 14.6) - The Regulations prohibit the importation, supply and use of all forms of asbestos. If existing asbestos containing materials are in good condition, they may be left in place; their condition monitored and managed to ensure they are not disturbed. The Asbestos Regulations also include the 'duty to manage asbestos' in non-domestic premises.

Planning Policy

14.2.2 Planning policy at the national, regional, county and local level is discussed in **Chapter 5 – Planning Policy Context** and corresponding **Appendix 5.1**. A summary of the scheme's compliance with legislation and planning policy is included in Section 14.6 of this Chapter.

Guidance

14.2.3 The following guidance has been used within this assessment:

- Health and Safety Executive (HSE), Guidance Note HS (G) 66, 'Protection of Workers and the General Public during the Development of Contaminated Land', 1991 (Ref. 14.7);
- BS10175 'Investigation of Potentially Contaminated Sites – Code of Practice' (Ref. 14.8);

- Environment Agency 'Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention (NC/99/73) (Ref. 14.9);
- Environment Agency, PPG1 'General Guide to the Prevention of Water Pollution' (Ref. 14.10);
- Environment Agency, PPG2 'Above Ground Oil Storage Tanks' (Ref. 14.11);
- Environment Agency, PPG6 'Working at Construction and Demolition Sites' (Ref. 14.12);
- Environment Agency, PPG8 'Safe storage and disposal of used oils' (Ref. 14.13);
- Environment Agency, PPG21 'Pollution Incident Response Planning' (Ref. 14.14);
- CIRIA C659 'Assessing risks posed by hazardous ground gases to buildings' (Ref. 14.15);
- Health and Safety Executive (HSE), INDG258, 'Safe Work in Confined Spaces', 2006 (Ref. 14.16);
- Environment Agency (EA), 'Guidance for the control of non-native invasive weeds in or near fresh water' (Ref:14.17); and
- Environment Agency (EA) 'The knotweed code of practice – Managing Japanese knotweed on development sites' (Ref: 14.18).

14.3 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

Scope of the Assessment

14.3.1 A formal Environmental Scoping Letter was issued to WMBC (October 2009) (**Appendix 2.2**). This document identified the impacts that the development will potentially have on ground conditions, hydrogeology and contamination during the site preparation, earthworks and construction and operational stages of the development.

14.3.2 The Environmental Scoping Letter identified the following potentially significant effects:

Site Preparation, Earthworks and Construction Phase

- Potential exposure to contamination/asbestos (associated with historical and current land use) and effects on human health (e.g. ground/ maintenance workers and third parties);
- Potential release/migration of contamination to controlled waters (on-site surface water and underlying major aquifer);
- Potential exposure to ground/maintenance workers to hazardous ground gases generated from potential sources both on-site (former landfills and Made Ground) and off-site (Bidston Moss Landfill);
- Potential risk to development workers from instability or compressible ground relating to underground structures (possible voids, tunnels or dock walls);
- Potential risk of exposure to Unexploded Ordnance to ground/maintenance workers; and
- Presence of Japanese Knotweed and associated effects on development structures.

Additional impacts that have been identified include:

- Reduction in groundwater quality underlying the Site from the construction of foundations and
- Reduction in the quality of soils and neighbouring sites from the disturbance / mobilisation of Contaminated Materials.

Operational Phase

- Potential exposure to contamination to future populations and third parties;
- Potential risk of hazardous ground gas ingress into properties and associated effects on human health of future populations and third parties; and
- Potential exposure to geotechnical risks within the development and associated effects on future populations and third parties.

Extent of the Study Area

14.3.3 Baseline desk study data obtained and reported within the Phase 1 Geo-Environmental Assessment extends up to 1km from the Site boundary for the majority of potential off-site contamination sources and sensitive receptors. However, baseline data for groundwater abstractions extend up to 2km from the Site.

The walkover survey was undertaken on 10 September 2009 and included an external inspection of buildings and features within the boundaries of the Site. Land uses of the land surrounding the Site were also noted at the time of the walkover survey.

Consultation

14.3.4 The following statutory and non-statutory consultee responses were reviewed as part of the Phase 1 Geo-Environmental Assessment (see **Appendix 14.1**):

- Merseyside Waste Disposal Authority;
- Wirral Metropolitan Borough Council (WMBC) Senior Technical officer; and
- The Mersey Docks and Harbour Company.

14.3.5 Where online databases were searched full details are presented in the Phase 1 Geo-environmental Assessment (**Appendix 14.1**).

Method of Baseline Data Collation

The following third party reports have been provided to WSP and relate to the wider area including East Float:

- '*Phase I Land Quality Assessment*', undertaken by Watermans on Behalf of Peel Holdings, dated June 2007 (Ref: EN6665/R/1.3/RA); and
- '*Geotechnical Desk Study*', undertaken by Watermans on behalf of Peel Holdings dated January 2008 (Ref: EN6665/R/1.4/GG).

Pertinent information contained within the above reports used to inform on baseline conditions include:

- Historical Ordnance Survey Maps for the Site;
- Geological Map Sheet no 96, Liverpool (Ref. 14.19), scale 1:50 000, Solid & Drift edition;
- Landmark Envirocheck Report (2007) (within **Appendix 14.1**);
- Environment Agency Groundwater Vulnerability Map. No. 16 West Cheshire, Scale 1:100,000 (Ref. 14.20); and
- Environment Agency, Groundwater Source Protection Zones (SPZ) and Protected Abstractions for Public Supply, web based database (www.environment-agency.gov.uk) (Ref. 14.21).

Significance Criteria

14.3.6 The assessment of potential impacts as a result of the proposed development has taken into account both the site preparation, earthworks and construction and operational phases. The significance level attributed to each impact has been assessed based on the magnitude of change due to the development proposals, and the sensitivity of the affected receptor/receiving environment to change, as well as a number of other factors that are outlined in more detail in **Chapter 2 – Approach to the EIA**. Magnitude of change and the sensitivity of the affected receptor/receiving environment are both assessed on a scale of high, medium, low and negligible (as shown in Table 2.2 in **Chapter 2 – Approach to the EIA**).

Impact Significance

14.3.7 The following terms have been used to define the significance of the impacts identified:

- **Major impact:** where the Site could be expected to have a very significant impact (either positive or negative) on the existing environment or human health (e.g. high to moderate sensitivity land uses, ecosystems and water resources resulting in human exposure to hazards). Where there is a pathway to



release/mobilise/expose the contamination to humans (e.g. potable water supplies) and/or ecosystem (e.g. fish kills). Where there is the potential for moderate and major changes to very sensitive systems (e.g. acute/chronic effects to human health or major fish kills and severely impacted biodiversity). Alternatively, where the removal of a source of contamination would result in a significant improvement to very sensitive systems.

- **Moderate impact:** where the Site could be expected to have a noticeable impact (either positive or negative) on the existing environment, (e.g. low sensitivity land uses, water receptors and ecosystems resulting in little or no human exposure). Where a pathway may exist and there is the potential for minor changes to ecosystems, e.g. minor fish kills and reduced biodiversity value, or where the partial or complete removal of a source of contamination could result in a noticeable improvement to ecosystems.
- **Minor impact:** where the Site could be expected to result in a small, barely noticeable impact (either positive or negative) on the existing environment (e.g. low sensitivity land uses, water receptors and ecosystems exposed to contaminants resulting in no human exposure with the potential for minor changes to ecosystems). High/moderately sensitive receptors exposed to contaminants found in relatively low concentrations that pose no significant risk to humans, animals or plants or where the partial or complete removal of a source of contamination found in relatively low concentrations could result in a small improvement to ecosystems.
- **Negligible:** where no discernible impact is expected as a result of the Site on humans, animals or plants.

14.4 BASELINE CONDITIONS

14.4.1 The Site is set within an operational heavy industrial port and comprises a mixture of land uses including Vittoria Dock, East Float, warehousing, offices, car parking and disused warehouses.


14.4.2 Ground Conditions are anticipated to comprise Made Ground deposits, underlain by an unknown thickness of Alluvial Deposits then Glacial Till, which in turn is underlain by Sherwood Sandstone, which is classified as a major aquifer by the Environment Agency. A Sherwood Sandstone channel orientated in a north to south direction is anticipated to be present in the East Float dock area, with rockhead estimated to be approximately 5m to 20m below ground level.

14.4.3 The site is considered to be of high environmental sensitivity primarily due to the adjacent East Float dock and underlying Major Aquifer (Sherwood Sandstone). Potential historical cutting of the dock into the Sherwood Sandstone and subsequent dredging may have removed low permeability superficial deposits increasing continuity between the dock and groundwater in the Sherwood Sandstone. East Float dock is also expected to be the receptor for surface water run off and shallow groundwater.

Site Reconnaissance

14.4.4 The following potential sources of contamination were identified during the site walkover:

- To the west beyond Duke Street lies 'West Float Docks' and a disused railway line;
- The southern part of the Site is occupied by warehouse / transit sheds and offices, which are located either side of Vittoria Dock. The main warehouse / shed structures are occupied by Denholm Handling, Robert Smith Steels, and Atlantic Steels. The three companies utilise the main warehouses for the handling and storage of steel and steel coils. Steel cutting is undertaken by Robert Smith Steels. In addition, Denholm also store MDF wood products. In addition, Proudman Oceanographic Laboratory and Gee and Co occupy smaller units to the northeast of Vittoria Dock. The Oceanographic Laboratory provides off shore testing facilities for tugs and vessels, although no access was gained to this area during the walkover. Gee and Co occupies a small single storey office;
- The area surrounding the buildings is mainly hardstanding and used for storage of materials with areas of informal vegetation on the perimeters. The hardstanding was noted to be in a generally poor state of repair. A number of gas bottles were noted during the visit stored informally upon the concrete along with a collection of tyres and ropes stored to the northeast of Vittoria Dock;
- A business park, which appears to be used as office spaces is located in the southeastern corner of the Site and comprises 25 units and associated car parking;

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- An above ground storage tank (AST) containing diesel is located to the northwest of the Denholm 'Clan Line' Warehouse. The bund is constructed from brick and is approximately 1.5m high and the tank contains approximately 10,000 litres. The diesel is reportedly used to refuel the forklifts in use across the site and the fill point is located outwith the bunded area. The bund is positioned upon concrete. During the walkover, localised black staining was noted in the vicinity of the fill point upon the concrete hardstanding. The AST is located some 12m from the East Float surface and no barrier is currently present to restrict the flow of diesel into the dock should a leak occur. Reportedly the Site has an emergency response plan should any spillage occur. This was not inspected as part of this survey;
 - East Float Dock extends across the northern part and eastern boundary of the Site. The northwestern corner of the site is currently openland; and
 - Japanese Knotweed (approximately 4 stands) were noted in the northwest corner of the Site.

Historical Land Uses

14.4.5 Historical Ordinance Survey maps generally identify the historical use of the Site as an industrial dockyard dating from pre 1876, with ancillary activities that include warehousing, maintenance workshops, works buildings and railway usage.

14.4.6 Surrounding land uses predominantly comprise dockyard activities and associated manufacturing. Other usages include a former landfilling, refuse destructor, scrapyards and railway activities in the immediate vicinity of the Site.

The historical maps are included in the Phase 1 Geo-Environmental Assessment provided in **Appendix 14.1**.

Geology and Hydrogeology

14.4.7 Geological Map Sheet no. 96, Liverpool, scale 1:50 000, Solid & Drift indicates that the Site is underlain by Alluvium and Glacial Till, overlying the Permo Triassic Sherwood Sandstone Group.

14.4.8 Environment Agency Groundwater Vulnerability Map. No. 16 West Cheshire indicates that the underlying Alluvium and Glacial Till deposits are classified as a minor and non aquifer respectively. The Permo Triassic Sherwood Sandstone Group is classified as a major aquifer.

14.4.9 The Site is located within a Zone III groundwater protection zone for an abstraction located over 1km from the boundary.

Hydrology and Flooding

14.4.10 One former discharge consent and two additional discharge consents are located on-site and are operated by Mersey Docks & Harbour Co for private sewage. It is not clear whether all of the discharge consents are current or historical.


14.4.11 East Float Dock is located within the Site and is linked to the Mersey Estuary through a system of locks approximately 500m to the east. These locks maintain a constant water level in the dock network during high and low tide events in the Mersey Estuary. For further information, please refer to **Chapter 13 – Drainage, Flooding and Water Resources**.

14.4.12 The River Birket has been identified on topographical mapping and the Landmark Envirocheck report approximately 1.2km west of the Site flowing in an east to west direction before entering a culvert. The course of the culvert is not clear but it is likely the outflow is into West Float Dock to the west of the site. For further information, please refer to **Chapter 13 – Drainage, Flooding and Water Resources**.

Potential Contamination Sources

14.4.13 Based on the findings of the Phase 1 Geo-Environmental Assessment (**Appendix 14.1**), the potential sources of contamination on-site are considered comprise the following:

- The diesel tank and refuelling point located to the northwest corner of the 'Clan Line' warehouse;
- The majority of the warehouses / transit sheds are used for mainly handling and storage of materials (mainly steel and MDF wood). Limited quantities of lubricating oil for the maintenance of the machinery in operation within the warehouse have the potential to have resulted in some localised contamination;

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- Japanese Knotweed presents a potential constraint due to its intrusive nature. Any wastes contaminated with untreated Japanese Knotweed material will be classified as special waste; and
 - Given the age of some of the buildings on-site, the potential exists for asbestos containing materials (ACM) to be present within the fabric of the buildings.

Potential Significant Receptors

14.4.14 The following sensitive receptors have been identified in relation to impacts from contaminated land on the Site:

- **Demolition and construction workers** – these potential receptors are considered to be of **high sensitivity** due to the possible severity that an impact could have on human health if the potential risks are not appropriately managed;
- **Future site occupants** – these potential receptors are considered to be of **high sensitivity** due to the possible severity that an impact could have on human health if the potential risks are not appropriately managed;
- **Third party land** – on the basis that the majority of the immediate surrounding areas comprise predominantly commercial / industrial land uses where human exposure to contaminants is likely to be limited and soils protected by superficial hardstanding, this potential receptor is considered to be of **low sensitivity**;
- **Underlying major aquifer and adjacent East Float Dock** – The Site is located within a Zone III groundwater protection zone and therefore the major aquifer receptor is considered to be of **high sensitivity**. East Float Dock would be immediately at risk from on-site contamination; however, no sensitive abstractions have been identified with the dock or River Birket flowing into the dock approximately 1.2km west of the site. On this basis, these receptors are considered to be of **moderate sensitivity**; and
- **Buildings and underground services** – The potential presence of soil and ground contamination may locally impact future below ground structures or permeate water supply pipes. On this basis, these receptors are considered to be of **moderate to high sensitivity** due to the possible severity on human health if not managed appropriately.


Significant Risks

14.4.15 Based on the available baseline data presented above and contained within the supporting appendices, it is considered that the following potentially significant risks are present:

- Potential contamination associated with diesel tank and refuelling point located to the northwest corner of the 'Clan Line' warehouse;
- Potential contamination associated with the warehouses / transit sheds;
- Potential exposure to Unexploded Ordnance (UXOs);
- Ground stability issues associated with significant thicknesses of Made Ground, voids, dock walls and obstructions;
- Potential ACMs within the fabric of the buildings;
- Constraints provided by Japanese Knotweed; and
- Potential exposure to hazardous ground gases associated with significant thicknesses of Made Ground and Alluvium deposits across the Site and historical landfilling offsite.

Future Baseline

14.4.16 Should the Site not proceed it is considered that the future baseline conditions in relation to contaminated land would remain relatively unchanged, although localised impacts may occur from ad hoc diesel or lubricating oil spillages. Potential ACM release is likely to be limited as long as the existing building fabric is not allowed to significantly deteriorate. Widespread hardstanding would limit infiltration and leaching



of any contaminants into the underlying aquifers or surface waters. However, costs associated with Japanese Knotweed treatment and removal is likely to increase should the stands be allowed to spread.

14.5 ASSESSMENT OF IMPACTS, MITIGATION AND RESIDUAL EFFECTS

Site Preparation, Earthworks and Construction Phase

Potential exposure to contamination / asbestos (associated with historical and current land use) and effects on human health (e.g. ground maintenance workers and third parties).

14.5.1 The Phase 1 Geo-Environmental Assessment (**Appendix 14.1**) has identified potential ACMs within the fabric of on-site buildings which may result in exposure to demolition and construction workers and the offsite general public during demolition of site buildings. It is understood an ACM register and management plan exists for the site, although assumptions regarding the presence of ACMs in some buildings may have been made.

14.5.2 Excavation of potentially contaminated soils can pose a health risk to site workers through dermal contact (i.e. direct skin contact with contaminated soils), ingestion (i.e. via the transfer of contaminated soils from unwashed hands during eating) and inhalation (i.e. breathing in contaminated dusts and particulate matter generated by excavation activities).

14.5.3 Excavation of potentially contaminated soils can also pose a health risk to the general public in the immediate vicinity of the Site, through inhalation of contaminated dusts and particulate matter generated by excavation activities.

14.5.4 The sensitivity of demolition and construction workers and the general public is high and the magnitude of change, prior to mitigation, is medium. Therefore, there is likely to be a direct, temporary, medium-term effect on demolition and construction workers and the general public of **moderate to major negative** significance prior to the implementation of mitigation measures.

Mitigation

14.5.5 Prior to the commencement of demolition and construction activities, the ACM register and management plan should be reviewed to identify buildings where ACMs have been assumed to be present. These buildings should be treated in the same manner as buildings with confirmed ACMs, as such they will be identified and removed in accordance with the Control of Asbestos Regulations 2006 to ensure the potential risks are appropriately managed (Ref. 14.6).

14.5.6 The findings of the intrusive investigation will be utilised to develop appropriate mitigation measures to protect demolition and construction workers and the general public from potential impacts to health.

14.5.7 All site works and ground works will be undertaken in accordance with the Considerate Contractors Scheme to help ensure a well-managed operation which minimises environmental risks.

14.5.8 Effects to the health of construction workers and the general public from potentially contaminated soils and materials will be controlled under the Construction (Design & Management) Regulations 2007 (Ref. 14.5) and a risk assessment will be prepared to ensure the protection of workers and the general public during the demolition and construction phases, which will specify appropriate safe working practices. If required, specific personal protective equipment (PPE) will be utilised, particularly during ground works. Generic safe working practices include, but are not limited to:

- Use of appropriately qualified persons for the intended task;
- Use of PPE;
- Provision of on-site washing facilities;
- Washing of hands at the end of every work period (including forearms, face etc if become dirty);
- No eating rule on-site and confining of smoking areas away from work site, and only after decontamination;
- Reporting of any ill health; and

- The damping down of exposed surfaces during periods of dry / windy weather.

14.5.9 All of the above measures and other relevant good site practices to avoid/minimise the likely significant effects at source, will be included within the Construction Environmental Management Plan (CEMP) and enforced throughout this phase.

14.5.10 In addition, all persons engaged in site development will be made aware of the findings of the intrusive investigation. If contamination is identified, the associated hazards of handling potentially contaminated materials will be conveyed to all site workers and all works will be conducted in accordance with the Health and Safety Executive publication entitled 'Protection of Workers and the General Public during the Development of Contaminated Land', 1991 (Ref. 14.7).

Residual Effects

14.5.11 The sensitivity of demolition and construction workers and the general public is high and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect on demolition and construction workers and the general public following the implementation of mitigation measures.

Potential release/migration of contamination to Controlled Waters (adjacent surface water and underlying major aquifer)

14.5.12 The Phase 1 Geo-Environmental Assessment (**Appendix 14.1**) has identified the potential for ground contamination associated with historical and current uses of the Site.

14.5.13 Disturbance and mobilisation of potential contamination could reduce the quality of the shallow groundwater across the Site, which in turn could migrate and reduce the quality of surface water. Potential historical cutting of the dock into the Sherwood Sandstone and subsequent dredging may have removed low permeability superficial deposits increasing continuity between the dock and groundwater in the Sherwood Sandstone. Potentially contaminated surface water run off from construction / demolition activities could therefore directly reduce the quality of East Float dock.

14.5.14 The sensitivity of the shallow groundwater within the major aquifer is high and the magnitude of change, prior to mitigation, is high. Therefore, there is likely to be a direct, temporary, medium-term effect on groundwater within the major aquifer of **major negative** significance prior to the implementation of mitigation measures.

14.5.15 The sensitivity of the East Float dock is medium and the magnitude of change, prior to mitigation is medium. Therefore, there is likely to be a direct, temporary, medium-term effect on surface water of **moderate negative** significance prior to the implementation of mitigation measures.


Mitigation

14.5.16 Potential areas of contamination identified within the Phase 1 Geo-Environmental Assessment (**Appendix 14.1**) will require an intrusive investigation to target the identified area of concern. The investigation will be undertaken in accordance with BS10175 'Investigation of Potentially Contaminated Sites – Code of Practice' (Ref. 14.8).

14.5.17 In the event that contamination is identified, the findings from the intrusive investigation will be utilised to finalise the detail of proposed mitigation measures to protect on-site soils and neighbouring properties. These measures are likely to include, but are not limited to:

- Suppression of contaminated dusts during excavation by damping down of soils, particularly during dry periods;
- Remediation of contamination hotspots;
- Segregation of contaminated waste types for appropriate off site disposal; and
- Use of wheel washes and covered wagons to reduce the potential for migration of contaminants off-site.

14.5.18 A variety of good environmental site practices will be implemented in order to avoid or minimise impacts at the source. Such measures include, but are not limited to, the following:

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- Working areas shall be clearly defined to ensure minimal disturbance of soils;
 - Haul routes and accesses shall be clearly defined to minimise the risk of accidents. Construction vehicles will be regularly maintained to reduce the risk of hydrocarbon contamination associated with leaks and spillage and will only be active when required;
 - Designated areas for the storage of hazardous materials, fuels and chemicals. All designated areas will be of hard-standing within bunds (110% the volume of the vessel) and all filler points/valves will be located within the extent of said bund or appropriate drip trays provided;
 - Implementation of a temporary drainage network to prevent surface runoff (silts, muds) from leaving the Site or entering surface water drains. Measures may include the cleaning of vehicle wheels prior to leaving Site;
 - Controlled, and covered, waste storage areas;
 - Provision of fuel emergency spill kits, located at strategic points;
 - Provision of environmental awareness training for site workers; and
 - Adopting the Environment Agency Pollution Prevention Guidelines (outlined below).

14.5.19 The position and extent of working areas shall reflect surrounding areas and works being carried out. The contractor shall appraise the suitability of such working areas in this respect as part of working method statements.

14.5.20 All site works will be undertaken in accordance with the Environment Agency's Pollution Prevention Guidelines, in particular;

- PPG1 'General Guide to the Prevention of Water Pollution' (Ref. 14.10);
- PPG2 'Above Ground Oil Storage Tanks' (Ref. 14.11);
- PPG6 'Working at Construction and Demolition Sites' (Ref. 14.12);
- PPG8 'Safe storage and disposal of used oils' (Ref. 14.13); and
- PPG21 'Pollution Incident Response Planning' (Ref. 14.14).

14.5.21 Ground workers will also be made aware of the findings of the intrusive site investigation, if necessary.

All measures, such as those described above, shall be included within the CEMP for the Site.

Residual Effects

14.5.22 The sensitivity of shallow groundwater and surface waters is high and moderate respectively and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect on shallow groundwater and surface waters following the implementation of mitigation measures.


Potential exposure to ground / maintenance workers to hazardous ground gases generated from potential sources both on-site (former landfills and Made Ground) and off-site (Bidston Moss Landfill)

14.5.23 The possible presence of significant Made Ground thickness on-site, former landfilling and Alluvium deposits (in limited localised areas on currently or previously developed land) could result in the generation of hazardous ground gases. Piling techniques and potentially other excavations undertaken on-site could result in demolition and construction workers being exposed to hazardous ground gases causing an adverse impact to health.

14.5.24 The sensitivity of demolition and construction workers is high and the magnitude of change, prior to mitigation, is high. Therefore, there is likely to be a direct, permanent, short-term effect on demolition and construction workers of **major negative** significance prior to the implementation of mitigation measures.

Mitigation

14.5.25 Prior to construction an appropriate intrusive ground investigation will be undertaken to assess the potential for hazardous ground gases at the Site. The investigation will be undertaken at the same time as



the intrusive investigation required to assess potential contamination associated with historical and current Site usage.

14.5.26 In the event that elevated concentrations of hazardous ground gases are identified, where entry into confined spaces and / or excavations is required by construction workers a combination of appropriate PPE/RPE, monitoring equipment and safe entry procedures will be utilised to mitigate any potential risk of exposure to hazardous gases / vapours.

14.5.27 All works will be conducted in accordance with the Health and Safety Executive publication entitled 'Safe Work in Confined Spaces', INDG258, 2006 (Ref. 14.16).

Residual Effects

14.5.28 The sensitivity of demolition and construction workers is high and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect on demolition and construction workers following the implementation of mitigation measures.

Potential risk to development workers from instability or compressible ground relating to underground structures (possible voids, tunnels or dock walls)

14.5.29 The Phase 1 Geo-Environmental Assessment (**Appendix 14.1**) has identified potential ground stability issues associated with the potential significant thickness of Made Ground, below ground obstructions, voids and dock walls that represent a Health and Safety risk to demolition and construction workers.

14.5.30 The sensitivity of the demolition and construction workers is high and the magnitude of change, prior to mitigation, is high due to potential Health and Safety risks. Therefore, there is likely to be a direct, permanent, short-term effect on construction workers of **major negative** significance prior to the implementation of mitigation measures.

Mitigation

14.5.31 Prior to construction an appropriate intrusive ground investigation and structural survey will be undertaken to identify any significant areas of ground and structural instability and inform on the most suitable foundation solution for the Site. The findings of the investigations will be utilised to develop appropriate mitigation measures to protect demolition and construction workers from potential exposure to risk and effects to their health arising from ground and structural instability.

14.5.32 Effects to the health of construction workers from ground instability will be controlled under the Construction (Design & Management) Regulations 2007 (Ref. 14.5) and a risk assessment will be prepared to ensure the protection of workers and the general public during excavation phases, which will specify appropriate safe working practices. It is important to note that some excavations or techniques employed to stabilise excavations may result in a 'Confined Space'. If this is the case, all works will be conducted in accordance with the Health and Safety Executive publication entitled 'Safe Work in Confined Spaces', INDG258, 2006 (Ref. 14.16).

14.5.33 In addition, all persons engaged in site development will be made aware of the findings of the intrusive investigation. If ground instability is identified, the associated hazards will be conveyed to all site workers.

Residual Effects

14.5.34 The sensitivity of demolition and construction workers is high and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect on demolition and construction workers following the implementation of mitigation measures.

Potential risk of exposure to Unexploded Ordnance to ground / maintenance workers

14.5.35 The Phase 1 Geo-Environmental Assessment (**Appendix 14.1**) has identified a potential risk of UXO within the dockland area originating from WWII. Piling techniques and potentially other excavations undertaken on-site could result in demolition and construction workers being exposed to this risk.

14.5.36 The sensitivity of the demolition and construction workers is high and the magnitude of change, prior to mitigation, is high due to the potential Health and Safety risks. Therefore, there is likely to be a direct, permanent, short-term effect on demolition and construction workers of **major negative** significance prior to the implementation of mitigation measures.

Mitigation

14.5.37 Prior to further site investigation and construction works an appropriate UXO assessment in accordance with CIRIA C681 'Unexploded Ordnance (UXO) A guide for the construction industry':2009 (Ref:14.23) shall be undertaken to determine the risk of UXOs being present within the ground across the Site. The findings of the assessment and intrusive investigation will be utilised to develop appropriate mitigation measures to protect construction workers from potential impacts to health.

14.5.38 Effects to the health of construction workers from potential UXOs will be controlled under the Construction (Design & Management) Regulations 2007 (Ref. 14.5) and a risk assessment will be prepared to ensure the protection of workers and the general public during the demolition and construction phases, which will specify appropriate safe working practices.

14.5.39 In addition, all persons engaged in site development will be made aware of the findings of the intrusive investigation. If contamination is identified, the associated hazards of handling potentially contaminated materials will be conveyed to all site workers and all works will be conducted in accordance with the Health and Safety Executive publication entitled 'Protection of Workers and the General Public during the Development of Contaminated Land', 1991 (Ref. 14.7).

Residual Effects

14.5.40 The sensitivity of demolition and construction workers is high and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect on demolition and construction workers following the implementation of mitigation measures.

Presence of Japanese Knotweed and associated effects on development structures

14.5.41 The Phase 1 Geo-Environmental Assessment (**Appendix 14.1**) has identified four stands of Japanese Knotweed in the northwest corner of the site. Japanese Knotweed is highly invasive and can damage the built environment (e.g. pavement formation). The built environment at risk would be limited to Northbank West, where the existing stands exist.

14.5.42 The sensitivity of future development structures is medium and the magnitude of change, prior to mitigation, is medium. Therefore, there is likely to be a direct, temporary, long-term effect on future development structures of **moderate negative** significance prior to the implementation of mitigation measures.

Mitigation

14.5.43 Prior to construction works, the Japanese Knotweed stands should be eradicated, which is best achieved using a combination of mechanical and herbicide treatment by a specialist contractor.


14.5.44 All works will be conducted in accordance with the Environment Agency publications 'Guidance for the control of non-native invasive weeds in or near fresh water' (Ref. 14.17) and 'The knotweed code of practice – Managing Japanese knotweed on development sites' (Ref: 14.18). Potential treatment options should be considered against the likely development programme in order to determine the most cost effective solution.

Residual Effects

14.5.45 The sensitivity of future development structures is medium and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect on the built environment following the implementation of mitigation measures.

Reduction in Groundwater Quality Underlying the Site from the Construction of Foundations

14.5.46 Based on the Phase 1 Geo-Environmental Report (**Appendix 14.1**) and the scale of the buildings proposed within the East Float Neighbourhood Parameter Plans and the Quarter Parameter Plans, piled



foundations to rockhead (Sherwood Sandstone) are a likely solution across the Site. The use of certain foundation techniques can involve the use of cementaceous material. Such materials are very alkaline when wet and consequently have the potential to reduce the quality of groundwater. In addition some techniques may facilitate the downward migration of contamination from shallow strata into the Sherwood Sandstone (major aquifer).

14.5.47 The sensitivity of the groundwater within the major aquifer is high and the magnitude of change, prior to mitigation, is high. Therefore, there is likely to be a direct, temporary, medium-term effect on groundwater within the major aquifer of **major negative** significance prior to the implementation of mitigation measures.

Mitigation

14.5.48 Intrusive investigation will be undertaken to determine suitable foundation solutions for the proposed structures across the Site. Based on the findings of this investigation, appropriate mitigation measures will be developed to minimise the potential reduction in the groundwater quality of the major aquifer. These measures may include, but are not limited to, the following:

- Use of shallow strip foundations situated above the groundwater table, where possible;
- Use of ground improvement techniques to enable the use of shallow concrete footings above the groundwater table; and,
- Use of pre-cast piled foundations in accordance with the Environment Agency document 'Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention (NC/99/73) (Ref 14.9).

Residual Effects

The sensitivity of groundwater within the major aquifer is high and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect on groundwater within the major aquifer following the implementation of mitigation measures.

Reduction in the Quality of Soils and Neighbouring Sites from the Disturbance / Mobilisation of Contaminated Materials

14.5.49 The Phase 1 Geo-Environmental Assessment (**Appendix 14.1**) has identified the potential for ACMs to be present within the fabric of buildings and ground contamination associated with historical and current uses of the Site.

14.5.50 Demolition and construction activities, (e.g. demolition of existing buildings, excavation of soils and movement of vehicles) may lead to the disturbance and mobilisation of contaminants within site soils and/or the building fabric.


14.5.51 The operation of vehicles and general activities associated with demolition and construction at the Site may give rise to the potential for spillages/leakages of fuel oils/other hazardous materials/chemicals from site vehicles or stores. Such spillages/leakages, should they arise, may directly contaminate the soils.

14.5.52 The sensitivity of on-site soils and neighbouring sites is low and the magnitude of change, prior to mitigation, is low. Therefore, there is likely to be a direct, temporary, medium-term effect on on-site soils and neighbouring sites of **minor negative** significance prior to the implementation of mitigation measures.

Mitigation

14.5.53 Prior to the commencement of phased demolition and construction activities, the ACM register and management plan should be reviewed to identify buildings where ACMs have been assumed to be present. These buildings should be treated in the same manner as buildings with confirmed ACMs, as such they will be identified and removed in accordance with the Control of Asbestos Regulations 2006 to ensure the potential risks are appropriately managed (Ref. 14.6)

14.5.54 Furthermore, areas of potential contamination identified within the Phase 1 Geo-Environmental Assessment (**Appendix 14.1**) will require an intrusive investigation to target the identified area of concern. The investigation will be undertaken in accordance with BS10175 'Investigation of Potentially Contaminated Sites – Code of Practice' (Ref. 14.8).



14.5.55 In the event that contamination is identified, the findings from the intrusive investigation will be utilised to finalise the detail of proposed mitigation measures to protect soils on-site and neighbouring properties. These measures are likely to include, but are not be limited to those discussed in Sections 14.5.18 to 14.5.21 respectively.

Residual Effects

The sensitivity of on-site soils and neighbouring sites is low and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect on soils and neighbouring sites following the implementation of mitigation measures.

Operational

Potential exposure to contamination to future populations and third parties

14.5.56 The Phase 1 Geo-Environmental Assessment (**Appendix 14.1**) has identified the potential for ground contamination associated with historical and current activities identified at the Site.

14.5.57 The potential for contaminated soils to be present within the wetland, park, terraced areas and other soft landscaped areas across the East Float Neighbourhood or service trenches can pose a direct health risk to future site occupants and maintenance workers through dermal contact (i.e. direct skin contact with contaminated soils), ingestion (i.e. via the transfer of contaminated soils from unwashed hands during eating) and inhalation (i.e. the breathing in of contaminated dusts and particulate matter generated by excavation activities). This is particularly relevant to areas of the application Site proposed for residential development where potential sources of contamination have been identified.

14.5.58 The sensitivity of future site occupants and maintenance workers is high and the magnitude of change, prior to mitigation, is medium. Therefore, there is likely to be a direct, permanent, long-term effect on future occupants and maintenance workers of **moderate to major negative** significance prior to the implementation of mitigation measures.

Mitigation

14.5.59 The mitigation measures above which have been specified to be undertaken during the demolition and construction phases (such as site investigation and remediation of contamination such as hydrocarbons if necessary and the removal of ACM's) will have been undertaken prior to the operational stage of the Site, as such the likely effect to the health of future residents and maintenance workers from potentially contaminated soils and materials will have been removed.

14.5.60 Should residual contamination remain at levels which could pose a risk to human health then mitigation measures will be developed using the data obtained during the intrusive investigation. These measures may include, but are not limited to, the following:

- Construction of hardstanding to break the pathway between the source and the receptor;
- Construction of a capping layer in appropriate areas to break the pathway between the source and the receptor;
- Use of 'clean' service trenches; and
- Use of 'protectaline' water supply pipes.

Residual Effects

14.5.61 The sensitivity of future site occupants and maintenance workers is high and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect on future site occupants and maintenance workers following the implementation of mitigation measures.

Potential risk of hazardous ground gas ingress into properties and associated effects on human health of future populations and third parties

14.5.62 The possible presence of significant Made Ground thickness on-site and the Alluvium and former landfilling in the vicinity of the Site could result in the generation of hazardous ground gases. Construction of

buildings without the incorporation of appropriate gas protection measures could result in future site occupants being exposed to hazardous ground gases.

14.5.63 The sensitivity of the future site occupants is high and the magnitude of change, prior to mitigation, is high. Therefore, there is likely to be a direct, permanent, long-term effect on future site occupants of **major negative** significance prior to the implementation of mitigation measures.

Mitigation

14.5.64 Prior to construction an appropriate intrusive ground investigation will be undertaken to assess the potential for hazardous ground gases at the Site. The investigation will be undertaken at the same time as the intrusive investigation required to assess potential contamination associated with historical and current site usage and will be in accordance the guidance document CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings' (Ref. 14.15).

14.5.65 In the event that elevated concentrations of hazardous ground gases are identified, data from the intrusive ground investigation and associated monitoring will be utilised to ensure appropriate mitigation measures are developed in accordance with CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings'.

Residual Effects

14.5.66 The sensitivity of future site occupants is high and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect on future site occupants following the implementation of mitigation measures.

Potential exposure to geotechnical risks within the development and associated effects on future populations and third parties

14.5.67 The Phase 1 Geo-Environmental report (Appendix 14.1) identified geotechnical risks to the Proposed Development in the form of dock walls, below ground obstructions and potential voids that may compromise the structure stability. Potential contamination within soils may also chemically 'attack' future below ground structures (e.g. foundations).

14.5.68 The sensitivity of future populations and third parties is high, and the magnitude of change, prior to mitigation, is high. Therefore, there is likely to be a direct, permanent, long-term effect on future populations and third parties of **major negative** significance prior to the implementation of mitigation measures.

Mitigation

14.5.69 Prior to construction an appropriate intrusive ground investigation will be undertaken to identify any significant areas of ground instability and inform on the most suitable foundation solution for the Site. The findings of the intrusive investigation will be utilised to develop appropriate mitigation measures to protect the future development from potential impacts arising from ground instability and aggressive ground conditions. These measures may include, but are not limited to, the following:


- Development of a below ground obstruction removal strategy;
- Development of an appropriate foundation zoning strategy;
- Use of ground improvement techniques; and
- Concrete specification in line with BRE SD1 (Ref: 14.22).

Residual Effects

The sensitivity of the future populations and third parties is high and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect on future populations and third parties following the implementation of mitigation measures.

Monitoring and Follow Up

14.5.70 A Construction Environmental Management Plan (CEMP) for control and management of potential risks at the Site will be developed and implemented by the Principal Contractor for the preparatory and



construction phases of the Site. The CEMP will incorporate the mitigation measures recommended above to reduce the significance and, where possible, eliminate the identified impacts.

14.5.71 The CEMP will be a live document setting out the management system to be adopted on site. Detailed risk assessments for all operations from which a safe system of work shall be developed. The Principal Contractor will be required to monitor this process and develop assessments and working methods appropriate to changes in work activities.

Limitations and Assumptions

14.5.72 In the absence of intrusive site investigations, assumptions have been made in relation to the potential presence of contaminated soils / materials. For example the presence of the diesel tank and refuelling area in the northwest corner of the 'Clan Line' warehouse has led to the assumption that the soils in the vicinity of this feature may have been impacted by contamination. In addition, an asbestos register is understood to have been completed for the site, which confirms the presence of ACMs within building fabric. Proposed mitigation measures have been developed based on these assumptions which are considered to represent a worst case scenario.

14.5.73 Targeted intrusive ground investigations and a review of the asbestos register and management plan have been proposed in order to confirm the presence or absence of existing soil contamination and ACMs. On completion of these investigations the findings will be incorporated in to the CEMP to ensure that an appropriate level of mitigation is provided.

Cumulative Effects

14.5.74 The consented Northbank East development lies immediately to the north of the Site. Whilst it is understood that potential contaminants may also exist within this Site and within its locality and the potential for interaction and combination of cumulative effects to human health, groundwater and the wider environment may be possible, the mitigation techniques outlined in paragraphs 14.5.9, 14.5.17 to 14.5.21 inclusive above will serve to reduce the potential cumulative effect. Similar mitigation measures are likely to be recommended as part of the Northbank East EIA.

14.5.75 In addition, cumulative effects within East Float will be reduced by the phased development over three phases (up to 2015, 2015-2030 and 2030-2050).

14.5.76 No significant impact interactions are anticipated to occur at the receptors outlined above and the receptors outlined within **Chapters 6-14**.


14.6 SUMMARY

14.6.1 The Site is set within an operational heavy industrial port and comprises a mixture of land uses including Vittoria Dock, East Float, warehousing, offices, car parking and disused warehouses. A number of potential sources of contamination have been identified on-site; these include a diesel tank and refuelling area and Asbestos Containing Materials (ACM's) associated with the buildings on the Site.

14.6.2 Geological mapping indicates that the Site is underlain by a potentially significant thickness of Made Ground, Alluvium and Glacial Till, overlying the Permo Triassic Sherwood Sandstone Group. The Alluvium and Glacial Till are classified as Minor and Non Aquifers respectively. The Sherwood Sandstone Group is classified as a Major Aquifer. A Sherwood Sandstone channel feature orientated in a north to south direction is anticipated to be present in the East Float dock area, with rockhead estimated to be approximately 5m to 20m below ground level.

14.6.3 There are a number of potentially significant effects which will be carefully managed at the Site. These include potential exposure of ground/maintenance workers, future Site users and third parties to contamination sources including asbestos, historical contamination, World War II ordnance and ground gas. These and other sources of contamination could also affect other sensitive receptors such as East Float dock and the underlying groundwater.

14.6.4 Potentially significant effects to both the future built development and existing structures (e.g. the dock walls), in terms of instability and geotechnical risks have been assessed and appropriate strategies to minimise risk clearly outlined.



14.6.5 A targeted intrusive site investigation will be undertaken to appropriately assess the potential for land contamination and hazardous ground gases beneath the Site. In addition, a review of the asbestos register and management plan and unexploded ordnance (UXO) assessment will be undertaken to confirm ACMs within the building fabric of existing buildings and the potential for UXOs below ground across the site. Should elevated concentrations of contaminants / hazardous ground gases, asbestos or high risk of UXOs be identified, mitigation measures will be implemented in line with current best practice and relevant guidance to protect human health, East Float Dock and underlying groundwater and the wider environment during the site preparation, demolition and construction and operational phases of the Proposed Development.

14.6.6 The sensitivity of some of the receptors in the vicinity of the Site has been identified as high. However, should the presence of elevated concentrations of contaminants within the soil, hazardous ground gases, asbestos or UXOs be confirmed, it is considered that the residual effects will be negligible assuming that the identified mitigation measures are implemented in accordance with current best practice and the relevant guidance.

14.6.7 The proposals for a targeted intrusive ground investigation and an asbestos survey comply with current legislation and the planning policy as they allow for detailed consideration of land and groundwater quality and are a means of identifying unacceptable risks to human health, controlled waters and the wider environment. The results of the investigation / survey will enable, if necessary, the design of detailed mitigation measures to ensure that contamination does not result in 'significant harm or significant possibility of harm' or 'the pollution of controlled waters'. At this stage the proposed mitigation measures indicate all impacts to be negligible.

Table 14.1 provides a summary of the impacts on ground conditions.

Table 14.1: Summary of Effects Table for Ground Conditions, Hydrogeology & Contamination

Description of Likely Significant Effects	Significance of Impacts					Summary Mitigation Enhancement Measures	of /	Significance of Residual Effects					Relevant Policy	Relevant Legislation
	(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)			(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)		
Site Preparation, Demolition and Construction														
Potential exposure to contamination/ asbestos (associated with historical and current land use) and effects on human health (e.g. ground / maintenance workers and third parties)	Moderate to Major	Negative	T	D	MT	<ul style="list-style-type: none"> ■ Review of asbestos register and management plan. ■ Implementation of Considerate Constructors Scheme. ■ Mitigation measures to be developed in line with published guidance and best practice, if required. ■ CEMP. ■ Use of generic safe working practices and PPE. 		Negligible	N/A	N/A	N/A	N/A	PPS 23 Annex 2;	Part IIA of the EPA 1990; EA 1995; Circular 01/2006 Contaminated Land
Potential release / migration of contamination to Controlled Waters (surface water features and underlying major aquifer)	Major (aquifer) Moderate (East Float Dock)	Negative	T	D	MT	<ul style="list-style-type: none"> ■ Review of asbestos register and management plan. ■ Mitigation measures to be developed in line with published guidance and best practice, if required. 		Negligible	N/A	N/A	N/A	N/A	PPS 23 Annex 2;	Part IIA of the EPA 1990; EA 1995; Circular 01/2006 Contaminated Land
Potential exposure to ground / maintenance workers to hazardous ground gases generated from	Major	Negative	P	D	ST	<ul style="list-style-type: none"> ■ Intrusive ground investigation. ■ Mitigation measures to be developed in 		Negligible	N/A	N/A	N/A	N/A	PPS 23 Annex 2;	Part IIA of the EPA 1990; EA 1995; Circular

Description of Likely Significant Effects	Significance of Impacts					Summary Mitigation Enhancement Measures	Significance of Residual Effects					Relevant Policy	Relevant Legislation
	(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)		(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)		
potential sources both on-site (former landfills and Made Ground) and off-site (Bidston Moss Landfill)						line with HSE guidance document INDG258.							01/2006 Contaminated Land
Potential risk to development workers from instability or compressible ground relating to underground structures (possible voids, tunnels or dock walls).	Major	Negative	P	D	LT	<ul style="list-style-type: none"> ■ Intrusive ground investigation. ■ Mitigation measures to be developed in line with HSE guidance document INDG258. 	Negligible	N/A	N/A	N/A	N/A	PPS 23 Annex 2,	Part IIA of the EPA 1990; EA 1995; Circular 01/2006 Contaminated Land
Potential risk of exposure to Unexploded Ordnance to ground / maintenance workers.	Major	Negative	P	D	ST	<ul style="list-style-type: none"> ■ UXO assessment by specialist contractor. ■ Intrusive ground investigation. ■ Mitigation measures in accordance with CIRIA 681. 	Negligible	N/A	N/A	N/A	N/A		Health & Safety At Work Act 1974 and associated legislation.
Presence of Japanese Knotweed and associated effects on development structures.	Moderate	Negative	T	D	LT	<ul style="list-style-type: none"> ■ Treatment and removal in accordance with EA publication 'Guidance for the control of non-native invasive weeds in or near fresh water' and 'the knotweed code of practice – Managing 	Negligible	N/A	N/A	N/A	N/A		Part IIA of the EPA 1990; EA 1995; Circular 01/2006 Contaminated Land



Description of Likely Significant Effects	Significance of Impacts					Summary Mitigation Enhancement Measures	Significance of Residual Effects					Relevant Policy	Relevant Legislation
	(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)		(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)		
						Japanese knotweed on development sites'							
Reduction in groundwater quality underlying the Site from the construction of foundations	Major	Negative	T	D	MT	<ul style="list-style-type: none"> Intrusive ground investigation to enable foundation design. If required, mitigation measures to be developed in line with EA guidance document NC/99/73 or use of shallow foundations. 	Negligible	N/A	N/A	N/A	N/A		Part IIA of the EPA 1990; EA 1995; Circular 01/2006 Contaminated Land
Reduction in quality of Soils and Neighbouring Sites from the disturbance / mobilisation of contaminated materials	Minor	Negative	T	D	MT	<ul style="list-style-type: none"> Review of asbestos register and management plan. Mitigation measures to be developed in line with published guidance and best practice, if required 	Negligible	N/A	N/A	N/A	N/A	PPS 23 Annex 2;	Part IIA of the EPA 1990; EA 1995; Circular 01/2006 Contaminated Land
Operational													
Potential exposure to contamination to future populations and third parties.	Moderate to Major	Negative	P	D	LT	<ul style="list-style-type: none"> Targeted intrusive investigation. If required, mitigation to be implemented during construction and may include removal of source, provision of 'clean' 	Negligible	N/A	N/A	N/A	N/A	PPS 23 Annex 2;	Part IIA of the EPA 1990; EA 1995; Circular 01/2006 Contaminated Land



Description of Likely Significant Effects	Significance of Impacts					Summary Mitigation Enhancement Measures	Significance of Residual Effects					Relevant Policy	Relevant Legislation
	(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)		(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)		
						capping layers, 'clean service' trenches etc. ■ Review of asbestos register and management plan. Removal of asbestos prior to demolition.							
Potential risk of hazardous ground gas ingress into properties and associated effects on human health of future populations and third parties	Major	Negative	P	D	LT	■ Intrusive ground investigation. ■ Mitigation measures to be developed in line with CIRIA guidance document CIRIA C659.	Negligible	N/A	N/A	N/A	N/A	PPS 23 Annex 2,	Part IIA of the EPA 1990; EA 1995; Circular 01/2006 Contaminated Land
Potential exposure to geotechnical risks within the development and associated effects on future populations and third parties.	Major	Negative	P	D	LT	■ Intrusive ground investigation. ■ Concrete specification in line with the BRE SD1	Negligible	N/A	N/A	N/A	N/A	N/A	N/A

Key to table:

P/T = Permanent or Temporary, D/I = Direct or Indirect, ST/MT/LT = Short Term, Medium Term or Long Term

N/A = Not Applicable



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