13 GROUND CONDITIONS

13.1 INTRODUCTION

13.1.1 Company

WYG Environment Planning Transport Ltd

13.1.2 Author

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13.1.3 Chapter Purpose

This chapter of the ES assesses the likely significant effects of the proposed development on the environment in terms of ground conditions (contamination and land stability). The chapter and its supporting appendices describe the planning policy context, the assessment methodology; the baseline conditions at the application site and surroundings; the likely significant effects; the mitigation measures required to prevent, reduce or offset any significant adverse effects; the likely residual effects after these measures have been employed; and the cumulative effects. In summary, the objectives of the chapter are to:

- Outline any legislation, planning policy and guidance which is relevant to the assessment of potential effects on and from geology, hydrogeology and potentially contaminated land associated with the proposed development;
- Determine the potential effects from the disturbance of ground on human health and the environment, and the effects of potentially contaminated ground or groundwater conditions on the proposed development; and,
- Assess if any mitigation measures are required to prevent, reduce or offset any significant adverse effects from contamination to the proposed development.

13.1.4 Chapter Updates for Revised Layout (December 2020 Submission)

This ES chapter relating to Ground Conditions has been reviewed, as part of the December 2020 submission, against the revised design; planning application consultation comments; and baseline data validity, and for each it was considered that no amendments to the chapter were required, Therefore, in accordance with the methodology outlined in Chapter 2, a Level 2 update has been undertaken.

13.1.5 Chapter Updates for Revised December 2020 Submission

This ES Chapter has been reviewed against the following aspects and for each, it has been confirmed that there are no amendments required to the content of the chapter (a 'Level 1' update):

- Proposed development design changes: are of no specific relevance to this assessment;
- Legislation/policy revisions: there have been no related updates to legislation/policy that have affected either the methodology or findings of this assessment; and
- Baseline data validity: there have been no relevant changes to the baseline conditions.

13.1.6 Figures

- Proposed Maximum Heights Parameter Plan 02 (ref: 2579-PLA-XX-XX-DR-U-0009 revision P01)

13.1.7 Appendices

- Appendix 13.1: WYG Preliminary Environmental Risk Assessment Report

13.2 METHODOLOGY

13.2.1 Guidance

A number of guidance documents have been referred to during the completion of this assessment of ground conditions and contamination, which are as follows:

- Model Procedures for the management of land contamination – contaminated land report, 2004 (CLR11) (1);
- Land Contamination: risk management (replacement of CLR11), June 2020 (2);
- Managing and Reducing Land Contamination: Guiding Principles (2010+2016 update) (3);
- BS10175:2011+A2:2017 Code of Practice for Site Investigations of Potentially Contaminative Sites (4);
- BS5930:2015 Code of Practice for Ground Investigations (5);
- CIRIA C665:2007 Assessing Risks Posed by Hazardous Ground Gases to Buildings (6); and
- BS8485:2015 (+A1:2019) Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings (7).

13.2.2 Legislation and Policy

13.2.2.1 Geological Sites and Features

Geological features can have protected status both nationally and locally. Geological sites are considered on the following basis:

- Nationally protected sites designated as Sites of Special Scientific Interest (SSSI) and/or as part of National Nature Reserves (NNR); and,
- Local and regional sites that are not legally protected but are taken into account by the planning authorities. These sites are known as Regionally Important Geological and Geomorphological Sites (RIGS) and have a similar status to Sites of Importance to Nature Conservation (SINCs).

13.2.2.2 National Legislation & Policy

National legislation relating to geological sites is limited but comprises:

- Countryside Act 1968 (8);
- Wildlife and Countryside Act 1981 (9); and,
- The Environment Act 1995 (10).

The following legislation is considered to be relevant to contaminated land issues:

- Part 2A of the Environmental Protection Act 1990 (as amended) (11);
- Contaminated Land (England) Regulations 2006 (as amended) (12); and
- Contaminated Land Statutory Guidance from the Department for Environment, Food and Rural Affairs (DEFRA) 2012 (13).

Part 2A of the Environmental Protection Act (EPA) 1990 outlines the legal responsibilities for dealing with contaminated or potentially contaminated land. Within the EPA contaminated land is defined as 'any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that (a) significant harm is being caused or there is a significant possibility of such harm being caused; or (b) pollution of controlled waters is being, or is likely to be caused'.

Part 2A of the EPA 1990 was introduced by the Environment Act 1995 and provides an overarching framework for the control of risks to the environment or human health from land contamination arising from historical or current site uses. It outlines the responsibilities of Local Authorities to inspect and act based upon suitable risk assessment in accordance with Statutory Guidance, except for 'Special Sites' that are regulated by the Environment Agency.

With regards to groundwater, the following legislation is relevant:

- European Commission (EC) Groundwater Directive (2006/118/EEC) on the Protection of Groundwater against Pollution (14);
- European Union (EU) Water Framework Directive (2000/60/EC) (15); and,
- Environmental Permitting Regulations (EPR) (2010, as amended) (16).

The Water Resources Act (1991) (17). (WRA) sets national regulatory controls and restrictions used to protect the water environment. Under Section 85 of the WRA, it is an offence to cause or knowingly permit any poisonous, noxious, or polluting matter to enter controlled waters, which includes groundwater and surface waters.

The Water Framework Directive (2000/60/EC) introduces consideration of 'significant' pollution of controlled waters. In determination of whether significant pollution is being caused, the following criteria are used:

- Pollution equivalent to 'environmental damage' as per the Environmental Damage (Prevention and Remediation) Regulations 2009 (18);
- Deterioration of abstracted water quality or such water intended for use in the future for human consumption such that additional treatment would be required to enable such use; or,
- A breach of statutory surface water Environmental Quality Standards (EQSs) and/or the input of a substance in groundwater resulting in a significant and sustained upwards trend in concentration of contaminants.

The Environmental Damage (Prevention and Remediation) (England) Regulations 2015 (SI 2015/810) (19) provide that, for certain activities, where there is an imminent risk of environmental damage, steps must be taken to prevent such damage, and if environmental damage has already occurred, the operator of the activity must prevent further damage.

To prevent unacceptable risks from land contamination, controls exist within the planning system, regulated under the Planning and Compulsory Purchase Act 2004 (20) and Town and Country Planning Act 1990 (as amended) (21) to ensure that new developments are appropriate for their location. Local planning authorities must take account of land contamination or the potential for contamination in determining individual applications for planning permission.

Guidance for planning authorities on the need to take into account the environmental consequences of land contamination in drawing up development plans and in determining planning applications is provided in the National Planning Policy Framework (NPPF) 2012 (updated in 2019)(22) which promotes the use of 'established procedures' (p.71) using current UK best practice and guidance as given in BS10175 and NHBC Standards Chapter 4.1.

Paragraph 170 of the NPPF details that planning decisions should contribute to and enhance the local environment, by, amongst others:

- Clause E – prevent the new development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil pollution or land stability; and,
- Clause F – remediate degraded, derelict, contaminated and unstable land where appropriate.

The NPPF stipulates that land contamination is a material consideration for planning consent and that permitted developments should ensure that (para. 178):

"A site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);

- *After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and*
- *Adequate site investigation information, prepared by a competent person, is available to inform these assessments."*

13.2.2.3 Local Planning Policy

The statutory development plan for the City of Liverpool currently comprises:

- Liverpool Unitary Development Plan (UDP) (adopted 2002) (23); and,
- Merseyside and Halton Joint Waste Local Plan (adopted 2013) (24).

The UDP will gradually be replaced when the Liverpool Local Plan (submission draft, May 2018) (25) is adopted.

Chapter 13 (Environmental Protection) of the UDP (excluding policies EP3-8 which are no longer in operation) addresses the Council's objectives for the protection and enhancement of Liverpool's environment through the re-use of vacant land and buildings, the control of polluting uses, securing the efficient disposal of waste and the investigation and promotion of renewable energy.

Liverpool City Council (LCC) also has a Contaminated Land Inspection Strategy, 3rd edition, June 2017 (26) which outlines the Council's policy on how contaminated land will be dealt with when considering developments. It provides guidance on the assessment of land contamination.

13.2.3 Consultees

Consultation regarding ground conditions has been undertaken through the EIA scoping process, which is documented below.

13.2.4 Scoping

Following issue of the EIA Scoping Report (Appendix 2.1) to LCC on 15th May 2017, LCC issued their Scoping Opinion (Appendix 2.2) on 7th July 2017. A summary of the comments made in regard to ground conditions is provided in Table 13.1 below.

Table 13.1

Relevant Scoping Consultation Responses

CONSULTEE	CONSULTEE RESPONSE	COMMENTARY
Environment Agency (EA)	The EA recommend that any proposal to develop the site will need to be accompanied by an assessment of the impacts of development upon the hydrogeology of the area. Due to the former land use(s), they consider that soil and/or groundwater contamination may exist at the site which could pose an unacceptable risk to the Principal Aquifer below.	The significance of the potential effects of the proposed development on the Principle Aquifer beneath the site has been assessed in this chapter. As set out in the mitigation section of this chapter (Section 13.7), prior to construction, a ground investigation will be undertaken at the site in order to refine the assessment of risk to the aquifer and other controlled waters.

13.2.5 Consideration of Climate Change

Climate change is unlikely to affect the presence or absence of contamination at the proposed development.

There may be a potential effect on soil conditions and land stability from climate change which may impact upon the proposed development. Soil conditions may become drier during the summer and wetter during the winter which may cause flooding and be a potential hazard to land stability. NHBC guidance (Chapter 4.1) provides information on managing risk from land stability issues. These effects, however, are unlikely to affect the validity of the results reporting within this chapter.

Risks associated with flooding are assessed in Chapter 14 of this volume of the ES.

13.2.6 Consideration of Human Health

A risk-based approach is used for assessing contamination which utilises a conceptual site model to identify 'source-pathway-receptor' linkages using the assessed baseline conditions for the proposed development. The key human health receptors considered in this assessment include construction workers, neighbours and future site users.

The Phase 1 Geo-Environmental Desk Top Study Report provided in Appendix 13.1, ES Volume III, includes a preliminary human health risk assessment for the proposed development (residential, retail, leisure, community use and commercial). The assessment is based on the consideration of whether the source of contamination can reach the receptor (people) and hence whether it is of significance. The risk assessment has been based on guidance provided within Contaminated Land Risk Assessment: A guide to good practice (C552) (27). Further

GROUND CONDITIONS

consideration of human health is provided in the subsequent sections of this ES chapter below.

13.2.7 Consideration of Risk of Major Accidents and/or Disasters

The major accidents and disasters identified to be of relevance to the site and proposed development have been reviewed and are not considered to be of relevance to this technical area.

13.2.8 Alternatives

Alternatives are addressed within Chapter 5 Alternatives and Design Evolution. None of the alternatives are considered relevant to this technical area.

13.2.9 Assessment of Baseline Conditions, Conceptual Site Model & Receptor Sensitivity

13.2.9.1 Assessment of Baseline Conditions

The baseline conditions at the site have been determined from a review of available published information. The information reviewed includes:

- Published geological, hydrogeological, aquifer vulnerability maps and historical Ordnance Survey maps; and,
- Information obtained from an Environmental Database.

This information is presented in the Phase 1 Geo-Environmental Desk Top Study Report, provided in Appendix 13.1, ES Volume III.

A radius of between 250m and 500m from the site boundary has been utilised for each data search, depending on the likely influence of the identified feature.

13.2.9.2 Conceptual Site Model

To assess the potential effects of the proposed development related to ground contamination and land stability, separate qualitive risk assessments have been carried out utilising a conceptual site model to identify 'source-pathway-receptor' linkages for the following phases of development:

- Baseline Conditions – based on the current sources, pathways and receptors and an assessment of the current risks related to ground contamination and land stability;
- Construction Phase – assessing the changes to sources, pathways and receptors and the consequent risks related to ground contamination and land stability during the construction of the proposed development on baseline conditions; and,
- Operational (Occupation) Phase – assessing the changes to source, pathways and receptors and the consequent risks related to ground contamination and land stability associated with the use of the proposed development.

Each conceptual site model considers:

- The principal pollutant hazards and land stability issues associated with the site (the sources);
- The principal pathways between the identified hazard (s) and receptors (s); and
- The principal receptors(s) at risk from the identified hazards, for example, human health, controlled waters, or flora.

The qualitative risk is determined by the inter-relationship between the potential for a source of contamination to be present, the potential for migration of the contaminant along a given pathway, and the significance of potential receptors for any identified 'source-pathway-receptor' linkage. Details of the methodology used are given in the guidance notes included in the Phase 1 Geo-Environmental Desk Top Study, provided in Appendix 13.1, ES Volume III.

The risk assessments allow the probability and magnitude of the possible consequences that may arise as a result of a hazard to be assessed and possible unacceptable risks resulting from the proposed development to be identified. The mitigation measures required to address possible unacceptable risks during both the construction and operational phases are then identified and the residual risks post- implementation of the mitigation measures assessed.

The residual effects of the proposed development related to ground contamination are then determined by comparing the risks associated with the construction phase to the baseline conditions, and the risks associated with the operational phase to the baseline conditions, both with the mitigation measures in place.

13.2.9.3 Receptor Sensitivity

The following receptors have been considered for the proposed development:

- Future site users (residential, retail, leisure, community and commercial uses)/neighbours;
- Site Workers;
- Groundwater & Surface Waters;
- Flora; and
- Built Environment.

The sensitivity of a receptor refers to its importance, i.e. its environmental value and attributes and how susceptible it is to change. Within this ES chapter, receptor sensitivity is defined as High, Medium, Low or Negligible.

Table 13.2 sets out the scale of sensitivity that has been applied to receptors identified and considered within this assessment.

Table 13.2
Scale of receptor sensitivity used in the assessment

SENSITIVITY	DESCRIPTION
High	Sensitive receptor (people) on site (or neighbouring properties) occupying land in residential land use with gardens or allotments; Site is underlain by a Principal Aquifer of regional importance which is used for potable water supply; Receptor designated for its geological importance on a national (SSSI/NNR) or international basis; Possesses flora that grows there specifically because of the geological conditions at the site; Buildings of high historic or local importance.
Medium	People on site (or neighbouring properties) occupying land in residential land use without gardens or using public open spaces; Is locally designated for its geological importance via RIGs system or locally designated ecological site; Receptor is a Secondary A Aquifer; Buildings and services.
Low	People (on site or neighbouring properties) occupying commercial or industrial buildings with hard and soft landscaping; Receptor is not a designated geological site; Receptor is a Secondary (undifferentiated) Aquifer; Site is of low ecological value; and, No contamination present on site.
Negligible	Land not accessible to public with no neighbouring properties. Non-aquifer or no controlled waters within close proximity to the site. No sites with ecological value within 1km of the site.

13.2.10 Assessment of Magnitude

Magnitude is determined by predicting the scale of any potential change in the baseline conditions. To assess the impact magnitude, any mitigation within the design or additional mitigation to reduce the environmental impact must be considered.

The assessment was undertaken based on the description of development contained in Chapter 3 of this volume of the ES. Table 13.3 indicates the scale of impact magnitude that has been used in undertaking the assessment. Magnitude is considered in this ES chapter as being Very large, Large, Medium or Small.

Table 13.3
Scale of Impact Magnitude

MAGNITUDE	DESCRIPTION

GROUND CONDITIONS

Large	Short term (acute) risks to human health, catastrophic damage to buildings/property, major pollution of controlled waters*.
Medium	Chronic risk to human health, pollution of sensitive controlled waters, substantial change to sensitive ecosystems or species*. Substantial damage to crops/buildings/infrastructure.
Small	Pollution of non-sensitive waters, localised damage to buildings or structures*. Non-permanent, easily preventable health effects on humans.
Negligible	No discernible negative effects.

** Based on Table 7.1 – Potential Hazard Severity Definition within Phase 1 Geo-Environmental Desk Top Study, Appendix 13.1, ES Volume III.*

13.2.11 Assessment of Significance

The assessment of significance within this chapter is based on the matrix presented in Table 13.4

Table 13.4
Significance Matrix

MAGNITUDE OF EFFECT	SENSITIVITY OF RECEPTOR			
	High	**Medium**	**Low**	**Negligible**
Large	Major Significance	Major Significance	Moderate/ Minor Significance	Negligible Significance
Medium	Major Significance	Moderate Significance	Minor Significance	Negligible Significance
Small	Moderate/ Minor Significance	Minor Significance	Minor Significance	Negligible Significance
Negligible	Negligible Significance	Negligible Significance	Negligible Significance	Negligible Significance

13.2.12 Relevant Associated Development

The proposed associated development is described in Chapter 3 of this volume of the ES. Any off-site groundworks required in relation to drainage or utility works would be similar in nature to the groundworks required within the site during the construction phase, which have been assessed in this chapter. As such, additional assessment of these associated development works is not considered necessary.

13.2.13 Assumptions/Limitations

In undertaking the assessments reported in this chapter, there are a number of limitations and constraints affecting the outputs from this work.

This assessment is in part based on published information which is associated with an area rather than specific to the site. Where this is the case, professional judgement has been used to inform the assessment in terms of likelihood and scale of contamination associated with the identified land uses. Further information on actual ground conditions will be obtained from an intrusive ground investigation in due course, which will be secured by condition, and used to inform the detailed design of the proposed development.

No investigation, however, can determine the absolute nature and extent of all contamination that could be present beneath the site. There will always be an element of uncertainty regarding ground conditions, although a ground investigation would be able to refine any potential risks anticipated at the site. This is standard limitation for this type of assessment.

The construction works will be undertaken in accordance with the construction methodology and programme as detailed in Chapter 4 Construction Strategy and CEMP,

It has been assumed that during the construction and operational phases on-site future baseline conditions will remain similar to the current baseline conditions in terms of the key receptors.

The application is made in outline, and the end users of the development site are not yet known. Accordingly, a number of assumptions have been made on the potential end users and uses of the site.

GROUND CONDITIONS

13.3 BASELINE CONDITIONS

KEY RECEPTORS	DESCRIPTION	SENSITIVITY	FURTHER INFORMATION
Construction Workers (construction phase)	Construction workers are considered to be high sensitivity without mitigation as they are most likely to be exposed to contaminants during excavation works. Contaminants potentially present at the site of relevance to this receptor are as follows: ■ Potential for asbestos, heavy metals and maintenance chemicals i.e. pesticides (spraying of the football pitch) (to be confirmed via a ground investigation at the site in due course); and, ■ Hydrocarbon contamination – off-site source (garage & tramway) (to be confirmed via a ground investigation at the site in due course).	High	Section 7.1 and 7.3 of PERA Report. Appendix 13.1, ES Volume III
Future Site Users (operational phase)	The proposed development includes a mix of uses, comprising residential units, residential institution, retail units, financial & professional services, food and drink use, drinking establishments, hot food takeaways, business use, non-residential institutions, and open space, with associated access, servicing, parking and landscaping. As current proposals are outline, the site has been considered for a residential end-use as this is the most conservative approach. Future site users are considered to be of high sensitivity as the development may include gardens. Contaminants potentially present at the site of relevance to this receptor are as follows: ■ Potential for asbestos, heavy metals and maintenance chemicals i.e. pesticides (spraying of the football pitch) (to be confirmed via a ground investigation at the site in due course); and, ■ Hydrocarbon contamination – off-site source (garage & tramway) (to be confirmed via a ground investigation at the site in due course).	High	Section 7.1 and 7.3 of PERA Report. Appendix 13.1, ES Volume III
Adjacent Properties and Land Users	Surrounding land uses within 250m of the site are predominantly commercial and residential. They are considered to be of high sensitivity as some of the surrounding land uses have gardens. Contaminants potentially present at the site of relevance to this receptor are as follows: ■ Potential for leaching and subsequent migration of heavy metal contamination to offsite receptors.	High	Section 7.1 and 7.3 of PERA Report. Appendix 13.1, ES Volume III
Stanley Park	Stanley Park is located in close proximity to the south. The receptor is considered to be of medium sensitivity due to the transient nature of visitors at the park and it being open space. Contaminants potentially present at the site of relevance to this receptor are as follows: ■ Potential for leaching and subsequent migration of heavy metal contamination to the offsite users of Stanley Park.	Medium	Section 7.1 and 7.3 of PERA Report. Appendix 13.1, ES Volume III
Principal Aquifer beneath the site (Chester Pebble Beds Formation)	BGS borehole logs show negligible thickness of superficial deposits to be present across the site which would offer some protection to the Principal Aquifer. The presence of hardstanding in the south of the site will limit any infiltration to the underlying aquifer under current conditions. An active groundwater abstraction well is located 80m south of the site but is used only for the refilling of surface water features within Stanley Park. There are no groundwater abstraction points within 1km of the site which are used for potable water supply. The site is not located within a Source Protection Zone (SPZ). The Principal Aquifer is considered to be of high sensitivity as it is of regional importance and is used for potable water supply, although not within 1km of the site. Contaminants potentially present at the site of relevance to this receptor are as follows: ■ Potential for heavy metals and hydrocarbon contamination (to be confirmed via a ground investigation at the site in due course).	High	Section 7.1 and 7.3 of PERA Report. Appendix 13.1, ES Volume III
Surface Waters (Lake in Stanley Park)	The nearest surface water feature is a lake located 40m south of the site in Stanley Park. Although the site may be in continuity with the lake via the nearby abstraction well, the receptor is considered to be of low sensitivity, as it is not considered to be a sensitive controlled waters receptor. Contaminants potentially present at the site of relevance to this receptor are as follows: ■ Potential for leaching and subsequent migration of heavy metal contamination to the surface water.	Low	Section 7.1 and 7.3 of PERA Report. Appendix 13.1, ES Volume III
Flora on-site	There is currently limited vegetation of low value on site (a sports pitch), There is currently limited potential for plant uptake from the underlying Made Ground due to the presence of hard standing and of material used in football pitch construction. Under the proposals, areas of open, vegetated space are proposed at the site. Flora on-site are considered to be of low sensitivity as the site is of limited ecological value. Contaminants potentially present at the site of relevance to this receptor are as follows: ■ Heavy metals (to be confirmed via a ground investigation at the site in due course).	Low	Section 7.1 and 7.3 of PERA Report. Appendix 13.1, ES Volume III
Built Environment on-site	The proposed development will include underground utilities, such as water pipes. Environmental database records show that the potential for ground stability hazards are 'no hazard' to 'very low'. The receptor is considered to be of medium sensitivity as it affects buildings and services. Contaminants potentially present at the site of relevance to this receptor are as follows: ■ Hydrocarbons, pH and sulphate (to be confirmed via a ground investigation at the site in due course); and, ■ Ground Gases/Vapours	Medium	Section 7.1 and 7.3 of PERA Report. Appendix 13.1, ES Volume III

GROUND CONDITIONS

13.4 POTENTIAL SIGNIFICANT IMPACTS

PHASE	DESCRIPTION	ADVERSE/BENEFICIAL
Construction	During earthworks activities, there is the potential for ground disturbance to create preferential pathways of possible on-site contamination to adjacent properties and land users (creation of dust, vapours or gas).	Adverse
Construction	During earthwork activities, there is the potential for construction workers to come into contact with contaminated material (if present) via direct or indirect ingestion of soils, inhalation of dusts and/or vapours/gases.	Adverse
Construction	During construction, the removal of hardstanding and general earthworks may increase the potential for infiltration beneath the site with consequent mobilisation and migration of perched groundwater (potentially impacted) to the aquifer below. Preferential pathways of contamination may be created through activities such as, the excavation of drainage trenches.	Adverse
Construction	During construction, the removal of hardstanding and general earthworks may increase the potential for infiltration beneath the site with consequent mobilisation and migration of perched groundwater and groundwater to nearby surface water receptors (lake in Stanley Park).	Adverse
Operation	In the absence of a detailed ground investigation, followed by subsequent remediation (if required), there would be the potential for future site users to be exposed to contamination (if present) via direct or indirect ingestion, and/or dermal contact if contamination is present in areas of proposed soft standing.	Adverse
Operation	There is potential for ground gas / vapour build up and migration in the proposed buildings/confined spaces, if contamination is present beneath the site.	Adverse
Operation	There is the potential for the migration of contamination (if present) along preferential pathways potentially created during the construction phase (i.e. drainage trenches) to the underlying aquifer.	Adverse
Operation	There is the potential for the migration of contamination (if present) along preferential pathways potentially created during the construction phase to nearby surface water receptors (i.e. through drainage trenches).	Adverse
Operation	There is potential for the loss of/damage to future flora due to the uptake of contaminants (if present), if mitigation (if required) is not undertaken.	Adverse
Operation	Without mitigation (if required) there is the potential for contamination to permeate below ground water supply pipelines or below ground concrete (sulphate attack). There is also the potential for migrating ground gases/vapours to accumulate in enclosed spaces in future buildings.	Adverse

13.5 DESIGN INTERVENTIONS

No design interventions have been implemented in relation to this technical area.

13.6 ASSESSMENT PRE-MITIGATION

PHASE	RECEPTOR(S) AFFECTED	IMPACT	MAGNITUDE PRE-MITIGATION	SIGNIFICANCE PRE-MITIGATION	MITIGATION PROPOSED?	FURTHER INFORMATION
Construction	Adjacent Properties/Land Users	There is potential during earthworks for the creation of preferential pathways for on-site contaminants (if present) to migrate off-site to adjacent properties and land users. The receptor is considered to be of high sensitivity and the magnitude of the impact is medium. The magnitude of the impact is considered to be medium as there could be a chronic risk to human health if a pathway is created.	Medium	Major Adverse	Yes	Section 7.4 of PERA Report. Appendix 13.1, ES Volume III
Construction	Stanley Park	There is potential during earthworks for the creation of preferential pathways for on-site contaminants (if present) to migrate off-site to Stanley Park. The receptor is considered to be of medium sensitivity and the magnitude of the impact is medium. The magnitude is medium as there could be a chronic risk to human health if a pathway is created.	Medium	Moderate Adverse	Yes	Section 7.4 of PERA Report. Appendix 13.1, ES Volume III
Construction	Construction/Maintenance Workers	There is potential for construction workers to come into contact with contaminated soils (if present) during earthworks. Construction workers are high sensitivity receptors and the magnitude of the impact is medium. The magnitude is medium as without mitigation, a chronic risk to human health could be present.	Medium	Major Adverse	Yes	Section 7.4 of PERA Report. Appendix 13.1, ES Volume III
Construction	Principal Aquifer	Following a site strip (removal of any hardstanding) during the construction works, the potential for contaminant (if present) migration to the Principal Aquifer through infiltration may be increased. For example, preferential pathways of contamination may be created through the excavation of drainage trenches, or through foundation design. The lack of overlying superficial deposits across the site will not offer protection to the aquifer below. The Principal Aquifer is a high sensitivity receptor and the impact magnitude is large. The magnitude is considered large as there is a possibility of pollution to a high sensitivity aquifer.	Large	Major Adverse	Yes	Section 7.4 of PERA Report. Appendix 13.1, ES Volume III
Construction	Surface Waters (lake in Stanley Park)	During earthworks there is a potential for increased leaching and migration of contamination (if present) to the receptor. Preferential pathways of contamination may be created through the excavation of drainage trenches etc. The lake is a low sensitivity receptor and the impact magnitude is small. The magnitude is small as the lake is considered to be a non-sensitive controlled waters receptor.	Small	Minor Adverse	Yes	Section 7.4 of PERA Report. Appendix 13.1, ES Volume III

GROUND CONDITIONS

PHASE	RECEPTOR(S) AFFECTED	IMPACT	MAGNITUDE PRE-MITIGATION	SIGNIFICANCE PRE-MITIGATION	MITIGATION PROPOSED?	FURTHER INFORMATION
Operation	Future Site Users	Although much of the proposed development will be covered in hardstanding, there are proposed areas of open space and possible gardens, therefore potential for future site users to come into contact with contaminants (if present) via direct/indirect ingestion, inhalation and / or dermal contact. Future site users are a high sensitivity receptor and the magnitude of impact is medium. The impact is medium as a chronic risk to human health could be caused.	Medium	Major Adverse	Yes	Section 7.4 of PERA Report. Appendix 13.1, ES Volume III
Operation	Future Site Users	There is potential for ground gas / vapour build up and migration in proposed buildings/confined spaces. No monitoring of ground gas/vapour has currently been carried out at the site. Future site users are a high sensitivity receptor and the magnitude of impact is large. The magnitude is large as if present, could cause asphyxiation or an explosion risk.	Large	Major Adverse	Yes	Section 7.4 of PERA Report. Appendix 13.1, ES Volume III
Operation	Principal Aquifer	There is the potential for the migration of contamination (if present) along preferential pathways potentially created during the construction phase (i.e. drainage trenches, foundation design) to the underlying aquifer. Consideration needs to be given to the construction of new buildings. At this stage, groundwater monitoring has not been completed at the site in order to refine the risk to the receptor. The Principal Aquifer is of high sensitivity and the magnitude of the impact is large. The magnitude is large as there is a possibility of pollution to a high sensitivity aquifer.	Large	Major Adverse	Yes	Section 7.4 of PERA Report. Appendix 13.1, ES Volume III
Operation	Surface Waters (lake in Stanley Park)	There is the potential for the migration of contamination (if present) laterally and vertically to this receptor via new preferential pathways potentially created during the construction phase. At this stage, groundwater monitoring has not been completed at the site in order to refine the risk to the receptor. The lake is of low sensitivity and the magnitude of the impact is small. The magnitude is small as the lake is not considered to be a sensitive controlled waters receptor.	Small	Minor Adverse	Yes	Section 7.4 of PERA Report. Appendix 13.1, ES Volume III
Operation	Flora	There is the potential for the uptake of contaminants (if present) by newly introduced flora at the site. Flora is a low sensitivity receptor and the magnitude of the impact is small. The magnitude of the impact is small as the impact to the ecosystem is limited.	Small	Minor Adverse	Yes	Section 7.4 of PERA Report. Appendix 13.1, ES Volume III
Operation	Future Built Environment	There is the potential for contamination (if present) to affect below ground concrete (sulphate attack) and for hydrocarbons to penetrate water supply pipelines. The sensitivity of the receptor is medium, and the magnitude is medium. The magnitude is medium as a chronic risk to human health could be created through hydrocarbon impact to water supply pipelines.	Medium	Major Adverse	Yes	Section 7.4 of PERA Report. Appendix 13.1, ES Volume III
Operation	Future Building Structures	There is the potential for the migration of ground gases/vapours into the proposed buildings/confined spaces at the site and for them to accumulate in confined spaces to explosive levels (if present). Ground gas monitoring has not been completed at the site to date. Building structures are a high sensitivity receptor and the magnitude is large. The magnitude is large as if gases/vapours are allowed to accumulate, they could cause asphyxiation and/or explosion.	Large	Major Adverse	Yes	Section 7.4 of PERA Report. Appendix 13.1, ES Volume III

13.7 MITIGATION & ENHANCEMENT MEASURES

PHASE	POSSIBLE EFFECT BEING MITIGATED	MITIGATION MEASURE	HOW SECURED / TRIGGER	MAGNITUDE POST-MITIGATION	ADVERSE / BENEFICIAL	FURTHER INFORMATION
Construction	Construction workers coming into contact with potentially contaminated materials on site	Implementation of good health and safety working practices and appropriate PPE.	CEMP secured by planning condition.	Negligible	Adverse	Chapter 4 Construction Strategy and CEMP
Construction	Adjacent properties and land users coming into contact with soil or contaminated materials (if present) from on-site	Implementation of good construction practices and dust suppression during the construction phase, as per the following: • Contaminated soils stockpiled in suitable skips or bunded areas; • Dampening down of material; • Vehicle washing; • Designated site haulage routes; and, • Dust monitoring and covering of exposed work faces. These measures will be included within the CEMP in due course.	CEMP secured by planning condition.	Negligible	Adverse	Chapter 4 Construction Strategy and CEMP

GROUND CONDITIONS

PHASE	POSSIBLE EFFECT BEING MITIGATED	MITIGATION MEASURE	HOW SECURED / TRIGGER	MAGNITUDE POST-MITIGATION	ADVERSE / BENEFICIAL	FURTHER INFORMATION
Construction	Adjacent properties and land users – Stanley Park coming into contact with soil or contaminated materials (if present) from on-site	Implementation of good construction practices and dust suppression during the construction phase, as per the following: • Contaminated soils stockpiled in suitable skips or bunded areas; • Dampening down of material; • Vehicle washing; • Designated site haulage routes; and, • Dust monitoring and covering of exposed work faces. These measures will be included within the CEMP in due course.	CEMP secured by planning condition.	Negligible	Adverse	Chapter 4 Construction Strategy and CEMP
Construction	Infiltration and migration of contamination (if present) to Principal Aquifer beneath site	Following demolition of existing structures on site, a ground investigation, including ground water monitoring will be undertaken to more fully understand the ground conditions beneath the site and the risk assessment for effects on the Principal Aquifer will be refined (including possible piling risk assessment). Should the results of the refined risk assessment indicate that remediation is necessary, a remediation strategy will be prepared and submitted to LCC for approval. Once approved, the contamination source (if present) would be removed in accordance with the agreed strategy. The following environmental controls will also be implemented on-site during the construction phase (and included within the CEMP): • control of water encountered – i.e. runoff collected and disposed of appropriately; • Minimise stockpiling of material – place material in skip or bunded areas; and, • Minimise infiltration where possible – place contaminated material in segregated areas of site, within skip or bunds.	Ground investigation, possible Remediation Strategy and CEMP to be secured by planning condition.	Negligible	Adverse	Chapter 4 Construction Strategy and CEMP
Construction	Infiltration and migration of contamination (if present) to lake within Stanley Park	Following demolition of existing structures on site, a ground investigation, including groundwater monitoring will be undertaken to more fully understand the ground conditions beneath the site and the risk assessment for effects on the lake within Stanley Park will be refined. Should the results of the refined risk assessment indicate that remediation is necessary, a remediation strategy will be prepared and submitted to LCC for approval. Once approved, the contaminated source (if present) would be removed in accordance with the agreed strategy. The following environmental controls will also be implemented on-site during the construction phase (and included within the CEMP): • Control of water encountered – i.e. runoff collected and disposed of appropriately; • Minimise stockpiling of material – place material in skip or bunded areas; and, • Minimise infiltration where possible – place contaminated material in segregated areas of site, within skip or bunds.	Ground investigation, possible Remediation Strategy and CEMP to be secured by planning condition.	Negligible	Adverse	Chapter 4 Construction Strategy and CEMP
Operation	Future site users coming into contact with potentially contaminated soil	Following the construction phase, which will include a ground investigation and possible remediation in order to refine the risks from contamination at the site, validation of such works may be required to ensure compliance with the agreed strategy. A validation report (if required) will be prepared and submitted to the LCC for approval. In soft landscaped areas, if required (based on the results of the refined risk assessment), importation of suitably clean material and marker layer would be placed over impacted material on-site.	Potential requirement for a Validation Report to be secured by planning condition.	Negligible	Beneficial	-
Operation	Ground gas/vapour build up in buildings to affect future site users	As part of the ground investigation, ground gas monitoring will be undertaken following demolition of the structures on site to refine the risk to future site users posed by ground gas/vapour build up. Should the results indicate a risk to future site users then either source removal or ground gas mitigation measures may be installed in buildings. If required, the works will follow an approved Remediation Strategy, which will be validated and reported in a Validation Report or Gas Verification Plan which may be submitted to LCC for approval.	Potential requirement for a Validation Report or Gas Verification Plan to be secured by condition.	Negligible	Beneficial	-
Operation	Infiltration and migration of contamination (if present) to Principal Aquifer beneath site	Following demolition of existing structures on site and following a ground investigation (including ground water monitoring) to fully understand the ground conditions beneath the site and the effects on the Aquifer, if necessary, a Remediation Strategy and piling risk assessment (if required) would have been prepared and submitted to the LCC for approval. During the operation phase, validation of these works would be carried out to ensure compliance with the approved strategy. If necessary, a Validation Report would be written which would be submitted to the LCC for approval.	Potential requirement for Validation Report and Piling Risk Assessment secured by planning condition.	Negligible	Beneficial	-

GROUND CONDITIONS

PHASE	POSSIBLE EFFECT BEING MITIGATED	MITIGATION MEASURE	HOW SECURED / TRIGGER	MAGNITUDE POST-MITIGATION	ADVERSE / BENEFICIAL	FURTHER INFORMATION
Operation	Infiltration and migration of contamination (if present) to lake within Stanley Park	Following demolition of existing structures on site and following a ground investigation (including ground water monitoring) to fully understand the ground conditions beneath the site and the effects on the lake within Stanley Park, should remediation be required, a Remediation Strategy would have been prepared and submitted to the LCC for approval. During the operation phase, validation of these works would be carried out to ensure compliance with the approved strategy. If necessary, the Validation Report would be submitted to the LCC for approval.	Potential requirement for Validation Report to be secured by planning condition.	Negligible	Beneficial	-
Operation	Loss of flora following uptake of contaminants (if present)	Following demolition of existing structures on site and following a ground investigation to fully understand the ground conditions beneath the site and the effects on flora, should remediation be required, a Remediation Strategy would have been prepared and submitted to the LCC for approval. During the operation phase, validation of these works would be carried out to ensure compliance with the approved strategy. If necessary, the Validation Report would be submitted to LCC for approval. In soft landscaped areas, if required (based on the results of the refined risk assessment and Remediation Strategy), importation of suitably clean material for planting with marker layer would be placed over impacted material on-site.	Potential requirement for Validation Report to be secured by planning condition.	Negligible	Beneficial	-
Operation	Future Built Environment (below ground concrete and water supply pipelines)	Following demolition of existing structures on site and following a ground investigation to fully understand the ground conditions beneath the site and the effects on the built environment, should remediation be required, a Remediation Strategy would have been prepared and submitted to the LCC for approval. During the operation phase, validation of these works would be carried out to ensure compliance with the approved strategy. If necessary, the Validation Report would be submitted to LCC for approval. If required, the Remediation Strategy will detail an appropriate concrete classification for the ground conditions and if necessary, water supply pipe work would also be upgraded.	Potential requirement for Validation Report to be secured by planning condition.	Negligible	Beneficial	-

13.8 ASSESSMENT POST-MITIGATION

PHASE	RECEPTOR	RESIDUAL IMPACT	RESIDUAL EFFECT					
			SIGNIFICANCE	ADV/BEN	ST/MT/LT	D/IND	P/T	R/IRR
Construction	Adjacent Properties/Land Users (including Stanley Park)	There is potential during earthworks for the creation of preferential pathways for on-site contaminants (if present) to migrate off-site to adjacent properties and land users. Implementation of good construction practices and dust suppression (i.e. dampening down material, vehicle washing etc.) shall mitigate this effect.	Negligible	Adverse	Short-term	Indirect	Temporary	Irreversible
Construction	Construction Workers/ Maintenance Workers	There is potential for construction workers to come into contact with contaminated soils (if present) during earthworks. Construction workers are high sensitivity receptors and the magnitude of impact is large, without mitigation. Effects are expected to be short term (if any). Implementation of good health and safety working practices and appropriate PPE shall mitigate this effect.	Negligible	Adverse	Short-term	Direct	Temporary	Irreversible
Construction	Principal Aquifer	There is the potential for contaminant (if present) infiltration and migration to the Principal Aquifer. Should it be present, and necessary, the contamination source will be removed in accordance with an agreed remediation strategy. If necessary, a piling risk assessment will be undertaken to assess the risk from piling (if utilised) on the aquifer below. Best practice environmental controls will also be implemented at the site during construction. With these measures in place, the residual effects are expected to be negligible.	Negligible	Adverse	Short-term	Indirect	Temporary	Reversible
Construction	Surface Waters (lake - Stanley Park)	There is the potential for contaminant (if present) infiltration and migration to this receptor. Should it be present, and necessary, the contamination source will be removed in accordance with an agreed remediation strategy. Best practice environmental controls will also be implemented at the site during construction. With these measures in place, the residual effects are expected to be negligible.	Negligible	Adverse	Short-term	Indirect	Temporary	Reversible
Operation	Future Site Users	There is the potential for future site users to come into contact with contaminants (if present) via direct/indirect ingestion, inhalation and / or dermal contact. Should it be present, and necessary, the contamination source will be removed in accordance with an agreed remediation strategy. Suitably clean material with a marker layer will be imported and placed over impacted material on-site in proposed landscaped areas, if required. With these measures in place, the residual effects are expected to be negligible.	Negligible	Beneficial	Long-term	Direct	Permanent	Irreversible
Operation	Future Site Users/Buildings	There is the potential for ground gas / vapour to build up and migrate into the proposed buildings. Should ground gas/vapours be present, the possible source of gas could be removed in accordance with an agreed remediation strategy and/or ground gas mitigation measures will be installed in all buildings/confined spaces, where a risk is identified. With these measures in place, the residual effects are expected to be negligible.	Negligible	Beneficial	Long-term	Indirect	Permanent	Irreversible

GROUND CONDITIONS

PHASE	RECEPTOR	RESIDUAL IMPACT	RESIDUAL EFFECT					
			SIGNIFICANCE	ADV/BEN	ST/MT/LT	D/IND	P/T	R/IRR
Operation	Principal Aquifer	There is the potential for increased infiltration and migration to the Principal Aquifer via preferential pathways. Should contamination be present, and where necessary, the contamination source will be removed in accordance with an agreed remediation strategy. With these measures in place, the residual effects are expected to be negligible.	Negligible	Beneficial	Long-term	Indirect	Temporary	Reversible
Operation	Surface Waters (lake - Stanley Park)	There is the potential for increased infiltration and migration to the receptor via preferential pathways. Should contamination be present, and where necessary, the contamination source will be removed in accordance with an agreed remediation strategy. With these measures in place, the residual effects are expected to be negligible.	Negligible	Beneficial	Long-term	Indirect	Temporary	Reversible
Operation	Flora	There is the potential for uptake of contaminants (if present) by newly introduced flora at the site. Suitably clean material for planting with a marker layer will be imported and placed over impacted material on-site in proposed landscaped areas if required. With these measures in place, the residual effects are expected to be negligible.	Negligible	Beneficial	Long-term	Direct	Permanent	Irreversible
Operation	Future Built Environment	There is the potential for contamination (if present) to affect below ground concrete (sulphate attack) and for hydrocarbons to penetrate water supply pipelines. Should it be present, and necessary, the contamination source will be removed in accordance with an agreed remediation strategy. An appropriate selection of concrete classification and an upgrade of water supply pipelines will also be undertaken, if required. With these measures in place, the residual effects are expected to be negligible.	Negligible	Beneficial	Long-term	Direct	Permanent	Irreversible

Key: ADV/BEN = Adverse/Beneficial; ST/MT/LT = Short-term/Medium-term/Long-term; D/IND = Direct/Indirect; P/T = Permanent/Temporary; R/IRR = Reversible/Irreversible

13.9 GROUND CONDITIONS: INTER-DEVELOPMENT CUMULATIVE SCHEME EFFECTS

Only one forthcoming scheme has been considered in the inter-development cumulative scheme assessment, as noted within the table below. Any further schemes located over 250m from the site are considered to be of sufficient distance to not have a cumulative impact alongside the proposed development.

CUMULATIVE SCHEME	SCHEME DESCRIPTION	POTENTIAL FOR CUMULATIVE EFFECTS?	CONSIDERED WITHIN ASSESSMENT?
Land Bounded by Walton Lane, Bullens Road and Diana Street (planning ref: 18F/1316)	To erect part four/part five storey block comprising 106 no. flats with associated car parking, landscaping and ancillary works	The Walton Lane residential scheme would have the potential to produce cumulative effects alongside the proposed development as a long-term beneficial impact would result from the remediation of any contaminated soils if present beneath each site. Implementation of good construction practices in accordance with a CEMP, which include best practice environmental controls (i.e. control of water encountered, minimise stockpiling of material, minimise infiltration where possible) should help limit impacts on potential receptors.	Yes

PHASE	RECEPTOR	POTENTIAL CUMULATIVE EFFECT	ADDITIONAL MITIGATION (IF REQUIRED)	CUMULATIVE RESIDUAL EFFECT				
				SIGNIFICANCE	ADV/BEN	ST/MT/LT	D/IND	P/T	R/IRR
Construction	Adjacent Properties /Land Users	During construction works, ground disturbance has the potential to create new preferential pathways for contaminants (if present) to migrate to off-site properties and land users. The risks will be managed through the individual Construction Strategies and CEMPs for the developments, which will include best practice construction measures, including dust suppression measures (i.e. dampening down material, vehicle washing etc.) With these measures in place, cumulative effects are expected to be negligible.	No additional mitigation required	Negligible	Adverse	Short-term	Indirect	Temporary	Reversible
Construction	Principal Aquifer	During construction, the removal of hardstanding and general earthworks may increase the potential for infiltration beneath the site with consequent mobilisation and migration of groundwater (potentially impacted) to the aquifer below. For example, preferential pathways of contamination may be created through the excavation of drainage trenches and foundation design. As is the case for the proposed Goodison Park Legacy Project development, it is expected that the Walton Lane residential scheme will undertake suitable remediation works, if they are necessary. Both schemes will also be constructed in accordance with a CEMP, which will include best practice environmental controls (i.e. control of water encountered, minimise stockpiling of material, minimise infiltration where possible). With these measures in place, cumulative effects are expected to be negligible.	No additional mitigation required	Negligible	Adverse	Short-term	Indirect	Temporary	Reversible

GROUND CONDITIONS

PHASE	RECEPTOR	POTENTIAL CUMULATIVE EFFECT	ADDITIONAL MITIGATION (IF REQUIRED)	CUMULATIVE RESIDUAL EFFECT					
				SIGNIFICANCE	ADV/BEN	ST/MT/LT	D/IND	P/T	R/IRR
Construction	Surface Waters (lake in Stanley Park)	During construction, the removal of hardstanding and general earthworks may increase the potential for infiltration beneath the sites with consequent mobilisation and migration of groundwater (potentially impacted) to nearby surface waters. For example, preferential pathways of contamination may be created through the excavation of drainage trenches and foundation design. As is the case for the proposed Goodison Park Legacy Project development, it is expected that the Walton Lane residential scheme will undertake suitable remediation works, if they are necessary. Both schemes will also be constructed in accordance with a CEMP, which will include best practice environmental controls. With these measures in place, cumulative effects are expected to be negligible.	No additional mitigation required	Negligible	Adverse	Short-term	Indirect	Temporary	Reversible

Key: ADV/BEN = Adverse/Beneficial; ST/MT/LT = Short-term/Medium-term/Long-term; D/IND = Direct/Indirect; P/T = Permanent/Temporary; R/IRR = Reversible/Irreversible

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GROUND CONDITIONS

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