Luton Rising
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London Luton Airport Expansion

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5.02 Appendix 17.5 Outline Remediation Strategy (for Former Eaton Green Landfill)

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5.02 ENVIRONMENTAL STATEMENT APPENDIX 17.5 OUTLINE REMEDIATION STRATEGY (FOR FORMER EATON GREEN LANDFILL)

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1 INTRODUCTION

1.1 Scope

1.1.1 This Outline Remediation Strategy has been developed by Luton Rising (a trading name of London Luton Airport Limited) ('the Applicant') to support the application for development consent for the expansion of London Luton Airport ('the Proposed Development').

1.1.2 This is an outline document which has been developed following consultation with the Environment Agency and Local Planning Authorities. As an outline document, this will inform the development of the final remediation strategy which must be substantially in accordance with this document.

1.1.3 The Application Site location is shown in **Figure 1** of this document, the Proposed Development is split into four distinct geographical components:

a. The Main Application Site;
b. Off-site Car Parks;
c. Off-site Highways Interventions; and
d. Off-site Planting.

1.1.4 This report sets out the Outline Remediation Strategy for the main area of concern with regard to potential contamination, this is the area of the former landfill (Eaton Green Landfill) located within the Main Application Site. This area was referred to as Area A in the various assessment reports (see **Section 1.3**), which support this Outline Remediation Strategy, for the purposes of this report it is referred to as 'the site'.

1.1.5 The northwestern edge of the landfill forms part of airport land and has already been remediated and redeveloped for two aircraft hangars and therefore does not form part of this Outline Remediation Strategy, see **Figure 1**. Further details are provided in the Preliminary Risk Assessment (PRA) (Ref 1.1) **Appendix 17.1** of the Environmental Statement (ES) **[TR020001/APP/5.02]**.

1.1.6 The PRA (Ref. 1.1) **Appendix 17.1** of the ES **[TR020001/APP/5.02]** notes ground investigation (GI) will be required in other areas of the Application Site, located off the landfill, which would be undertaken at detailed design. The additional GI would be secured through a Requirement in the Development Consent Order (DCO) and included in the Mitigation Route Map which summarises the proposed mitigation measures.

1.2 Report objectives

1.2.1 The purpose of the Outline Remediation Strategy is to:

a. Define the remediation objectives;
b. Describe feasible remediation options;
c. Evaluate the feasible options for each of the identified relevant contaminant linkages (RCLs);

d. Identify the best practicable remediation option;
e. Present the RCLs addressed by this strategy and how the proposed remediation works will mitigate the associated risks, to render the Main Application Site suitable for the Proposed Development;
f. Identify the regulatory regime under which the works are to be undertaken and any regulatory controls, i.e. required permits/licences;
g. Identify how the proposed works will achieve the remediation options appraisal objectives including sustainability issues/targets;
h. Identify methods for verifying the remediation works, including; monitoring, measuring, recording and reporting;
i. Identify control measures required to manage the risk from RCLs/ potential contaminant linkages (PCLs) during remediation works to human health (site workers/adjacent site users), ecology and surrounding environment;
j. Describe how the works will be integrated into the earthworks/construction and design of site redevelopment;
k. Be practical, achievable, effective, durable and verifiable; and
l. Outline the approach to dealing with unexpected contamination/contingency planning.

1.3 Information sources

1.3.1 This report is based on the findings of the following reports:

a. Luton Rising (2023). Preliminary Risk Assessment (PRA) of Land Contamination. (Ref. 1.1).
b. Luton Rising (2023). Land Contamination. Generic Quantitative Risk Assessment (GQRA) Report. (Ref. 1.2).
c. Luton Rising (2023). Detailed Quantitative Risk Assessment Report: Human Health and Ground Gases. (Ref. 1.3)
d. Luton Rising (2023). Detailed Quantitative Risk Assessment Report: Controlled Waters. (Ref. 1.4).
e. Luton Rising (2023). Construction Method Statement and Programme Report. (Ref. 1.5).
f. Arup (2019) Geotechnical Investigation Report (GIR). (Ref. 1.6).
g. Luton Rising (2023) Hydrogeological Characterisation Report. (Ref. 1.7).
h. Luton Rising (2023) Foundation Works Risk Assessment (FWRA) for Former Eaton Green Landfill. (Ref. 1.8).
i. Luton Rising (2023). Drainage Design Statement. (Ref. 1.9).

1.4 Key stakeholders

1.4.1 Details of the key stakeholders with regards to remediation at the site are shown in **Table 1.1** below.

Table 1.1 Key stakeholders for remediation of the site

Stakeholder	Details
Luton Rising	Client for the Proposed Development who are responsible for airport development. Luton Rising are wholly owned by Luton Borough Council.
Environment Agency	Statutory consultee with specific responsibilities for protection of controlled water and waste management regulation.
Luton Borough Council (LBC) and neighbouring councils	Local Authority consultee with regard to protection of human health from contaminated land.
London Luton Airport Operator Limited (LLAOL)	Airport operator will require operation of existing airport not to be disrupted by remediation activities.
Local residents/schools	There are a number of residential properties in close proximity to the Proposed Development as well as schools in the local area.
Remediation Contractor	To be confirmed. Appointment of contractor will depend on procurement approach by Client.

1.5 Proposed Development

1.5.1 The Proposed Development on the site includes the creation of a second terminal, extension to the existing apron, extension to the Luton Direct Air to Rail Transit (Luton DART), a new cable-hauled fast passenger transit connecting Luton Airport Parkway station to the airport and new station, two new piers, car parking and development of Green Horizons Park.

1.5.2 The development will be delivered incrementally to match airport capacity demand. There are three assessment phases, Phase 1, Phase 2a and Phase 2b, which are referred to in the ES. The proposed masterplan for the Main Application Site for each assessment phase are presented in **Figure 2a, Figure2b** and **Figure 2c** of this document.

1.5.3 A detailed description of the Proposed Development and assessment phases are provided in **Chapter 4** of the Proposed Development of the ES **[TR020001/APP/5.01]**.

1.6 Earthworks

1.6.1 The earthworks required to facilitate development across the site are described in **Table 1.2** below.

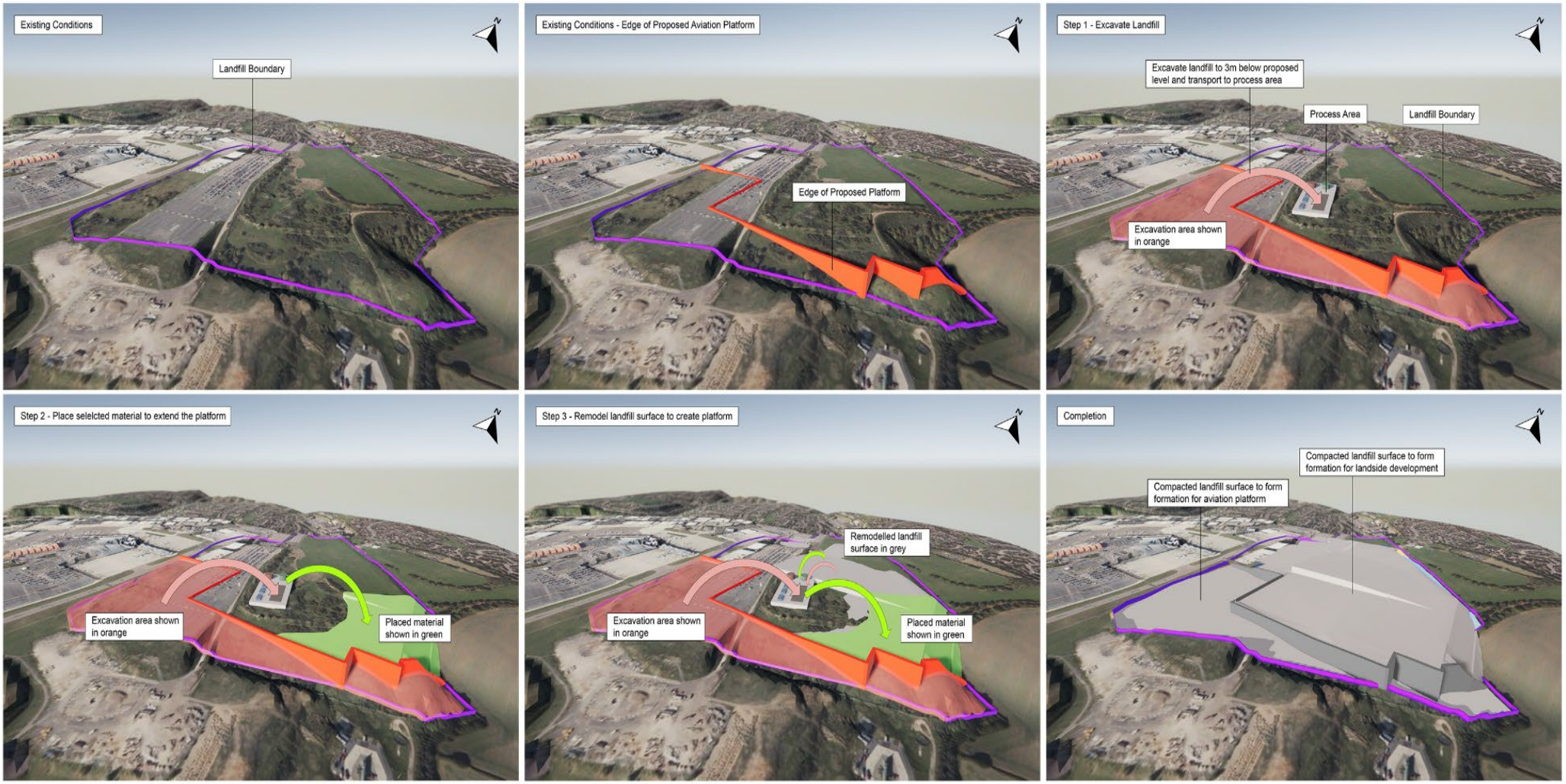
Table 1.2 Summary of Proposed Development within the site and associated earthworks

Proposed Development	Likely earthworks required
1.6.2 New piers, apron, stands and taxiways. 1.6.3 A new terminal building. Extension to the Luton DART 1.6.4 Energy centre, coach station and car parking 1.6.5 A temporary 'decked' car park 1.6.6 Green Horizons Park including: a. Buildings such as offices and hotel. b. Car parking, new road infrastructure and landscaping. c. A multi-storey car park (MSCP). d. Other airport buildings. e. Drainage infrastructure, including attenuation tanks.	a. In the southern end of the site major earthworks will be required to create a development platform to tie-in with the existing airport levels. This will require excavation, processing and relocation of a significant volume of landfill wastes/Made Ground. b. Excavation of landfill material for provision of airport access road (AAR). c. For Green Horizons Park – remodelling of the landfill surface will be required. d. Import of engineering fill for development platform. e. Piling through the landfill into underlying chalk for foundations. f. Excavation of landfill waste to create tunnel for the Luton DART extension.

1.6.7 The works will require approximately 390,000m^3 of landfill material to be excavated and processed, approximately 310,000m^3 (Ref. 1.5) is expected to be reused to create part of the 'landside' platform. 20% of this is assumed to be 'lost' from recyclable materials and unsuitable materials disposed off-site and losses from compaction.

1.6.8 The landfill material is required to be removed to facilitate the construction of the development platform as it does not have the geotechnical properties required to meet settlement standards for aviation. A simplified schematic of the earthworks required to create the development platform for the expansion work is shown in **Drawing 1** below.

Drawing 1 Simplified schematic of the work required to create the development platform for the expansion work



Please note vertical exaggeration has been applied to the above images to aid understanding

2 CONCEPTUAL SITE MODEL AND RISK ASSESSMENT

2.1 Introduction

2.1.1 The site background including the physical and environmental setting and historical and current land use has been used to identify and characterise the site, identify potential contaminant sources, potential pathways and receptors and identify PCLs. Details of the background information are available in the PRA (Ref. 1.1) (**Appendix 17.1**) and GQRA reports (Ref. 1.2) (**Appendix 17.2**) of the ES **[TR020001/APP/5.02]**.

2.1.2 The risk assessment process aims to establish whether unacceptable risks exist and if so what further actions need to be taken in relation to the site. It is an iterative tiered approach which consists of three progressively detailed stages of risk assessment; PRA, GQRA and detailed quantitative risk assessment (DQRA). Depending on the nature of the site and contamination present, not all stages of risk assessment may be required.

2.1.3 A PRA (Ref. 1.1) (**Appendix 17.1**), GQRA (Ref. 1.2) (**Appendix 17.2**) and DQRAs (Ref. 1.3 and Ref. 1.4) (**Appendices 17.3** and **17.4**) **[TR020001/APP/5.02]** have been undertaken for the site which should be referred to for the full details of the development of the conceptual site model (CSM). The contaminant linkages addressed by this Outline Remediation Strategy report are presented in **Section 2.2**.

2.2 Potential contaminant linkages (PCLs) and identified relevant contaminant linkages (RCLs)

2.2.1 The DQRAs (Ref. 1.3 and Ref. 1.4) (**Appendices 17.3** and **17.4**) of the ES **[TR020001/APP/5.02]** indicated that in its current state, the site generally represents a low risk to all receptors and remedial action is not required. However, the development will change the potential risk to future users and other receptors. Where a PCL has been identified and mitigation measures inherent in the construction or operation of the Proposed Development might not be sufficient to break the pollutant linkage, there is assessed to be a RCL that would require specific measures to be implemented. For ease of identification within this Outline Remediation Strategy these PCLs have also been assigned an identifying RCL number and are detailed in **Table 2.1** below.

2.2.2 In addition to the RCLs, a number of PCLs were identified within the DQRA (Ref. 1.3) (**Appendix 17.3** of the ES **[TR020001/APP/5.02]**) associated with the enabling/construction phase of the development. No specific remediation activities are required to address these PCLs. However, these linkages need to be considered in the selection of an appropriate remediation technique and the works should manage these PCLs to protect site users and site neighbours. Recommended mitigation measures for theses PCLs are also included in this Outline Remediation Strategy and presented in **Table 2.2** below.

Table 2.1 Revised CSM – RCLs

PCL No.	RCL no.	Phase applicable to (see key)	Source	Pathway	Receptor	Qualitative Assessment of Risk	Justification of Qualitative Assessment of Risk and identification of required remediation
Gas							
1	RCL1	DEV	Ground gases from former landfill e.g. methane	Migration into future buildings and aviation apron resulting in build-up of gases	Users of future development – public/airport operatives/ Green Horizons Park users	Moderate	High concentrations of bulk landfill gases (carbon dioxide and methane) were recorded within the waste but there are low or negligible standpipe emission flow rates, indicating low/very low rates of continuing biodegradation of residual organic matter. A methane/carbon dioxide characteristic situation (gas regime) of CS4 (maximum) is considered protective – many parts of the site might be only CS2 or CS3. Gas protection measures are required in proposed buildings consistent with those detailed in DQRA volume 2 and BS8485.
2	RCL2	DEV CON		Migration off-site	Adjacent site users (e.g. residential housing and other buildings on Luton Airport, WVP Community Centre/ pavilion)	Low/ Moderate	Results do not suggest a current potential risk from gas migration but the proposed development may increase the potential risk of migration therefore boundary mitigation measures are required. Measures will be required to treat existing preferential pathways e.g. Thames Valley Drain.
Human Health							
6	RCL3	DEV	Waste in former landfill	Direct contact e.g. dermal contact, soil ingestion	Future maintenance workers	Low/ Moderate	The GQRA (Ref. 1.2) (**Appendix 17.2**) of the ES **[TR020001/APP/5.02]** indicated there were very few exceedances and the risk to future maintenance workers at the new airport development is low. Maintenance workers may

PCL No.	RCL no.	Phase applicable to (see key)	Source	Pathway	Receptor	Qualitative Assessment of Risk	Justification of Qualitative Assessment of Risk and identification of required remediation
							be exposed to areas of landfill waste during future excavation. This can be reduced by the placing of services in a clean cover system.
7	RCL4	DEV			Users of future development – public/airport operatives/ Green Horizons Park users	Low	The GQRA (Ref. 1.2) (**Appendix 17.2**) of the ES **[TR020001/APP/5.02]** indicated there were very few exceedances and the risk to future users of the new airport development is low. The future development will comprise buildings and hardstanding, therefore there is unlikely to be any contact with landfilled wastes. However, given the heterogeneous nature of landfills and the lack of engineered cover system, it should be assumed that measures will be required, particularly in landscape areas to prevent direct contact with the waste.
9	RCL5	DEV		Direct or indirect contact with radionuclides – incurring radiation dose by indirect dose received from ingestion of radium (or other alpha emitting contaminated material) or direct risk from contact with beta emitters such as Carbon-14 or Caesium-137	Future maintenance workers	Low	The recent GI included testing for radionuclides, which indicated levels observed were consistent with background levels. However, given the heterogeneous nature of landfills and the lack of engineered cover system, it should be assumed that measures will be required. Maintenance workers may be exposed to areas of landfill waste during future excavation. This can be reduced by the placing of services in a clean cover system.
10	RCL6	DEV			Users of future development – public/airport operatives/ Green Horizons Park users	Low	The recent GI included testing for radionuclides, which indicated levels observed were consistent with background levels. However, given the heterogeneous nature of landfills and the lack of engineered cover system, it should be assumed that measures will be required, particularly in landscape areas to prevent direct contact with the waste.

PCL No.	RCL no.	Phase applicable to (see key)	Source	Pathway	Receptor	Qualitative Assessment of Risk	Justification of Qualitative Assessment of Risk and identification of required remediation
14	RCL7	DEV		Inhalation of airborne contaminants/ dust/ asbestos fibres and microorganisms	Users of future development – public/airport operatives/ Green Horizons Park users	Low	The future development will comprise buildings and hardstanding, therefore there is unlikely to be any contact with landfilled wastes. However, given the heterogeneous nature of landfills and the lack of engineered cover system, it should be assumed that measures will be required, particularly in landscape areas to prevent generation of dusts which may contain asbestos fibres.
21	RCL8	DEV	Leachate in former landfill[1]	Direct contact e.g. dermal contact	Future maintenance workers	Moderate/ Low	The GI undertaken indicates there is likely to be limited leachate present. Maintenance workers may be exposed to areas of landfill waste during future excavation. This can be reduced by the placing of services in a clean cover system.
22	RCL9	DEV			Users of future development – public/airport operatives/ Green Horizons Park users	Low	The GI undertaken indicates there is likely to be limited leachate present. The future development will be buildings and hardstanding and is likely to include an engineered cover layer and leachate control system, therefore there is limited potential for contact with any leachate in the landfill.
29	RCL10	DEV	Contaminants in Made Ground (car park, capping material)	Direct contact e.g. dermal contact, soil ingestion	Future maintenance workers	Moderate/ Low	The GQRA (Ref. 1.2) (**Appendix 17.2**) of the ES **[TR020001/APP/5.02]** indicated there were very few exceedances and the risk to maintenance workers of the new airport development is low. Maintenance workers may be exposed to areas of Made Ground during future excavation. This can be reduced by the placing of services in a clean cover system and

[1] The source of the leachate in assumed to be the landfill waste material

PCL No.	RCL no.	Phase applicable to (see key)	Source	Pathway	Receptor	Qualitative Assessment of Risk	Justification of Qualitative Assessment of Risk and identification of required remediation
							adoption of appropriate site management protocols and personal protective equipment (PPE).
30	RCL11	DEV			Users of future development – public/ airport workers/users of Green Horizons Park	Low	The GQRA (Ref. 1.2) (**Appendix 17.2**) of the ES **[TR020001/APP/5.02]** indicated there were very few exceedances and the risk to future users of the new airport development is low. The future development will comprise buildings and hardstanding, therefore there is unlikely to be any contact with Made Ground. However, given the heterogeneous nature of landfills and the lack of engineered cover system, it should be assumed that measures will be required, particularly in landscape areas to prevent direct contact with the Made Ground.
32	RCL12	DEV		Inhalation of soil derived dusts/asbestos fibres	Future maintenance workers	Low	The future development will comprise buildings and hardstanding, therefore there is unlikely to be the potential for generation of soil derived dusts. Maintenance workers may be exposed to areas of Made Ground during future excavation. This can be reduced by the placing of services in a clean cover system and adoption of appropriate site management protocols and PPE.

PCL No.	RCL no.	Phase applicable to (see key)	Source	Pathway	Receptor	Qualitative Assessment of Risk	Justification of Qualitative Assessment of Risk and identification of required remediation
33	RCL13	DEV			Users of future development – public/ airport workers/users of Green Horizons Park	Low	The future development will comprise buildings and hardstanding, therefore there is unlikely to be the potential for generation of soil derived dusts. However, given the heterogeneous nature of landfills and the lack of engineered cover system, it should be assumed that measures will be required, particularly in landscape areas to prevent generation of dusts which may contain asbestos fibres.
Controlled Waters							
17	RCL14	CON	Waste in former landfill	Driving of contaminants downward during any future piling	Principal aquifer in Chalk	Moderate	The GQRA (Ref. 1.2) (**Appendix 17.2**) of the ES **[TR020001/APP/5.02]** has indicated that there are isolated hot spots of contaminants present and a localised area of free product was encountered at location WS224. Care will be required during construction not to create a pathway. This may involve localised removal of hotspots in locations where works may create a pathway. Incorporation of localised removal at select locations in the remediation strategy for site to reduce potential for creation of pathways. Risk from piling and construction can be mitigated by completion of piling risk assessment report to determine appropriate assessment for pile design and construction.

PCL No.	RCL no.	Phase applicable to (see key)	Source	Pathway	Receptor	Qualitative Assessment of Risk	Justification of Qualitative Assessment of Risk and identification of required remediation
23	RCL15	DEV	Leachate in former landfill[2]	Downward migration of leachate	Principal aquifer in Chalk	Moderate/ Low	DQRA (Ref. 1.3) (**Appendix 17.3** of the ES **[TR020001/APP/5.02]**) has identified the potential for downward migration of leachate from the landfill. A weak leachate plume appears to be present immediately down gradient of the landfill, however groundwater monitoring completed to date does not suggest there is a significant contaminant plume affecting the aquifer. The sensitivity analysis indicated that minimising the rate of infiltration will prevent contaminants breaking through the base of the unsaturated zone and reaching receptors. Installation of a cover system with a drainage system to collect all infiltration in the area of the landfill will minimise any future risks to the groundwater from contaminants within the landfill.
26	RCL16	CON	Contaminants in perched water	Driving of contaminants downward during any future piling	Principal aquifer in Chalk	Low	GQRA (Ref. 1.2) (**Appendix 17.2**) of the ES **[TR020001/APP/5.02]** indicated that perched water was present in some locations within the landfill. The GQRA indicated that there are isolated hot spots of contaminants present and a localised area of free product. Care will be required during construction not to create a pathway. This may involve localised removal of hotspots in locations where works may create a pathway. Risk from piling and construction can be mitigated by completion of piling risk assessment report to determine appropriate assessment for pile design and construction.

[2] The source of the leachate in assumed to be the landfill waste material

PCL No.	RCL no.	Phase applicable to (see key)	Source	Pathway	Receptor	Qualitative Assessment of Risk	Justification of Qualitative Assessment of Risk and identification of required remediation
27	RCL17	CON		Migration of contaminants via preferential pathways e.g. drainage	Principal aquifer in Chalk	Moderate	Survey and assessment of purpose of drain passing through landfill to be undertaken and incorporated into design. Measure to be incorporated in design to prevent creation of preferential pathways.
40	RCL18	DEV	Contaminants in groundwater (dissolved phase)	Lateral migration of contaminants in groundwater	Controlled waters (including potable water groundwater abstraction)	Moderate	Overall there were relatively few exceedances of potential contaminants of concern recorded in groundwater beneath the site. DQRA (Ref. 1.3) (**Appendix 17.3**) of the ES **[TR020001/APP/5.02]** indicated that whilst there is evidence of a weak leachate plume in groundwater down-gradient of the site, on-site groundwater monitoring provides little evidence that the landfill is causing significant contamination of the groundwater. The sensitivity analysis indicated that minimising the rate of infiltration will prevent contaminants breaking through the base of the unsaturated zone and reaching receptors. Installation of a cover system with a drainage system to collect all infiltration in the area of the landfill will minimise any future risks to the groundwater from contaminants within the landfill.
Others							
25	RCL19	DEV		Leachate breakout and plant uptake	Areas of Landscaping in the airport and Green Horizons Park developments/WVP allotments	Low	No evidence of leachate breakout currently occurring. The GI undertaken indicates there is likely to be limited leachate present. A clean cover system with suitable depth of growth medium will further reduce this risk.

PCL No.	RCL no.	Phase applicable to (see key)	Source	Pathway	Receptor	Qualitative Assessment of Risk	Justification of Qualitative Assessment of Risk and identification of required remediation
KEY: CON- RCL during excavation, remediation and construction phase DEV- RCL associated with future use of Proposed Development							

Table 2.2 Revised CSM - PCLs

PCL No.	Phase applicable to (see key)	Source	Pathway	Receptor	Qualitative Assessment of Risk	Justification of Qualitative Assessment of Risk
Gas						
Human Health						
3	DEV	Volatile radionuclides occupying buildings overlying radioactive land contamination	Migration into future buildings and build-up of gases	Users of future development – public/airport operatives/ Green Horizons Park users	Low	The recent GI included testing for radionuclides, which indicated levels observed were consistent with background levels. No further risk assessment of the radionuclide risks is required. However, a watching brief will be required during excavation works and procedures in place to ensure any suspected radionuclide containing material encountered is appropriately managed.
4	DEV		Migration off-site through preferential pathways	Adjacent site users (e.g. residential housing and other buildings on Luton Airport, WVP Community Centre/ pavilion)	Low	
5	CON	Waste in former landfill	Direct contact e.g. dermal contact, soil ingestion	Construction worker	Low	Based on the results of the GQRA (Ref. 1.2) (**Appendix 17.2**) of the ES **[TR020001/APP/5.02]** no special precautions, above and beyond best practice, are considered necessary during construction works to control potential acute risks. Appropriate measures should be undertaken during construction to ensure the site is secure and dusts are controlled. Any risks to construction workers can be reduced by adoption of appropriate site management protocols and PPE.
8	CON		Direct or indirect contact with radionuclides – incurring radiation dose by indirect dose received from	Construction workers	Low/ Moderate	Potential for radioactive materials to be present within the earlier waste which was deposited prior to the introduction of the Radioactive Substances Act in 1963. Potential for arisings from piling and foundation activities to encounter such materials. The recent GI included testing for radionuclides, which indicated levels observed were

PCL No.	Phase applicable to (see key)	Source	Pathway	Receptor	Qualitative Assessment of Risk	Justification of Qualitative Assessment of Risk
			ingestion of radium (or other alpha emitting contaminated material) or direct risk from contact with beta emitters such as Carbon-14 or Caesium-137			consistent with background levels. Procedures during construction should be in place to detect any radionuclides which may be encountered.
11	CON	Waste in former landfill	Inhalation of vapours	Construction worker	Low	The GI provided sufficient information to characterise the potential risks from soils vapours. No elevated soil vapours were identified. However, due to the variable nature of landfill and potential for variability in vapour generation over time, vapour monitoring should be continued; prior to, during and post earthworks to confirm this assessment. A detailed monitoring strategy should be included in the remediation strategy. In addition, due to the heterogenous nature of the landfill, the remediation strategy should include measures to detect and appropriately deal with material encountered which is different from those assessed and may have high vapour generation potential. The odour assessment indicates odour suppression techniques are likely to be required during the excavation works. Any future works should have an odour management plan in place to control any odours generated during works.
12	DEV			Future maintenance workers	Low	The GI provided sufficient information to characterise the potential risks from soil vapours. No elevated soil vapours identified during DQRA assessment which could be considered to pose a risk to the future development. Post earthworks monitoring will be undertaken to confirm assessment. A detailed monitoring strategy should be
13	DEV			Users of future development – public/airport operatives/	Low	

PCL No.	Phase applicable to (see key)	Source	Pathway	Receptor	Qualitative Assessment of Risk	Justification of Qualitative Assessment of Risk
				Green Horizons Park users		included in the remediation strategy. If elevated concentrations are detected post earthworks the need for specific mitigation measures to prevent vapour intrusion into buildings should be reassessed.
15	CON	Waste in former landfill	Inhalation of airborne contaminants/ dust/ asbestos fibres and microorganisms	Adjacent site users (e.g. residential housing, Luton Airport visitors and operatives, users of WVP)	Low	The GI provided sufficient information to characterise the condition of asbestos present within the landfill and inform this assessment. Overall the risk is considered to be low based on; the ACMs types encountered, their degradation state and fibre content. However, it is recognised that the landfill is heterogenous in nature and as such localised areas of increased frequency of ACMs may exist. Future works will require significant movement of waste i.e. for waste processing/re-engineering, therefore there is the potential for generation of airborne contaminants, which could affect adjacent site users. Careful consideration of techniques for waste processing/re-engineering will be required to minimise dust production, as well as good site management practices, monitoring and mitigation measures to reduce the potential risk. Any future works should have appropriate Environmental Management Plans in place to include perimeter monitoring, with adoption of additional control measures as necessary.
16	CON			Construction workers	Moderate	The GI provided sufficient information to characterise the condition of asbestos present within the landfill/Made Ground and inform this assessment, but it is recognised that the landfill/Made Ground is heterogenous in nature and as such localised areas of increased frequency of ACMs may exist. Therefore, a strategy for managing ACMs should be developed as part of the remediation strategy for the works. Construction workers are likely to be exposed to areas of landfill waste during future excavation. Any excavation work would adopt appropriate site management protocols and PPE to include personal monitoring and

PCL No.	Phase applicable to (see key)	Source	Pathway	Receptor	Qualitative Assessment of Risk	Justification of Qualitative Assessment of Risk
						protection against airborne asbestos fibres as necessary based on outcome of risk assessments.
20	CON	Leachate in former landfill[3]	Direct contact e.g. dermal contact	Construction workers	Moderate/ Low	Construction workers may be exposed to landfill leachate during future excavation works. The GI undertaken indicates there is likely to be limited leachate present. Any excavation work would adopt appropriate site management protocols and PPE.
28	CON	Contaminants in Made Ground (car park, capping material)	Direct contact e.g. dermal contact, soil ingestion	Construction workers	Moderate/ Low	Based on the results of the (Ref. 1.2) (**Appendix 17.2**) of the ES **[TR020001/APP/5.02]** no special precautions, above and beyond best practice, are considered necessary during construction works to control potential acute risks. Appropriate measures should be undertaken during construction to ensure the site is secure and dusts are controlled. Any risks to construction workers can be reduced by adoption of appropriate site management protocols and PPE.
31	CON		Inhalation of soil derived dusts/asbestos fibres	Construction workers	Moderate	The GI provided sufficient information to characterise the condition of asbestos present within the landfill/Made Ground and inform this assessment, but it is recognised that the landfill/Made Ground is heterogenous in nature and as such localised areas of increased frequency of ACMs may exist. Therefore, a strategy for managing ACMs should be developed as part of a remediation strategy for the works. Construction workers are likely to be exposed to areas of landfill waste during future excavation. Any excavation work would adopt appropriate site management protocols and PPE to include personal monitoring and protection against airborne asbestos fibres as necessary based on outcome of risk assessments.

[3] The source of the leachate in assumed to be the landfill waste material

PCL No.	Phase applicable to (see key)	Source	Pathway	Receptor	Qualitative Assessment of Risk	Justification of Qualitative Assessment of Risk
34	CON	Contaminants in Made Ground (car park, capping material)	Inhalation of soil derived dusts/asbestos fibres	Adjacent site users (e.g. residential housing, Luton Airport, WVP)	Low	The GI provided sufficient information to characterise the condition of asbestos present within the Made Ground and inform this assessment. Overall the risk is considered to be low based on; the ACMs types encountered, their degradation state and fibre content. However, it is recognised that Made Ground is heterogenous in nature and as such localised areas of increased frequency of ACMs may exist. Future works will require significant movement of material, therefore there is the potential for generation of airborne contaminants, which could affect adjacent site users. Careful consideration of techniques will be required to minimise dust production, as well as good site management practices, monitoring and mitigation measures to reduce the potential risk. Any future works should have appropriate Environmental Management Plans in place to include perimeter monitoring, with adoption of additional control measures as necessary.
35	CON		Inhalation of vapours	Construction worker	Low	The GI provided sufficient information to characterise the potential risks from soils vapours. No elevated soil vapours were identified. However, due to the variable nature of Made Ground and potential for variability in vapour generation over time, vapour monitoring should be continued; prior to, during and post earthworks to confirm this assessment. An outline monitoring strategy should be included in the remediation strategy The remediation strategy should include measures to detect and appropriately deal with material encountered which is different from those assessed and may have high vapour generation potential.
36	DEV			Future maintenance workers	Low	The GI provided sufficient information to characterise the potential risks from soils vapours. No elevated soil vapours identified during DQRA assessment which could be considered to pose a risk to the future development. Post
37	DEV			Users of future development – public/	Moderate/ Low	

PCL No.	Phase applicable to (see key)	Source	Pathway	Receptor	Qualitative Assessment of Risk	Justification of Qualitative Assessment of Risk
		Contaminants in Made Ground (car park, capping material)		airport workers/users of Green Horizons Park		earthworks monitoring will be undertaken to confirm assessment. A detailed monitoring strategy should be included in the remediation strategy. If elevated concentrations are detected post earthworks the need for specific mitigation measures to prevent vapour intrusion into buildings should be reassessed.
38	DEV			Adjacent site users (e.g. residential housing, Luton Airport, WVP Buildings)	Low	DQRA (Ref. 1.3) (**Appendix 17.3** of the ES **[TR020001/APP/5.02]**) indicated that risks from soil vapours is low. During construction works an appropriate Environmental Management Plan should be in place to include perimeter monitoring, with adoption of additional control measures as necessary. Post earthworks monitoring will be undertaken to confirm assessment.
Controlled Waters						
39	CON	Contaminants in Made Ground (car park, capping material)	Balancing pond	Principal aquifer in Chalk	Very Low	Thames Water balancing pond present in the north of the former landfill area will remain in place during the Proposed Development. Appropriate site management and construction techniques will be required during the development construction process in the vicinity of the current pond to reduce the risk.
Others						
18	DEV	Waste in former landfill	Direct contact of foundations of future development	Foundations of future buildings	Moderate	Presence of landfill waste in contact with building foundations may cause damage to foundations through aggressive ground conditions. Site investigation data will be considered in the design of the foundation. Risk can be mitigated by appropriate geotechnical design to select suitable foundation materials/concrete classification.
19	CON	Japanese Knotweed (JK)	Direct contact with rhizomes on floor slabs, external	Floor slabs/drainage/pavement	Moderate/ Low	JK has been identified in WVP, this can cause damage to buried infrastructure/buildings and pavement through growth of rhizome. Risk can be mitigated through

PCL No.	Phase applicable to (see key)	Source	Pathway	Receptor	Qualitative Assessment of Risk	Justification of Qualitative Assessment of Risk
			pavement and drainage			application of treatment with herbicide/removal/on-site burial/containment.
24	DEV	Leachate in former landfill	Direct contact with foundations of future development	Foundations of future buildings	Moderate/ Low	Presence of leachate in contact with building foundations may cause damage to foundations through aggressive ground conditions. The GI undertaken indicates there is likely to be limited leachate present. Consider in the geotechnical design.
41	CON	Unexploded Ordnance (UXO)	Driving of piles impact UXO	Construction workers/public/ terminal buildings	High/ Moderate	Based on Detailed UXO Risk Assessment 'Very High' probability of UXO on-site. Low risk where works are to be undertaken within post war fill material- correct detection and monitoring procedures will be required during site works to mitigate risks.
KEY: CON- PCL during excavation, remediation and construction phase DEV- PCL associated with future use of Proposed Development						

3 OUTLINE REMEDIATION STRATEGY

3.1 Approach and guidance

3.1.1 In line with Environment Agency guidance, the approach to developing the Outline Remediation Strategy is based on 'Land contamination risk management' (Ref. 3.1)

3.1.2 The approach involves completion of the following steps:

a. Undertake risk assessment (summarised in **Section 2** above);
b. Define relevant contaminant linkages (summarised in **Table 2.1** and **Section 2** above);
c. Define remediation objectives and remediation criteria;
d. Identify technically feasible options which address relevant contaminant linkages and meet remedial objectives; and
e. Selection of most suitable option or combination of options.

3.2 Remediation objectives

3.2.1 There are two categories of objectives: technical and managerial. Technical objectives primarily address the site-specific RCLs. Management objectives reflect the main drivers for the successful execution of the remedial works to ensure the identified RCLs have been managed effectively. All objectives relate either directly or indirectly to the reduction or control of risks on the site and deal with both general objectives and those individual pollutant linkages identified as requiring some form of risk management. These are summarised below in **Table 3.1.**

Table 3.1 Summary of remediation objectives

Remediation Objectives	Type of Objective
Enable the former landfill to be remodelled and its surface redeveloped without risks to future site users, neighbours and maintenance workers following completion of development works by addressing the RCLs/PCLs identified in **Section 2.2** of this document.	Technical
Ensure the former landfill does not pose a risk of detrimental impact to quality of controlled waters by addressing the RCLs/PCLs identified in **Section 2.2** of this document.	Technical
To ensure the Proposed Development is not at risk from gases within the landfill or that neighbouring properties are not at risk from gases migrating off-site by addressing the RCLs/PCLs identified in **Section 2.2** of this document.	Technical

Remediation Objectives	Type of Objective
To use materials and concrete for permanent structures which are resistant to degradation in the ground conditions.	Technical
Produce a remediation strategy that accords with the requirements of both aviation design standards and regulatory authorities.	Management
Reuse of excavated landfill material in a way that meets the requirements of and enables future use of the site.	Technical
Minimise all environmental impacts during implementation of the remediation strategy.	Management
Minimise all health & safety impacts during implementation of the remediation strategy.	Management
Minimise/avoid long term monitoring and management requirements	Management
To utilise a remediation technique whereby any requisite permissions can be obtained within required timescales.	Management
Remediate site within acceptable timescales	Management
Ensure that the work is sustainable from the point of view of resources, cost and environment.	Technical

3.3 Remediation criteria

3.3.1 Remediation criteria provide a measure against which conformity with the remediation objectives outlined in **Table 3.1** can be measured. The remediation criteria below are considered likely to be acceptable to the regulatory authorities, to protect human health and controlled waters:

a. Confirmation that no gross pollution is caused to the underlying Principal Chalk Aquifer;

b. Materials to be reused within the works must not pose a risk to human health, controlled waters or other receptors, see **Section 9.2** of this document; and

c. No accumulation of ground gases or volatile vapour phase contaminants within the proposed buildings in the development.

3.4 Site characteristics and constraints relevant to remediation

3.4.1 A number of features of the site and constraints have been identified which will affect site remediation, these are detailed in **Table 3.2** below.

Table 3.2 Identified potential remediation constraints

Remediation constraint	Details
Invasive species	Previous ecological surveys have confirmed the presence of Japanese Knotweed (JK) within the area of Wigmore Valley Park (former landfill). JK is an invasive non-native plant that is listed under Part II Schedule 9 (of the Wildlife and Countryside Act 1981 (as amended) where it is an offence to plant or grow in the wild. The presence of JK will impact the construction works and therefore there will be a requirement to eradicate what is present to prevent the spread of rhizomes during works. Invasive species can require extended treatment (chemical treatment can take approximately 3 years to be fully effective).
Protected species	Previous ecological surveys have indicated the presence of badger setts within Wigmore Valley Park. Badgers and their setts are protected under the Protection of Badgers Act 1992. The badgers will require relocation prior to construction work, which can take an extended period of time and can require a number of repeat surveys. Work to relocate badger setts can only be carried out between July and November in accordance with best practice. Sufficient time will be required in programme for this to ensure it does not impact on commencement of remediation works.
Potential preferential pathways - Drains	Diversion of Thames Valley Drain (TVD) (also referred to as the Thames Water overflow pipe) drain beneath the former landfill to ensure it does not present a preferential pathway for landfill gas or leachate. Any other drains and services present should also be appropriately decommissioned prior to works.
Space constraints	The site is approximately 40ha within the wider Proposed Development site. The Proposed Development would be delivered in undefined increments that appropriately respond to demand over time. This may mean there are space constraints in terms of operation and storage of plant involved in the remediation works, or for stockpiling or ex-situ treatment of contaminated or uncontaminated material. There is also a need to maintain a substantial area of the site as a temporary car park during the works. Careful control of the works will be required to ensure efficient working.
Operational airport	The former landfill is adjacent to the airport which will be operational throughout the development work. Therefore, the remediation strategy will need to

Remediation constraint	Details
	accommodate ongoing operations during its implementation.
Proximity to sensitive human health receptors	Residential housing and users of the airport are adjacent to the former landfill site. Therefore, there are sensitive human health receptors in close proximity to the site. The remediation strategy will need to minimise the potential impacts to these receptors from odours and dusts which may be generated during the remediation activities.
Traffic	The roads around Luton are currently very congested. The remediation technique used will need to minimise the amount of lorry movement to and from the site.
Unexploded ordnance	The area of the former landfill was identified as having a 'Very high' risk from UXOs. The older material within the landfill (1940s-1950s) is considered to present the highest risks as this was being placed during WWII. The risk will need to be considered in the remediation and construction works.
Landfill heterogeneity	Due to the nature of historical landfills i.e. no specific controls on waste types deposited, there is likely to be a high degree of heterogeneity in the waste. A substantial amount of ground investigation data is available; however, no ground investigation can completely characterise a site and contamination may exist or be in an area where contamination was not expected. Therefore, the remediation strategy will need to include measures to detect and deal with unexpected contamination.
Weather	Conditions during the remediation period could cause problems for some remediation techniques. Summer working could lead to increased dust and odour issues-suppression techniques would be required. Similarly, winter working could be affected by increased rainfall affecting the soil/landfill waste and trafficking of plant.

3.5 Feasible remediation options

3.5.1 There are three general types of remediation that can "break" the RCLs, these are as follows:

a. Managing the receptor;
b. Reducing (or removing) the source term; and
c. Breaking the pathway.

3.5.2 The three general types of remediation in relation to the identified RCLs are discussed in detail in **Annex A**.

3.5.3 To identify the feasible remediation options that could address the RCLs a remediation options appraisal (ROA) of the available treatment processes and technologies has been undertaken. A screening matrix for remediation technologies is present in **0**. No techniques relating to groundwater remediation have been considered as the DQRA indicated no specific remediation of the groundwater was required.

3.5.4 Proposed remediation methods detailed in **Table 3.3** below indicate the techniques considered to be the most feasible to break the RCLs.

3.5.5 An assessment of how each of the proposed techniques addresses the objectives set out in **Table 3.1** above is provided in **Table 3.3.**

Table 3.3 Techniques considered to be the most feasible to break the RCLs

RCL no. (see Table 2.1)	Source	Pathway	Receptor	Remediation required
Ground Gases				
RCL1	Ground gases from former landfill e.g. methane	Migration into future buildings and build-up of gases	Users of future development – public/airport operatives/ Green Horizons Park users	Gas protection measures in development (See **Paragraph 5.3.3**)
RCL2		Migration off-site	Adjacent site users (e.g. residential housing and other buildings on Luton Airport, WVP Community Centre/ pavilion)	In ground barrier such as virtual gas curtain (see **Section 5.3.17**). Measures required to treat existing preferential pathways e.g. Thames Valley Drain (see **Paragraph 5.3.19**)
Human Health				
RCL3	Waste in former landfill	Direct contact e.g. dermal contact, soil ingestion	Future maintenance workers	Engineered cover system (see **Section 5.4)**
RCL4			Users of future development – public/airport operatives/ Green Horizons Park users	Engineered cover system (see **Section 5.4**)
RCL5		Direct or indirect contact with radionuclides – incurring radiation dose by indirect dose received from ingestion of alpha emitting	Future maintenance workers	Engineered cover system (see **Section 5.4**)
RCL6			Users of future development – public/airport operatives/	Engineered cover system (see **Section 5.4**)

RCL no. (see Table 2.1)	Source	Pathway	Receptor	Remediation required
		contaminated material or direct risk from contact with beta emitters	Green Horizons Park users	
RCL7		Inhalation of airborne contaminants/ dust/ asbestos fibres and microorganisms	Users of future development – public/airport operatives/ Green Horizons Park users	Engineered cover system (see **Section 5.4**)
RCL8	Leachate in former landfill[4]	Direct contact e.g. dermal contact	Future maintenance workers	Engineered cover system (see **Section 5.4**)
RCL9			Users of future development – public/airport operatives/ Green Horizons Park users	Engineered cover system (see **Section 5.4**)
RCL10	Contaminants in Made Ground (car park, capping material)	Direct contact e.g. dermal contact, soil ingestion	Future maintenance workers	Engineered cover system (see **Section 5.4**)
RCL11			Users of future development – public/ airport workers/users of Green Horizons Park	Engineered cover system (see **Section 5.4**)
RCL12		Inhalation of soil derived dusts/asbestos fibres	Future maintenance workers	Engineered cover system (see **Section 5.4**)
RCL13			Users of future development – public/ airport workers/users of Green Horizons Park	Engineered cover system (see **Section 5.4**)
Controlled Waters				
RCL14	Waste in former landfill	Driving of contaminants downward during any future piling	Principal aquifer in Chalk	Removal of localised area of free product identified in WS224 and any additional areas identified during excavation. Treatment through bioremediation (see **Section 5.2**) Selection of appropriate piling technique (**see Section 4.2**)
RCL15	Leachate in former landfill[5]	Downward migration of leachate	Principal aquifer in Chalk	Engineered cover system (see **Section 5.4** and **5.5**) Measures to control potential leachate encountered during

[4] The source of the leachate in assumed to be the landfill waste material
[5] The source of the leachate in assumed to be the landfill waste material

RCL no. (see Table 2.1)	Source	Pathway	Receptor	Remediation required
				works are discussed in **Section 7.5.**
RCL16	Contaminants in perched water	Driving of contaminants downward during any future piling	Principal aquifer in Chalk	Selection of appropriate piling technique (see **Section 4.2**).
RCL17		Migration of contaminants via preferential pathways e.g. drainage	Principal aquifer in Chalk	Measures required to treat existing preferential pathways e.g. Thames Valley Drain (see **Paragraph 5.3.19**)
RCL18	Contaminants in groundwater (dissolved phase)	Lateral migration of contaminants in groundwater	Controlled waters (including potable water groundwater abstraction)	Engineered cover system (see **Section 5.4** and **5.5**)
Other				
RCL19	Leachate in former landfill	Leachate breakout and plant uptake	Areas of Landscaping in the airport and Green Horizons Park developments/WVP allotments	Engineered cover system (see **Sections 5.4** and **7.5**)

3.6 PCLs where impact is possible but can be mitigated by design and/or managed

3.6.1 **Section 2** identifies a number of PCLs where the potential impact could be managed or mitigated by design. The measures to manage these PCLs are summarised in **Table 3.4** below.

3.6.2 Table 3.4 PCLs where potential impact can be managed or mitigated by design

Source	Pathway	Receptor	Design mitigation and/or management measure	PCLs	Comments
Radionuclides in waste in former landfill	Migration into future buildings and build-up of gases	Users of future development	Watching brief for unexpected conditions and management plan for any encountered	PCL 3 PCL 4 PCL 8 PCL 11 PCL 12 PCL 13 PCL 35 PCL 36 PCL 37 PCL 38	See **Section 6 and 7**
	Migration off-site through preferential pathways	Adjacent site users			
	Direct or indirect contact	Construction workers			

Source	Pathway	Receptor	Design mitigation and/or management measure	PCLs	Comments
Waste in former landfill and/or contaminants in Made Ground	Inhalation of vapours and dusts	Construction worker Adjacent site users	Management plans and monitoring for dusts, odours etc. Use of suppression techniques where required	PCL 11 PCL 12 PCL 13 PCL 15 PCL 35 PCL 36 PCL 37 PCL 38	See **Section 8** and **Paragraph 8.3.6.**
	Inhalation of asbestos fibres	Construction worker Adjacent site users	Asbestos management strategy including completion of risk assessment, preparation of plan of work, watching brief and action plan for unexpected asbestos finds	PCL 15 PCL 16 PCL 31 PCL 34	See **Section 7**
Waste in former landfill and/or contaminants in Made Ground Leachate in former landfill	Direct contact	Construction workers	Site management protocols, construction techniques and adoption of appropriate PPE	PCL 5 PCL 15 PCL 20 PCL 28 PCL 31 PCL 39	See **Section 7**
Leachate in former landfill Waste in former landfill	Direct contact with foundations of future development	Foundation of future buildings	Mitigation of damage to foundations/ services due to aggressive ground conditions through design and use of appropriate foundation/ concrete class	PCL 18 PCL 24	See **Paragraph 4.2.1**
Japanese knotweed			Damage to floor slabs, drainage and pavement from rhizomes	PCL 19	See **Paragraph 4.2.3**
Unexploded Ordnance	Driving of piles impact UXO	Construction workers/ public/ terminal buildings	UXO detection and monitoring during works	PCL 41	See **Section 7**

4 REMEDIATION PROCESS AND PROGRAMME

4.1.1 This section provides an overview of the likely processes involved with the management and remediation of landfill materials. An illustration of the remediation process and materials management is presented in **Drawing 2** of this document. An outline of the types of remediation methods currently available and likely to be used is provided in **Section 5** and typical techniques used for management of landfill earthworks in **Section 6** and **Annex B**, of this document**.**

4.2 Key stages

Design development

4.2.1 Further design development is required to inform the landfill earthworks. The following, but not limited to, require further development at the detailed design stage:

a. Consult and agree Remediation Strategy with regulators, amend as necessary;

b. Settlement predictions and design of utilities to protect from settlement;

c. Complete segregation trials/additional site investigation to identify the best combination of treatment technologies and efficient process. These may be done at either design development or preparatory stage;

d. Determine the detailed phasing for the earthworks and material movements;

e. Determine suitability criteria for materials to be reused and criteria for surrender of permit, suggested criteria are noted in **0**;

f. Develop the earthworks specification detailing the geotechnical requirements for the processed landfill material;

g. A general description of the requirements of the cover system is provided in **Section 5.4** of this document. However, the final design will be completed at detailed design stage when additional requirements such as location of tree pits, further drainage layers and membrane specifications will be decided;

h. A FWRA (Ref. 1.8) (**Appendix 17.6** of the ES **[TR020001/APP/5.02]**) to inform the most appropriate technique for foundation piling to minimise the potential risk of creating a pathway through the annulus of the pile. It is key to managing and breaking the pathway for RCLs 14 and 16;

i. The gas protection measures for each building will need to be considered further during the detailed design stage. The general gas protection requirements based on a conservative assessment are detailed in **Section 5.3** of this document;

j. Develop the detailed design with regards to gas protection for Luton DART and the apron and other infrastructure;

k. Determine best compaction technique to be used within the landfill earthworks; and

l. Foundations within the landfill may be exposed to aggressive ground conditions as identified in **Table 2.2** above (PCL18, 24). Further assessment is required at the detailed design stage to confirm the requirements.

Planning stage

4.2.2 The DCO permission will include requirements that must be met for which regulatory sign-off will be necessary prior to commencement of preparatory works for the Proposed Development during the planning stage, these are as presented in **Table 4.1** below.

Table 4.1 Planning stage activities

Activity		Details
1	Obtain necessary permits and licences. Produce and agree plans for management of materials.	Appropriate licences and agreements will be required for materials management and for certain aspects of the remediation works. Further detail is presented in **Sections 6.2** of this document.
2	Agree monitoring and communication plans with regulators	Agree baseline conditions, intervention and action criteria, monitoring plans, communication, reporting and supervision with regulators (Environment Agency / Local Authority). See **Section 8** of this document.
3	Agree plan for submission of verification documentation and surrender of permit	Agree programme for submission of verification documents based on the phasing of works and criteria for surrender of permits. See **Section 9** of this document.

Preparatory works

4.2.3 There are a number of site preparation and enabling work activities which are required prior to commencement of the landfill earthworks/remediation work, these are detailed in **Table 4.2** below.

Table 4.2 Site preparation and enabling works required prior to commencement of landfill earthworks

Activity		Details
1	JK – eradication prior to site establishment (PCL 19)	JK was identified as a potential constraint in Table 3.2 of this document. Several stands of JK were identified in the Habitat Study completed in May 2018 and are recorded in the

Activity		Details
		Ecology Baseline Report (Ref. 4.1); the stands are located at two distinct areas; the northern boundary adjacent the Thames Valley balancing pond, and in the south eastern (woodland) area of the site. JK is classed as a noxious weed and under the Wildlife and Countryside Act 1981 it is illegal to plant or allow it to be spread. It can also be classed as a statutory nuisance if the plant spreads onto neighbouring property. Removal of JK is required prior to the start of earthworks to prevent the spread of the plant. It can be very difficult and take several years to treat effectively with chemicals. Soils affected by JK rhizomes cannot be reused within the general fill materials on site. JK requires either burial consistent with special conditions under Environment Agency permission, specialist disposal off-site or chemical eradication over several seasons to be completed in accordance with current guidance (Ref. 4.2). It is understood that the LBC are currently undertaking a programme of spraying the plant with herbicide. However, a survey will be required by a specialist contractor and a strategy developed to deal with JK prior to commencement of earthworks.
2	Relocation of badger setts	Protected species were identified as a potential constraint within **Table 3.2** . There are currently two active badger setts on site located within the County Wildlife Site on the landfill. Badgers are a protected species under the Protection of Badgers Act 1992. Therefore, a licence to exclude the badgers from their sett and relocate them will be obtained from Natural England, before site preparation works commence.
3	Relocation of Wigmore Valley Park	Wigmore Valley park to be relocated to the east to allow for the earthworks.
4	Relocation of Long Stay Car Park	The current long stay car park will need to be relocated to allow for the earthworks. Alternative provision to be provided.
5	Decommissioning of wells which have been identified as redundant	The groundwater/ground gas monitoring wells which are no longer required will be formally decommissioned in accordance with Environment

Activity		Details
	due to their location in respect of excavation/ construction works.	Agency guidance (Ref. 4.3) to prevent pathways to the underlying Chalk during construction.
6	Install fencing	Secure the construction area for remediation and ensure there are adequate security provisions.
7	Create haul roads	Set up haul roads for transportation of material within the site boundary.
8	Locate and treat old utilities such as the TVD along the base of the landfill which is to be diverted.	To remove potential pathway for migration of contamination; landfill leachate/ groundwater/ground gas (RCL 17).
9	Establish Site Compound for stockpiling and processing of soils	To control works and potential for pollution i.e. installation of temporary drainage and waste water treatment system, boundary air monitoring (dust, vehicle emissions, vapours and asbestos fibres), prevent unauthorised access.
10	Install permanent boundary gas protection (see **Section 5.3.16**).	Install gas protection on boundary of landfill to prevent any migration off-site during and post works.
11	Install monitoring points and other gas/leachate controls to perimeter	Installation of monitoring points and protection of boreholes in appropriate locations to ensure they can be retained during construction work. Install gas control to boundary i.e. vent trench/virtual curtain (RCL 2,14).
12	Preparation of existing surfaces e.g. benching etc	Prepare surfaces in areas where material is to be placed.

Landfill earthworks

4.2.4 The earthworks to create the development platform will necessitate the excavation of landfill waste. The works will be completed prior to creation of the cover system outlined in **Section 5.4** below. The likely main activities are described in **Table 4.3** below and presented schematically on **Drawing 2** of this document**.**

Table 4.3 Landfill earthworks process

Activity		Purpose
1	Remodel the landfill adjacent to Eaton Green Road	For highways works.
2	Remodel the landfill surface generally	Enable the construction of the development.

Activity		Purpose
3	Excavation and selective separation of former landfill materials beneath the proposed airside platform and for reprofiling works on the landside platform.	Achieves the required remodelling of the landfill to allow the construction of the new aviation platform.
5	During excavation of material separation of any soils grossly impacted with hydrocarbons such as around WS224 (see **Section 5.2**).	To prevent cross contamination of other material and remediate to improve properties to allow reuse on site.
6	Separation of clean cover materials from waste materials requiring treatment at source.	Maximise the material that can be reused and minimise waste.
7	Physical treatment (primary), waste materials to be screened and sorted into their component parts i.e. wood, plastic, metal etc.	Allows materials with high gassing/leachate potential i.e. wood waste to be separated for further treatment. Improves physical condition of material for reuse, if required.
8	Verification- chemical testing of materials	Testing of treated/stockpiled materials for reuse to ensure they meet required criteria (see **Section 9.2**).
9	Selective blending of material prior to reuse within the scheme to improve its properties	Improves geotechnical properties for reuse and can reduce overall gassing/leachate potential by combination of materials.
10	Placement of treated material within suitable areas of the scheme.	Selective placement of certain materials allows long term risks to be managed.
11	Compaction of existing and treated materials where required	Compaction improves geotechnical properties and reduces long term risks associated with gas, leachate and settlement.

4.3 Post landfill earthworks

Remediation implementation

4.3.1 The key activities with regards to the remediation works are detailed in **Paragraph 4.4.6** and **Drawing 2** of this document.

4.3.2 Due to the duration of the construction programme it is likely that interim monitoring reports will also be required to confirm environmental controls are effective and there is no migration of contamination off site. This would likely be

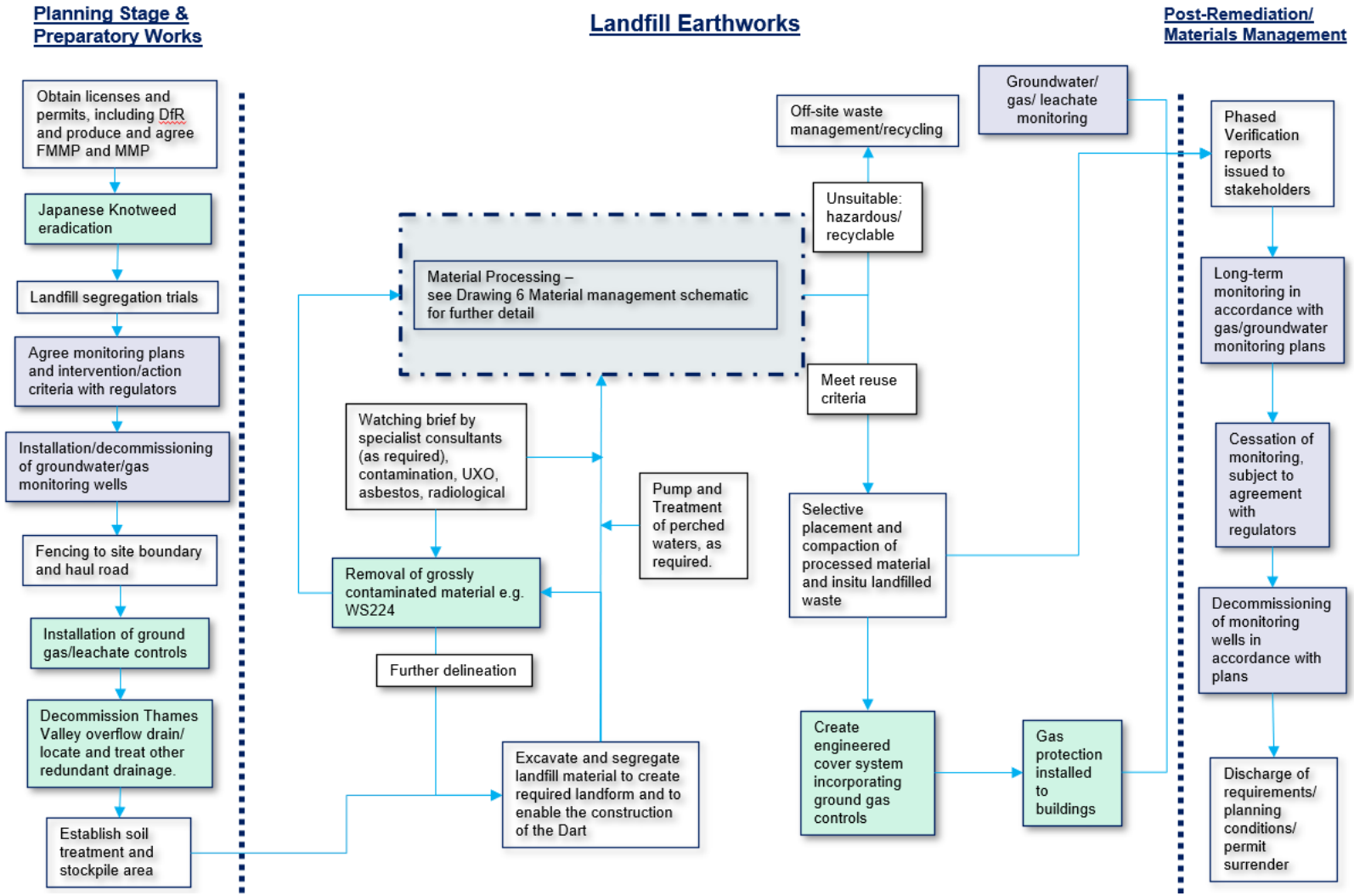
agreed with the relevant regulators in the preparatory stage (see **Paragraph 4.2.3**).

Table 4.4 Key activities during remediation works

Activity		Purpose
1	Cover system across the surface of the site (see **Section 5.4** of this document).	Prevent future users of the site coming into contact with materials, provides a clean corridor for services and utilities and prevents future infiltration into the landfill.
2	Gas and leachate control systems (see **Paragraphs 5.3.13**, **5.3.15** and **Section 7.5** of this document for details).	The re-engineered waste will have a low residual risk with regards to leachate and gas. However, the remaining in-situ landfill materials would have a higher residual risk, even after improvement through compaction. Therefore, gas and leachate control systems would be required to prevent potential impacts. The control system would be incorporated within the cover system design.
3	Build in gas protection measures in buildings and vulnerable infrastructure on the site (see **Section 5.3** of this document for gas protection measures).	Prevent landfill gas risks associated with build-up of gases in structures.
4	Submission of verification reports	UK guidance requires a verification report to be submitted on completion of the remediation work. The verification report is then submitted to the Planning Authority for regulatory agreement. Due to the timescales and incremental delivery of the Proposed Development it is likely that more than one verification report may be required and that a programme for submission of these reports will be agreed, prior to works commencing, with the Planning Authority.
5	Submission of long-term monitoring reports	Long term monitoring of groundwater, leachate and gas conditions is likely to be required as a condition of both the Environmental Permit and DCO. A programme for submission of regular monitoring reports would need to be agreed with the Regulators, prior to works commencing. See **Table 4.1** and **Section 8** of this document for further details.
6	Surrender Environmental Permit and discharge of DCO requirements	Once agreed compliance levels have been achieved an application to surrender the environmental permit would be made. In addition, when the DCO requirements have been met an application would be made to the planning authority to discharge the requirements. This may occur over a different

Activity		Purpose
		timescale to the surrender of the Environmental Permit.
7	Decommissioning of gas/groundwater wells.	The groundwater/gas monitoring wells would be formally decommissioned, subject to agreement with the regulator, once agreed compliance levels have been achieved. See **Section 8.5** of this document for further details.

Drawing 2 Indicative schematic of key remediation/ landfill earthworks stages



4.4 Assessment Phases

4.4.1 The Proposed Development will be delivered in increments to respond to changes in aviation demand. The assumed assessment phases for the purposes of the EIA are shown in **Table 4.5** below:

Table 4.5 Assessment Phases

Assessment Phase	Commence work	Complete work
Phase 1	2025	2027
Phase 2a	2033	2036
Phase 2b	2037	2041

4.4.2 Preparatory works described in **Table 4.2** above will be undertaken along with the relocation of Wigmore Valley Park during the preparatory works stage of the construction programme.

4.4.3 It is assumed the bulk of the landfill earthworks will be completed during assessment Phase 1 and 2a and will include:

a. Excavation, treatment and placement of recovered materials;

b. Piling works; and

c. The treatment compound would be reduced in size to allow the construction of Terminal 2.

4.4.4 The boundary gas protection system to the landfill would be installed prior to any disturbance of the landfill. The construction of external gas control and engineered cover systems will be on-going during the construction of the Proposed Development.

4.4.5 The landfill treatment compound will be retained on site for the duration of the construction works to allow for recovery of material from the landfill which is likely to occur throughout the whole construction period. However, the size of the compound would be reduced to accommodate it alongside the new developments.

4.4.6 Groundwater, ground gas and leachate monitoring would be completed during preparatory works to add to baseline information then through the whole of the construction programme and for a period after completion of the Proposed Development to confirm agreed targets have been met post construction, see **Section 8** of this document. The scope and duration of the monitoring will be set out in groundwater/gas monitoring plans to be agreed with regulators (Environment Agency/Local Authorities) prior to start of works.

5 REMEDIATION METHODS

5.1.1 This section of the strategy sets out the specific details of the remediation methods to be used at the site.

5.2 Excavation of hotspots of contamination (RCL 14)

5.2.1 During landfill earthworks there will be a watching brief in place (see **0** of this document) to identify hotspots of gross contamination identified during the landfill earthworks, such as that identified at location WS224. This material will be excavated and segregated from the rest of the material.

5.2.2 Where visual hotspots of contamination are encountered an area will be excavated around the hotspot to the required depth until all visually identified gross contamination (free product) has been removed. The impacted soils could be treated on site if appropriate and the soils reused if they meet the remedial criteria. The soils will be included on the materials tracking (**Section 6.3**) and treated soils will be subject to verification as described in **Section 9.**

5.3 Ground gases (RCLs 1 and 2)

5.3.1 The DQRA (Ref. 1.3) (**Appendices 17.3**) of the ES **[TR020001/APP/5.02]** has identified the requirement for gas control measures to be installed to protect human health, buildings, infrastructure and to prevent off-site migration of ground gases during both construction works and the operational period. The following sections illustrate the types of gas protection measures to be installed, the detail of which is to be confirmed at detailed design. The protection measures installed would provide protection for the lifetime of the development.

5.3.2 The specification for the detailed gas protection measures would be based on appropriate guidance and would likely include:

a. Detailed justification for the measures specified with reference to the guidance and how it meets the objectives;

b. Full written description of the measures with specifications;

c. Detailed drawings, clearly showing where the measures would be installed and in relation to buildings and infrastructure, how they would fit into the design of the foundations;

d. A verification method statement, verification plan and validation report to be produced for the gas control measures, further detail of the verification works is provided at **Section 9**;

e. Details of the persons verifying the gas protection measures. The persons would be: independent, appropriately experienced and qualified in accordance with best practice, such as the CL:AIRE Gas Protection Verification Accreditation Scheme (GPVS); and

f. Continued gas monitoring during construction and operational periods would provide evidence of the efficacy of the control measures and / or identify if additional control measures are required.

Gas management for buildings

5.3.3 Gas protection measures would be incorporated into the buildings to protect future occupants/users. **17.3** of the ES **[TR020001/APP/5.02]**) established that gassing conditions representative of CS4 were considered protective of proposed buildings constructed over the landfill area. The conservative assessment would allow scope for a change in conditions resulting from the landfill earthworks.

5.3.4 The objective for the gas protection measures in all buildings is to provide protection to prevent landfill gases from entering the building and to provide a pathway for gases to discharge safely beyond the edges of the building. Each of the buildings should be considered on a case-by-case basis at detailed design stage, taking into account: the depth and nature of the landfill; GI results; the form and size of the building; the foundation and floor slab structural design; the size, use and ventilation of internal spaces; and any other relevant details.

5.3.5 To achieve CS4 protection score a combination of two or more of the following three types of protection measures would be used:

a. The structural barrier of the floor slab, or of the basement slab and walls if a basement is present;

b. Ventilation measures, such as a pressure relief pathway; and

c. Gas resistant membrane.

5.3.6 Full detail of the potential protection measures is presented in Section 6 of **Appendix 17.3** of the ES **[TR020001/APP/5.02].**

5.3.7 **Figure 3** of this document indicates the type of gas protection measures required. The gas protection measures installed will be independently verified see **Section 9**.

Gas management for the Luton DART tunnel

5.3.8 The Luton DART will be extended from the existing Terminal 1 to the new Terminal 2 via a tunnel. To ensure this structure is protected from gas ingress it would be protected by a combination of:

a. Appropriate structural detailing of the tunnel (to resist gas ingress);

b. An external gas membrane tanking of the tunnel; and

c. The high level of internal ventilation that will be provided.

5.3.9 Gas protection detail for the tunnel will be incorporated into the design, see **Section 4.2**.

Gas management for aviation apron

5.3.10 The aviation apron will be partially constructed over landfill and therefore will also require gas protection measures to prevent build up of gases beneath the pavement.

5.3.11 Venting gases within the area of aviation is undesirable from an aviation operation perspective. Therefore, where landfill is present beneath the proposed apron area, it is recommended that the high permeability 'gas pathway/venting layer' is installed across the area. This would be vented via a network of gravel trenches, located in areas away from the stands and taxiways and would diffuse gases away preventing any build up.

5.3.12 Further details would need to be developed at the detailed design stage alongside the development of the design for the aviation apron.

Gas protection for hard paved areas

5.3.13 Where there is a significant thickness of landfill waste below hard paved areas it is recommended that the high permeability 'gas pathway/venting layer' shown in **Figure 4** of this document is installed across the area above the landfill waste or selected arisings (in areas of fill) and is vented via a network of gravel filled vertical drains, gravel filled trenches (or bollard type low level vents in areas where these are more suitable).

5.3.14 The MSCP can be regarded as a hard-paved area and not as a building for the purpose of gas protection requirements.

Gas protection for landscaped areas

5.3.15 In soft landscaping areas there would be a geomembrane or clay fill layer installed to prevent surface water infiltration into underlying waste (see **Section 5.4** and **Figure 5** of this document). This low permeability layer would confine additional gases generated and potentially cause them to migrate laterally. Therefore, a passive pressure relief layer would be installed below the geomembrane leading to vents at the perimeters of the areas.

Gas migration off-site

5.3.16 The Proposed Development has the potential to alter the current ground gas regime within the landfill and increase the potential for lateral migration of ground gas which could pose a risk to off-site properties including the residential area to the north of the site. Landfill boundary gas protection measures would be incorporated into the development to mitigate against any potential risks.

5.3.17 Currently options considered for landfill boundary gas protection include a virtual gas barrier or gas vent trench. The virtual barrier has several advantages over a gas vent trench including; minimal excavation of contaminated material, no import of aggregate venting media and options for use of recycled and recyclable materials for its creation. The feasibility of this option and investigation of other viable options will be undertaken at detailed design by the remediation contractor. Illustrative detail of a virtual gas barrier is presented on **Figure 6** of this document.

5.3.18 In areas where a barrier cannot be placed e.g. at the northern boundary due to access constraints (see **Figure 7** of this document), an alternative option would be passive venting, if required, using measures such as gas venting stacks. The

requirement will be subject to the results of the continued ground gas monitoring.

5.3.19 Existing services, including the TVD which runs along the base of the landfill, would be diverted and old structures decommissioned, e.g. grouted to prevent potential pathways for landfill gas to migrate off-site. Detail of gas control measures to prevent off-site migration are presented on **Figure 7** of this document.

5.3.20 The new service corridors would be lined with concrete, a gas membrane and backfilled with clean fill to prevent landfill gas ingress and potential for migration off-site. This would also protect future maintenance workers see **Paragraph 5.4.6** below. Further measures to prevent gas migration such as use of low permeability plugs or venting would be incorporated where required if identified in the detailed design process. An illustrative cross section of a service corridor is shown on **Figure 6** of this document.

5.4 Protection of human health (RCL3-13,19)

Engineered cover system

5.4.1 It is proposed to install an engineered cover system on the landside development platform. An engineered cover system is designed to provide the complete separation of the receptor from the hazard. Detailed guidance on this type of cover system is given in CIRIA Special Publications 105 (Ref. 5.1), 106 (Ref. 5.2) and 124 (Ref. 5.3).

5.4.2 Illustrative detail of a cover system is shown on **Figures 4** and **5** of this document, which also shows the incorporated gas control measures in areas of hard and soft landscaping respectively.

5.4.3 The likely design detail for the cover system is described below:

a. To avoid future excavation into the underlying landfill waste a minimum depth of 1500mm is considered appropriate based on current best practice. The cover system should be made up of selected processed landfill material. Locally increased depth may be required for tree-pits/ utility corridors;

b. A technique often used is to place a brightly coloured geotextile marker layer onto the insitu landfilled waste, above which selected site-won arisings (see **Section 9.2** of this document) are placed;

c. A second geotextile layer is placed onto the selected arisings above which a capillary break layer is formed usually to a minimum depth of 300mm thickness. This layer also serves to provide drainage for the cover system;

d. A geomembrane or compacted clay layer (from site won clays) would be placed above the capillary break layer; and

e. A third geotextile layer placed above the clay layer on which the pavement make-up, usually 200mm minimum thickness, (sub-base and pavement or topsoil/subsoil) is placed.

5.4.4 A second lateral drainage layer could be included above the geomembrane/clay layer for collection of surface water and to prevent surface water logging in landscaped areas. This would be considered at detailed design stage. Verification of the cover system is described in **Section 9.3** of this document.

5.4.5 Creation of the cover system in areas of soft landscaping would also protect plants (RCL 19) and prevent maintenance workers coming into contact with residual landfill material (RCL 3). The cover system is likely to be locally deepened to create sufficient planting depth for deeper rooted vegetation i.e. tree pits, as shown in **Figure 8** of this document. Appropriate growth medium would be used within the cover system and topsoil would meet both the requirements of BS3882:2015 (Ref. 5.4) and the landscape architects' specification.

Protection of drainage and other services

5.4.6 Drainage and other services would be installed within the engineered cap and coordinated so they can occupy prepared service runs which would be lined and backfilled with clean material which meets the reuse criteria for clean cover materials (**Figure 6** of this document). This would prevent risks to future maintenance workers by preventing exposure to landfill waste.

5.4.7 Drainage corridors would be designed in a way which would allow for settlement up to the maximum amount. Preliminary assessments indicate there are two proposed solutions in achieving an adequate design which takes account of the high settlement involved within the landfill area, these are indicated below:

a. Where pipes are located adjacent to structures, suspended drainage can be incorporated into the design to mitigate the settlement risks. However, areas outside of the vicinity of any structures could be flexible to withstand approx. 200mm of settlement. This would not be enough and therefore would include re-laying of any pipework when settlement values of larger than approximately 200mm are experienced, this would entail a double trench width of the drainage corridor; and

b. Where pipes are located adjacent to structures, suspended drainage would be incorporated to the design to mitigate the settlement risks. Areas outside of the vicinity of structures would be laid within concreted corridors (or similar) along with monitoring sensors for real time results of settlement. When this settlement occurs, an expansive geopolymer resin would be injected through small holes on each side of the trench to raise the drainage back up to the required level.

5.5 Protection of controlled waters (RCLs 15 and 18)

5.5.1 The cover system described above in **Section 5.4** would reduce infiltration into the landfill /recovered waste, thereby reducing potential for leachate generation and break-out of contaminants to the underlying aquifer. The capillary break layer and the compacted clay layer in combination act as a ‘barrier layer’ and serves to minimise percolation of surface water through the cover system.

5.5.2 A positive drainage system would be constructed across the landfill, incorporated into the engineered cover system, as previously described, to ensure all surface waters are collected and directed off the landfill. The surface water will enter a water treatment system and subsequently be discharged to ground (off the landfill) via an attenuation tank. Further description is provided in the Drainage Design Statement (Ref. 1.9).

5.5.3 Based on current evidence there are not anticipated to be significant quantities of leachate, however, leachate sumps would be installed as a precautionary measure during the earthworks/construction phase. These would be retained for a period post construction, this would address RCL 15 and reduce potential for leachate break-out, through collection and periodic removal of the leachate. See **Section 7** of this document for further details.

5.5.4 Long-term groundwater monitoring would be undertaken, see **Section 8.5** of this document.

6 MANAGEMENT OF LANDFILL EARTHWORKS

6.1.1 To create the earthwork platforms (airside and landside) it will be necessary to excavate a section of landfill and the arisings would be recovered and processed prior to reuse. The excavation and reuse of the landfill material is essential to the viability and sustainability of the development.

6.1.2 The following sections describe the regulatory regimes and processes for excavation and recovery of the waste.

6.2 Regulatory regime

6.2.1 Consultation with the Environment Agency identified that a bespoke deposit for recovery permit (DfR) under Environmental Permitting Regulations (2019) (Ref. 6.1) would be required for reuse of the landfill material. A formal response from the Environment Agency to the Preliminary Environmental Information Report (PEIR) (Ref. 6.2) and during stakeholder meetings has confirmed this.

6.2.2 To meet requirements of the current legislative regime it is proposed to use a combination of CL:AIRE Definition of Waste Code of Practice (DoW CoP) (Ref. 6.3) and DfR (Ref. 6.4), for the earthworks and management of the landfill materials, subject to regulatory approval.

6.2.3 The Applicant plans to seek an agreement in principle for the DfR permit prior to obtaining development consent. This will require the production of a Waste Recovery Plan for agreement with the Environment Agency. Sufficient detail is to be provided to support the assertion that the reuse of the landfill materials is a recovery process and not waste disposal. This will ensure the lead contractor will be able to submit an application for the DfR permit after obtaining development consent.

6.2.4 DoW CoP would be used for the re-use of non-waste which is any material not considered to be waste as defined by the Waste Framework Directive (WFD) (Ref. 6.5). A waste material as defined by the WFD is material which a producer or holder discards, intends to discard, or is required to discard (Ref. 6.6). Non-waste materials for the purpose of this document are Made Ground, natural soils and recycled aggregate from demolition material which meets the WRAP quality protocol. This includes material present to the south of the landfill boundary (within LLAOL Contractor's Compound and adjacent areas) which has previously been placed under a Materials Management Plan (MMP) obtained by LLAOL as part of a previous planning application for soil reuse (LBC planning application reference 17/02219/FUL).

6.2.5 The natural chalk soils excavated for the airside platform are considered to be excluded from waste regulation in accordance with Waste Framework Directive (2008) (Ref. 6.7), however due to the time period over which the Proposed Development will be constructed and the likelihood that soils will be stockpiled for long periods it is proposed this material will also be reused under DoW CoP.

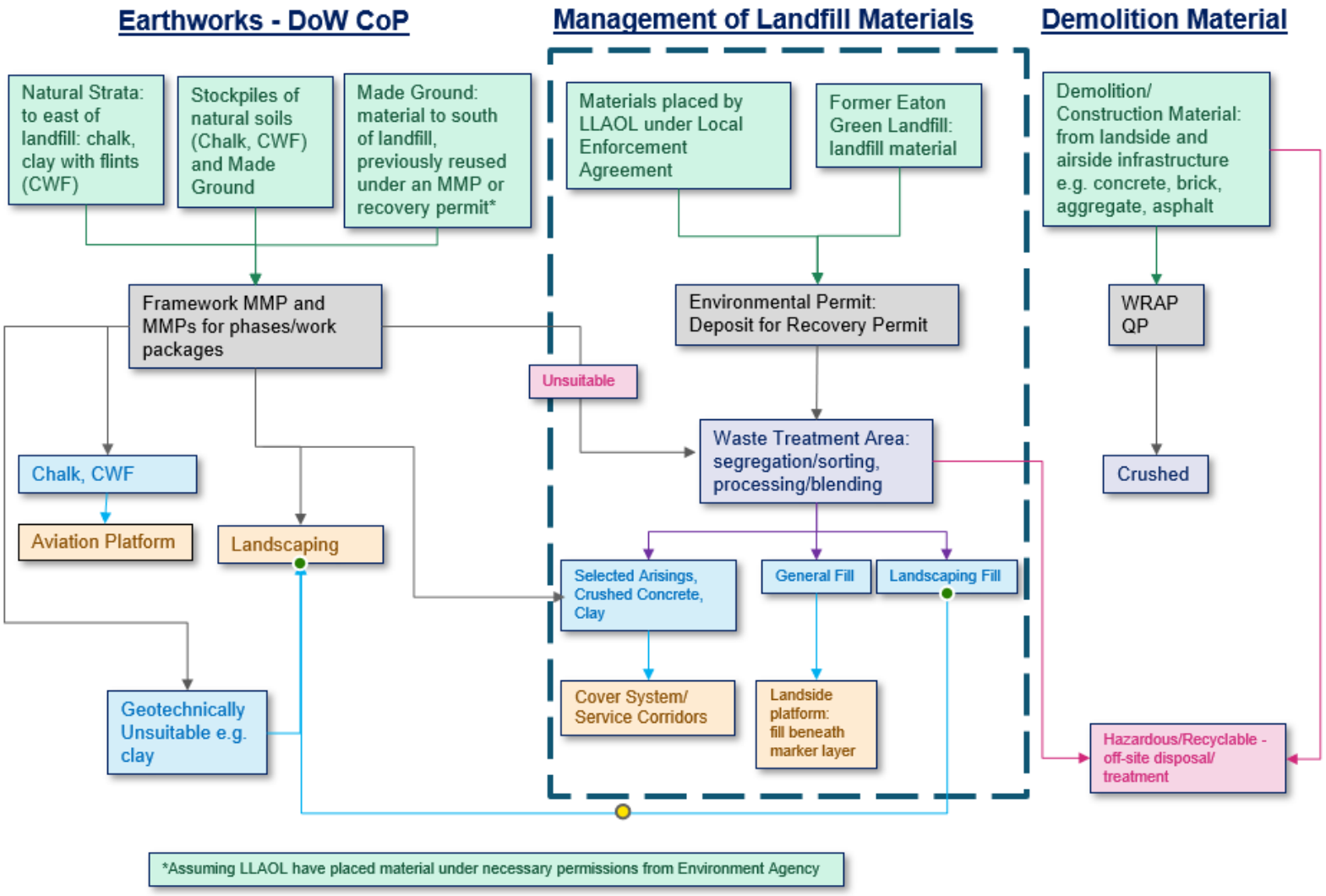
6.2.6 A Framework Materials Management Plan (FMMP) would be produced by the lead contractor to describe how materials are proposed to be reused under DoW CoP (Made Ground, natural soils) how they would be handled, stockpiled

and reused on site, during construction works. The framework would be applied to all excavated materials reuse and management (including storage) with the exception of materials classed as waste (landfill materials). Individual MMPs would be produced for all work packages. The FMMP would provide evidence that excavated and stockpiled materials are being managed in accordance with best practice and provide a clear audit trail to ensure the construction activity will not be classed as a waste activity by the Environment Agency.

6.2.7 A stockpile management plan may also be required by the Environment Agency, to be confirmed following consent of the DCO, if granted. The FMMP and MMPs would be produced and agreement in principle obtained from the regulatory authorities (Environment Agency and Local Authority) post consent, prior to preparatory works commencing. A flow chart depicting the proposed reuse of materials under the different regulatory regimes is presented at **Drawing 3** below.

6.2.8 The lead contractor would be obliged to co-ordinate the different regulatory regimes during the construction works to ensure all works comply with waste regulations.

Drawing 3 Proposed management of materials under the current legislative regime



6.3 Excavation, processing and filling

6.3.1 Detail of a typical methodology for excavation and processing of landfill waste and filling using the treated materials is presented in **Annex B**. It provides an example of how the work could be done. A brief summary of the main elements is presented below and illustrated in **Drawing 4**:

a. Waste processing compound – expected to be established prior to commencement of earthworks, see **Figure 9** of this document for illustrative layout. The layout/ design is to be specified in the Remediation Method Statement (RMS) to be prepared by the contractor.

b. Excavation process – the location of areas of cut are indicated on **Figure 10** of this document. Controlled excavation which minimises the area of landfill exposed at anyone time to reduce the risks associated with vermin, birds, dust, odours. It would also reduce the amount of rainwater which could enter the remaining in-situ waste which could mobilise contaminants. The likely environmental controls are described in further detail in **Annex C** of this document.

c. Segregation – initial segregation is anticipated prior to relocating to the processing area, likely based on visual identification of waste types as described in Table B 1 of **Annex B** of this document.

d. Watching brief - for unexpected contamination and ACMs (see **Annex C** for further detail).

e. Processing, would likely include: complex sorting (cleaning, washing, stockpiling), bioremediation and aerobic composting. The final techniques would be based on results of the segregation trials undertaken by the remediation contractor at the detailed design stage and included in their remediation strategy.

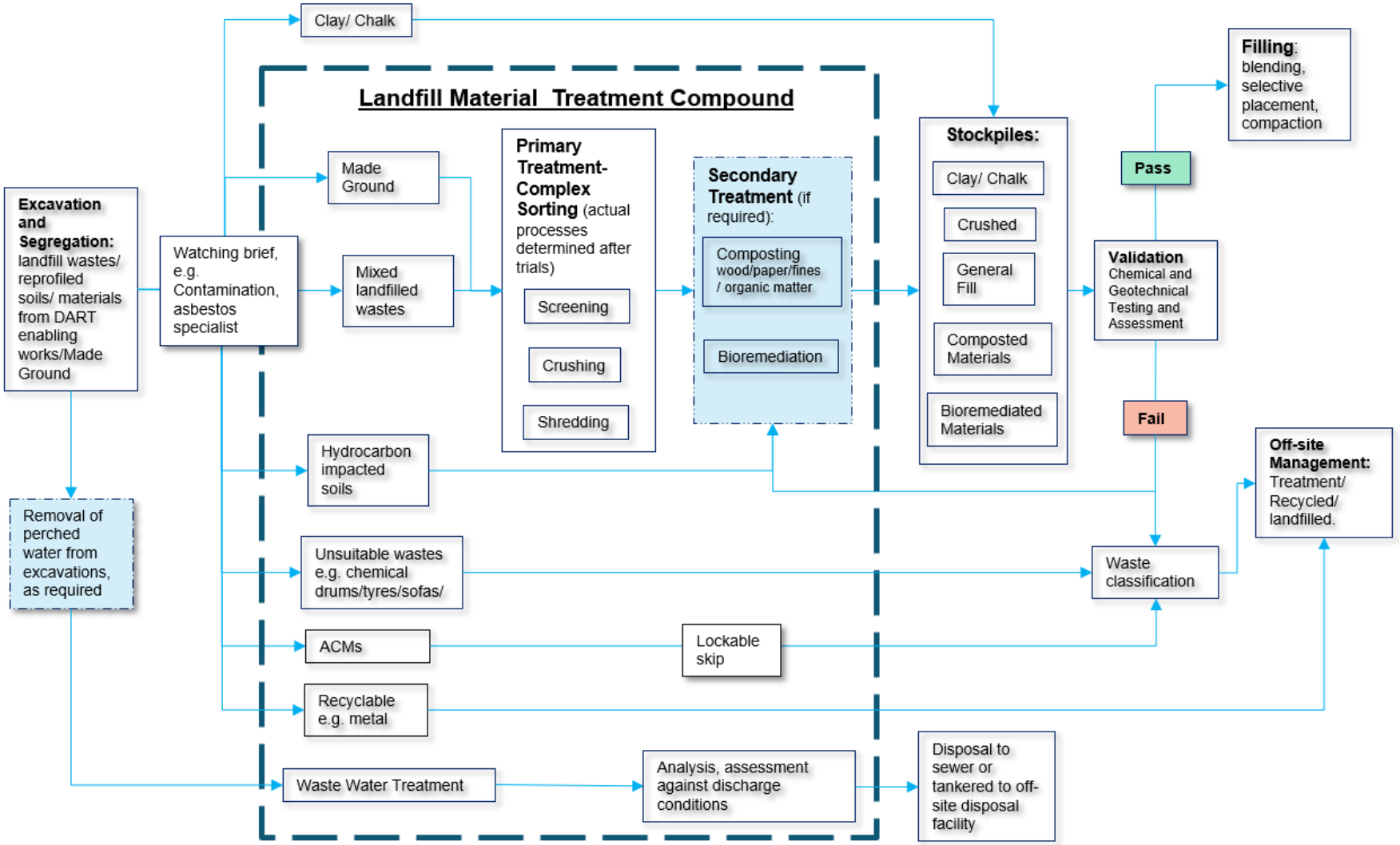
f. Filling – across three areas on the landfill (see **Figure 10** of this document), the main area will be in the southeast where materials will be placed up to 15m, in other areas the depth would be between 2m to 4m.

g. Filling process – processes are likely to include blending, compaction and placement.

h. Verification - all materials to be validated prior to reuse to ensure it meets the specified reuse criteria, see **Section 9.2** of this document.

i. Material tracking – monitoring and tracking of material movements and volumes is crucial to the management of the process and auditable records would be produced for both the DfR permit and MMP for the verification reports.

Drawing 4 Indicative material management process flowchart



7 SITE MANAGEMENT AND CONTROLS

7.1.1 To reduce the risk to human health and the environment from the landfill wastes and contaminants, the works would need to be strictly managed and controlled to meet environmental and health and safety regulations such as Construction (Design and Management) Regulations (CDM) (Ref. 7.1). It is expected that relevant guidance such as; Protection of workers and the general public during the development of contaminated land (HSE, 1991) (Ref. 7.2) and **Annex C** of BS 10175 (Ref. 7.3) would be followed. Examples of the types of controls are set out in the Construction Code of Practice (Ref. 7.4) **Appendix 4.2** of the ES **[TR020001/APP/5.02]**.

7.1.2 Where applicable the measures which address the PCLs identified in **Table 2.1** in **Section 2** are identified. Further detail can be found in **0**.

7.2 General management

a. Site establishment – to include site security, main construction compound set up with decontamination unit, restricted zones where landfill waste is being excavated/processed and haul roads.

b. Permit requirements – in addition to the DfR likely to include discharge consents, notification for treatment of JK (PCL 19).

c. Site supervision – the remediation contractor is expected to have a representative(s) on site full-time overseeing the remediation/materials management and recovery of landfill materials. The appropriate person would have experience of such works and be suitably qualified/competent. A detailed watching brief would be included in the RMS to be followed by the person(s) overseeing the works. Specialist contractors would be appointed as necessary for UXO, asbestos, radiological contamination.

d. Documentation and training – to be prepared by the remediation contractor to include the Remediation Method Statement (RMS), monitoring plans and verification plan. Appropriately qualified personnel would be appointed to undertake the works and all personnel would receive a site induction and training prior to commencement of works.

e. Management of Health and Safety and monitoring - as described in the Code of Construction Practice (CoCP) (Ref. 7.5) **Appendix 4.2** of the ES **[TR020001/APP/5.02]**.

f. RMS – this would be produced and agreed with the regulators prior to start of earthworks and would detail how the works are to be completed to include: details of the landfill earthworks as described above, protocol to be followed if unexpected contamination is identified and an incident plan should there be accidental uncontrolled releases of chemicals/files.

g. Communication strategy with general public and regulators to be established by the lead contractor, see CoCP (Ref. 7.5) **Appendix 4.2** of the ES **[TR020001/APP/5.02]** for further detail.

7.3 Asbestos management (PCLs 15,16,31 & 34)

7.3.1 The DQRA (Ref. 1.3) (**Appendices 17.3**) of the ES **[TR020001/APP/5.02]** concluded that based on the GI data to date specific advanced remediation of the landfill and scrapyard area for asbestos was not required. However, control measures are required to reduce the potential risk to construction workers and adjacent site users during works.

7.3.2 All excavation in the former landfill and scrapyard would be classed as 'work with asbestos' based on the Control of Asbestos regulations 2012 (Ref. 7.6) and should be carried out under a specialist asbestos brief.

7.3.3 CL:AIRE Interpretation for managing and working with asbestos in soils CAR-SOIL™ (Ref. 7.7) should be followed by the remediation contractor. The remediation contractor would produce a methodology which limits or reduces to as low as reasonably practicable the intensity and the potential for release of asbestos fibres. Measures would include: all personnel to be appropriately trained, use of PPE/RPE, dust control measures, segregation of visible ACMs, secure storage and air monitoring.

7.3.4 Potential for asbestos in arisings from foundation excavations would also have to be managed post earthworks. The proposed engineered cover system would prevent future contact with any residual asbestos contaminated soils. Any materials used in the cover system would be verified as free from visible ACMs and asbestos fibres. Further detail on the likely control measures for working with asbestos in soils are presented in **Annex C**.

7.4 Unexploded ordnance (UXO) (PCL 41)

7.4.1 The remediation contractor should raise awareness of UXO through tool-box awareness talks. An emergency response procedure would be established, in accordance with CIRIA guidance, C681 (Ref. 7.8). A watching brief by a specialist UXO contractor would be required for earthworks in older wastes identified as higher risk.

7.5 Leachate control measures (RCL 15, PCL 20)

7.5.1 Although the GIs have found limited leachate, as a precautionary measure a leachate control system would be installed. This would comprise a series of strategic sump points and pipework around the area to be excavated. For illustrative purposes a general arrangement is shown in **Figure 9** of this document. The locations and design of the leachate network would need to be agreed with the Environment Agency.

7.6 Airborne emissions and odour control measures (PCLs 11, 15, 16, 31, 34, 35, 38)

7.6.1 The remediation contractor would control and limit dust, air pollution, odour and exhaust emission during the construction works as far as reasonably practicable and in accordance with best practicable means (BPM). The measures would be

detailed in their Dust Management Plan, detail of further measures are provided in the CoCP (Ref. 7.5) **Appendix 4.2** of the ES **[TR020001/APP/5.02]**.

8 MONITORING REQUIREMENTS

8.1.1 Monitoring and measurement of groundwater, ground gas and air quality is required to ensure that remediation/earthworks and subsequent construction on site will not create new contamination issues or cause migration of current contamination. It is also required to demonstrate the success of the remediation undertaken on site.

8.1.2 Full details of the monitoring requirements will be provided within the individual monitoring plans prepared by the remediation contractor to include monitoring locations and contaminants to be monitored. The monitoring plans will be agreed with the relevant regulators and will cover baseline, during remediation/materials management, post works and long-term.

8.1.3 Significant baseline monitoring of groundwater, vapour, leachate and ground gas has been completed over 12 months of monitoring. An Outline Strategy Report for Groundwater, Ground Gas and Leachate Monitoring has been prepared, see **Appendix 17.7** of the ES **[TR020001/APP/5.02]**. The Environment Agency were consulted on the proposed monitoring programme which is to obtain additional baseline data whilst DCO approval is sought and provide a snapshot of current conditions. If the DCO is approved, an appointed lead contractor would continue to monitor in the lead up to the landfill earthworks, and then continue monitoring during earthworks and post construction works.

8.1.4 Outline likely monitoring requirements pre-, during and post- remediation /earthworks are provided below.

8.2 Pre-remediation/earthworks monitoring (baseline)

Groundwater

8.2.1 Baseline monitoring will be undertaken at a rate to be agreed with the regulators for at least 12 months prior to application for the environmental permit and prior to the implementation of the remediation scheme. Monitoring will be required from boreholes across the entire site area and at down-hydraulic gradient, the existing groundwater installations installed as part of previous GIs will be monitored, the locations of which are shown on **Figure 9** of this document. The monitoring suite will be established during the detailed remediation design phase. However, samples will likely be screened for a full suite of metals, VOCs, SVOCs, TPH, PAHs, PFAS, and ammoniacal nitrogen as well as groundwater levels.

Leachate

8.2.2 The leachate wells installed for previous GIs will continue to be monitored on a regular basis for levels and quality as part of baseline information to identify any changes which could influence the proposed control measures.

Ground gas/vapour monitoring

8.2.3 Ground gas/vapour monitoring will be undertaken to provide additional information on soil and groundwater vapours ahead of the main stages of remediation/earthworks. In particular there should be focus on the boundaries of the site close to residential areas. The ground gas and vapour suites will be the same as those for the GI.

Air monitoring

8.2.4 Details of the air monitoring for dust and air pollutant emissions would be provided in a Dust Management Plan prepared by the lead contractor and consulted on with the relevant local authorities. Suitable monitoring sites and contaminants to be monitored would be established during detailed design. However, it is likely that as a minimum, monitoring at the boundary of the site will be required and consideration will be given to monitoring at sensitive receptor locations, where appropriate. Further detail on proposed air quality monitoring and control measures is provided in the CoCP (Ref. 7.5), **Appendix 4.2** of the ES **[TR020001/APP/5.02]**.

8.2.5 An on-site meteorological station would record wind speed and wind direction data to inform monitoring positions/location of treatment works.

8.3 Monitoring during landfill earthworks

8.3.1 The pre-remediation monitoring regime would continue during the remediation/earthworks works. Samples would be taken from the same locations as pre-works monitoring. For groundwater/ground gas monitoring, existing installations would therefore be used where possible. Additional wells would be installed as considered necessary and where wells are removed due to progression of the earthworks.

8.3.2 The samples would be analysed for the same suite of contaminants to identify effects of the remediation on groundwater, ground gas, vapour and air quality.

Groundwater/leachate

8.3.3 The groundwater monitoring would be used to judge the effectiveness of the control measures being utilised on site. The results will be assessed against ‘investigation’ and ‘action levels’ (see **Section 8.4**) usually set for down-hydraulic gradient wells (Ref. 8.1). Where levels are breached, further risk assessment would be required to determine if adjustments to the remediation methodology, implementation of further control measures or groundwater remediation, is required. The likely measures would be described in the monitoring and management plan, and a contingency plan would be prepared by the remediation contractor.

8.3.4 Leachate sumps would be installed as part of control measures which would be monitored on a regular basis for levels, volumes and quality such that there can be periodic removal, as required.

Ground gas/vapour

8.3.5 Gas monitoring to the site boundaries is proposed to confirm there is no off-site migration of landfill gas/vapours and confirm efficacy of the gas control measures. Monitoring of in-situ wastes will be continued to determine if the works are impacting the existing gas regime, which would assist in finalising the risk assessment for gas protection measures for buildings.

Air monitoring

8.3.6 Monitoring would be in accordance with the relevant plans e.g. Dust Management Plan which would be developed by the lead contractor and in accordance with agreed consents.

8.3.7 Monitoring results would be reviewed regularly to ensure the investigation/action levels are not exceeded and provided to the regulators to demonstrate compliance, see **Section 8.4** below. Indicative monitoring locations are identified on **Figure 9** of this document.

8.3.8 Airborne asbestos fibres monitoring would be completed during the remediation works/ recovery of landfill materials, as detailed in **Section 7.6** and **0**.

8.4 'Investigation' and 'action' levels

8.4.1 The baseline monitoring will be used to establish 'investigation' and 'action' levels for the site during works. These levels will be used to inform the appropriate measures to be taken during the remediation if exceeded.

8.4.2 Investigation levels are intended to draw the attention of site management to adverse or unexpected trends in monitoring data; such trends may result from ongoing construction, failure of site engineering and/or management systems. Investigation levels are primarily used as an early warning to enable appropriate investigative or control measures to be implemented before significant action is required.

8.4.3 Action levels are higher than investigation levels. They indicate a greater probability that site activities may be causing an adverse impact. For example, they might indicate a large release of potential contamination as opposed to a slight seepage that might be picked up by the investigation levels. If the action levels are breached a more immediate response is usually required to identify the cause and mitigation required to protect the environment/human health.

8.4.4 Investigation/action levels for air emissions will be agreed with the regulators prior to works commencing and will be in accordance with Control of Pollution Act 1974 (as amended) (Ref. 8.2)

8.4.5 Ground gas/vapour control levels will also be set to be protective of construction personnel and will meet requirements of Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) (Ref. 8.3) and Occupational Health exposure limits.

8.4.6 The specific action/ investigation levels and measures to be taken if exceeded will be provided in the relevant monitoring and management plans to be produced by the remediation contractor and agreed with the regulators.

8.5 Post works and long-term monitoring

8.5.1 Monitoring will be required throughout the construction works so retaining the monitoring locations, where possible, will ensure a continuous data set. The requirements for site wide long-term monitoring and any necessary management measures would be identified following the remediation/main earthworks at the verification stage.

8.5.2 Post construction groundwater and ground gas monitoring would be completed in accordance with groundwater and ground gas monitoring plans which will be agreed with the Environment Agency for the permit application, prior to commencement of earthworks. The monitoring strategies may be amended during the course of the works based on the monitoring results. The plans would establish appropriate compliance criteria for cessation of monitoring, at which point approval will be sought from the regulators to cease monitoring and formally decommission the monitoring wells. Discharge of relevant requirements or conditions will subsequently be sought from the relevant planning authority.

9 REMEDIATION CRITERIA AND VERIFICATION PROCEDURE

9.1.1 This section provides detail on the soil remediation criteria and verification plan against which the recovered materials and imported soils will be assessed to confirm the materials reused do not present a significant risk to human health, environment or groundwater receptors.

9.1.2 An earthworks specification will be developed for geotechnical re-use criteria for materials and compaction specification, in accordance with Design Manual for Roads and Bridges (Ref. 9.1). This Outline Remediation Strategy will inform the earthworks specification.

9.2 Remediation criteria

Soil reuse criteria

9.2.1 Material (landfill waste, Made Ground, natural soils) will be excavated, treated and reused under two different regulatory regimes. For materials such as Made Ground and natural soils reused under CL:AIRE DoW CoP, a FMMP and MMPs will be prepared which will refer to the DQRAs (**Appendix 17.3** and **Appendix 17.4** of the ES **[TR020001/APP/5.02]**) and this Outline Remediation Strategy as supporting evidence that reuse of treated materials on-site will not present a significant risk to human health or the environment.

9.2.2 Reuse criteria to validate the recovered materials and confirm their suitability for use would be developed based on appropriate land use criteria and local / regional background concentrations, to be specified in the Remediation Strategy and agreed with the regulators. Suggested generic soil and groundwater criteria are presented in **Annex D** along with sampling frequencies. The criteria adopted would be protective of both human health and controlled waters based on the assumption an engineered cover system would be in areas of both hard and soft landscaping.

9.2.3 The landfill waste would be excavated and reused under the environmental permit regime, a DfR permit would be supported by a Waste Recovery Plan, detailed HRA and CQA plan which would include site specific soil reuse criteria based on waste acceptance criteria (WAC).

9.3 Verification procedures

Cover system

9.3.1 Verification procedures for the cover system would be based on Environment Agency guidance (Ref. 9.2). The likely main elements are described in **Annex D** further detail would be provided in the RMS produced by the specialist remediation contractor.

Gas protection

9.3.2 Verification procedure would be in accordance with CIRIA C735 (Ref. 9.3) and be completed by an independent third party. A verification plan would be developed by the third-party and agreed with the regulators. A programme of

visual inspections and integrity testing would be developed, see **Annex D** for further detail.

9.4 Verification reporting

9.4.1 The Proposed Development would be delivered in undefined increments that appropriately respond to demand over time, therefore it is likely that more than one verification report may be required and that a programme for submission of these reports would be agreed with the relevant planning authority. The remediation and verification works can only be considered as completed once written approval is provided by the regulators and DCO requirements discharged.

9.4.2 A MMP verification report would be produced under the DoW CoP scheme and a CQA verification report for the DfR permit. A separate independent verification report would be produced to confirm adequacy of gas protection measures.

9.4.3 The verification report would include sufficient lines of evidence to confirm the remediation objectives have been achieved, see **Annex D** for likely contents.

9.5 Operating and maintenance manual

9.5.1 Throughout the design, implementation and verification stages an operating and maintenance manual would be collated for the site. This would incorporate the information required for the Health and Safety file and include data, records and guidance that would allow the future maintenance of the remediated site and management of any residual risks. Typically it would include the following:

a. Significant background data;
b. Reports, strategies and specifications;
c. Verification records;
d. Surveys;
e. Locations of residual asbestos contamination to form part of an asbestos management plan;
f. Manufacturer’s handbooks for installed plant and membranes etc; and
g. Guidance for the design of new construction on the site, this is of particular relevance as T2 is planned to be extended.

10 OUTLINE REMEDIATION STRATEGY SUMMARY

10.1.1 An Outline Remediation Strategy has been developed for the former Eaton Green Landfill considering the complexity of the works to be undertaken and the constraints. A summary of the overall Outline Remediation Strategy is provided in the following sections.

10.2 Remediation requirements

10.2.1 The site generally represents a low risk to all receptors and remedial action is not required to protect current site users, neighbours or groundwater. However, the development will change the potential risk to future users and other receptors, therefore these pollutant linkages were identified as RCLs requiring remediation measures to break the linkage.

10.2.2 The Outline Remediation Strategy evaluated the feasible remediation options for each of the identified RCLs. The most feasible option to address the identified RCLs is considered to break or manage the pathway. The remediation options appraisal identified there is only a single solution available to break the pathway for each RCLs (except for RCL 14) as follows:

a. The majority of the RCLs can be addressed with an engineered cover system. Cover systems are a proven approach for managing historical landfills and would minimise infiltration rates, thereby decreasing the potential for leaching of contaminants from the fill to groundwater. The method would also break the pathways between contaminated soil and future site users. The method would limit the amount of material requiring off-site disposal. Gas protection measures could be incorporated into the overall cover system design;

b. For migration of gases off-site, both during and post construction, the use of an in-ground barrier such as virtual gas barrier will provide an appropriate pathway break; and

c. For small localised areas (hotspots) of hydrocarbon contamination (RCL 14) which may be identified during excavation, it is proposed to use bioremediation to reduce concentrations to allow reuse on site wherever possible.

10.2.3 In addition to the RCLs, a number of PCLs were identified within the DQRA associated with the enabling/construction phase of the development. No specific remediation activities are required to address these PCLs. However, these linkages need to be managed throughout the works to protect users, the environment and site neighbours. These measures are set out in **Section 6** and **Annex C** of the strategy.

10.2.4 A key requirement to managing these PCLs is to undertake a watching brief during excavation works, to ensure risks associated with asbestos and unexpected contamination conditions are controlled and managed.

10.3 Landfill earthworks

10.3.1 A substantial amount of landfill material is required to be excavated as part of the earthworks at the site. This will be recovered and processed to improve its physical properties before reuse elsewhere in the development. No specific remediation is required to make this material suitable for use. The landfill earthworks will be undertaken in a manner to ensure that no PCLs are created and to achieve betterment of environmental conditions. It is proposed this work will comprise:

a. Selective segregation at point of excavation- this will segregate materials which do not require processing and can be directly reused subject to meeting assessment criteria; and

b. Complex sorting- divide the waste material into its different components. Components such as metals will be sent for recycling off-site. Wood will undergo aerobic composition (subject to confirmation of viability by contractor and regulatory agreement) to biodegrade to a product suitable for reuse on site.

10.3.2 Depending on the nature of the material produced from the complex sorting, processing and blending of the materials may be possible to form structural and non-structural fill i.e. plastics could be shredded on-site and mixed with cohesive and granular fills to provide modified class 2C fill.

10.3.3 The re-engineered landfill material will be placed selectively within the development depending on its properties.

10.3.4 The landfill earthworks will predominately be undertaken under a bespoke waste recovery Environmental Permit. The specific details of this permit and material types which are permitted to be reused within the scheme still need to be discussed and agreed with the Environment Agency Environmental Permitting Team.

10.4 Achieving remediation objectives

10.4.1 The overall objectives of the Outline Remediation Strategy were detailed in **Table 3.1** of this document. **Table 10.1** below details how the proposed remediation and landfill earthworks detailed in the strategy meets the overall objectives. Any residual risks and uncertainties are also noted.

Table 10.1 Summary of remediation objectives achieved by the strategy, including identified risks and uncertainties

Remediation Objectives	Type of Objective	How objective is met by strategy	Risks/ uncertainties
Enable the former landfill to be remodelled and its surface redeveloped without risks to future	Technical	Monitoring, with appropriate intervention and action thresholds, to be undertaken during	None

Remediation Objectives	Type of Objective	How objective is met by strategy	Risks/ uncertainties
site users, neighbours and maintenance workers following completion of development works.		remodelling works to ensure no impacts. Incorporation of cover system and selective placement of re-engineered landfill material will ensure no risks to future site users, neighbours and maintenance workers following completion of development works.	
Ensure the former landfill does not pose a risk of detrimental impact to quality of controlled waters	Technical	Incorporation of cover system and selective placement of re-engineered landfill material ensures no risk posed to controlled waters. Monitoring and controls during work to assess leachate and groundwater quality to ensure no detrimental impact to controlled waters.	Risk that piling activities will impact underlying aquifer. A piling risk assessment will be undertaken to establish the most suitable technique to ensure no impacts to the underlying aquifer.
To ensure the Proposed Development is not at risk from gases within the landfill or that neighbouring properties are not at risk from gases migrating off-site.	Technical	Incorporation of gas protection measures in building and boundary gas protection to prevent migration of gases.	Uncertainty surrounding post earthworks gassing conditions. Gases to be monitored to verify and redundancy incorporated into design to allow for variability in conditions post works.
To use materials and concrete structures which are resistant to degradation in the ground conditions that remain below ground.	Technical	Initial geotechnical assessment has been undertaken and recommended concrete class.	Uncertainty of conditions post landfill earthworks. Strategy recommends further assessment at

Remediation Objectives	Type of Objective	How objective is met by strategy	Risks/ uncertainties
			detailed design stage.
Produce a remediation strategy that accords with the requirements of both aviation design standards and regulatory authorities.	Management	The strategy has been developed around the performance requirements for aviation settlement standards, which has driven the need to excavate a significant quantity of landfill material.	Settlement may occur within the area of the landfill. The strategy incorporates measures to protect drainage and other services from settlement.
Reuse of excavated landfill material in a way that meets the requirements of and enables future use of the site.	Technical	Strategy sets out criteria for reuse of material in **Section 9.2** to ensure that the site is suitable for use.	Complexity of regulatory regimes means differing criteria may be required for different materials. Material being treated and reused under Environmental Permit will be subject to waste acceptance criteria which need to be agreed with the Environment Agency.
Minimise all unacceptable environmental impacts during implementation of the remediation strategy.	Management	Proposed environmental controls detailed in **Annex C** of the strategy.	Due to the heterogenous nature of the landfill there is a risk unexpected contamination may be encountered. Strategy incorporates measures to detect and deal with such occurrences.
Minimise all unacceptable health & safety impacts during implementation of the remediation strategy	Management	Required site management and controls are set out in **Section 7** and detail requirements to minimise	Due to the heterogenous nature of the landfill there is a risk unexpected

Remediation Objectives	Type of Objective	How objective is met by strategy	Risks/ uncertainties
		health and safety impacts of work.	contamination may be encountered. Strategy incorporates measures to detect and deal with such occurrences.
Minimise/avoid long term monitoring and management requirements	Management	Monitoring and management of gas protection/cover system will be required. The requirements are set out in the strategy in **Sections 8** and **Section 9**).	Length of monitoring required will be determined by Environmental Permit requirements.
To utilise a remediation technique whereby any requisite permissions can be obtained in required timescales.	Management	Remediation techniques i.e. cover system and gas protection are well established techniques which are readily achievable in a short timescale.	Whilst remediation techniques are well established, the Environmental Permit requirements for the landfill earthworks can take a substantial amount of time to agree with the Environment Agency. Early engagement would take place to reduce this risk.
Remediate site within acceptable timescales	Management	Remediation techniques i.e. cover system and gas protection are well established techniques which are readily achievable in a short timescale.	Landfill earthworks will be the main constraining factor to achieving timescales. Early contractor engagement and segregation trials can reduce the uncertainty associated with processing rates and reduce this risk.

Remediation Objectives	Type of Objective	How objective is met by strategy	Risks/ uncertainties
Ensure that the work is sustainable from the point of view of resources and cost	Technical	The feasible remediation options were reviewed in **Section 3.5** of the strategy. The strategy developed is based on the most sustainable option, see **Annex A**.	As those previously noted associated with the recommended remediation techniques above.

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FIGURES

All structure positions are indicative. The proposed works will be subject to detailed design development. The changes will be within limits of deviation specified in the Development Consent Order.

Legend

- Order Limits
- Off-site Planting
- Airport Access Road
- Site Subdivisions
- Approximate extent of area previously remediated

Main Application Site

- Existing Airport Land
- LLAOL Contractor's Compound
- Area A Former Landfill
- Area B Land West of Winch Hill Lane
- Area C Land East of Winch Hill Lane

Other Areas

- Area D Off-site Car Park North
- Area E Off-site Car Park South
- Off-site Highway Interventions

Revision History	Drawn	Checked / Approved	Date	Rev.
First Issue	AB	RB / TB	22/02/23	P02

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Drawing Title

Figure 1
Location of Proposed Development

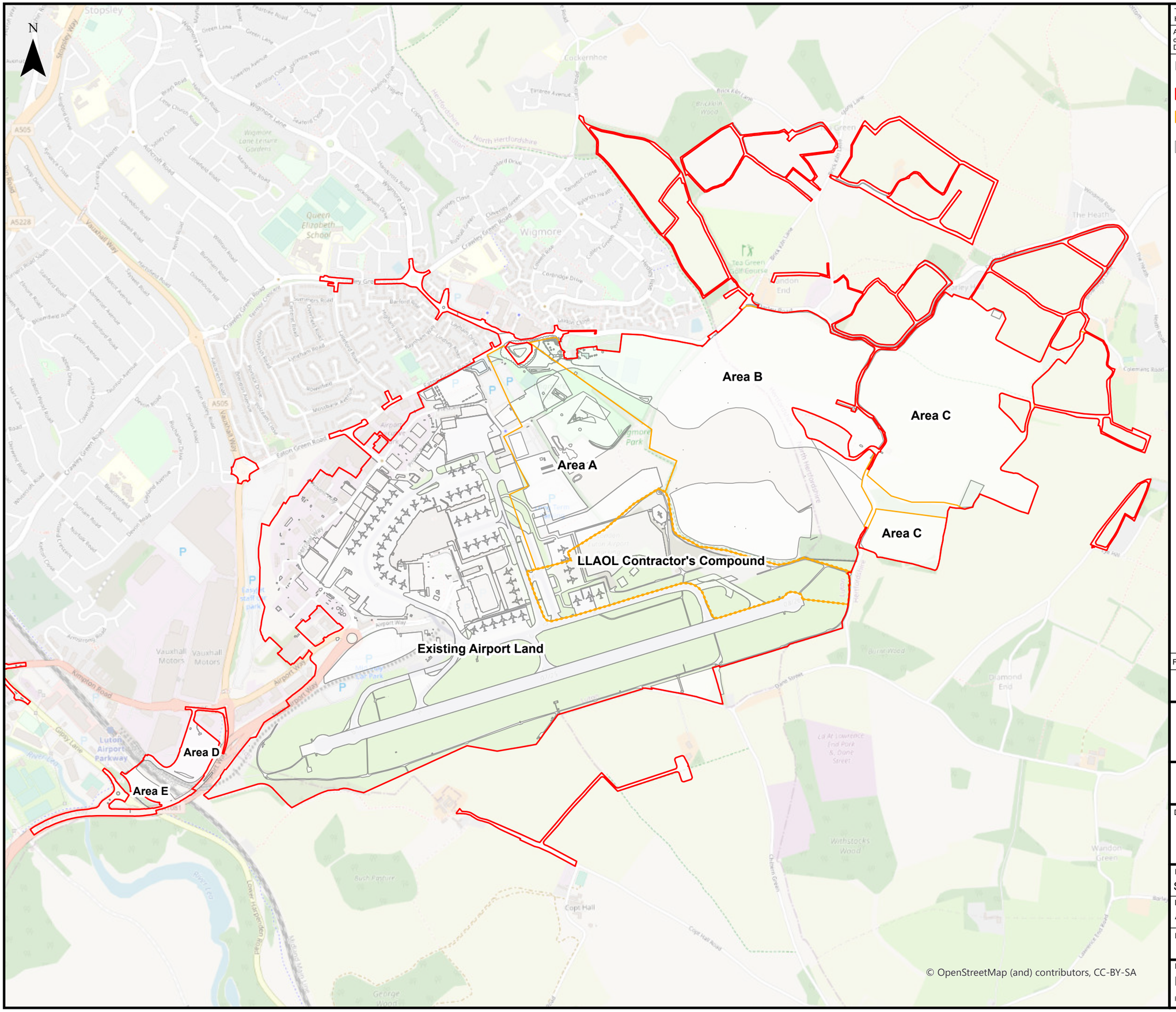
Purpose of issue	Suitability
SUITABLE FOR INFORMATION	S2

Drawn	Checked	Approved	Date	Scale	Size
AB	RB	TB	22/02/23	1:25,000	A3

DCO Application Ref.	APFP Regulation	DCO Document Ref.
TR020001	APFP 5(2)(a)	TR020001/APP/5.03

Drawing Number	Revision
LLADCO-3C-ARP-00-00-DR-YE-0155	P02

Project - Phase - Originator - Asset/Zone - Sub Asset - Type- Discp. - Number



All structure positions are indicative. The proposed works will be subject to detailed design development. The changes will be within limits of deviation specified in the Development Consent Order.

Legend

- Order Limits
- Site Subdivisions
- Airport Infrastructure Layout - Assessment Phase 1

Revision History	Drawn	Checked / Approved	Date	Rev.
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Drawing Title

Figure 2a
Proposed Masterplan - Assessment Phase 1

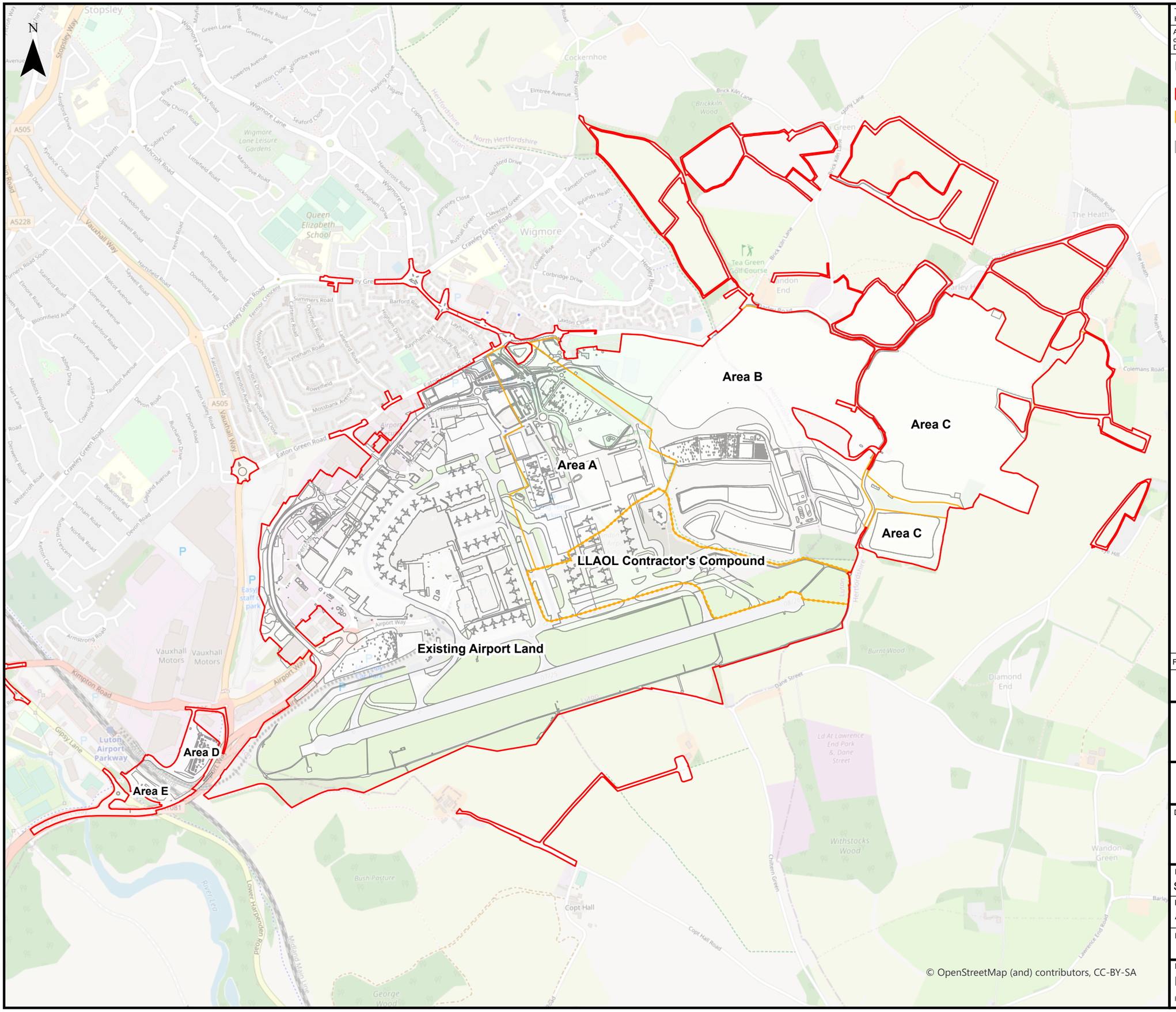
Purpose of issue	Suitability
SUITABLE FOR INFORMATION	S2

Drawn	Checked	Approved	Date	Scale	Size
AB	RB	TB	22/02/23	1:15,000	A3

DCO Application Ref.	APFP Regulation	DCO Document Ref.
TR020001	APFP 5(2)(a)	TR020001/APP/5.03

Drawing Number	Revision
LLADCO-3C-ARP-00-00-DR-YE-0156	P02

Project - Phase - Originator - Asset/Zone - Sub Asset - Type- Discp. - Number



All structure positions are indicative. The proposed works will be subject to detailed design development. The changes will be within limits of deviation specified in the Development Consent Order.

Legend

- Order Limits
- Site Subdivisions
- Airport Infrastructure Layout - Assessment Phase 2a

Revision History	Drawn	Checked / Approved	Date	Rev.
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Drawing Title

Figure 2b
Proposed Masterplan - Assessment Phase 2a

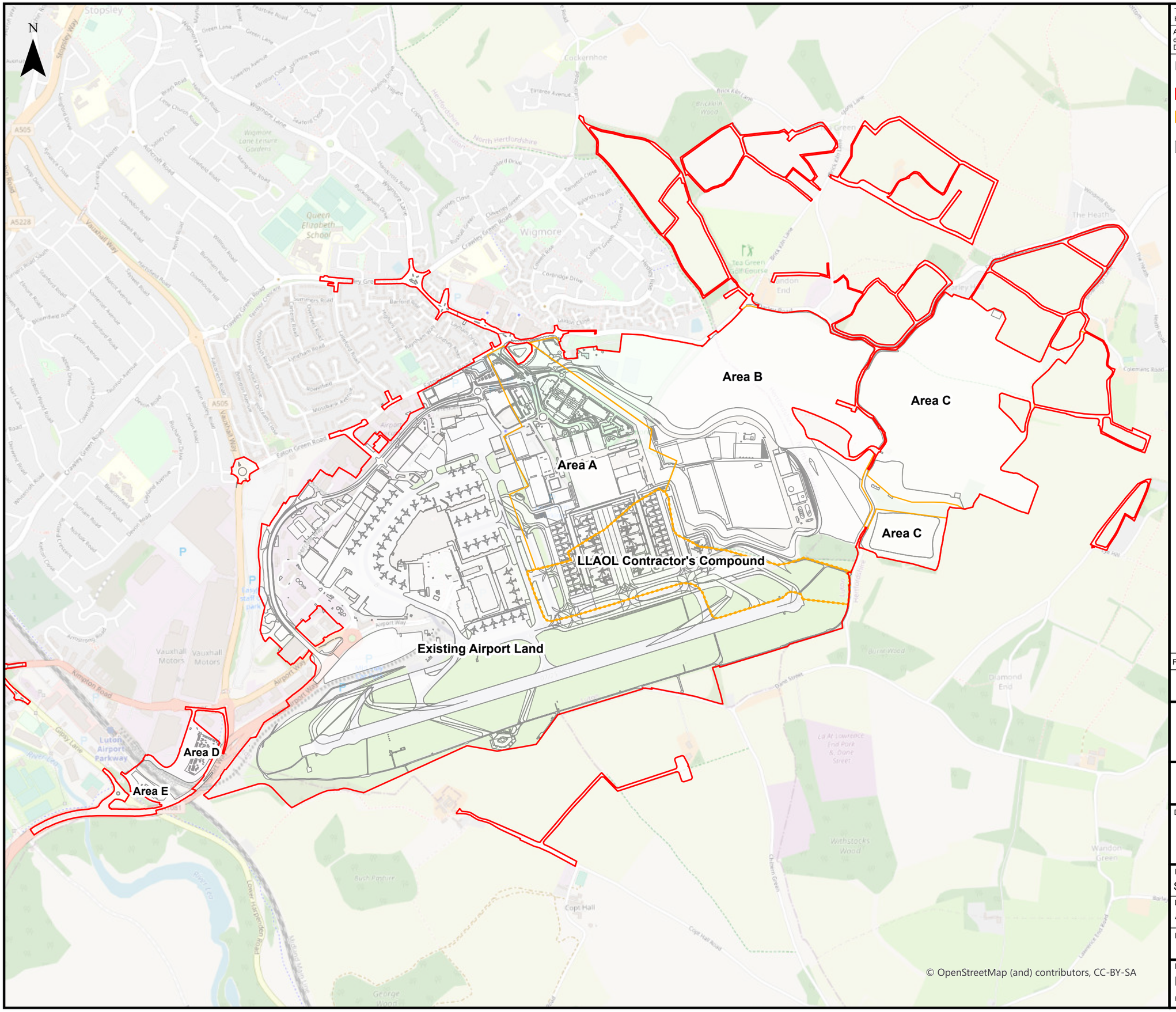
Purpose of issue	Suitability
SUITABLE FOR INFORMATION	S2

Drawn	Checked	Approved	Date	Scale	Size
AB	RB	TB	22/02/23	1:15,000	A3

DCO Application Ref.	APFP Regulation	DCO Document Ref.
TR020001	APFP 5(2)(a)	TR020001/APP/5.03

Drawing Number	Revision
LLADCO-3C-ARP-00-00-DR-YE-0157	P02

Project - Phase - Originator - Asset/Zone - Sub Asset - Type- Discp. - Number



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Legend

- Order Limits
- Site Subdivisions
- Airport Infrastructure Layout - Assessment Phase 2b

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Drawing Title

Figure 2c
Proposed Masterplan - Assessment Phase 2b

Purpose of issue	Suitability
SUITABLE FOR INFORMATION	S2

Drawn	Checked	Approved	Date	Scale	Size
AB	RB	TB	22/02/23	1:15,000	A3

DCO Application Ref.	APFP Regulation	DCO Document Ref.
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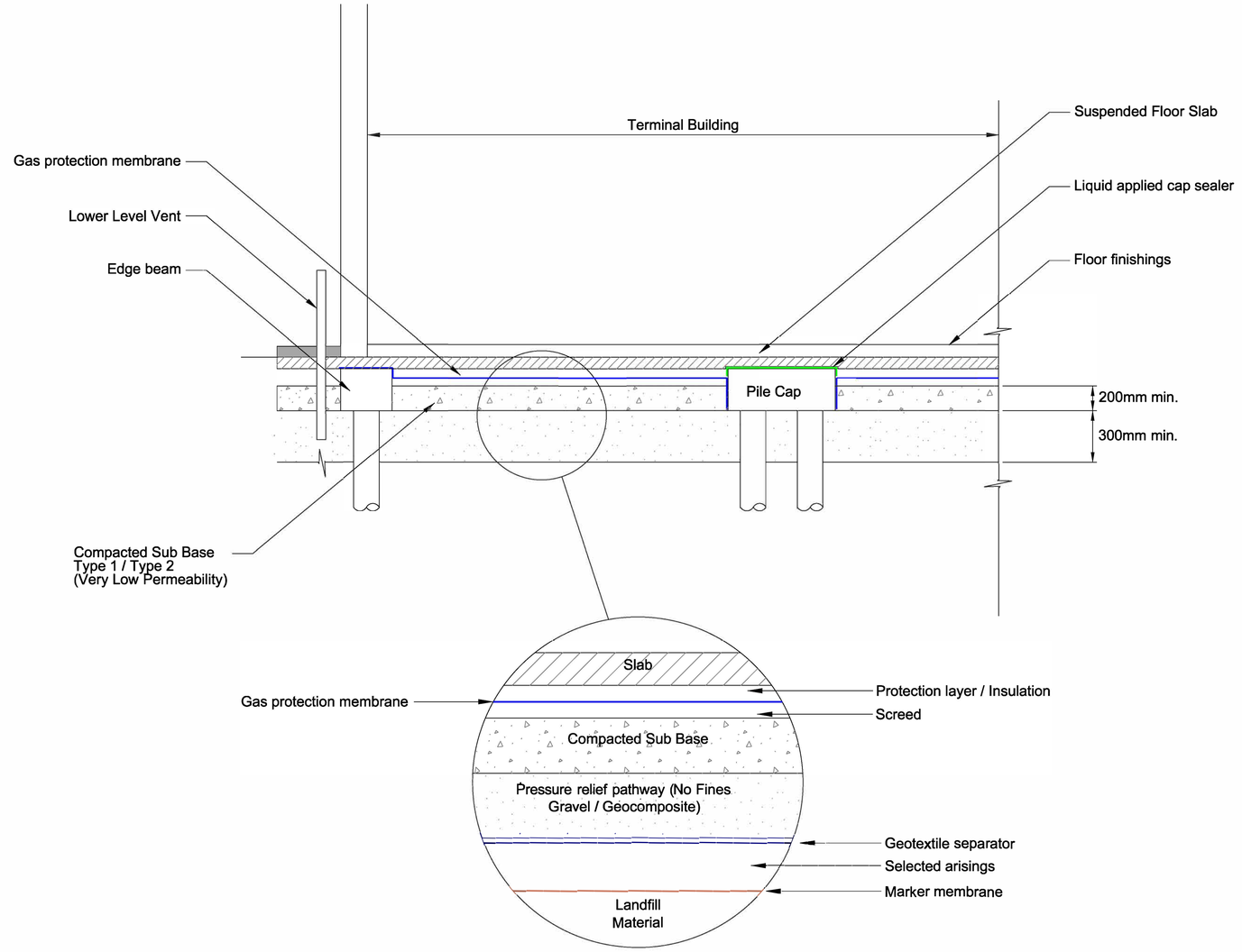
Drawing Number	Revision
LLADCO-3C-ARP-00-00-DR-YE-0158	P02

Project - Phase - Originator - Asset/Zone - Sub Asset - Type- Discp. - Number

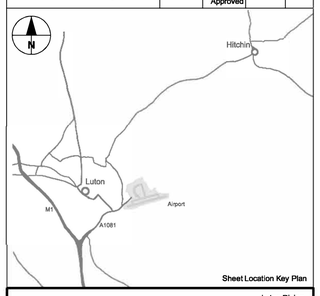


Illustrative Section of Gas Protection Measures
for buildings located on the Landfill

Not to Scale

All structure positions are indicative. The proposed works will be subject to detailed design development. The changes will be within limits of deviation specified in the Development Consent Order.

Revision History	Drawn	Checked / Approved	Date	Rev.
Issue	IJ	RB / TB	30/09/22	P02
Issue	IJ	RB / TB	16/12/21	P01



Sheet Location Key Plan

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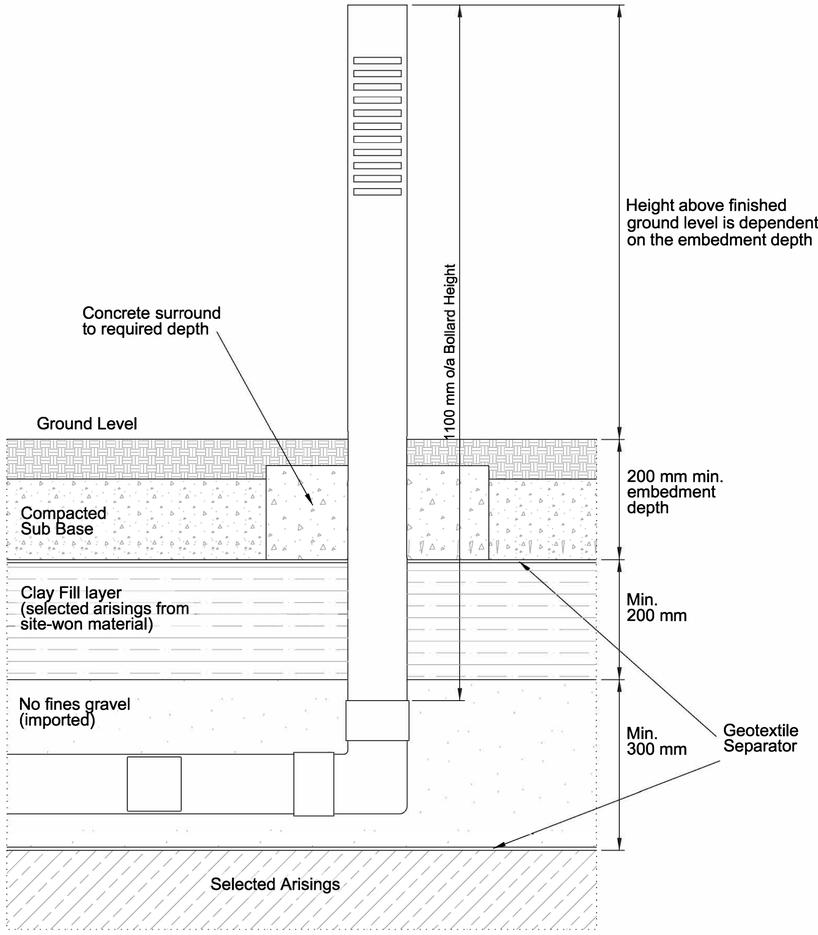
Drawing Title

Figure 03
Illustrative Gas Protection Measures

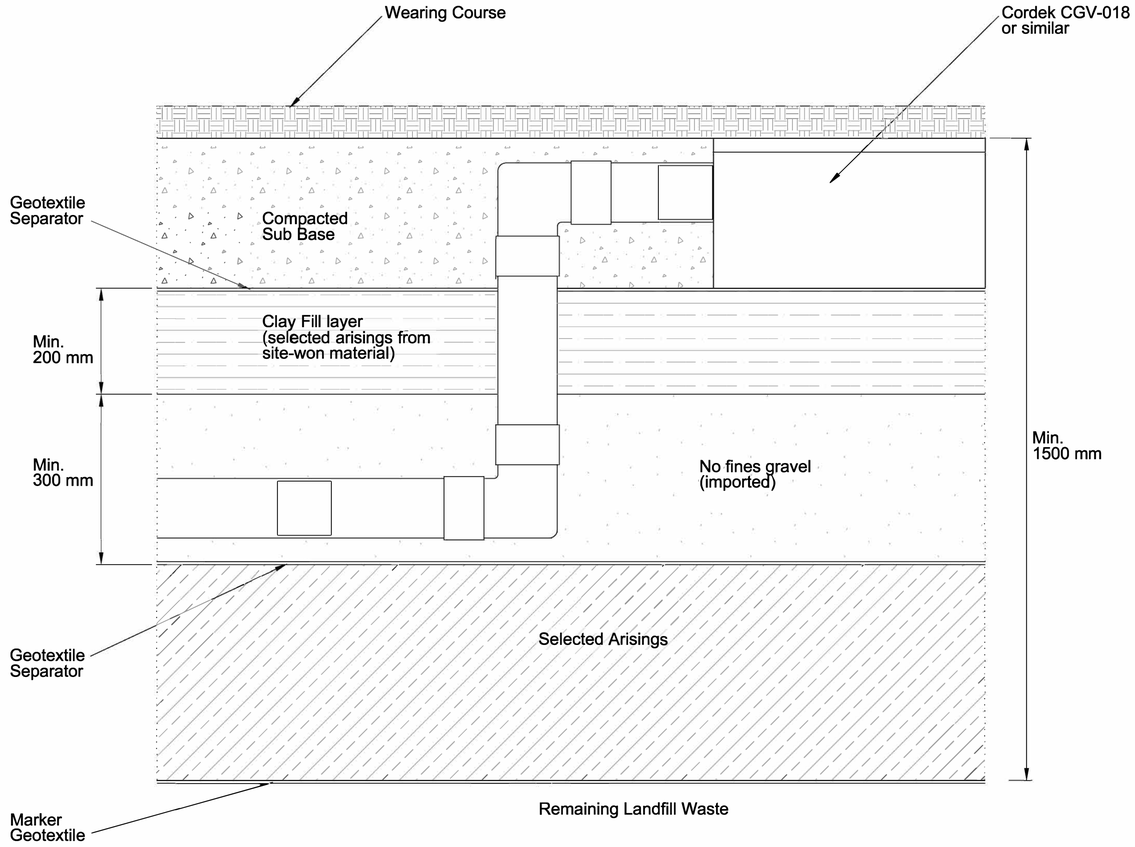
Purpose of issue				Suitability
SUITABLE FOR COORDINATION				S2
Drawn	Checked	Approved	Date	Scale / Size
IJ	RB	TB	30/09/22	NTS / A1
DCO Application Ref.	APFP Regulation	DCO Document Ref.		
TR020001				

Drawing Number	Revision
LLADCO-3C-ARP-00-00-DR-YE-0190	P02
Project – Phase – Originator – Asset/Zone – Sub Asset – Type – Discp. – Number	



Typical Standard Detail for Vent Bollard

Not to Scale



Typical Standard Detail for Ground Level Vent Box

Not to Scale

Illustrative Capping Detail for Hard Paved Areas (Including MSCP)

All structure positions are indicative. The proposed works will be subject to detailed design development. The changes will be within limits of deviation specified in the Development Consent Order.

Notes

1. Vent bollard will require protection if in car park area.
2. Spacing and layout to be determined
3. No fines gravel could be replaced with suitable geo composite and vent detail amended accordingly
4. Drainage above clay layer to be determined

Revision History	Drawn	Checked / Approved	Date	Rev.
Issue	IJ	RB / TB	30/09/22	P02
Issue	IJ	RB / TB	16/12/21	P01

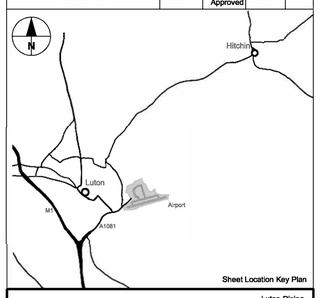


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Figure 04
Illustrative Capping and Gas Control Detail for Hard Paved Aareas

Purpose of issue	Suitability
SUITABLE FOR COORDINATION	S2

Drawn	Checked	Approved	Date	Scale	Size
IJ	RB	TB	30/09/22	NTS	A1

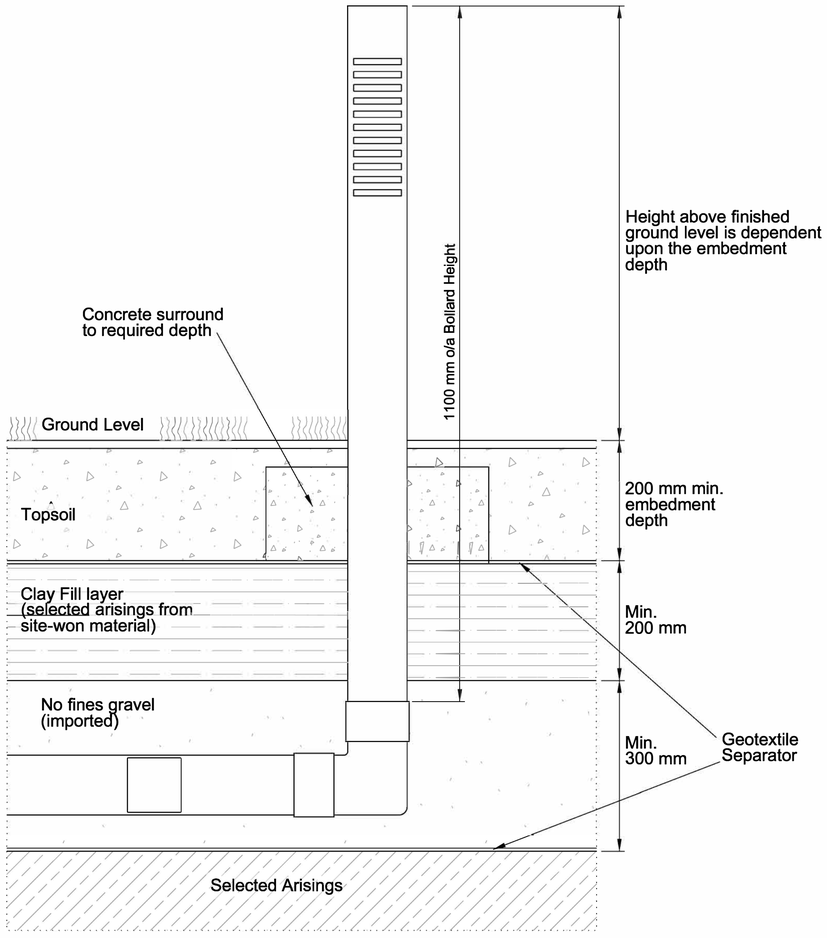
DCO Application Ref.	APFP Regulation	DCO Document Ref.
TR020001		

Drawing Number	Revision
LLADCO-3C-ARP-00-00-DR-YE-0191	P02
Project – Phase – Originator – Asset/Zone – Sub Asset – Type – Discp. – Number	

All structure positions are indicative. The proposed works will be suject to detailed design development. The changes will be within limits of deviation specified in the Development Consent Order.

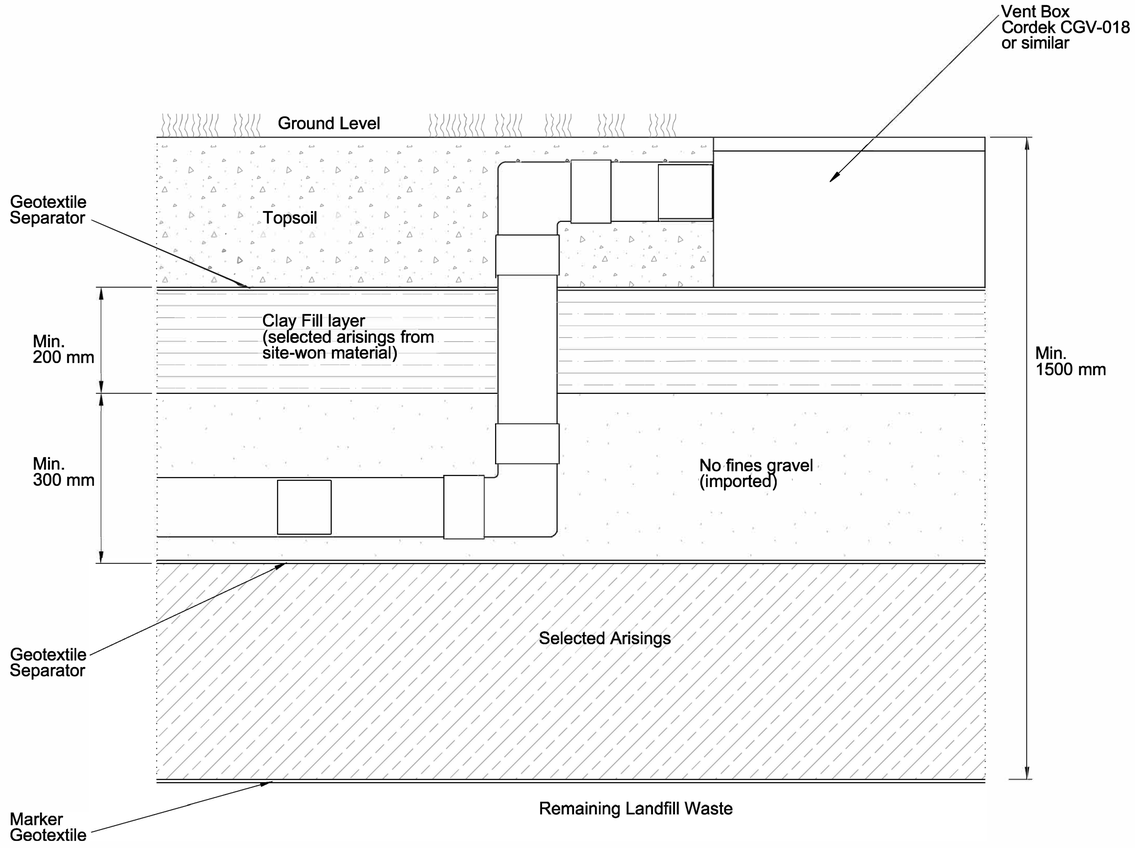
Notes

1. Vent type depends on area of landscaping. Vents only required at perimeter of area.
2. Spacing and layout to be determined
3. No fines gravel could be replaced with suitable geocomposite and vent detail amended accordingly
4. Drainage above clay layer to be determined



Typical Standard Detail for Vent Bollard

Not to Scale



Typical Standard Detail for Ground Level Vent Box

Not to Scale

Illustrative Capping Detail for Landscaping Areas

Issue	IJ	RB TB	30/09/22	P02
Issue	IJ	RB TB	16/12/21	P01
Revision History	Drawn	Checked Approved	Date	Rev.

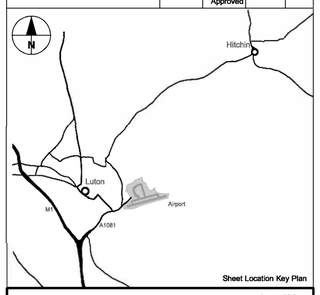


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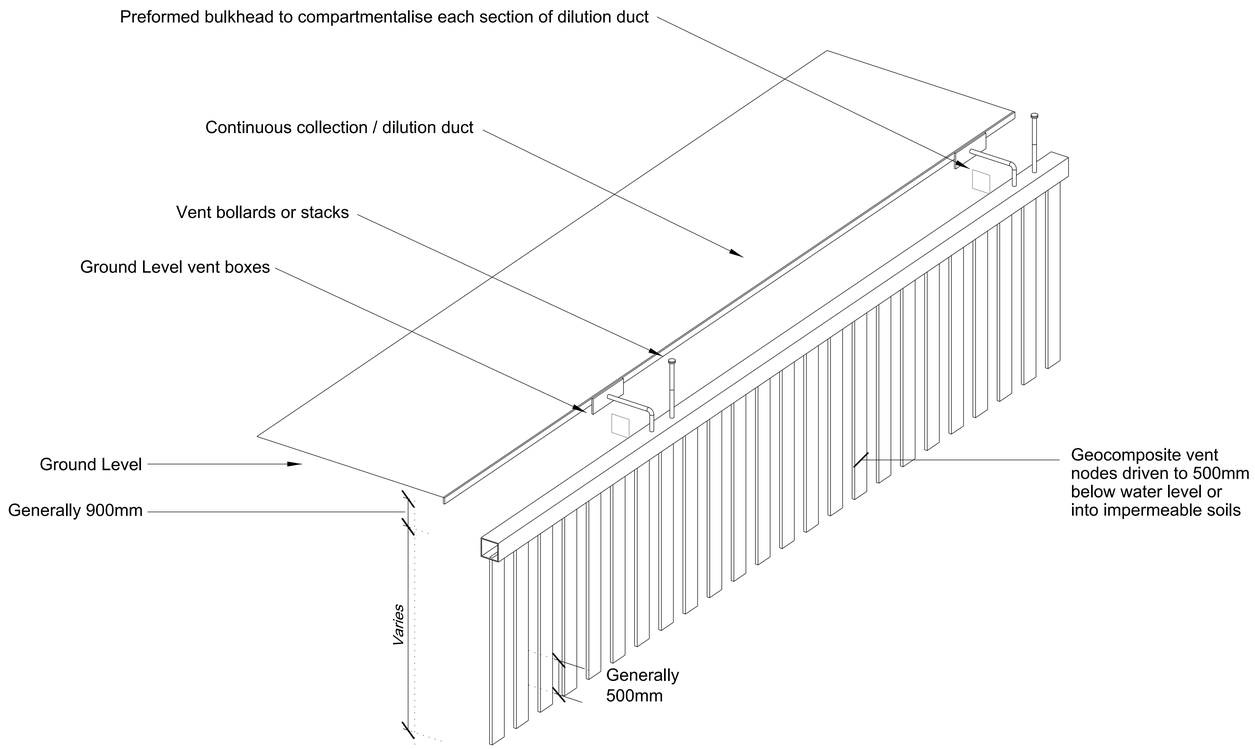
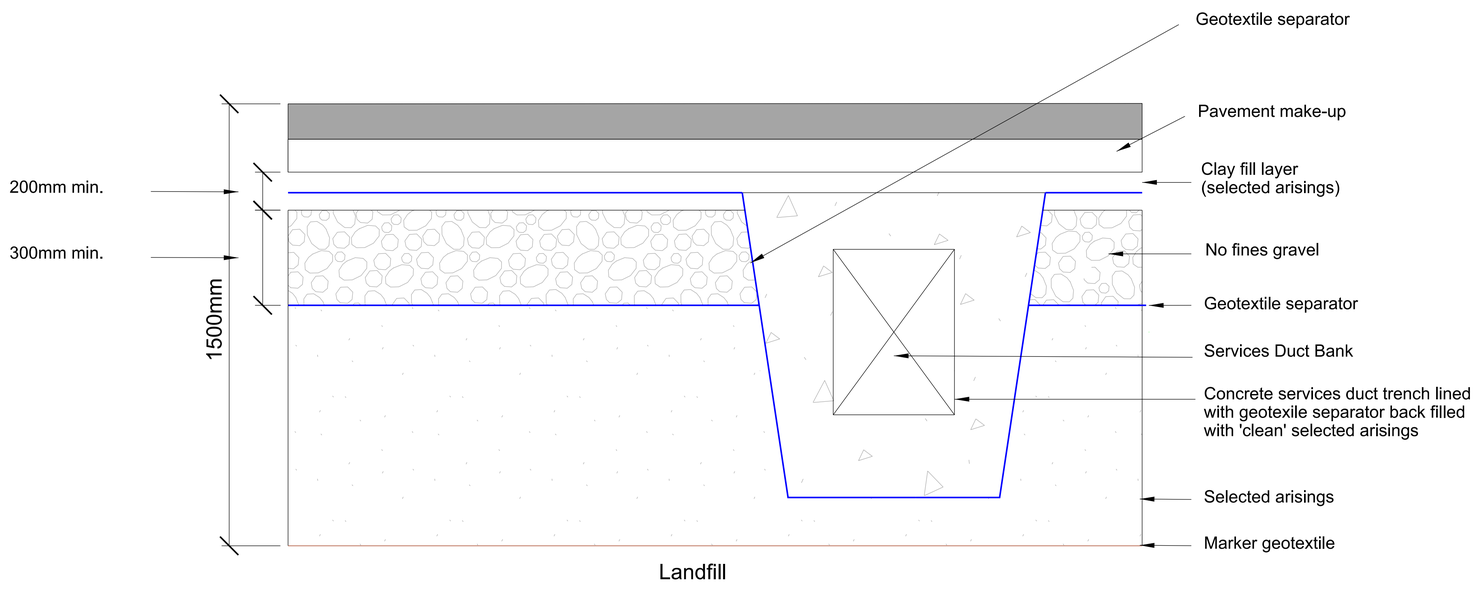
Figure 05
Illustrative Capping and Gas Control Detail for Landscaping Areas

Purpose of issue				Suitability
SUITABLE FOR COORDINATION				S2
Drawn	Checked	Approved	Date	Scale / Size
IJ	RB	TB	30/09/22	NTS / A1
DCO Application Ref.	APFP Regulation	DCO Document Ref.		
TR020001				
Drawing Number				Revision
LLADCO-3C-ARP-00-00-DR-YE-0192				P02
Project – Phase – Originator – AssetZone – Sub Asset – Type – Discp. – Number				



Virtual Gas Barrier Schematic Illustrative of Boundary Gas Protection



Standard Detail for Gas Protection for Service Corridors

All structure positions are indicative. The proposed works will be subject to detailed design development. The changes will be within limits of deviation specified in the Development Consent Order.

Revision History	Drawn	Checked / Approved	Date	Rev.
Issue	IJ	RB / TB	30/09/22	P02
Issue	IJ	RB / TB	16/12/21	P01

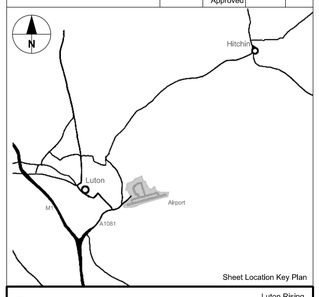


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Figure 06
Illustrative Gas Protection Details

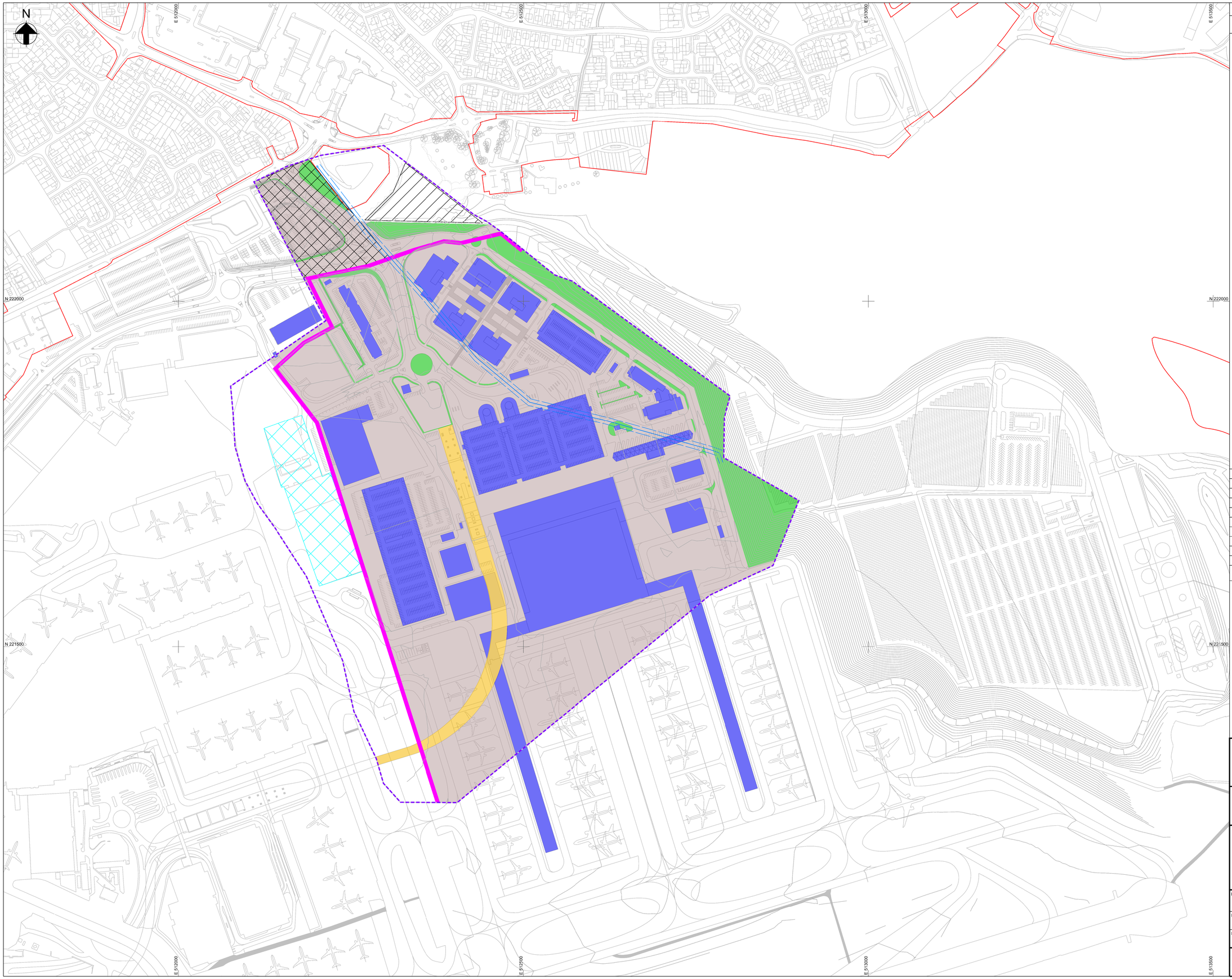
Purpose of issue	Suitability
SUITABLE FOR COORDINATION	S2

Drawn	Checked	Approved	Date	Scale	Size
IJ	RB	TB	30/09/22	NTS	A1

DCO Application Ref.	APFP Regulation	DCO Document Ref.
TR020001		

Drawing Number	Revision
LLADCO-3C-ARP-00-00-DR-YE-0193	P02

Project – Phase – Originator – Asset/Zone – Sub Asset – Type – Discp. – Number



All structure positions are indicative. The proposed works will be subject to detailed design development. The changes will be within limits of deviation specified in the Development Consent Order.

Legend

- The Order Limits
- Landfill Boundary
- 32MPPA Earthwork Contours
- Boundary Gas Protection
- Existing Thames Valley Drain (to be treated)
- Gas Protection to DART
- Gas Protection to Buildings
- Gas Control in landscaping
- Gas control in hard paved areas
- Passive venting. e.g. vent stacks
- Landfill Material removed as part of AAR
- Approx. extent of area previously remediated

Notes

1. Do not scale from this drawing.
2. All levels are in metres above ordnance datum unless noted otherwise.
3. These drawings are primarily intended to be viewed electronically. Some details may not be clear or visible on a printed version.

Revision History	Drawn	Checked / Approved	Date	Rev.
Issue	IJ	RB / TB	30/09/22	P02
Issue	IJ	RB / TB	16/12/21	P01

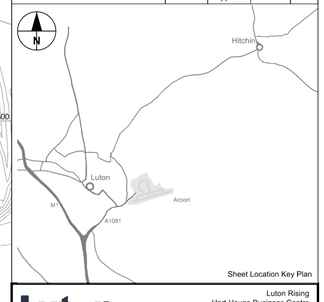


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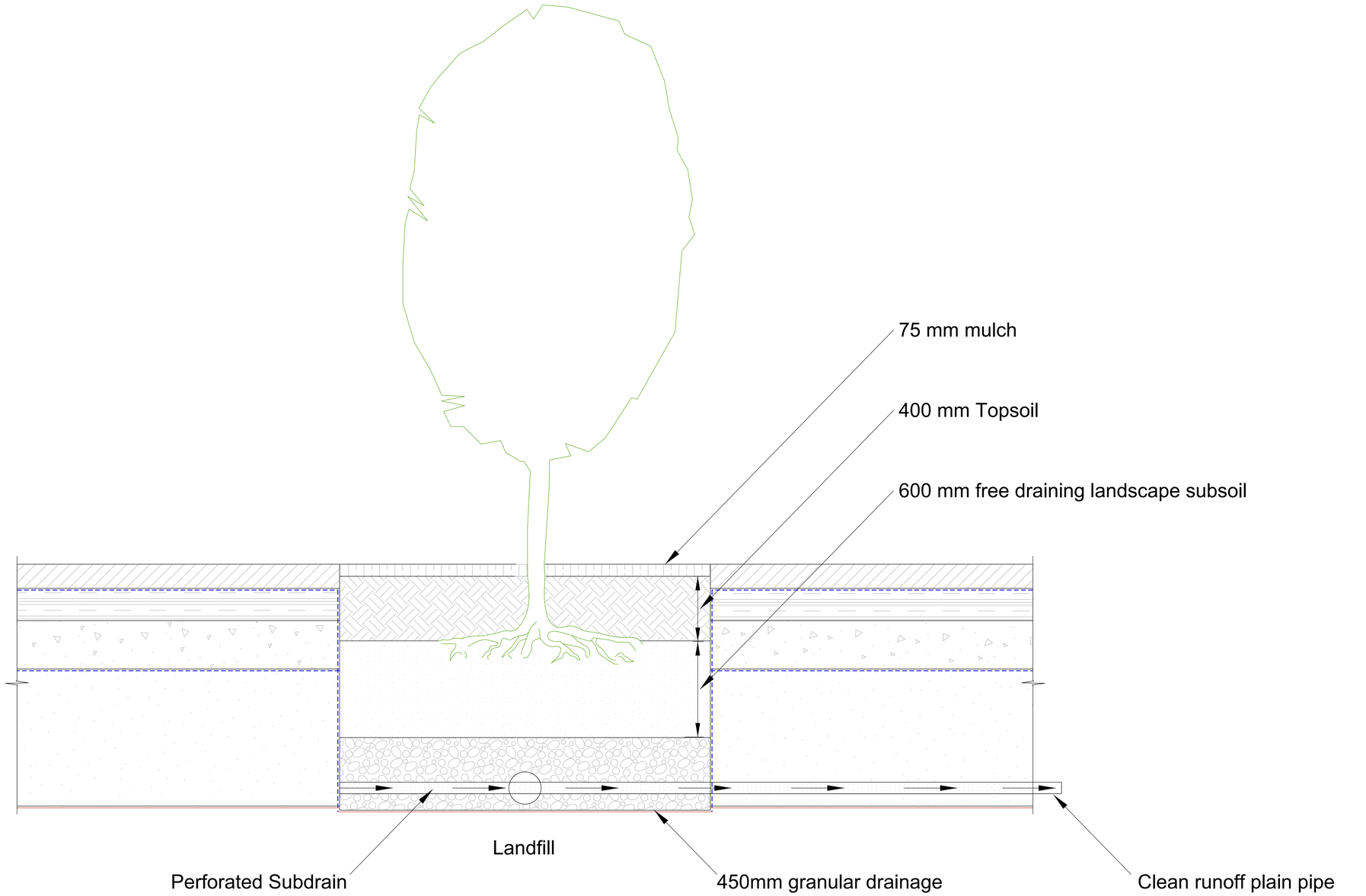
Figure 07
Landfill Gas Control Measures

Purpose of issue				Suitability
SUITABLE FOR COORDINATION				S2
Drawn	**Checked**	**Approved**	**Date**	**Scale** / **Size**
IJ	RB	TB	30/09/22	1:2500 / A1
DCO Application Ref.	**APFP Regulation**		**DCO Document Ref.**	
TR020001	(APFP 5(2)(a))		TR020001/APP/5.02	

Drawing Number	Revision
LLADCO-3C-ARP-00-00-DR-YE-0194	P02
Project – Phase – Originator – AssetZone – Sub Asset – Type – Disp. – Number	



Illustrative Tree Pit Detail

All structure positions are indicative. The proposed works will be subject to detailed design development. The changes will be within limits of deviation specified in the Development Consent Order.

Legend

- Clay
- No fines gravel
- Selected arisings
- Geotextile separator
- Marker membrane
- Pavement/soft landscaping make-up

Revision History	Drawn	Checked / Approved	Date	Rev.
Issue	IJ	RB / TB	30/09/22	P02
Issue	IJ	RB / TB	16/12/21	P01

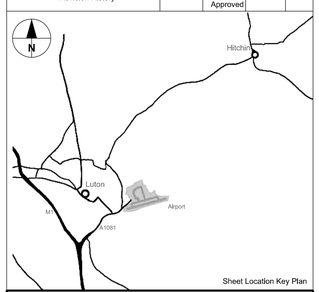


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Figure 08
Illustrative Tree Pit Details

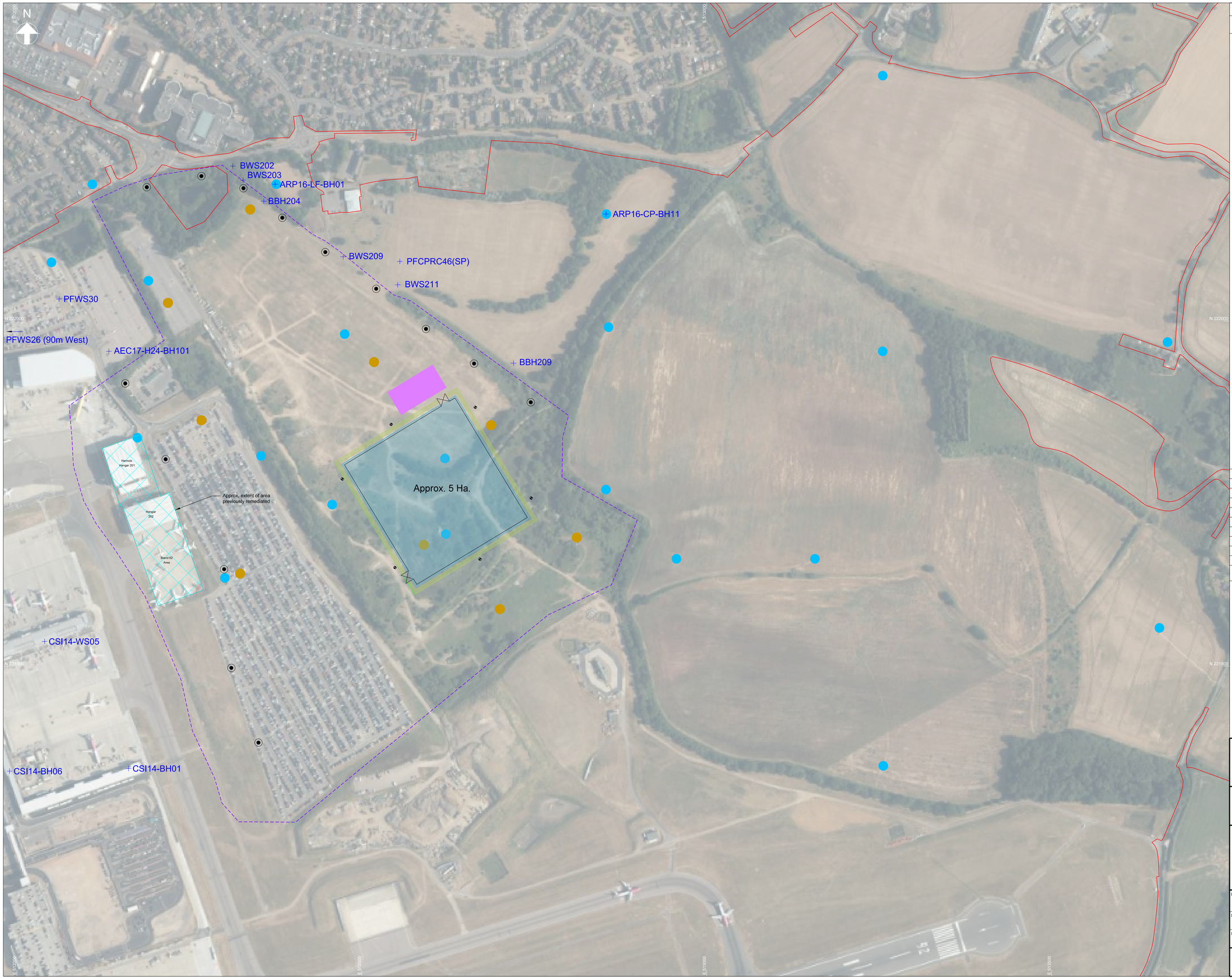
Purpose of issue	Suitability
SUITABLE FOR COORDINATION	S2

Drawn	Checked	Approved	Date	Scale	Size
IJ	RB	TB	30/09/22	NTS	A1

DCO Application Ref.	APFP Regulation	DCO Document Ref.
TR020001	(APFP 5(2)(a))	TR020001/APP/5.02

Drawing Number	Revision
LLADCO-3C-ARP-00-00-DR-YE-0195	P02

Project – Phase – Originator – Asset/Zone – Sub Asset – Type – Discp. – Number



All structure positions are indicative. The proposed works will be subject to detailed design development. The changes will be within limits of deviation specified in the Development Consent Order.

Legend

- The Order Limits
- Landfill boundary
- Waste treatment compound
- Indicative waste water treatment area
- Approx. extent of area previously remediated
- Boundary air monitoring
- Treatment compound air monitoring
- Leachate control wells
- Groundwater monitoring locations
- Longterm Boundary Gas Monitoring

Notes

1. Do not scale from this drawing.
2. All levels are in metres above ordnance datum unless noted otherwise.
3. These drawings are primarily intended to be viewed electronically. Some details may not be clear or visible on a printed version.
4. Bing Maps Aerial - © 2021 Microsoft Corporation © 2021 Maxar ©CNES (2021) Distribution Airbus DS

Revision History	Drawn	Checked / Approved	Date	Rev.
Issue	IJ	RB / TB	30/09/22	P02
Issue	IJ	RB / TB	16/12/21	P01

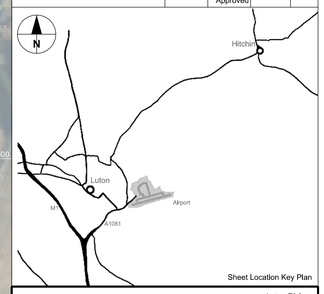


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Figure 09
Site Management
Monitoring and Controls

Purpose of issue				Suitability
SUITABLE FOR COORDINATION				S2
Drawn	Checked	Approved	Date	Scale / Size
IJ	RB	TB	30/09/22	1:2500 / A1
DCO Application Ref.	APFP Regulation		DCO Document Ref.	
TR020001	(APFP 5(2)(a))		TR020001/APP/5.03	
Drawing Number				Revision
LLADCO-3C-ARP-00-00-DR-YE-0196				P02
Project – Phase – Originator – Asset/Zone – Sub Asset – Type – Discp. – Number				

All structure positions are indicative. The proposed works will be subject to detailed design development. The changes will be within limits of deviation specified in the Development Consent Order.

Legend

- The Order Limits
- Landfill Boundary
- Approx. extent of area previously remediated
- Area of Chalk Material Excavated

Landfill Isopach - Cut and Fill Depths

Area of Deposition (Fill)
- 16.00m
- 15.00m
- 14.00m
- 13.00m
- 12.00m
- 11.00m
- 10.00m
- 9.00m
- 8.00m
- 7.00m
- 6.00m
- 5.00m
- 4.00m
- 3.00m
- 2.00m
- 1.00m
- 0.25m

Area of Excavation (Cut)
- -0.25m
- -1.00m
- -2.00m
- -3.00m
- -4.00m
- -5.00m
- -6.00m
- -7.00m
- -8.00m
- -9.00m
- -10.00m
- -11.00m
- -12.00m
- -13.00m
- -14.00m
- -15.00m
- -16.00m
- -17.00m

Notes

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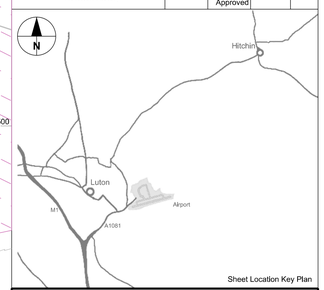
2. All levels are in metres above ordnance datum unless noted otherwise.
3. These drawings are primarily intended to be viewed electronically. Some details may not be clear or visible on a printed version.

Revision History	Drawn	Checked / Approved	Date	Rev.
Issue	IJ	RB / TB	30/09/22	P02
Issue	IJ	RB / TB	16/12/21	P01



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Drawing Title

Figure 10
Landfill Areas of Cut and Fill

Purpose of issue				Suitability
SUITABLE FOR COORDINATION				S2
Drawn	Checked	Approved	Date	Scale / Size
IJ	RB	TB	30/09/22	1:2500 / A1
DCO Application Ref.	APFP Regulation		DCO Document Ref.	
TR020001	(APFP 5(2)(a))		TR020001/APP/5.03	

Drawing Number	Revision
LLADCO-3C-ARP-00-00-DR-YE-0197	P02
Project – Phase – Originator – Asset/Zone – Sub Asset – Type – Discp. – Number	

ANNEX A - REMEDIATION OPTIONS APPRAISAL

A1.1.1 The DQRA (Ref. 1.3 and Ref. 1.4) (Appendices 17.3 and 17.4 of the ES [TR020001/APP/5.02]) indicated that the concentrations of contaminants present within the landfill are not currently posing a risk to human health or controlled waters. However, it is noted that:

a. The nature of historical landfills i.e. no specific controls on waste types deposited, means there is likely to be a high degree of heterogeneity in the waste. Therefore, whilst site investigation has appropriately characterised conditions there may be localised areas not yet encountered where contamination conditions vary; and

b. The construction works required and subsequent development will alter the potential risk to future users and other receptors.

A1.1.2 The assessment presented in Table 2 1 in Section 2 of this document identifies potential risks where measures inherent in the construction or operation of the Proposed Development might not be sufficient to break the pollutant linkage. These PCLs were identified as RCLs and will be subject to remediation measures as described in the following sections.

A1.1.3 To identify the feasible remediation options that could address the RCLs a remediation options appraisal (ROA) of the available treatment processes and technologies has been undertaken. A screening matrix for remediation technologies is presented in Table A1.1. No techniques relating to groundwater remediation have been considered as the DQRA indicated no specific remediation of the groundwater was required.

A1.1.4 Details on the suitability, clean up time, costs and reliability for the screening matrix have been obtained from the following key sources:

a. Environment Agency. Land contamination risk management (Ref. 3.1).

b. CIRIA C622 Selection of remedial treatments for contaminated land[6].

c. CIRIA C549 Remedial processes for contaminated land principles and practice[7].

A1.1.5 The three general types of remediation in relation to the RCLs are discussed in detail in Table A1.1, the feasible remediation options are:

A1.2 Managing the receptor

A1.2.1 Managing the receptor is not considered a suitable approach as for controlled waters it is not possible to move or manage the underlying Principal Aquifer. In addition, for human health there are few changes that can be made to the proposed masterplan which would further reduce the relevant human health linkages. Therefore, this is not considered a feasible option for these receptors.

[6] CIRIA. Selection of remedial treatments for contaminated land: a guide to good practice. C662. 2004
[7] CIRIA. Remedial processes for contaminated land - principles and practice. C549. 2001

A1.3 Reducing (or removing) the source term

A1.3.1 It is not considered feasible or necessary to remove the source term i.e. remove all landfill material. This would involve the removal of approximately 4,400,000m3 of landfill material. It would remove all potential linkages, but it is considered an unfeasible option due to the following:

a. Excavation and disposal of all the landfill material would not be the most sustainable or the best option for the environment according to the waste hierarchy set out in The Waste Regulations 2011. Reuse of existing landfill materials within the scheme would best achieve the requirements of the waste hierarchy;
b. Create an unfeasibly large number of lorry movements on local and regional roads. Lorry movements and the related traffic impacts and pollution were identified during the non-statutory consultation process as a key concern for the public and should be minimised wherever possible;
c. If the landfill material was removed the resulting void would require a significant amount of material for backfilling, which would use natural resources. This is not considered sustainable practice, when it is possible to retain the existing materials;
d. No local landfill capacity for disposal of the volume of material;
e. Treatment of all the landfill material to reduce contamination concentrations would be impractical and unwarranted based on the DQRA (Ref. 1.3 and Ref. 1.4) (**Appendices 17.3** and **17.4** of the ES **[TR020001/APP/5.02]**);
f. Potentially exposing construction workers to contamination in large volumes of landfill material; and
g. Treatment of the volume of material would not be achievable in programme timescales.

A1.3.2 Therefore, based on the above points the excavation of former landfill material will be minimised. However, where the aviation platform is to be constructed it is necessary to excavate the top part of the landfill material and compact the material that remains as it does not have the geotechnical properties required to meet settlement standards for aviation (see Section 1.6 and Drawing 1 of this document). Further areas of reprofiling will be undertaken north of the aviation platform to create the formation level for the new structures and access road. The material recovered from the landfill will be suitable for reuse in this reprofiling. This would limit the potential construction related risks associated with disturbing the landfill and address constraints relating to space and construction programme.

A1.3.3 The landfill material which is excavated will be recovered and processed to improve its physical properties before reuse elsewhere on site. Feasible options for treatments to improve its physical properties were identified in the screening matrix in Table A1.1 below. Details are provided in Section 6.

A1.3.4 The approach also supports sustainability objectives; an essential element for the success of the development is to minimise the number of heavy goods vehicles (HGV) movements (see constraints in Table 3.2). Recovery and reuse

of the waste materials on site would help to meet this sustainability objective. Additional sustainability credentials associated with the use of waste as a replacement for non-waste materials are that it would conserve natural resources and reduce pressure on landfill by retaining the materials on site.

A1.3.5 Whilst it is not considered practical to use remediation technologies to treat the majority of the landfill material, it may feasible to use specific remediation technologies to treat small areas of localised free product identified (e.g. WS224) (RCL14) or additional areas encountered during works, to allow it to be reused on site. The ROA (Table A1.1) identifies that treatment through bioremediation (windrows or biopiles) is likely to be the most effective for this small volume of material.

A1.4 Breaking the pathway

A1.4.1 The most feasible option to address the identified RCLs is considered to break or manage the pathway. The remediation options appraisal identified there is only a single solution available to break the pathway for each RCL (except for RCL 14 discussed above).

A1.4.2 The majority of the RCLs can be addressed with an engineered cover system. Cover systems are a proven approach for managing historic landfills and would minimise infiltration rates, thereby decreasing the potential for leaching of contaminants from the fill to groundwater. The method would also break the pathways between contaminated soil and future site users. The method would limit the amount of material requiring off-site disposal. Gas protection measures could be incorporated into the overall cover system design.

A1.4.3 For migration of gases off-site, both during and post construction, the use of an in-ground barrier such as virtual gas curtain will provide an appropriate pathway break.

Table A1.1 Summary of Remediation Options Screening Matrix

Remediation technology	Contaminants							Screening criteria					Applicable RPLs or constraints preventing use
	VOCs	Heavy	TPH	PAHs	Asbestos	Pesticides	Landfill gases	Cost	Capital or operational/ maintenance intensive	Reliability	Suitable for ground conditions	Clean-up time (years)	
Civil Engineering Methods													
Containment-cover systems	✓	✓	✓	✓	✓	✓	✓	£	Capital intensive	Average to high	✓	<1	RPLs 1, 3-13,15,18,19
In ground gas barrier i.e. virtual gas curtain	✘	✘	✘	✘	✘	✘	✓	£	Capital intensive	Average to high	✓	<1	RPL 2
Physical treatment													
Complex Materials Sorting and Reuse	✘	✘	✘	✘	✘	✘	✘	££	Capital and O&M intensive	Average	✓	1-2	Not required to address RPLs but will improve physical properties of material to be reused
Screening/ Handpicking	✘	✘	✘	✘	✓	✘	✓	££	Capital and O&M intensive	Average to high	✓	1-2	Not required to address RPLs but option should be kept under review as option dependant on conditions encountered.
In-situ biological treatment													
Bioventing or sparging	✓	✘	✓	✓	✘	✘	✘	£	Not capital or O&M intensive	Average	O	0.5-3	RPL14
Phytoremediation	✓	✓	✓	✓	✘	✓	✘	£	Not capital or O&M intensive	Low	✘	>3	Not feasible. Time frame and low reliability.
In-situ physical/chemical treatment													
Soil vapour extraction (SVE)	✓	✘	✓	✓	✘	✘	✘	£	O&M intensive	Average	O	1-3	RPL 14
Chemical oxidation	✓	O	✓	✓	✘	✓	✘	££	O&M intensive	Average	O	<1	RPL 14
Electrokinetic separation	✘	✓	✘	✘	✘	✘	✘	£££	O&M intensive	Average	O	1-3	Considered not feasible due to limited application,

Remediation technology	Contaminants							Screening criteria					Applicable RPLs or constraints preventing use
	VOCs	Heavy	TPH	PAHs	Asbestos	Pesticides	Landfill gases	Cost	Capital or operational/ maintenance intensive	Reliability	Suitable for ground conditions	Clean-up time (years)	
													timeframe and excessive cost.
Soil flushing	✓	✓	✓	✓	✗	✓	✗	£££	O&M intensive	Average	**O**	1-3	RPL 14
Stabilisation and solidification (e.g. cement, hydraulic binders)	✓	✓	✓	✓	✓	✓	✗	££	Capital intensive	Average	**O**	<0.5	Not required to address RPLs but will improve physical properties of material to be reused. Only viable in conjunction with other remediation methods (e.g. material sorting and reuse).
In-situ thermal methods													
Thermal desorption	✓	✓	✓	✓	✗	✓	✗	£££	Capital and O&M intensive	High	✓	<0.5	N/A (excessive cost and energy)
Vitrification	✓	✓	✓	✓	✓	✓	✓	£££	Capital and O&M intensive	High	✓	<0.5	N/A (excessive cost and energy)
Ex-situ biological treatment													
Landfarming	✓	✗	✓	✓	✗	✗	✗	£	Not capital or O&M intensive	Average	**O**	1-3	RPL 14 Requires very large area for treatment therefore space unlikely to be available.
Windrows	✓	✗	✓	✓	✗	✗	✗	£	Not capital or O&M intensive	Average	**O**	0.5-2	RPL 4
Biopiles	✓	✗	✓	✓	✗	✗	✗	£	Not capital or O&M intensive	Average	**O**	0.5-2	RPL 14

Remediation technology	Contaminants							Screening criteria					Applicable RPLs or constraints preventing use
	VOCs	Heavy	TPH	PAHs	Asbestos	Pesticides	Landfill gases	Cost	Capital or operational/ maintenance intensive	Reliability	Suitable for ground conditions	Clean-up time (years)	
Slurry phase biotreatment	✓	✖	✓	✓	✖	✖	✖	£	Not capital or O&M intensive	Average	**O**	0.5-2	RPL 14 Requires very large area for treatment therefore space unlikely to be available.
Ex-situ physical/chemical treatment													
Soil washing	✓	✓	✓	✓	✖	✓	✖	££	Capital and O&M intensive	High	✖	<0.5	RPL 14 Soil washing is typically suited to granular soils (i.e. a fines content <10%). Fine content in landfill is high.
Stabilisation and solidification (e.g. cement, hydraulic binders)	✓	✓	✓	✓	✓	✓	✖	££	Capital intensive	Average	**O**	<0.5	Not required to address RPLs but will improve physical properties of material to be reused. Only viable in conjunction with other remediation methods (e.g. material sorting and reuse).
Ex-situ thermal methods													
Incineration	✓	✓	✓	✓	✓	✓	✓	£££	Capital and O&M intensive	High	✓	<0.5	N/A (excessive cost and energy)
Thermal desorption	✓	✓	✓	✓	✓	✓	✓	££	Capital and O&M intensive	Average	✓	<0.5	N/A (excessive cost and energy)
Pyrolysis	✓	✓	✓	✓	✓	✓	✓	£££	Capital and O&M intensive	High	**O**	<0.5	N/A (excessive cost and energy)

Key:
✓ Technique is applicable
✖ Not applicable

Remediation technology	Contaminants							Screening criteria					Applicable RPLs or constraints preventing use
	VOCs	Heavy	TPH	PAHs	Asbestos	Pesticides	Landfill gases	Cost	Capital or operational/ maintenance intensive	Reliability	Suitable for ground conditions	Clean-up time (years)	
O: Limited suitability dependant on ground conditions or contaminant type £: Low cost £+: Low to medium cost ££: Medium cost £££: High cost Technically feasible technique Technical feasible in combination with other technologies													

ANNEX B – MANAGEMENT OF LANDFILL EARTHWORKS

B1.1.1 The following section provides a details of a typical landfill waste recovery process, the final methodology would be determined by the specialist remediation contractor after site segregation trials are completed at detailed design stage.

B1.2 Waste processing compound

B1.2.1 The treatment area would include design features to control surface water run-off with water treatment facilities, to prevent discharge to ground and wider environment. As a minimum, a concrete base with overlying membrane would be expected to be placed across the whole processing area with a perimeter ditch and collection and treatment of run off. Illustrative arrangement is indicated on Figure 9 of this document.

B1.3 Excavation process

B1.3.1 Landfill material would be excavated in sections to minimise the area of landfill exposed at any one time. This would reduce the risks associated with vermin, birds, dust, odours and reduce the amount of rainwater which could enter the remaining in-situ waste. The likely environmental controls are described in further detail in Annex C of this document. Prior to relocation to the soil treatment area the materials would be subject to an initial segregation process.

B1.3.2 The processes described below would also apply to the Made Ground and waste materials excavated for the reprofiling of the landside platform. Location of areas of cut are indicated on Figure 10 of this document.

B1.4 Segregation at source

B1.4.1 During ground investigations at the site the waste in the landfill was classified into different waste types, based on a forensic assessment, further detail is provided in GQRA (Ref. 1.2) Appendix 17.2 of the ES [TR020001/APP/5.02]. A summary of types and descriptors are presented in Table B1 below:

Table B 1- Waste types

Waste Type	Overall Description
Non-chalky Cover	Cover material with a non-chalky matrix – largely derived from superficial deposits such as Clay with Flints/Dry Valley deposits.
Chalky Cover	Cover materials with a chalky matrix – largely derived from Chalk.
Old-domestic	Household waste from pre-1970 – typically comprising ashy household waste.
Recent domestic	Household waste from post 1970 – typically brown to dark grey in colour largely comprising ‘black plastic bag’ waste from household bins.

Waste Type	Overall Description
Commercial	Office and retail waste – typically greater amounts of mixed paper, newsprint, corrugated cardboard, plastic and wood in the form of pallets.
Industrial	Waste arising from factories, scrapyards etc – varied composition spanning all eras of deposition, derived from local factories, garages and former scrapyard in the northwest of the site.
Construction	Material from construction projects – largely derived from reworked natural superficial deposits, with anthropogenic inclusions; mainly brick and concrete with smaller quantities of wood, plastic, glass ferrous and other organics.
Made Ground	Typically, arisings from past airport projects, but also includes the construction of car parks etc. Includes material, south of the landfill from LLAOL contractor's compound and adjacent areas (if placed under an MMP or DfR permit).

B1.4.2 The waste would be segregated and stockpiled as excavation proceeds based on visual identification into the following categories:

a. Cover materials (clay/chalk) which is likely to be uncontaminated and therefore unlikely to require treatment for contamination prior to reuse (geotechnical treatment may be required);
b. Made Ground;
c. Mixed landfill waste;
d. Hydrocarbon impacted materials; and
e. Unsuitable wastes for recycling and off-site treatment/disposal i.e. sofas, car parts, tyres, metal drums etc.

B1.4.3 A watching brief for ACMs during excavation and stockpiling would be required, see Annex C of this document for details of management of asbestos.

B1.4.4 A watching brief would also be required to identify any unexpected contamination conditions. The process for identification and further excavation of hotspots is detailed in Annex C of this document.

B1.4.5 The wastes identified for further treatment may be processed as described below, actual processes would be determined by the remediation contractor following segregation trials undertaken at planning stage. A schematic showing how the materials management might be implemented is presented at Drawing 4 of this document. The actual management methods would be determined as part of the detailed design.

B1.5 Processing

Mixed landfill waste – complex sorting

B1.5.1 The waste material would be transferred to the waste processing compound where material would be screened, washed (if required) and sorted into their component parts and stockpiled separately, these are likely to be:

a. Wood;
b. Plastic;
c. Sand and gravel*;
d. Metal; and
e. Silt/organic matter*.

*Incidental materials resulting from their association with the waste materials.

B1.5.2 Metals derived from this process would be recycled off-site. Wood, silts and separated organic matter would be subject to secondary treatment as well as any hydrocarbon impacted soils, see section below on secondary treatment.

B1.5.3 The processing plant used would depend on the results of the segregation trials, which will identify the most efficient configuration.

Hydrocarbon impacted soils

B1.5.4 Soils contaminated with free-phase hydrocarbons i.e. hotspot at WS224 (RCL 14) are proposed to be subject to bioremediation to reduce contaminant loading to an acceptable level, subject to confirmation by the remediation contractor.

Aerobic composting

B1.5.5 Wood from the landfill is proposed to be treated using aerobic composting to biodegrade the wood into a product suitable for reuse on site and reduce its gassing potential.

B1.5.6 The application of this process would be dependent on the results of the segregation trials indicating there would be sufficient volumes of suitable materials to warrant aerobic composting and would be subject to regulatory agreement.

Filling process

B1.5.7 The current masterplan includes three main areas where the processed material would be reused within the development; to the southeast and across the east of the site and in the northwestern area, see Figure 10 of this document.

B1.5.8 The main area of proposed filling is in the southeast of the former landfill, where re-engineered landfill material would be placed (up to 15m in places) to achieve the required levels. Between 2m to 4m of fill is to be placed across the remaining areas.

B1.5.9 The filling process is likely to comprise of three main elements: blending, compaction; and placement. Further details are provided below.

Blending

B1.5.10 Depending on the nature of the materials produced from waste processing, blending of materials may be possible to form structural and non-structural fill, i.e. plastics would be shredded on-site and mixed with cohesive and granular fill materials using in-situ rotavation equipment to

form a modified class 2C fill suitable for the construction areas or blended with composted materials and used to create non-structural fill within landscape areas.

B1.6 Compaction

B1.6.1 A dynamic compaction (DC) methodology is proposed to improve the geotechnical characteristics of the in-situ wastes and reduce risks from settlement. The re-engineered waste materials would be placed in layers and compacted to reduce settlement. The compaction of recovered materials would reduce the potential for future gas and leachate generation. However, the potential impacts on surrounding land from vibration caused by the compaction process would require consideration by the contractor.

B1.7 Placement

B1.7.1 All soils would be validated prior to reuse to ensure it meets the specified reuse criteria, see Section 9.2 and Annex D of this document. The existing landfill surface would be prepared through stripping of vegetation etc. Where the materials are to be placed onto an existing slope e.g. at the eastern extent of the landfill, the surface will be benched to allow placement of soils. A geotextile marker layer would be placed between the selected arisings (processed materials) and in-situ waste, see Section 5.4 of this document.

B1.7.2 In areas where there is to be follow-on construction of buildings at a later stage the membrane would be placed onto the landfill surface overlain by a temporary capping layer to prevent exposure to contaminants and damage of the membrane due to trafficking of construction vehicles. It is proposed to remove the capping layer locally over the building footprints during piling and construction of the pile caps. The floor slabs would then be cast on the pile caps which would replace the capping layer locally.

B1.7.3 The re-engineered landfill material would likely be placed selectively depending on its properties. For example, material which may still contain some organic matter (i.e. material undergoing secondary treatment) may be placed in areas where gassing of this material would not present a risk, i.e. open space areas. Materials which meet the criteria for cover materials e.g. clay previously used as capping may be used within the cover system.

B1.8 Material tracking

B1.8.1 Key to the excavation and reuse of the processed materials on site is the monitoring and tracking of material movements and volumes. This would be a requirement for both the DfR permit and material reuse under DoW CoP.

B1.8.2 For materials moved under DoW CoP, a FMMP would be prepared by the lead contractor to describe how materials (Made Ground and natural soils) would be stockpiled, handled and reused on site, during construction works. Individual MMPs would be prepared for each phase/work package and maintained by the lead contractor/remediation

contractor which would detail how compliance would be achieved and provide a material tracking system. The material tracking system would be developed by the lead contractor/ remediation contractor and include volumes, locations of excavation and placement, material description, combining of materials and results of chemical and geotechnical testing. The remediation contractor would prepare a materials management verification report for each phase of work.

B1.8.3 A similar auditable record will be created for the works done under DfR and would form an element of the Construction Quality Assurance (CQA) Plan and verification8.

B1.8.4 A rigorous protocol for the tracking of the materials under the two different regimes would be developed during the detailed design for the works.

B1.8.5 Records would also be kept by the lead contractor for materials disposed off-site with copies of all waste transfer documentation. Details of licensed waste carriers and disposal facilities would also be provided.

[8] Environment Agency. Engineering construction proposals for deposit for recovery. 2021.

ANNEX C - SITE MANAGEMENT AND CONTROLS

C1.1 Site establishment

C1.1.1 Site security will be integral to safe management of the works and as a minimum will include securing the construction zones and site compounds with fencing and minimal secured access/egress points. Vehicle access points will include measures such as jet-wash and inspection of vehicles, pre-sheeting etc to prevent vehicles tracking contaminants/soils off-site. Secured access will also allow the recording of vehicle movements onto and off site for the purposes of material tracking. It is likely that there will also be restricted access into the waste management areas to ensure only appropriately trained personnel enter these zones with the required PPE.

C1.1.2 The earthworks have been designed to retain almost all the excavated materials on-site, with engineering fill materials also sourced within the development boundaries, thus internal haul roads will be constructed within the site boundaries for movement of materials. Haul roads will be constructed and maintained to reduce generation of dusts with methods to clean and suppress dust along the routes.

C1.1.3 A main site construction compound, including welfare facilities is proposed to be established to the east of the landfill within the main construction area. The site compound will include a decontamination unit (DCU) appropriate to the contaminants likely to be found in the landfill materials i.e. asbestos, as a minimum this will include clean and dirty ends and a showering facility.

C1.2 Permit requirements

Aside from the re-use of materials on site, other elements of the proposed remediation process will require the relevant permits/licenses/exemptions to be obtained by the contractor. These are likely to include:

a. A discharge consent from the local water company (Thames Water) will be required for treated water collected from excavations to be disposed to sewer;

b. Environmental permit (mobile treatment licence (MTL) for treatment/processing of waste on site e.g. crushing, screening, bioremediation etc; and

c. If JK is to be treated/disposed on site, appropriate notice will be given to the Environment Agency, in accordance with current UK guidance (Ref. 3.3) (PCL 19).

C1.3 Site supervision

C1.3.1 The remediation contractor would be responsible for the verification of the remediation works/materials management/ensuring DfR permit requirements are met. The remediation contractor is expected to have a representative(s) on site full-time overseeing the remediation/materials management and recovery of landfill materials, who has appropriate experience and who is suitably qualified/competent. The CQA plan and guidance identifies the training and experience required by personnel to

oversee the operation of the DfR permit. An independent and appropriately qualified person should inspect the installation of the gas control measures, see Section 5.3 above.

C1.3.2 The remediation contractor would appoint specialist contractors as necessary e.g. asbestos, radionuclide and unexploded ordnance.

C1.3.3 Given the complex nature of the works Luton Rising may choose to appoint an environmental consultant to provide independent scrutiny of the remediation works to ensure specifications are achieved and audit the works on an ongoing basis.

C1.4 Documentation and training

C1.4.1 The appointed remediation contractor will prepare relevant documents to guide the works including the remediation method statement (RMS) and verification plan which will provide a detailed design of the recovery process and re-engineering of materials and include details of the segregation trials.

C1.4.2 Groundwater/gas monitoring plans will also be prepared by the remediation contractor for the pre-remediation works and long-term monitoring post-construction and agreed with the regulators, see **Section 8** of this document.

C1.4.3 Health and Safety issues associated with the remediation works will be dealt with as part of the remediation contractor's health and safety plan to be produced prior to the start of works and communicated to all personnel. The plan will include advice on the requirement and level of personal protective equipment (PPE), and designation of respiratory protective equipment (RPE) zones etc. taking into account specific requirements identified within this strategy.

C1.4.4 Risk assessments will be completed for specific activities in accordance with relevant guidance[9] to control potential environmental impacts, i.e. odour, noise and vibration, bioaerosols. This would also be required for the application for the DfR permit.

C1.4.5 Appropriately qualified personnel would be appointed to undertake the works and all personnel will receive a site induction and training prior to commencement of works to ensure their roles are adequately understood, including:

a. Health and safety requirements;
b. Good house-keeping;
c. Tracking of materials;
d. Tool-box talks;
e. Specific roles regarding environmental issues;
f. Asbestos awareness; and
g. Dealing with unforeseen environmental incidents.

[9] Environment Agency. Risk assessments for your environmental permits. 2022.

C1.4.6 A Code of Construction Practice (CoCP) **Appendix 4.2** of the ES **[TR020001/APP/5.02]** (Ref. 7.5) has been prepared as part of the submission for the DCO which includes detail regarding management of health and safety and monitoring/management of air, noise, vibration, traffic etc, including procedures to be followed should threshold levels be breached. A specific strategy is required to address risks from asbestos which is described in the following section.

C1.5 Asbestos management (PCLs 15,16,31 & 34)

C1.5.1 The DQRA (Ref. 1.3) (**Appendix 17.3**) of the ES **[TR020001/APP/5.02]** concluded that based on the GI data specific advanced remediation of the landfill and scrapyard area for asbestos was not required. However, control measures are required to reduce the potential risk to construction workers and adjacent site users during works.

C1.5.2 The relatively small proportion of asbestos in soils indicates that the most efficient method of managing the asbestos would be via excavation with relevant controls in place. Concentrations of asbestos have been identified above trace levels[10] within the site. As such all excavation in the former landfill and scrapyard would be classed as 'work with asbestos' based on the CAR 2012 (Ref. 7.6) and should be carried out under a specialist asbestos brief.

C1.5.3 The JIWG DST (Ref. 7.7) assessment concluded the work would be NLW, however, it may be prudent to assume some works may be Notifiable Non-Licensed Work (NNLW) so that this is planned as a contingency should certain conditions prevail. This in turn may limit the potential for delay due to the requirements for advance notifications and the associated procedures and assessments required. For NNLW the relevant enforcing body must be notified prior to commencement of the works by the remediation contractor.

C1.5.4 CL:AIRE Interpretation for managing and working with asbestos in soils CAR-SOIL™ (Ref. 7.7) should be followed by the remediation contractor. A plan of work and risk assessments should be completed by the remediation contractor in accordance with the requirements of CAR 2012 (Ref. 7.6) and the appointed remediation contractor will employ an asbestos specialist to advise on the works.

Controls required during earthworks and construction

C1.5.5 Based on the assessment within the DQRA of the asbestos type, and the concentration and conditions in the landfill, the control measures would include:

a. Adoption by the remediation contractor of a methodology which limits / reduces to as low as reasonably practicable the intensity and the potential for the asbestos to deteriorate during the works;

b. Defined working areas with controlled access and egress;

[10] CAR-SOIL defines 'trace' as soil and construction and demolition materials where no fragments of ACMs are isolated and fewer than three fibres are identified during the detailed and extended identification and gravimetric analysis procedures combined, the mass concentration of asbestos fibre is likely to be many orders of magnitude below the 0.0001% w/w Limit of Detection.

c. Dedicated area for decontamination of site workers and waste to be allocated and clearly demarked;

d. All personnel to have had an appropriate level of training and be provided with a sufficient level of information and instruction to complete the task safely;

e. All personnel would be equipped with appropriate PPE and RPE;

f. In the compound area appropriate containment and collection of water runoff would be undertaken to prevent dispersion of asbestos fibres mobilised by water in the drainage system;

g. All landfill material would be kept damp when being handled or when exposed at the surface including in stockpiles. Dust prevention would be proactive (i.e. not reactive). Dust prevention measures would be in place before work commences and surfaces wetted before and during excavation works as necessary. Landfill material would be managed so that it cannot be tracked off-site which will require wheel-washing;

h. Stockpiles of landfill material would be appropriately managed by the remediation contractor to prevent the spread of material, dust generation and potential cross contamination;

i. The contractor would provide appropriate specialist supervision for the duration of the earthworks to inspect landfill materials during the excavation as part of a watching brief. This would include continuous inspection of excavations and stockpiles for visible ACMs;

j. Visual ACMs were most common in the commercial waste type and segregation of this waste type would be undertaken (where readily identifiable in sufficient quantities) such that more detailed inspection can be completed;

k. Following identification of visible ACMs in soil, potential treatment or processing would be considered to facilitate re-use onsite or to provide a cost-effective solution for offsite disposal at suitably licensed facilities;

l. The complete removal of ACM and fibres is not required, and may not be possible, but reasonable efforts to segregate significant amounts of larger visually identifiable ACM may be beneficial;

m. Such treatment could be in the form of ad-hoc hand-picking of visible ACMs or creation of a treatment picking station if significant quantities are identified during the earthworks; and

n. ACMs would be stored in clearly labelled lockable containers, prior to off-site disposal.

C1.6 Monitoring

C1.6.1 Based on the assessment within the DQRA (Ref. 1.3) of the landfill site, the following monitoring would be undertaken:

a. Sampling and representative testing of materials and ACM to be completed during the works as part of the verification process, see **Section 9.2** of this document;

b. Airborne fibre concentration monitoring is expected to be required during works to confirm control limits are not exceeded in the area of excavation including personal monitoring for workers. Reassurance boundary monitoring for asbestos fibres is required to demonstrate low risk to adjacent site users. Monitoring to be completed by an asbestos specialist; and

c. If asbestos fibre concentrations are higher than trigger levels, then amendments to the excavation methodology or additional control measures would be implemented to reduce fibre generation.

C1.7 Procedure for unexpected ACMs

C1.7.1 If during the excavation of waste unexpected ACM conditions or a significant cache are identified the following procedure is recommended:

a. Excavation works in the location to stop;

b. Suspect ACMs to be sampled and covered over;

c. Sample to be tested for asbestos identification, quantification and respirable fibre index;

d. If laboratory analysis proves positive for asbestos fibres, risk assessment is to be undertaken by the remediation contractor to re-evaluate control measures and licensing status, based on the analysis results;

e. Plan of work to be completed and methodology identified for removal of ACM; and

f. Excavation to recommence with appropriate controls in place and management of landfill material in accordance with the plan of work.

C1.8 Post earthworks controls

C1.8.1 Asbestos risks will also have to be managed during excavation for foundations (piles and pile caps). This will require completion of a risk assessment in accordance with CAR 2012 (Ref. 7.6) to identify appropriate control measures and a plan of works. The piling contractor would be supported in this by a specialist asbestos consultant.

C1.8.2 The piling technique will be either continuous flight auger (CFA) or rotary bored; the type will be subject to detailed design. Both are classed as non-displacement techniques and will therefore generate arisings at the surface, which will include material from the landfill, see FWRA (Ref. 1.8) for further details.

C1.8.3 The controls required will be dependent on the risk assessment but would likely include:

a. Use of PPE/RPE as identified by the risk assessment;

b. Use of dampening down measures during the piling works so materials are dampened as they arrive at the surface;

c. Airborne fibre monitoring at piling locations with control measures adapted should trigger levels be exceeded;

d. Watching brief by specialist consultant to identify if visible ACMs are brought to the surface, with hand picking as required; and

e. Relocation of landfill arisings (if ACMs identified) to waste treatment compound, where they will be treated as described below.

C1.9 Cover system

C1.9.1 The landfill material which is excavated to allow the development of the aviation platform would be subject to the measures described in the section above to remove visible ACMs. In practice, it is not possible to remove all asbestos from the soils and therefore low-level concentrations of fibres and fragments of ACM may remain in the material to be reused. A cover system to prevent future contact with any residual asbestos contaminated soils would mitigate the potential risks, providing it is adequately maintained. **Section 5.4** of this document describes the formation of the cover system.

C1.9.2 Soils used within the engineered cover system would be free of visible ACMs and asbestos fibres, confirmed through the verification process. Material reused below the marker layer may contain asbestos fibres, see **Section 9.2** for criteria.

C1.9.3 The position of the marker layers and depth of cover above them should be recorded for maintenance records.

C1.10 Unexploded ordnance (UXO) (PCL 41)

C1.10.1 Most of the waste was deposited during the 1950 to 1980 period but UXO have been identified as a moderate to high risk in wastes which were deposited prior to and during the WWII period. Lower risk has been identified for wastes deposited during the post war period. UXO risk should be specifically addressed by the remediation contractor. The remediation contractor should raise awareness of UXO through tool-box awareness talks, and an emergency response procedure would be established, in accordance with CIRIA guidance, C681 (Ref. 7.8). A watching brief by a specialist UXO contractor will be required for earthworks in older wastes identified as higher risk.

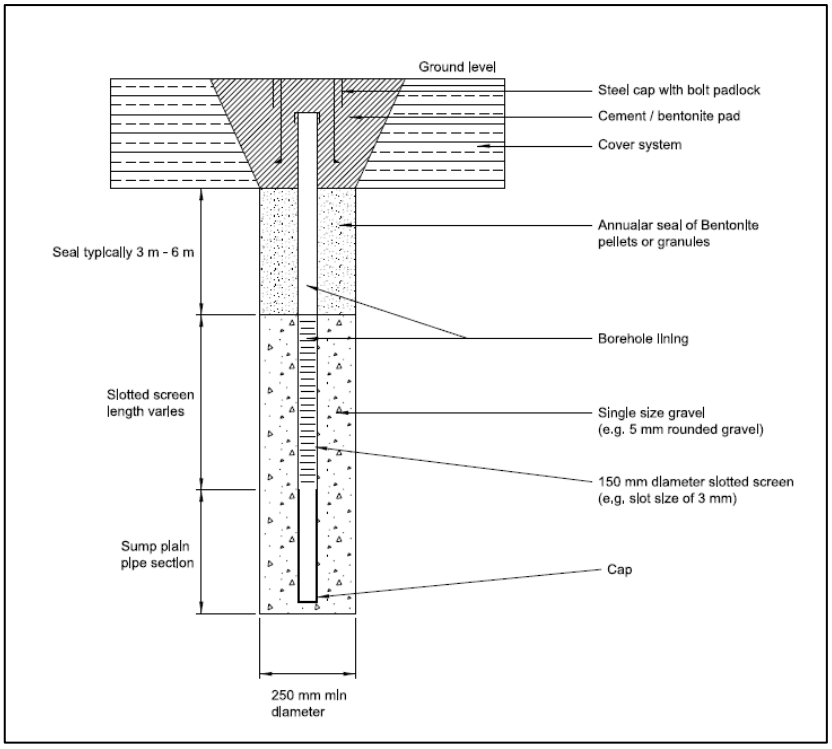
C1.11 Leachate control measures (RCL 15, PCL 20)

C1.11.1 The GI indicated that there are currently limited volumes of leachate recorded in the landfill waste. However, the earthworks have the potential to increase leachate generation or mobilise existing leachate. As a precautionary measure it is proposed to install a leachate control system. This would likely be a series of strategic sump points around the area to be excavated to the required depth (based on GI data) and pipework installed. If significant quantities of leachate are collected these would be pumped out and either passed through the water treatment system prior to disposal to sewer (subject to a discharge consent from Thames Water) or removed to an offsite waste treatment facility.

C1.11.2 The locations and design of the leachate network would need to be agreed with the Environment Agency. For illustrative purposes a

general arrangement is shown in **Figure 9** and assumes that nine wells would be required across the former landfill site based on guidance in LFTGN02 (Ref. 8.1). It is anticipated in the long-term that leachate sumps would not be required and can be decommissioned post construction subject to findings of the groundwater monitoring (see **Section 8.5** of this document). A detail showing typical leachate sump is presented below in Drawing C 1 Detail of Typical Leachate Sump.

Drawing C 1 Detail of Typical Leachate Sump



C1.11.3 The leachate sumps and groundwater/gas monitoring wells will require protecting during the construction works and may require relocating/replacing as necessary.

C1.12 Airborne emissions and odour control measures (PCLs 11, 15, 16, 31, 34, 35, 38)

C1.12.1 The remediation contractor should control and limit dust, air pollution, odour and exhaust emission during the construction works as far as reasonably practicable and in accordance with best practicable means (BPM).

C1.12.2 Control measures would be employed on site for dust, odours, and vapours. These could include:

a. Boundary odour control system, i.e. use of masking or scrubbing agent;

b. Covering of stockpiles to; control odour and potential for contaminated run-off and dust generation especially in dry weather, compacting stockpiles will also reduce dust/odour generation; and

c. Dust suppression measures i.e. covering of waste, dampening of stockpiles and haul roads, reduce drop-heights when loading.

C1.12.3 The remediation contractor would prepare a dust management plan as part of their environmental management plan (EMP). Further detail of measures is provided in the CoCP (Ref. 7.5) **Appendix 4.2** of the ES **[TR020001/APP/5.02]**.

C1.13 Noise and vibration control

C1.13.1 Best practicable means (BPM) measures will be employed to minimise noise (including vibration) arising from construction activities. This could include the following;

a. Maintenance of plant and equipment;
b. Fit noise reducing equipment to machinery;
c. Erect sound barrier if it cannot be addressed through amendments to operational procedures;
d. Restricted operational hours; and
e. Employ appropriate PPE to protect workers.

C1.13.2 Further details are provided in the CoCP (Ref. 7.5) **Appendix 4.2** of the ES **[TR020001/APP/5.02].**

C1.14 Bird strikes

C1.14.1 Luton Airport has a 15km safeguarding zone around the aerodrome to ensure no developments/activities within the zone can have an adverse effect on the airport's operation. The proposed earthworks have the potential to impact the airport's operation if the movement of wastes attract birds to congregate, which can cause a potential hazard for aircraft. This is considered a low risk, however as a precaution, control methods would be established to modify bird behaviour to encourage them to avoid the area which could include:

a. Using bio-acoustic technology, sonic cannons, recorded predator calls, and other noise generators to disrupt birds;
b. Using lasers at dawn and dusk to simulate predators and scare birds away; and
c. Scarecrow Technology which is already in use at Luton Airport and could be extended to cover the development area.

C1.15 Incident reporting

C1.15.1 Environmental incidents can occur due to accidents, uncontrolled releases of chemicals /fuels stored on site or due to mobilisation of contaminants in the landfilled wastes. It is expected the remediation contractor would prepare an incident response plan for such occurrences.

C1.16 Earthworks on the landfill

C1.16.1 The specialist remediation contractor would produce a detailed method statement for the watching brief for the earthworks on the landfill as previously unidentified contamination may be encountered. The

individual responsible for the watching brief and inspection of materials is to be competent and experienced in the identification of potential evidence of contamination. Daily site inspections should be completed and records made, the anticipated information is detailed in the CoCP (Ref. 7.5) **Appendix 4.2** of the ES **[TR020001/APP/5.02]**.

C1.17 Unexpected contamination

C1.17.1 A set of protocols would be established by the remediation contractor describing the actions to be taken in the event of unexpected contamination or much higher concentrations of known contaminants being identified during the remediation/earthworks. A draft set of protocols for ACMs is described in above.

C1.17.2 This would ensure any unexpected contamination is appropriately identified, recorded and treated. This process would be documented and verified consistent with the verification reporting requirements set out in **Section 9.4** of this document.

C1.17.3 If ground conditions are encountered that are not in keeping with the data or if visual and olfactory evidence of contamination is encountered, then works would be stopped and the following approach taken:

Stop – Analyse – Assess – Reuse (or treat and reuse) – Validate.

C1.17.4 Unexpected contamination may be identified by:

a. Odour, for example hydrocarbons and chlorinated hydrocarbons; and
b. Visual evidence for example asbestos, free-phase hydrocarbons etc.

C1.17.5 It is recognised that soils may be contaminated without any obvious visual or olfactory evidence; however, an extensive series of ground investigations has been completed at the site. If markedly different materials are exposed then additional testing may be required to determine whether the existing risk assessment is appropriate. Given the heterogenous nature of the landfilled materials this is entirely feasible.

C1.17.6 Works would be stopped, additional soil or groundwater samples taken for testing and the risks assessed by a suitably qualified person. Should mitigating or remedial action be required to render the materials suitable then further treatment would be carried out on the materials.

C1.17.7 The regulator would be informed in writing of the scale and area of any unknown contamination encountered and the approach for mitigation/remediation works, validation and reporting agreed.

C1.18 Communication strategy

C1.18.1 The applicant or a nominated representative would prepare a Community Engagement Plan with the overall approach to community engagement, general enquiries and complaints procedures. Further detail is provided in the CoCP (Ref. 7.5) **Appendix 4.2** of the ES **[TR020001/APP/5.02]**.

C1.19 Regulatory approvals

C1.19.1 The DCO permission will include requirements that must be met for which regulatory sign-off will be necessary prior to the Proposed Development being occupied. This will require the relevant planning authority to review the documentary evidence for verification of remediation works and provide written confirmation that remediation objectives have been achieved to their satisfaction. The Environment Agency would be consulted on matters relating to its functions.

C1.19.2 A verification plan would be produced by the lead contractor. The document would describe the criteria for completion of the remediation and/or surrender of permits or discharge of requirements/conditions. This would be agreed with the LBC contaminated land officer/Environment Agency as part of future consultation regarding the remediation strategy/methodology prior to start of remediation works.

C1.19.3 A series of verification reports would be required to obtain regulatory sign off for the bulk earthworks of the landfill remediation to enable discharge of associated requirements/conditions (see **Section 9** of this document).

ANNEX D - VERIFICATION PROCEDURES

D1.1 Soil remediation criteria

D1.1.1 For materials used in the formation of the cover system, landscaping and reused as general fill below the cover system, the following typical criteria may be appropriate, see **Table D 1**. These criteria will be reviewed and may be revised as part of the detailed design of the works and specified in the Remediation Strategy.

D 1 Soil remediation criteria

Material Type	Description/Location	Human Health Criteria	Soil Criteria protective of Groundwater
General Fill	Recovered landfill materials placed beneath the engineered cover system below the geomembrane marker layer in areas of fill.	Generic assessment criteria (GAC) for commercial/industrial land use. Asbestos <1% fibres and no visible ACMs (i.e. below hazardous waste limit).	Soil Leachate criteria based on UK DWS or criteria based on WAC if placed under an environmental permit (to be derived by the remediation contractor for the permit application).
Landscaping Fill	Recovered materials used within landscaping	GAC for public open space (POS) – female 0-6 years. No asbestos detected. Higher organic content could be appropriate in areas of soft landscaping.	
Selected Arisings	Recovered materials used within the cover system, see **Figures 5** and **6** of this document.	GAC for POS – adult maintenance. No asbestos detected. Organic content <4% [11] [12]in areas of hard landscaping. Higher organic content could be appropriate in areas of soft landscaping.	
Clay Fill	Clay materials selected from recovered materials, see **Figures 5** and **6** of this document.		
Imported Materials – pavement make-up	Imported materials used within cover system, see **Figure 5** of this document.	GAC for POS – adult maintenance. No asbestos detected.	

[11] British Standards Institution (BS). Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings. BS8485:2015+A1:2019. 2019.
[12] CL:AIRE. A Pragmatic Approach to Ground Gas Risk Assessment. Research Bulletin 17. (RB17).2012.

Material Type	Description/Location	Human Health Criteria	Soil Criteria protective of Groundwater
		Materials to meet geotechnical specifications (Ref. 9.1).	
Imported soils - topsoil	Imported soils used within cover system, see **Figure 6** of this document.	GAC for POS - female 0-6 years. No asbestos detected. Topsoil to meet BS3882:2015 (Ref. 5.4) and landscape architects' specification.	

D1.2 Soil sampling frequencies

D1.2.1 Sampling rate would be agreed with the regulators and included in documentation submitted for the deposit for recovery permit/MMP. However, based on previous schemes, likely testing rates could be as follows:

a. Recovered material/general fill 1:1000m^3;

b. Cover materials/selected arisings/landscaping 1:250m^3; and

c. Imported topsoil 1:5000m^3 (in accordance with BS3882 (Ref. 5.4)).

D1.2.2 Sampling frequency is subject to variation during the works dependent upon source of the materials, its homogeneity and analyses results.

D1.3 Verification procedure for cover system

D1.3.1 The main elements are likely to be:

a. Verification of soil profile – topographical survey prior to placement, to confirm thickness of impermeable layer and post placement of surface layer;

b. Photographic evidence;

c. Site diary;

d. Procedures for record keeping and selection of appropriate materials for location and depth of placement;

e. Supervision by appropriately qualified engineer, attendance to be appropriate to volume of material being re-laid;

f. Materials to meet reuse criteria as specified and geotechnical properties, records kept of all chemical/geotechnical test results, and material tracking; source, quantity, dates etc;

g. Hand-dug inspection pits and verification sampling post placement; and

h. Record kept of unsuitable materials and action taken.

D1.4 Verification of gas protection

D1.4.1 Verification procedure would be in accordance with CIRIA C735 (Ref. 9.3) and be completed by an independent third party. A verification plan would be developed by the third-party and agreed with the regulators. This is likely to include a programme of visual inspections and integrity testing as below:

a. Inspection of ground prior to placement;
b. Inspection of membrane in particular; laps, joints, sealing around penetrations etc;
c. Inspection of venting system;
d. Inspection of integrity;
e. Confirmation products installed meet specification; and
f. Review of post installation conditions.

D1.4.2 The guidance recommends early engagement with the consultant to ensure the verifier is present throughout the entire process such that issues can be addressed early in the programme.

D1.4.3 The gas protection should be installed by a suitably qualified installation workforce as dictated by the gas regime and complexity of the design.

Due to the phasing of the works a verification report would likely be produced for the whole site, with certificates for each building to allow occupation.

D1.5 Verification reporting

D1.5.1 The verification reports would provide a detailed account and photographic evidence of the on-site operations (remediation and validation) as well as interim assessment of the ground and groundwater conditions on site. Consignment notes would be provided for all materials excavated and removed off site, and tracking records for those processed and reused. The report would be produced by an appropriately qualified engineer/environmental consultant. The report would include sufficient lines of evidence to confirm the remediation objectives have been achieved. This will include, but not be limited to, the following:

a. The details and roles of contractor / sub-contractors involved in the remediation work;
b. A summary of the original site conditions, with reference to the original site;
c. Investigations and assessments;
d. A description of the remedial works;
e. A statement of the remediation objectives, and how these have been achieved;
f. The CSM for the remediation and reference to the lines of evidence which demonstrate that the pollutant linkages have been broken or mitigated;

g. Plans showing the remediated (i.e. hotspot excavations) and validated areas;
h. Tracking sheets and volumes of materials processed and reused and their final location on site;
i. Site records; engineers daily records, visual inspections, non-conformance and actions taken monitoring records and results;
j. Photographic record of the remedial works;
k. Quality assurance data for construction of the cover system;
l. Records of consultations with regulators, as required;
m. Details of any required deviations from the strategy;
n. Records of excavated materials disposed/recycled off-site including a description of the material, chemical quality, weights or volumes, as well as waste transfer and consignment notes;
o. Validation chemical test certificates for groundwater, gas and leachate monitoring and treated waters disposed to sewer;
p. Validation chemical tests certificates for the imported and/or site-derived materials, as well as their origin and location on site;
q. Validation geotechnical test certificates for site-won and imported materials;
r. Validation sampling plans and chemical test certificates for any hotspot excavations/unexpected contamination excavated and removed across the site;
s. ‘as-built’ plans and sections;
t. Justification for any deviations from the agreed plan;
u. Any post remediation arrangements that require further management; and
v. A final summary of the ground conditions and groundwater quality across the site, including any information on residual contamination and ongoing monitoring.