
13. MATERIAL RESOURCES AND WASTE

13.1 Introduction

13.1.1 This chapter assesses the potential impacts resulting from the use of material resources associated with the works and waste management in the construction, demolition and excavation (CD&E) phases of the Scheme. It also assesses potential embodied carbon impacts associated with material resources¹ to be used and the management of waste.

13.1.2 This assessment does not make reference to impacts associated with the offsite manufacture of products. These stages of the products' or material resources' life-cycles are outside the boundaries of this assessment due to the range of unknown variables associated with extraction and manufacturing processes.

13.1.3 In October 2011, Highways England (HE) issued the Interim Advice Note (IAN) 153/11 (Guidance on the Environmental Assessment of Materials Resources) (Ref 13-2). It outlines an approach for the consideration of material resources use and waste as part of statutory and non-statutory Environmental Impact Assessment (EIA) process for new construction, improvement and major maintenance. The terms 'material resources' and 'waste' are explained more fully below:

- Material resources include primary raw materials, such as aggregates and minerals, and manufactured construction products which include recycled and secondary aggregates. Many material resources originate offsite, purchased as construction products, and some arise onsite such as excavated soils or recycled road planings; and
- Waste is defined in Article 1(a) of the European Waste Framework Directive 2008/98/EC (Ref 13-3) as 'any substance or object in the categories set out in Annex I which the holder discards or intends to discard or is required to discard'. The term 'holder' is defined as the producer of the waste or the person who is in possession of it and

¹ The term 'materials' was introduced within the Design Manual for Roads and Bridges ('DMRB') Volume 11 in August 2009 (Ref 13-1) and embraces the main material resources required to construct the Scheme and construction-related waste.

'producer' is defined as anyone whose activities produce waste. Waste can be further classified as hazardous, non-hazardous or inert.

13.2 Regulatory and policy framework

13.2.1 This impact assessment has been undertaken in accordance with current international and national legislation, and national, regional and local plans and policies relating to materials resources and waste in the context of the Scheme. A summary of relevant legislation and policies, the requirements of these policies and Scheme response has been provided below.

13.2.2 Of particular relevance is the National Road and Rail Networks: National Policy Statement (NN NPS) (Ref 13-4). Section 5.42 of the NN NPS provides that:

'The applicant should set out the arrangements that are proposed for managing any waste produced. The arrangements described should include information on the proposed waste recovery and disposal system for all waste generated by the development. The applicant should seek to minimise the volume of waste produced and the volume of waste sent for disposal unless it can be demonstrated that the alternative is the best overall environmental outcome.'

The Secretary of State should consider the extent to which the applicant has proposed an effective process that will be followed to ensure effective management of hazardous and non-hazardous waste arising from the construction and operation of the proposed development. The Secretary of State should be satisfied that the process sets out:

- *Any such waste will be properly managed, both onsite and offsite;*
- *The waste from the proposed facility can be dealt with appropriately by the waste infrastructure which is, or is likely to be, available. Such waste arisings should not have an adverse effect on the capacity of existing waste management facilities to deal with other waste arisings in the area; and*

- *Adequate steps have been taken to minimise the volume of waste arisings, and of the volume of waste arisings sent to disposal, except where an alternative is the most sustainable outcome overall.'*

13.2.3 The delivery of the mitigation measures set out in the mitigation section of this chapter will support adherence to the requirements of the NN NPS through the application of the waste hierarchy. The Scheme will apply the waste hierarchy by moving waste management practices as far up the hierarchy as practicable, and by minimising disposal and maximising reuse and recycling.

Table 13-1 Material Resources and Waste additional regulatory and policy framework

Policy/ Legislation	Summary of requirements	Scheme response
EU Landfill Directive (Directive 1999/31/EC on the landfill of waste) (Ref 13-2)	Establishes a framework for the management of waste across the European Community. It also defines certain terms, such as 'waste', 'recovery' and 'disposal', to ensure that a uniform approach is taken across the EU.	A Preliminary Site Waste Management Plan (SWMP) has been developed for the Scheme and will be refined and updated as the design and the Scheme progresses. The Preliminary SWMP considers how the waste hierarchy can be applied and details how all wastes are to be managed. The Preliminary SWMP also provides a framework for checking compliance with waste legislation and the Duty of Care.
EU Waste Framework Directive (Directive 2006/12/EC on waste) (Ref 13-4)	The Waste Framework Directive (WFD; Directive 2006/12/EC on waste) contains the definition of waste. This definition is used to establish whether a material is a waste or not. It sets targets for recycling non-hazardous construction and demolition waste (70% by weight by 2020: Article 10).	A Preliminary SWMP has been developed for the Scheme and will be refined and updated as the design and the Scheme progresses. The Preliminary SWMP considers how the waste hierarchy can be applied and details how all wastes are to be managed. The Preliminary SWMP also provides a framework for checking compliance with waste legislation and the Duty of Care. Recycling and reuse targets will be developed.
The Clean Neighbourhoods and Environment Act 2005 (Ref 13-5)	It is the responsibility of everyone working in the construction industry to ensure that all waste is disposed of properly. All employees need to be made aware that if they are tasked with waste disposal this must be carried out in	A Preliminary SWMP has been developed for the Scheme and will be refined and updated as the design and the Scheme progresses. The Preliminary SWMP considers how the waste hierarchy can be applied and details how all wastes are to be managed.

Policy/ Legislation	Summary of requirements	Scheme response
	accordance with the law, or they risk being fined	<p>Training (e.g. Toolbox Talks) will be provided to all persons working on site to ensure that they are aware of their responsibilities and how waste produced by the Scheme must be managed and disposed of.</p> <p>The Scheme will participate in the Considerate Constructors Scheme, aiming to achieve the highest practicable score, monitored against a Code of Construction Practice, designed to encourage best practice beyond statutory requirements.</p>
Environmental Permitting (England & Wales) Regulations 2007 (Ref 13-6) and 2010 (Ref 13-7)	The Environmental Permitting (England and Wales) Regulations (EPR) were created to standardise environmental permitting and compliance in England and Wales to protect human health and the environment.	The Scheme will comply with the requirements of the EPR Regulations in the disposal of waste. This will be achieved by the Scheme ensuring all relevant permits and consents are in place and compliance is maintained. The Preliminary SWMP will be used to achieve this.
The Hazardous Waste (England and Wales) Regulations 2005, Statutory Instrument 2005 No. 894 (Ref 13-8), and 2009	Under the Hazardous Waste Regulations 2005 Regulations, <i>'it is an offence to produce hazardous waste at premises, or remove that waste from premises, unless those premises are either registered with the Environment Agency or are exempt.'</i>	A Preliminary SWMP has been developed for the Scheme and will be refined and updated as the design and the Scheme progresses. The Preliminary SWMP considers how the waste hierarchy can be applied and details how all wastes are to be managed. It also incorporates the findings of the Ground Investigation undertaken on site by including contaminated soils.

Policy/ Legislation	Summary of requirements	Scheme response
amendment SI 507 (Ref 13-9)		The Preliminary SWMP also provides a framework for checking compliance with waste legislation and the Duty of Care.
Waste (England and Wales) Regulations 2011 (Ref 13-10), and 2012 amendment (Ref 13-11)	The Waste Regulations transpose the Waste Framework Directive into English law. The Regulations require businesses to confirm that they have applied the waste management hierarchy, introduce a new waste hierarchy permit condition and a two-tier system for waste carrier and broker registration.	A Preliminary SWMP has been developed for the Scheme and will be refined and updated as the design and the Scheme progresses. The Preliminary SWMP considers how the waste hierarchy can be applied and details how all wastes are to be managed. The Preliminary SWMP also provides a framework for checking compliance with waste legislation and the Duty of Care.
Waste Strategy for England 2011 (WSE 2011) (Ref 13-12)	This strategy builds on the Waste Strategies for 2000 and 2007. The strategy contains actions and commitments, which set a clear direction towards a zero-waste economy.	The assessment has been carried out against the context of the WSE 2011 and as a minimum, the targets in this Strategy will be met via the implementation of the Preliminary SWMP. The assessment also applies the waste hierarchy with a focus on resource efficiency. The Scheme aims to reuse as much site won material as possible. Any material that cannot be reused on site will be sent for beneficial reuse (e.g. at Wallasea) and will only be disposed of at landfill if unsuitable or use elsewhere (e.g. contaminated soils) or no alternatives can be found.
National Planning Policy	Sets out detailed waste planning policies. States that ' <i>when determining planning</i>	The assessment also applies the waste hierarchy with a focus on resource efficiency. The Scheme aims to reuse as

Policy/ Legislation	Summary of requirements	Scheme response
for Waste (Department for Communities and Local Government, 2014) (Ref 13-13)	<p><i>applications for non waste development, local planning authorities should ensure that</i></p> <ul style="list-style-type: none"> • <i>the likely impact of proposed, non-waste related development on existing waste management facilities, and on sites and areas allocated for waste management, is acceptable and does not prejudice the implementation of the waste hierarchy and/or the efficient operation of such facilities;</i> • <i>the handling of waste arising from the construction and operation of development maximises reuse/recovery opportunities, and minimises off-site disposal.'</i> 	much site won material as possible. Any material that cannot be reused on site will be sent for beneficial reuse (e.g. at Wallasea) and will only be disposed of at landfill if unsuitable or use elsewhere (e.g. contaminated soils) or no alternatives can be found.
Waste Management Plan for England (DEFRA, Dec 2013) (Ref 13-14)	The plan confirms the UK's commitment to meet its target under the Waste Framework Directive of recovering at least 70% by weight, of construction and demolition waste.	The assessment has been carried out against all current relevant information and policies. As the plan is a compilation of existing information and policies, the assessment addresses the requirements of the Waste Management Plan for England.
National Planning Policy Framework	The NPPF does not contain specific waste policies.	No specific waste policies are included within the NPPF. As such the Scheme makes no direct response to the NPPF in terms of waste.

Policy/ Legislation	Summary of requirements	Scheme response
(NPPF) March 2012 (Ref 13-15)		
National Planning Policy for Waste, Department for Communities and Local Government, 2014 (Ref 13-16)	This document sets out detailed waste planning policies, specifically providing guidance on the processes to be considered to ensure adequate provision of waste management facilities.	By providing a waste forecast, the Scheme is supporting the local planning authorities in planning and making adequate provision for wastes likely to arise within their jurisdictions.
The Definition of Waste: Development Industry Code of Practice, Contaminated Land: Applications in Real Environments (CL:AIRE), 2011 (Ref 13-17)	This Code of Practice (CoP) provides best practice for the development industry to use when assessing if materials are classified as waste, or not, and determining when treated waste can cease to be waste for a particular use.	A Preliminary SWMP has been developed for the Scheme and will be refined and updated as the design and the Scheme progresses. The Preliminary SWMP considers how the waste hierarchy can be applied and details how all wastes are to be managed. Any reuse of materials on site will consider using the CoP.
The London Plan: the spatial development	The London Plan outlines the Mayor's commitment to making better use of waste and its management in an attempt to reduce	A Preliminary SWMP has been developed for the Scheme and will be refined and updated as the design and the Scheme progresses. The Preliminary SWMP considers how

Policy/ Legislation	Summary of requirements	Scheme response
strategy for London consolidated with alterations since 2011 (Ref 13-18)	London's impact on climate change. The London Plan describes waste as a valuable resource that can be exploited for London's environmental, economic and social benefit.	the waste hierarchy can be applied and details how all wastes are to be managed. Waste and materials will be transported to and from site by water as far as possible (either by ships or barges). The Reference design has been produced being mindful of waste minimisation and includes elements such as pre-cast concrete primary lining tunnel segments.
The Greater London Authority Sustainable Design and Construction, Supplementary Planning Guidance, Mayor of London, 2014 (Ref 13-19)	The Greater London Authority (GLA) Sustainable Design and Construction Supplementary Planning Guidance (SPG) was published in April 2014. The Sustainable Design and Construction SPG provides additional guidance on Policy 5.3 Sustainable Design and Construction, as well as a range of other policies, of the London Plan.	A Preliminary SWMP has been developed for the Scheme and will be refined and updated as the design and the Scheme progresses. The Preliminary SWMP considers how the waste hierarchy can be applied and details how all wastes are to be managed.
Joint Waste Development Plan for the East London Waste Authority (ELWA) Boroughs, London Borough	Under this partnership, the ELWA and its four constituent Boroughs are working together to manage the waste apportionment targets, as set by the London Plan.	A Preliminary SWMP has been developed for the Scheme and will be refined and updated as the design and the Scheme progresses. The Preliminary SWMP considers how the waste hierarchy can be applied and details how all wastes are to be managed.

Policy/ Legislation	Summary of requirements	Scheme response
of Barking & Dagenham, London Borough of Havering, London Borough of Newham, London Borough of Redbridge, 2012 (Ref 13-20)		
Newham 2027: Newham’s Local Plan – The Core Strategy, London Borough of Newham, 2012 (Ref 13-21)	<p>With regards to waste, Policy INF3 Waste and Recycling states that waste produced within the London Borough of Newham should be managed in accordance with the waste hierarchy.</p> <p>Also, transport of waste materials should first consider rail and waterway options over road transport routes.</p>	<p>A Preliminary SWMP has been developed for the Scheme and will be refined and updated as the design and the Scheme progresses. The Preliminary SWMP considers how the waste hierarchy can be applied and details how all wastes are to be managed.</p> <p>Waste and materials will be transported to and from site by water as far as possible (either by ships or barges).</p>
Royal Greenwich Local Plan: Core Strategy with Detailed Policies, Royal Borough of Greenwich, 2014 (Ref 13-22)	<p>Sustainability measures will have to be incorporated into new developments to reduce waste, water and energy consumption. Policy DH1 requires that all developments demonstrate evidence of waste reduction and use of recycled materials.</p>	<p>A Preliminary SWMP has been developed for the Scheme and will be refined and updated as the design and the Scheme progresses. The Preliminary SWMP considers how the waste hierarchy can be applied and details how all wastes are to be managed.</p> <p>Waste and materials will be transported to and from site by water as far as possible (either by ships or barges).</p>

Policy/ Legislation	Summary of requirements	Scheme response
	Policy IM5: Freight, requires that the movement of construction and demolition materials by water is maximised.	
Core Strategy Development Plan Document 2025, London Borough of Tower Hamlets, 2010 (Ref 13-23)	The strategic objective is to plan for and manage the borough’s waste efficiently, safely and sustainably, by minimising the amount of waste produced, maximising recycling, and managing non-recyclable waste using treatment methods other than landfill. Policy SP05 1c requires all developments to reduce and reuse waste from construction and demolition, and 1d states that the borough will be “supporting developments that use recycled materials”.	<p>A Preliminary SWMP has been developed for the Scheme and will be refined and updated as the design and the Scheme progresses. The Preliminary SWMP considers how the waste hierarchy can be applied and details how all wastes are to be managed.</p> <p>Waste and materials will be transported to and from site by water as far as possible (either by ships or barges).</p> <p>Recycled materials will be incorporated into the design whenever feasible.</p>

13.3 Methodology

General approach

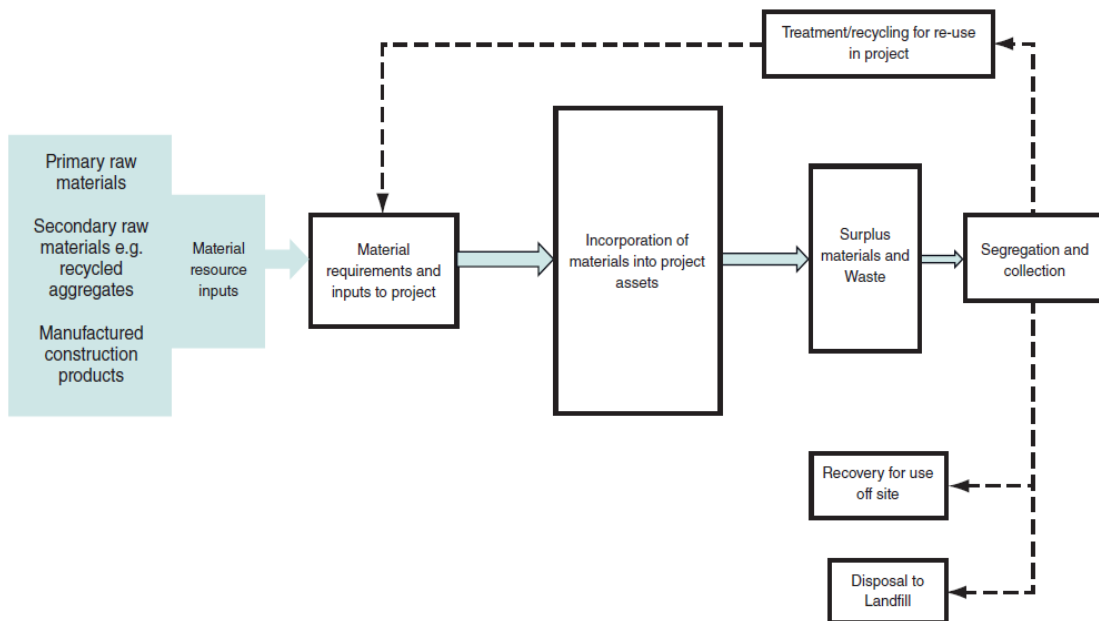
- 13.3.1 This assessment identifies the environmental impacts associated with material resources use and waste, waste arisings from the different phases of the Scheme and the measures which will be implemented to mitigate the impacts.
- 13.3.2 A detailed assessment has been undertaken, as opposed to a simple assessment, in accordance with Design Manual for Roads and Bridges and IAN 153/11 which states that:
- '[a detailed assessment] is most likely to be used for complex capital maintenance, improvement and large new construction projects.'*
- 13.3.3 Professional judgement has been used to determine that the Scheme is a 'large new construction project' given the projected capital costs of the works.
- 13.3.4 Throughout this chapter, 'material resources' will be addressed first, followed by 'waste'.
- 13.3.5 There are no accepted criteria for determining the value (sensitivity) of material resources and waste (including waste infrastructure). In the absence of such guidance, the materials assessment has been undertaken using professional judgement. The assessment criteria used for assessing environmental value (or sensitivity) and typical descriptors is included in Table 13-4.
- 13.3.6 In order to present all material resources and waste quantifications in tonnes, conversion factors from the Waste Resources Action Programme's ('WRAP's') NetWaste Tool (Ref 13-25) (for material resources) and the Environment Agency (Ref 13-26) (for waste) have been used when necessary.
- 13.3.7 Professional judgement has been applied to determine the likely significance of effects.

Material resources

13.3.8 Material resources include primary raw materials, such as aggregates and minerals, and manufactured construction products which include recycled and secondary aggregates. Many material resources originate offsite, purchased as construction products, and some arise onsite such as excavated soils or recycled road planings.

13.3.9 The way in which material resources are used throughout the construction process is known as the Material Resource Flow. A simplified flow diagram representing the flow of material resources and the management of waste is shown at Figure 13-1:

Figure 13-1 Scheme material flow diagram



13.3.10 This assessment of materials covers the requirements for construction related material resources and their transportation. There are no obvious environmental receptors for material resources in the way that there are for other topic areas. However, it has been possible to quantify the use of typical key material resources required for the Scheme in absolute terms, for example, tonnes of primary aggregate, concrete and steel.

13.3.11 As noted above, there is no standard criteria for determining the value (sensitivity) or resource for material resources, and therefore the material resources assessment has been undertaken using professional judgement. The sensitivity of material resources used has been based on

the availability of the material resource and whether its use in the Scheme could result in significant depletion. For example, high sensitivity might pertain to a rare material resource that is not available locally or only available locally in very limited amounts. The scarcity of the required material resource could therefore lead to it being significantly depleted. Conversely, a low sensitivity of material resource may be considered as one that is very common locally or that primarily comprises reused, recycled or recovered material resources such that its use would contribute to meeting waste reduction targets and the avoidance of the use of primary material resources.

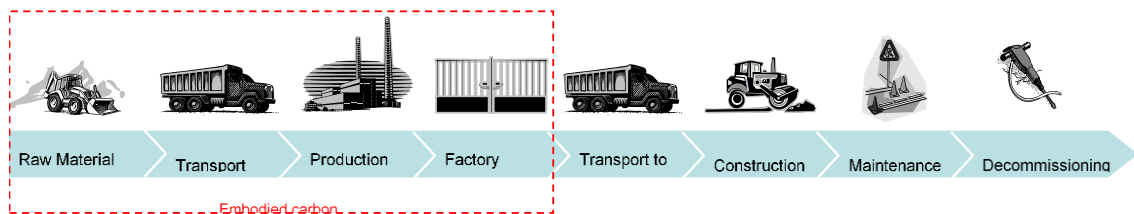
- 13.3.12 In the absence of local material resources information, the assessment of key material resources to be used has been made against UK-wide material demand/procurement data. This presents a reasonable worst case scenario for material resources as the Scheme will be applying a market-wide procurement policy, allowing international markets to be accessed if necessary.
- 13.3.13 UK-wide material demand/procurement data has been gathered for the key material resources likely to be required for the Scheme. Data for concrete and aggregates has been taken from the Mineral Products Association (Ref 13-34). Data for steel has been taken from the International Steel Statistics Bureau (ISSB) (Ref 13-27).
- 13.3.14 Potential lorry movements associated with the key material resources have been assessed quantitatively and the subsequent effects on the vehicular capacity of the existing highways network have been assessed in the Preliminary Transport Assessment.
- 13.3.15 The potential barge and ship movements associated with the key material resources have been presented quantitatively and the subsequent effects on the river capacity assessed.
- 13.3.16 It has been possible to assign a proxy for the environmental impacts of material resources through the calculation of the embodied carbon dioxide associated with the specific material resources used for the Scheme. This is explained further in the section below.

Embodied carbon content of materials

- 13.3.17 For the purposes of this assessment, the embodied carbon dioxide (CO₂) emissions of a material is the total carbon dioxide equivalent emissions released prior to it leaving the factory gate. 'Carbon' is used as short hand

to refer to the basket of six greenhouse gases (GHGs) recognised by the Kyoto Protocol. GHGs are converted to carbon dioxide equivalents (CO_{2e}) based on their global warming potential per unit as compared to one unit of CO₂. This would normally include extraction or harvesting, the manufacturing process and any pre-distribution transportation as shown in Figure 13-2. It does not include the carbon dioxide emissions associated with transport from the factory gate to site, construction activities, maintenance or decommissioning. The boundary condition used for this assessment is known as ‘cradle-to-gate’.

Figure 13-2 Diagrammatic representation of the measure of embodied carbon in relation to material life cycle



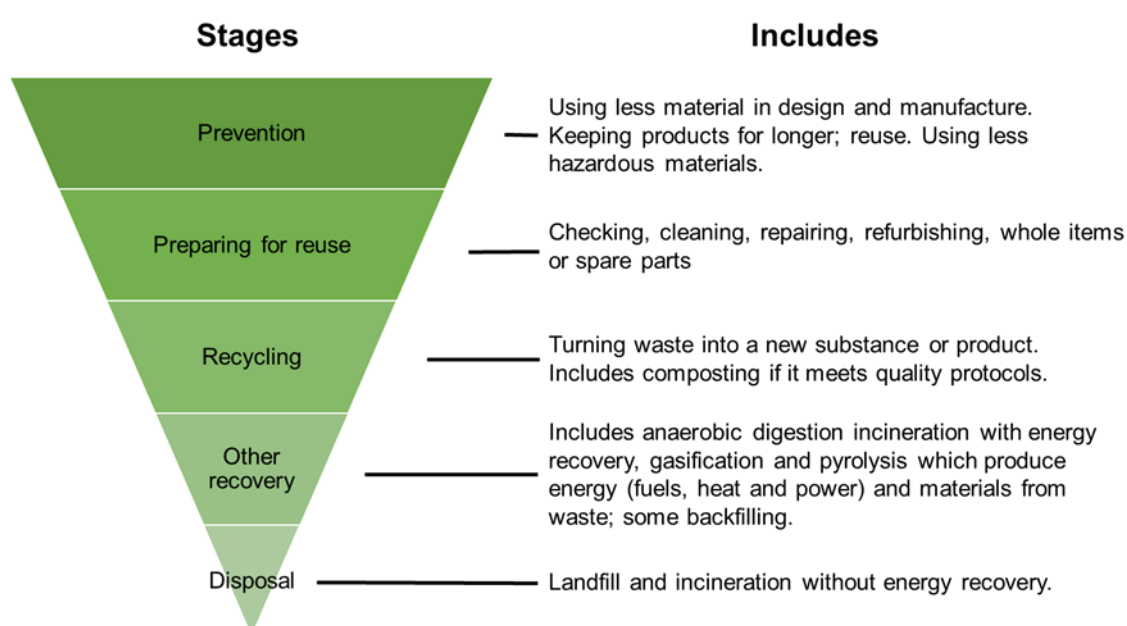
Waste

- 13.3.18 The Scheme will result in the production of waste arising from a number of activities, including damage to materials and products, off-cuts and packaging. The potential environmental impacts for waste are associated with its production, storage, transport, processing and disposal.
- 13.3.19 Waste arisings primarily from tunnel boring and the ‘cut-and-cover’ required by the Scheme have been forecast using reference design information and are presented in the Preliminary Site Waste Management Plan (Appendix 13.B).
- 13.3.20 As the development of the design continues the accuracy and extent of the figures for material resources use and waste quantifications will improve, supporting the effective planning and management of any wastes likely to arise from the Scheme.
- 13.3.21 The sensitivity of waste arisings has been based on the capacity of waste management infrastructure within the study area (see section 13.4.7 below) for any waste arisings from the Scheme. Assessing the scale and significance of the impacts associated with the production and management of waste has been based on a combination of the waste management methods identified and the effects that forecast waste arisings will have on available waste management infrastructure. In this

way, the assessment reflects both the quantities of waste produced (relative to the capacities of the available waste infrastructure) and the position within the waste hierarchy of the chosen waste management methods.

- 13.3.22 Application of the waste hierarchy (shown in Figure 13-3) provides a protocol to reduce waste generation at source and reduce the volume of waste sent to landfill (by promoting reuse and recycling).

Figure 13-3 Waste Hierarchy



- 13.3.23 The waste hierarchy ranks waste management options according to what is best for the environment. It gives priority to prevention, then preparing waste for reuse, then recycling, then recovery, and last of all disposal (e.g. landfill).

- 13.3.24 Another consideration has been the 'proximity principle', which advocates that waste should be disposed of (or otherwise managed) close to the point at which it is generated, thus aiming to achieve responsible self-sufficiency at a regional or sub-regional level.

- 13.3.25 The available waste management infrastructure has been considered the primary receptor for waste and the impacts on the capacity of these sites within reasonable proximity of the Scheme has been assessed. The production of large quantities of waste within a short period of time, through the production of a large volume of concrete, for example, could have adverse effects on waste infrastructure by reducing the capacity to

manage other waste streams. For some types of waste management infrastructure, such as landfill, this impact can be permanent via a permanent reduction in landfill void capacity. For other types of infrastructure, such as waste transfer stations, material recovery facilities or recycling sites, the impacts would be temporary. Identifying recycling options for wastes produced by the Scheme will be considered to have a lower environmental impact than sending waste to landfill.

- 13.3.26 Potential lorry movements associated with waste arisings have been assessed quantitatively and the subsequent effects on the vehicular capacity of the existing highways network have been assessed in the Preliminary Transport Assessment.
- 13.3.27 The potential barge and ship movements associated with waste arisings have been assessed quantitatively and the subsequent effects on capacity on the river.
- 13.3.28 Onsite effects have also been considered during the assessment of impacts associated with waste.

Consultation

- 13.3.29 Consultation has been undertaken as part of the assessment to:
- define the targets in the London Borough of Tower Hamlets, Royal Borough of Greenwich and London Borough of Newham waste policies;
 - discuss waste management aspirations for the proposed development and set targets; and
 - determine a formal position with regards to any future waste facilities in the region and implications on waste management at the proposed development.

The study area

- 13.3.30 A specific study area for the materials assessment has not been identified as a whole market approach will be used to procure materials required for the scheme. Efforts will be made to source materials locally whenever possible.

- 13.3.31 Many materials will originate on-site, such as excavated soil. Other material resources used within construction will be sourced off-site and their environmental impact will also be taken into account.

Methodology for establishing baseline conditions

Establishing the existing baseline

- 13.3.32 Baseline conditions for material resources (including construction materials) have been established through desktop research. As a specific study area has not been set for material resources, the quantitative assessment has been based on available material resources data for the UK.
- 13.3.33 Baseline conditions to support the quantitative assessment of waste arisings have been established through desktop research, including the review of key data bases such as the Environment Agency Environmental Permitting Regulations database, the Waste Survey of Arisings Use of Alternatives to Primary Aggregates in England (Ref 13-30) and the Waste management for England 2013 Statistics (Ref 13-31).

Forecasting the future baseline (“without scheme” scenario)

- 13.3.34 No future baseline has been forecast for material resources as there are no publicly available sources of information for predictions of material resources production.
- 13.3.35 The future waste arisings in the study area have been obtained from the Revised London Plan Waste Arisings Study Review for the Greater London Authority Model Guide and Task 4 Findings, Jan 2014 (Ref 13-33).

Defining the importance/sensitivity of resource

- 13.3.36 The importance or sensitivity of each resource is assessed using the criteria provided in Table 13-2.

Table 13-2 Determining the importance / Sensitivity of resource

Importance/ sensitivity of resource or receptor	Criteria
Very High	<ul style="list-style-type: none"> • Very high scarcity of required material resource.

Importance/ sensitivity of resource or receptor	Criteria
	<ul style="list-style-type: none"> • There is no available waste management infrastructure capacity within the study area for any waste arising from the Scheme. • Very high importance and rarity, national scale. Very limited materials reuse, recycling and or recovery. • No capacity of existing highways network or river to accommodate any increases in lorry and barge and/or ship movements resulting from the flow of material resources and wastes to and from the Scheme.
High	<ul style="list-style-type: none"> • High scarcity of required material resource. • There is limited waste management infrastructure capacity within the study area in relation to the forecast waste arising from the Scheme. • High importance and rarity, regional scale. Limited materials reuse, recycling and or recovery. • Low capacity of existing highways network or river to accommodate any increases in lorry and barge and/or ship movements resulting from the flow of material resources and wastes to and from the Scheme.
Medium	<ul style="list-style-type: none"> • Medium scarcity of required material resource. • There is adequate waste management infrastructure capacity within the study area for the majority of waste arising from the Scheme. • High or medium importance and rarity, regional scale. Moderate materials reuse, recycling and or recovery. • Medium capacity of existing highways network or river to accommodate any increases in lorry and barge and/or ship movements resulting from the flow of material resources and wastes to and from the Scheme.
Low	<ul style="list-style-type: none"> • Low scarcity of required material resource. • There is adequate available waste management infrastructure capacity within the study area for all waste arising from the Scheme. • Low or medium importance and rarity, local scale. High materials reuse, recycling and or recovery. • High capacity of existing highways network or river to accommodate any increases in lorry and barge and/or ship

Importance/ sensitivity of resource or receptor	Criteria
	movements resulting from the flow of material resources and wastes to and from the Scheme.
Negligible	<ul style="list-style-type: none"> • Negligible scarcity of required material resource. • There is waste management infrastructure capacity within the study area for all waste arisings from the Scheme. • Negligible importance and rarity, local scale. Very high materials reuse, recycling and or recovery. • Very high capacity of existing highways network or river to accommodate any increases in lorry and barge and/or ship movements resulting from the flow of material resources and wastes to and from the Scheme.

Source: Professional judgement

Methodology for assessing effects

13.3.37 The magnitude of each impact is assessed using the criteria provided in Table 13-3.

Table 13-3 Assessing magnitude of Impact

Magnitude of impact	Criteria
Major	<ul style="list-style-type: none"> • Loss of natural resources and or quality and integrity of natural resources; severe damage to key characteristics, features or elements. • Waste arisings from the Scheme are predominantly disposed of to landfill or to incineration without energy recovery with little or no prior segregation. • Generation of large quantities of hazardous and inert waste which are managed for disposal using methods lower down the waste hierarchy (e.g. landfill or incineration with energy recovery). • The embodied carbon contained within the main material resources is above 40,000 CO₂e.
Moderate	<ul style="list-style-type: none"> • Loss of natural resources, but not adversely affecting the integrity; partial loss of or damage to key characteristics, features or elements. • Waste arisings from the Scheme are predominantly disposed

Magnitude of impact	Criteria
	<p>of by incineration with energy recovery.</p> <ul style="list-style-type: none"> • Generation of moderate quantities of hazardous and inert waste which are managed for disposal using methods lower down the Waste Hierarchy (e.g. landfill or incineration with energy recovery). • The embodied carbon contained within the main material resources is between 20,000 and 40,000 CO_{2e}.
Minor	<ul style="list-style-type: none"> • Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements • Waste arisings from the Scheme are predominantly segregated and sent for composting, recycling or for further segregation and sorting at a materials recovery facility. • Generation of small quantities of hazardous and inert waste which is managed for disposal using methods lower down the Waste Hierarchy (e.g. landfill or incineration with energy recovery). • The embodied carbon contained within the main material resources is between 5,000 and 20,000 CO_{2e}.
Negligible	<ul style="list-style-type: none"> • Very minor loss or detrimental alteration to one or more characteristics, features or elements. • Waste arisings from the Scheme are predominantly reused on site or at an appropriately licensed or registered exempt site elsewhere. • Generation of negligible quantities of hazardous and inert waste which are managed for disposal using methods lower down the Waste Hierarchy (e.g. landfill or incineration with energy recovery). • The embodied carbon contained within the main material resources is between 1,000 and 5,000 CO_{2e}.
No Change	<ul style="list-style-type: none"> • No loss or alteration of characteristics, features or elements; no observable impact in either direction. • All waste arisings from the Scheme are reused on site or at an appropriately licensed or registered exempt site elsewhere. • No generation of hazardous waste. All inert materials reused onsite. • The embodied carbon contained within the main material resources is below 1,000 CO_{2e}.

Source: Professional judgement

13.3.38 The significance of each effect is assessed using the criteria provided in Table 13-4.

Table 13-4 Assessing significance of effect

Sensitivity of the receptor	Magnitude of impact				
	Major	Moderate	Minor	Negligible	No Change
Very high	Very Large	Large or Very Large	Moderate or Large	Slight	Neutral
High	Large or Very Large	Moderate or Large	Slight or Moderate	Slight	Neutral
Medium	Moderate or Large	Moderate	Slight	Neutral or Slight	Neutral
Low	Slight or Moderate	Slight	Neutral or Slight	Neutral or Slight	Neutral
Negligible	Slight	Neutral or Slight	Neutral or Slight	Neutral	Neutral

Source: Professional judgement

13.3.39 Those effects shaded bold are considered to be significant effects.

13.3.40 The definition of significance is defined as detailed in Table 13-5.

Table 13-5 Definition significance of effect

Significance	Definitions
Very Large	Significant change in environmental conditions. Impacts are likely to be of a very high magnitude and frequency and will impact on the existing strategy to deal with material resources and waste. Impact likely to be on a permanent basis.
Large	Considerable change in environmental conditions. Impacts are likely to be of a high magnitude and frequency and will have an effect on the existing strategy to deal with material resources and waste. Impact likely to be on a permanent basis.
Moderate	Noticeable change in environmental conditions. Impacts are likely to be of a high magnitude and frequency and will have an effect on the existing

Significance	Definitions
	strategy to deal with material resources and waste. Impact likely to be on a permanent basis
Slight	Barely perceptible change in environmental conditions. Impacts are likely to be of a low magnitude and frequency and will have an effect on the existing strategy to deal with material resources and waste. Impact likely to be on a temporary basis.
Neutral	No discernible change in environmental conditions. Impacts are likely to be of a negligible magnitude and frequency and will not have an effect on the existing strategy to deal with material resources and waste. No impact.

Source: Professional judgement

Limitations and Assumptions

- 13.3.41 This chapter, and all waste and recycling assessments, is based on the current Reference design and assumes that the Scheme will be developed in accordance with this information.
- 13.3.42 Whilst considered sufficient to inform the assessment, initial quantifications of the material resources use and waste arisings forecast from the Scheme have been derived from the reference design information, the Preliminary Site Waste Management Plan and professional judgement.
- 13.3.43 Total CD&E waste for the study area is available from 2005. However, this data does not split the CD&E waste into specific waste streams to enable an assessment of the Scheme’s specific waste stream arisings against this baseline.
- 13.3.44 Therefore, to gain a baseline split of specific waste streams arising from the study area, 2013 Office of National Statistics data for waste has been used. However, this data is not specifically related to CD&E waste and is inclusive of CD&E, municipal, commercial and industrial wastes, etc.
- 13.3.45 Both the 2005 and 2013 data have been presented to enable the context of the levels of waste likely to arise from the Scheme to be appropriately discussed.

- 13.3.46 Consistent and complete waste infrastructure capacity data for specific CD&E waste streams is not available for the study area.
- 13.3.47 Total waste management capacity for inert and contaminated soils has not been presented due to a lack of an available, consistent data-set being provided from the consulted local planning authorities. As such, it has been assumed that all waste will be sent to a transfer station or landfill. However, it is anticipated that, where possible, suitable excavated material will be sent to an appropriate site for beneficial reuse such as Wallasea Island.

13.4 Description of the baseline conditions

Existing baseline

Materials

- 13.4.1 The quantitative assessment has been based on available material resources data for the UK, as material resources data are not available for the study area. Table 13-6 provides a breakdown of the annual UK demand of key material resources expected to be used by the Scheme:

Table 13-6 Annual UK demand of key material resources

Material resources	Quantities (tonnes)
Aggregates	200,000,000
Pavement	20,000,000
Concrete	52,000,000
Steel	10,700,000

- 13.4.2 Given the high levels of UK supply and demand of these key materials, the sensitivity of this receptor (material resources) is judged to be low.

Waste

- 13.4.3 The Waste Framework Directive has targeted recovery of at least 70% of all CD&E waste by 2020. Table 13-7 outlines the volume of CD&E waste produced in England during 2008, 2009 and 2010 and how it is managed.

Table 13-7 Current CD&E waste arisings and management in England

Impact description	Waste arisings (tonnes)					
	2008		2009		2010	
Waste transferred for treatment processes	7,053,000	7%	6,885,000	8%	7,203,000	9%
Reuse	52,730,000	55%	42,184,000	55%	42,184,000	54%
Waste exemptions (i.e. no permit needed)	10,978,000	12%	9,708,000	13%	8,150,000	11%
Landfill	23,785,000	26%	18,192,000	24%	19,839,000	26%
Total	94,546,000	100%	76,696,000	100%	77,356,000	100%

Source: DEFRA Statistics (Ref 13-31)

Current local waste arisings

13.4.4 A breakdown of CD&E waste arisings for the Royal Borough of Greenwich, Tower Hamlets and Newham is not available. Instead, data for East London (Boroughs of Barking and Dagenham, Havering, Newham and Redbridge) has been used.

13.4.5 East London has an estimated total CD&E waste arisings of 3,689,749 tonnes per year (Ref 13-21) (based on 2005 data). Of this total:

- 58% was recycled to produce graded and ungraded aggregates and soil (excluding topsoil) by the regions 45 recycling crushers;
- 21% entered licensed landfill sites (of this 83% was used for engineering and capping and 17% was waste); and
- 21% was used on exempt sites.

Waste capacity

13.4.6 Following consultation with the three boroughs, they were able to provide limited information on the capacities of waste infrastructure sites falling within their jurisdiction areas. Information on waste capacity has subsequently been taken and derived from publically available information, the Preliminary Site Waste Management Plan and the EA's EPR database.

13.4.7 The London Borough of Newham forms one of the four constituent Boroughs of the East London Waste Authority, which is responsible for the collection and management of municipal waste generated within the authority boundary. As such, the London Borough of Newham is obliged to deliver all waste generated within the Borough to East London Waste Authority designated facilities.

13.4.8 The total capacity of waste infrastructure sites that could potentially receive CD&E waste arising from the Scheme within the study area has been assessed using data from the Environment Agency EPR database. Only information from permitted sites has been included in the assessment and as such exempt sites that are able to receive inert soils have not been included. Table 13-8 details the annual waste infrastructure capacities from sites taking CD&E waste within the study area.

Table 13-8 Annual CD&E waste infrastructure capacity within the study area

Borough	Waste infrastructure capacity (tonnes)		
	Landfills	Waste facilities	Totals
Greenwich	117,000	1,658,947	1,775,947
Tower Hamlets	none	820,054	820,054
Newham	none	1,403,093	1,403,093
Total	117,000	3,882,094	3,999,094

Source: EA EPR database

Contaminated soil

13.4.9 Chapter 12, Geology and Soils details the findings of the Ground Investigation and potential for contaminated soils to be produced during excavation works. All contaminated soils will need to be handled and treated appropriately in line with the requirements and processes set out in Chapter 12. Geology and Soils.

Future baseline

13.4.10 The projected CD&E waste arisings for London Borough of Tower Hamlets, Royal Borough of Greenwich and London Borough of Newham are presented in Table 13-9:

Table 13 -9 Projected CD&E waste arisings (tonnes)

Borough	2012	2016	2021	2026
Royal Greenwich	222,000	233,000	244,000	253,000
Newham	270,000	294,000	316,000	333,000
Tower Hamlets	226,000	248,000	268,000	281,000
Total	718,000	775,000	828,000	867,000

Source: Revised London Plan Waste Arisings Study Review for the Greater London Authority Model Guide and Task 4 Findings.

- 13.4.11 A total of approximately 828,000 tonnes of waste are predicted to be produced within the study area in 2021. This has been identified as the most suitable future baseline year from the data available (the construction programme identifies works commencing in late 2018 and ending in 2022/23). This represents 21% of current total waste infrastructure capacity.

Cumulative baseline

- 13.4.12 Individual waste forecasts for consented/planned developments within the study area have not been collated at this stage but will be developed for the Environmental Statement where information is available. As such, the cumulative baseline for the PEIR has been developed using the future baseline and the waste forecast for the Scheme.
- 13.4.13 The combined total waste arisings from the future baseline and the waste forecast for the Scheme (756,055 tonnes) (assuming all waste is sent for recycling or to landfill) is 1,584,055 tonnes. This represents 40% of current waste infrastructure capacity.

13.5 Scheme design and mitigation

Construction materials and waste forecasts

- 13.5.1 This section summarises the anticipated material resource use of the Scheme and the anticipated waste arisings generated by the Scheme during the CD&E phases, based on preliminary design information and professional judgement. The residual effects of such use and generation (incorporating proposed mitigation) are assessed in section 13.6.

13.5.2 The choice of material resources and opportunities for waste reduction have been considered during the reference design phase, and will be considered further during the detailed design phase of the Scheme. The waste hierarchy illustrates that implementing waste minimisation at the reference and detailed design phases are the most effective options for reducing waste generated by a Scheme.

Material resources

13.5.3 CD&E material resources required for the Scheme will consist of imported fill, Type 1 sub base, pavement, concrete, steel and grout. Although the reuse of materials within the site will be maximised, raw materials will still be needed for the construction works.

13.5.4 Aggregates will be required for earthworks, structures, drainage and road pavement construction. These can be either primary aggregates, such as sand, natural gravels and rocks; secondary aggregates such as incinerator bottom ash aggregate and reclaimed railway ballast; or recycled aggregates, such as recycled concrete and recycled road planings.

13.5.5 The extraction of primary aggregates (e.g. sands and gravels) and lime from quarries will deplete finite material resources. Secondary (or recycled) aggregates may not always have the lowest impact on the environment and material resources will be selected based on a consideration of all relevant impacts. The choice of whether to use primary or secondary aggregates (or a combination of both) will be made taking into consideration a combination of factors including material resources source, specification, production and transport. These factors will inform the use of secondary or recycled aggregates over primary aggregates having regard to the environmental impact.

13.5.6 Using the reference design information and professional judgement, the material resources likely to be needed for the construction phase of the Scheme have been forecast. These forecasts are likely to be refined and subject to change as the Scheme design progresses. For that reason, the forecasts have been made on a reasonable worst case scenario basis.

13.5.7 The key material resources presented in Table 13-10 are the estimated quantities required for the construction phase of the Scheme.

Table 13-10 Estimated key material resources to be used in the construction phase of the Scheme

Material resources	Estimated quantities (tonnes)			
	North	Tunnel	South	Total
Imported fill	1,091	106,786	2,259	110,136
Type 1 sub base	35,496	0	59,831	95,327
Pavement	7,692	8,954	13,327	29,973
Mass Concrete	0	54,168	0	54,168
Structural Concrete	41,920	300,367	82,904	425,191
Steel Reinforcing bar	19,217	128,779	38,284	186,280
Structural Steel	0	0	1,062	1,062
Primary Tunnel Lining (Segmental concrete)	0	33,253	0	33,253
Secondary Tunnel Lining (In situ Concrete)	0	54,038	0	54,038
Grout to tunnel excavation voids	0	32,122	0	32,122

Source: Reference Design

- 13.5.8 The estimated quantities detailed in Table 13-12 do not account for any other minor construction activities associated with the Scheme such as cabling.

Embodied carbon

- 13.5.9 The embodied carbon contained within the key material resources has been calculated using the Highways England's Carbon Calculation for Major Projects (CCMP) (Ref 13-35). This has provided a figure of approximately 391,095 tonnes of CO_{2e}.
- 13.5.10 Table 13-11 provides details for the embodied carbon contained within the material resources presented in Table 13-12.

Table 13-11 Estimated embodied carbon contained within the key material resources

Material resources	Total estimated embodied carbon (tonnes of CO ₂ e)			
	North	Tunnel	South	Total
Imported fill	5	555	12	572
Type 1 sub base	185	0	311	496
Pavement	977	1,137	1,693	3,807
Mass Concrete	0	5,796	0	5,796
Structural Concrete	8,761	62,777	17,327	88,865
Steel Reinforcing bar	26,904	180,291	53,598	267,093
Structural Steel	0	0	1,551	1,551
Primary Tunnel Lining (Segmental concrete)	0	4,522	0	4,522
Secondary Tunnel Lining (Insitu Concrete)	0	11,294	0	11,294
Grout to tunnel excavation voids	0	7,099	0	7,099
Total				391,095

13.5.11 Table 13-12 summarises the material resources use during the CD&E phases of the Scheme, following the requirements of IAN 153/11.

Table 13-12 Summary of material resource use

Scheme activity	Material resources required for the Scheme	Estimated quantities of material resources required (tonnes)	Additional information on material resources
Site remediation/ preparation earthworks	Aggregates will be required for earthworks,	205,462	Cut and cover balancing will be optimised in order to maximise the reuse of excavated materials for

Scheme activity	Material resources required for the Scheme	Estimated quantities of material resources required (tonnes)	Additional information on material resources
	structures, drainage and road pavement construction.		infilling and landscaping and an MMP will be produced to support the optimal reuse of site-won materials (e.g. soils) on the Scheme.
Demolition	N/A	N/A	N/A
Construction	Pavement, concrete, steel and grout.	816,107	The choice of whether to use primary or secondary aggregates (or a combination of both) will be made taking into consideration a combination of factors including material resources source, specification, production and transport. These factors will inform the use of secondary or recycled aggregates over primary aggregates having regard to the environmental impact.

Waste

- 13.5.12 The waste arisings forecast from the construction and excavation phases, shown in Table 13-13, include arisings from the demolition, central reserve and verge works, tunnel boring excavation, signs, lighting, communications, resurfacing and office compounds. These forecasts will be moderated as the Scheme design progresses.
- 13.5.13 It is anticipated that the Scheme will produce a total of 807,620 tonnes of CD&E waste, 713,965 tonnes of which will be classed as inert materials.

13.5.14 Table 13-13 summarises the wastes forecast during construction, demolition and excavation activities (including temporary works associated with the jetty) as identified in the Preliminary SWMP.

Table 13-13 Summary of key CD&E waste arisings

Waste	Estimated Quantities (tonnes)
Bricks	169
Mixed waste	12,584
Wood	73
Gypsum	54
Metals	2152
Glass	21
Concrete	32,300
Mix concrete, bricks and tiles	5,863
Materials containing asbestos* ²	16
Inert soils and stones	675,613
Remediation waste	51,761
Soils and stones containing dangerous substances	1,125
Bitumous mixtures	1,749
Packaging	255
Plastic	20
Dredgings	23,866
Total	807,620

13.5.15 Table 13-14 describes a summary of CD&E waste arisings forecast following the requirements of IAN 153/11.

² Hazardous waste

Table 13-14 Summary of CD&E waste arisings from the Scheme

Scheme activity	Waste arisings from the Scheme	Quantities of waste arisings (tonnes)	Additional information on waste
Site remediation/ preparation earthworks	Excavated natural soils from tunnel bores and cut and cover.	675,613	Cut and cover balancing will be optimised in order to maximise the reuse of excavated materials for infilling and landscaping and an MMP will be produced to support the optimal reuse of site-won materials (e.g. soils) on the Scheme. The preference for any materials that cannot be reused on site will be for beneficial use off site.
	Contaminated soils	52,886	
	Concrete	11,633	
Demolition	Concrete, bricks etc. from existing structures and drainage.	10,110	Some demolition materials will be retained / reused onsite (e.g. elements of the drainage are going to be retained and utilised within the current design). Metals will be sent off site for recycling.
	Metals	553	
Construction	Concrete	10,474	Over-ordering will be avoided and materials will be stored securely to minimise damage.
	Metals	1,562	
	Sub base and imported fill	12,238	Construction waste will be segregated to facilitate recycling and reuse of materials/wastes.
	Bitumous mixtures	1,749	Metals will be sent off site for recycling.
Temporary works	Dredgings	23,866	All wastes will be segregated to facilitate off site reuse and recycling.
	Concrete	1,214	
	Iron and steel	37	Metals will be sent off site for recycling.

Transport of material resources and waste

- 13.5.16 Material resources will be required and waste produced at both Silvertown and Greenwich sites. Impacts on the affected transport infrastructure for material resources and waste have been assessed together.
- 13.5.17 The removal of material resources and waste would be made by either river or road from the Silvertown site and by road from the Greenwich site. As a worst case scenario, it has been assumed that all materials would be transported to and from site on the existing highway network. However, the use of river transport will be maximised where possible to reduce the effect on the highway network.
- 13.5.18 It is estimated that the largest number of lorry movements will be made to/from the Silvertown works site.
- 13.5.19 Table 13-15 shows the approximate number of lorry movements by works element and site, assuming a worst case that all waste is transported by road.

Table 13-15 Approximate material resource and waste lorry movements over the four year construction period

Works element	Silvertown site (worst case)	Greenwich site
Site buildings	2,600	2,000
Cut and Cover Tunnel	41,100	38,600
Bored Tunnel	86,500	-
Highways	13,200	24,100
Mechanical & Electrical	2,500	2,500
Landscaping	1,000	1,000
Site Establishment	7,300	3,400
TBM Delivery/Removal	1,000	-
Total	155,200	71,600

- 13.5.20 The conveyor system in the chamber at the Greenwich site (once operational) will be utilised as far as possible to transfer materials from

Greenwich through to Silvertown for disposal using the river logistics solution, once the Tunnel Boring Machine has started on the second drive.

- 13.5.21 Calculations for road transportation have been based on lorry movements. The total number of lorry movements per day required for both the Silvertown and Greenwich sites is not expected to affect the capacity on the highways network and as such the highways network has been assessed to have a low sensitivity.
- 13.5.22 This information will be refined as the Scheme design and available information develops. A Preliminary Transport Assessment has been prepared as a standalone document and Effects on All Travellers are presented in Chapter 11.

Construction mitigation

- 13.5.23 Measures would be implemented to reduce the impacts of material resources use and waste arising from the Scheme.
- 13.5.24 A Code of Construction Practice (CoCP) will be submitted with the Development Consent Order (DCO) application. A Preliminary Code of Construction Practice has been prepared as part of this consultation. The CoCP submitted with the DCO application will be finalised by the DBFM contractor and must be approved by the relevant planning authority prior to the commencement of construction of the Scheme. The CoCP will require the contractors to:
- promote opportunities for the potential reusing and recycling of all material resources and waste;
 - sort and segregate waste into different waste streams; and
 - manage material use to maximise the environmental and Scheme benefits from the use of surplus materials.
- 13.5.25 The CoCP will include several subsidiary management plans, which form part of the suite of mitigation measures of particular relevance to materials and waste. These will be but not limited to:
- The updated SWMP which will be used to record how waste will be reduced, reused, recycled and disposed of by the Scheme.

- The outline Materials Management Plan (MMP) which will help to ensure that materials are handled and used in a way that prevents harm to human health and pollution of the environment.
- The Construction Logistics Plan which will be ultimately developed by the DBFM contractor to better manage all types of freight vehicle movement to and from the Scheme.

Targets

13.5.26 A sustainable design review workshop was held with TfL on 18 June 2015 for the Scheme. As agreed at the sustainable design review workshop, and in accordance with the London Plan, the following targets relevant to material resources and waste have been set for the Scheme:

- aim that suitable excavated material be transported by river instead of road;
- where specification allows, a portion of construction materials to include a reused and recycled content;
- use of primary aggregates will be minimised by the selection of secondary materials, where possible;
- materials specified will have low embodied carbon;
- 95% recovery of CD&E waste (in accordance with London Plan);
- zero waste to landfill (excluding hazardous waste); and
- A score of Very Good and ideally Excellent using CEEQUAL, adherence to materials and waste elements.

13.5.27 The design will continue to apply the five key principles of waste minimisation (Design for: Reuse and Recovery, Off Site Construction, Materials Optimisation, Waste Efficient Procurement and Deconstruction and Flexibility) in future design phases to support the use of materials in a more efficient manner and to consider how reuse, recycling and recovery of materials can be incorporated into the design and ultimately reduce waste to landfill.

13.5.28 Some of the key aspects of waste minimisation that will be considered during future design phases are:

- Designing for site conditions: the design will accommodate strategies to manage particular constraints (e.g. contaminated land) which may impact on waste.
- Design complexity: reduce the complexity of the design to standardise the construction process and reduce the quantity of materials required.
- Specifications: avoid over specification and minimise variation in materials, components and joints; evaluate the reuse and recycling opportunities for the specified materials before specification.

13.5.29 The contractor would register with the Considerate Constructors Scheme and apply for the Considerate Constructor Scheme's National Site Award.

Material resources

13.5.30 The key Scheme sustainability targets will be embedded within all relevant procurement documentation, along with the methodology for monitoring and reporting.

13.5.31 Contractors will be encouraged to apply good practice to source construction materials from suppliers with responsible sourcing certification (as far as practicable). To this end, contractors will adopt the BES 6001 Responsible Sourcing of construction products standard.

13.5.32 Contractors will be encouraged to follow The Mayor of London's Green Procurement Guide.

13.5.33 All timber products used will be obtained from sustainable sources. In line with TfL commitments, all timber procured will be obtained from recycled, reclaimed sources or be accredited to meet sustainable forestry standard such as the Forestry Stewardship Council (FSC). Any remaining timber not sourced through the above will target a known temperate source using the Department for Environmental, Food and Rural Affairs (Defra) central point of expertise in timber (CPET).

13.5.34 The depletion of finite material resources could occur through extraction of primary aggregates (e.g. sands and gravels). Structures, drainage and signage products will be procured with consideration of the environmental impacts associated with their manufacture, as well as other considerations such as structural design, carbon footprint, energy consumption, long-life performance, visual impacts, durability and cost.

- 13.5.35 The procurement process shall ensure that materials are ordered so that the timing of the delivery (e.g. 'just in time' deliveries), the quantity delivered and the storage are optimised to reduce opportunity for oversupply and damage on site.
- 13.5.36 It is anticipated that, wherever possible and where specification allows construction materials will include a measurable recycled content in their manufacture.
- 13.5.37 Materials will be ordered, where possible, in sizes to prevent wastage e.g. in form of off cuts and waste to be able to be returned to the original supplier e.g. plastic pipe.
- 13.5.38 Materials delivered to the project will be received and controlled by the DBFM contractor's Logistics Team or appointed person. Materials will be stored to minimise the potential of damage or wastage. Measures will include off-ground storage e.g. on pallets, remaining in original packaging, protection from rain or collision by plant or vehicles. The materials storage area will be secured during out of hours to prevent unauthorised access.
- 13.5.39 Consideration of the durability of the materials to be utilised by the Scheme (considering the 120 year design life of the tunnel) will be provided at a detailed design stage.
- 13.5.40 Modular construction (e.g. pre-cast concrete instead of cast in situ concrete) could be utilised for the tunnel lining segments; improving quality, reducing on-site activities and installation time whilst utilising a controlled, waste optimised construction environment.
- 13.5.41 Scheme gantries will be manufactured off-site (whenever possible) improving quality, reducing on-site activities and installation time.
- 13.5.42 Wherever possible, standardisation of materials and building elements will be incorporated into the Scheme design in order to minimise required material resources and the production of waste. For example, the diameter of the tunnel will be optimised to minimise waste and the requirements for lining and piling.
- 13.5.43 Space under the deck may be used to house utilities however, this option is still under discussion. By utilising this space the design will save space and materials.

- 13.5.44 Where possible, consideration will be given to the re-use of material (e.g. uncontaminated soils) back into the project. However the proposed Scheme will require specific materials to be imported to the site (e.g. additional bulk fill materials). Some demolition materials will be retained / reused onsite (e.g. elements of the drainage are going to be retained and utilised within the current design). The percentage of materials to be retained / reused is yet to be confirmed. Maximum reuse of site-won materials will be secured through the further development and implementation of the MMP and Construction Logistics Plan.
- 13.5.45 Local sources will be used for aggregate supplies whenever possible.
- 13.5.46 Agreements will be sought with suppliers to reduce the amount of packaging used to protect materials or to participate in a packaging take back scheme.

Waste

- 13.5.47 Excavated material will be targeted for fill and landscaping where this is feasible and the material is suitable. Excavated materials, such as soils, will be carefully stored in segregated piles for subsequent re-use on the site, where possible. If the material is contaminated then it will be kept separate from the clean material and sent for either recycling or recovery, where appropriate, or disposal at appropriately permitted facilities.
- 13.5.48 Any surplus inert excavated materials (e.g. soils, stone, bricks, clay, rubble, rock) can be suitable for re-use in land reclamation projects. This would require compliance with the criteria and thresholds for an exemption or a permit under the Environmental Permitting Regulations 2010 (as amended). The CL:AIRE CoP may also be applicable for the reuse of this material.
- 13.5.49 As with other similar construction projects, where possible excavated materials will be sent for beneficial reuse to a site such as Wallasea Island on the Essex coastline. Wallasea Island is part of the Royal Society for the Protection of Birds (RSPB) project to transform the whole island into a wetland habitat. The volume of spoil that could be transported will depend on the suitability and condition of the excavated material for transport by river and for the intended end use.
- 13.5.50 The historical use of the area on the Greenwich Peninsula and Silvertown has the disadvantage of a legacy of contamination of the made ground and river terrace gravels that are likely to necessitate remediation to make

the materials suitable for reuse off site. This remediation can be undertaken either onsite, permitting disposal with inert materials or removed from site for treatment with additional cost and the likelihood of requiring road transport to take to a treatment centre. The alternative is disposal at a suitable location (i.e. landfill). There are also potentially hazardous materials to be excavated that will require disposal at a licensed site.

- 13.5.51 Unusable CD&E waste materials will be collected in receptacles for subsequent separation and disposal at an off-site facility.

Vegetation

- 13.5.52 In order for construction to take place, areas of vegetation, comprising mainly of grass and shrubs will require clearance. Any vegetation removed will be sent for composting. As appropriate, any vegetation will be turned into mulch or compost to be re-used back in the scheme.
- 13.5.53 Waste generated by the clearance of Japanese knotweed from site will be segregated from all other wastes and managed in accordance with the Environment Agency's Code of Practice (Ref 13-28).
- 13.5.54 If any material deemed acceptable from the enabling works is produced e.g. good quality topsoil, this will be stored and re-laid, within the project or, if this is not possible, will be sent for composting.

Hazardous waste

- 13.5.55 Hazardous wastes, including any contaminated soil will be identified, removed and kept separate from other CD&E waste materials, in order to avoid contaminating 'clean' materials and will be disposed of in accordance with the Hazardous Waste (England and Wales) Regulations 2005.
- 13.5.56 Asbestos based materials and other contaminants may arise during the excavation for tunnels and portals, especially in areas of previously high industrial use and the historic gas works. Should asbestos or other contaminants be encountered, they will be managed by a qualified asbestos removal contractor and all asbestos will be removed off site in accordance with legislation and disposed of at a licensed landfill by a licensed contractor in accordance with all appropriate regulation.

Site practices

- 13.5.57 The proposed scheme would have a Waste Manager or Champion who would oversee the implementation of the waste control strategy and the handling of any waste material.
- 13.5.58 A waste management compound will be set up to handle incoming waste from construction activities. This will be designed to facilitate the segregation of key waste streams to maximise the opportunity to re-use, recycle and return wastes generated on site.
- 13.5.59 The construction and demolition work will be carried out closely with the waste management contractors, in order to determine the best techniques for managing waste and ensure a high level of recovery of materials for recycling.
- 13.5.60 A specific area will be laid out and labelled to facilitate the separation of materials, where possible, for potential recycling, salvage, reuse and return. Recycling and waste bins are to be kept clean and clearly marked/colour coded in order to avoid contamination of materials. Skips for segregation of waste identified currently are:
- mixed inert (e.g. inert plastics, concrete and rubble);
 - hazardous (e.g. asbestos, Poly Chlorinated Bi-phenols);
 - mixed non-hazardous (biodegradable waste, welfare waste, general waste);
 - metal (e.g. copper and iron);
 - wood (e.g. fencing/hoarding);
 - food (canteen waste);
 - paper and cardboard (office waste); and
 - WEEE: Waste Electronic and Electrical Equipment (e.g. cables, disused electrical appliances and equipment).
- 13.5.61 Successful recycling relies upon early planning, clear responsibility and space within a compound for segregation and storage. Shelter may be needed to prevent some materials such as cardboard and paper from deteriorating while being sorted or awaiting collection.

- 13.5.62 Discussions will be required between the Client and the DBFM contractor to identify space requirements within the compound to accommodate skips and storage of reusable materials.
- 13.5.63 For all waste management options on the site compound, consideration will need to be given for identifying whether waste exemptions or permits are required to enable the storage and treatment of waste materials.
- 13.5.64 Waste management options will be supported by the identification of appropriately permitted waste management and recycling facilities in close proximity to the site compound.

Transport of materials and waste

- 13.5.65 A Construction Logistics Plan will be implemented to minimise transport movements and passage plans will be produced in conjunction with the Port of London Authority and other stakeholders to mitigate any effects on river capacity. The plan will be reviewed by the Logistics Manager at regular intervals to ensure relevance to ongoing activities and adjacent developments.
- 13.5.66 Off-site consolidation and logistics centre(s) will be considered which will reduce the space required on the worksite for storage of materials, creating a safer worksite and reducing the risk of damage to materials. The centre will be detailed within and managed through the Logistics Plan.

Operation materials and waste forecasts

- 13.5.67 At present, there is uncertainty regarding the operation and maintenance activities required for the Scheme. As such, details of the materials required and the wastes for these activities will be incorporated into the Environmental Statement.

13.6 Assessment of impacts

Construction impacts

Material resources

- 13.6.1 A quantitative assessment of estimated key material resources to be used by the Scheme (aggregates, concrete and steel) during the excavation and construction phases has been made against UK wide material production data, presented in Table 13-16.

Table 13-16 Key materials resource UK demand vs Scheme demand

Material Resources	Annual UK demand 2013 (tonnes)	UK demand (duration of Scheme, based on 2013 figures) (Tonnes)	Scheme demand (total) (Tonnes)
Aggregates	200,000,000	8,000,000,000	205,462
Pavement	20,000,000	80,000,000	29,974
Concrete	52,000,000	208,000,000	598,771
Steel	10,700,000	42,800,000	187,343

13.6.2 The Scheme will, where possible, maximise the reuse of site-won materials and procure materials where specification allow with recycled content. The sensitivity of the UK supply of the key materials identified for the Scheme is assessed to be low as there is low scarcity of these materials. The total embodied carbon for the key materials identified for the Scheme is 390,094 CO₂e. This is assessed to have a **major adverse** magnitude of impact as this is above 40,000 CO₂e. The significance of effect is therefore assessed to be **Slight Adverse** due to the availability of these materials.

Waste

13.6.3 It is anticipated that the Scheme will produce a total of 807,620 tonnes of CD&E waste, 713,965 tonnes of which will be classed as inert materials. Inert materials will be used for beneficial reuse either on site or off site (e.g. Wallasea Island). As such, only 93,655 tonnes of waste from the Scheme will be sent for recycling or to landfill which is equal to 2.3% of the current baseline capacity.

13.6.4 The capacity of waste management infrastructure within the east London is estimated to be 3,999,094 tonnes. A worst case scenario would be all CD&E waste generated by the Scheme being sent for recycling or for disposal at landfill. In this scenario, the waste generated by the Scheme would be equal to 20% of the current baseline capacity.

13.6.5 The capacity of the waste management infrastructure within the study area for all waste arising from the Scheme is deemed adequate and this receptor is assessed as having low sensitivity. As the majority of waste generated by the Scheme will be predominantly segregated and sent for beneficial reuse, recycling or for further segregation and sorting at a

materials recovery facility the magnitude of the impact is assessed to be **minor adverse**.

- 13.6.6 The significance of the effect is assessed to be **Slight Adverse**.

Transport of material resources and waste

- 13.6.7 The existing highways network and river have a high capacity to accommodate the increases in lorry and barge/ship movements associated with the transport of materials and waste, and as such have been assessed to have a low sensitivity. The magnitude of the impact on the highways network and river is assessed to be **minor adverse** due to the available capacity. Therefore the significance of effect is assessed to be **Slight Adverse**.

Operational impacts

- 13.6.8 At present, there is uncertainty regarding the operation and maintenance activities required for the Scheme. As such, details of the materials required and the wastes for these activities will be incorporated into the Environmental Statement.

13.7 Cumulative impacts

- 13.7.1 A quantitative assessment of the cumulative effects arising through interactions with other consented/planned developments has not been undertaken at this stage. Information relating to the volumes of waste produced and materials required by other schemes will be collated, where available, to inform the ES submitted with the DCO application.

Construction cumulative impacts

- 13.7.2 The depletion of finite natural resources e.g. aggregate for construction will result from the Scheme and other developments. As identified above, the sensitivity of the UK supply of key construction is assessed to be low as there is low scarcity of these materials. It is not possible to provide a quantitative assessment of the embodied carbon of the materials required for the Scheme plus other developments however, it is reasonable to assume that it will have a **major adverse** magnitude of impact in line with the assessment undertaken for the scheme alone. Therefore the qualitative assessment of the significance of this effect is **Moderate Adverse**.

- 13.7.3 The requirement to dispose of CD&E waste from the Scheme and other developments will result in a permanent reduction in landfill capacity within reasonable proximity of the Scheme. A total of approximately 828,000 tonnes of waste are predicted to be produced within the study area in 2021 (see Table 13-8). When combined with the 807,620 tonnes of waste estimated to be produced by the Scheme, the predicted total is 1,635,620 tonnes which represents 41% of current capacity. There is adequate waste management infrastructure capacity within the study area for the majority of waste arisings from the Scheme in conjunction with predicted CD&E waste arisings, therefore this is assessed to be of medium sensitivity.
- 13.7.4 In the absence of detailed cumulative assessment at this stage, it is assumed that all consented schemes within the study area will be required to meet the requirements of relevant legislation and local policies. This will include adherence to the waste hierarchy and a target of at least 70% recovery of wastes generated (as per the Waste Framework Directive). As such it is assumed that waste arisings from consented schemes will be segregated and sent for composting, recycling or for further segregation and sorting at a materials recovery facility. As such this impact is assessed as having a **minor adverse** impact. The significance of this effect is assessed to be a **Slight Adverse**.

Transport of material resources and waste cumulative impacts

- 13.7.5 As detailed in Chapter 11 Effects on All Travellers and Table B.11-8 within Appendix 11.B, the increase in traffic during the construction of the Scheme is assessed to have a negligible adverse impact on all travellers (and therefore the network). The significance of this effect is assessed to be Slight Adverse.

Operational cumulative impacts

- 13.7.6 At present, there is uncertainty regarding the operation and maintenance activities required for the Scheme. As such, details of the materials required and the wastes for these activities will be incorporated into the assessment as further information becomes available.

13.8 Further work to be done

- 13.8.1 Further work relating to the materials to be used and the wastes to be produced during the operation and maintenance of the tunnel is ongoing.

- 13.8.2 The SWMP and waste forecasts will require updating once the remedial strategy has been produced.
- 13.8.3 Soil treatment, waste treatment and waste disposal sites and their capacities will be determined and included in the ES.
- 13.8.4 The quantities of the different soil types produced by the Tunnel Boring Machine (TBM) (e.g. London Clay, Thanet Sands) are to be determined.
- 13.8.5 A quantitative assessment of the cumulative effects arising through interactions with other consented/planned developments will be undertaken by collating information relating to the volumes of waste produced and materials required by other schemes, where available.

13.9 National Road and Rail Networks: National Policy Statement compliance

- 13.9.1 NN NPS states that the Secretary of State should set out the arrangements that are proposed for managing any waste produced.
- 13.9.2 'The arrangements described should include information on the proposed waste recovery and disposal system for all waste generated by the development. The applicant should seek to minimise the volume of waste produced and the volume of waste sent for disposal unless it can be demonstrated that the alternative is the best overall environmental outcome.'
- 13.9.3 This chapter presents a forecast of the waste likely to arise from the Scheme and assesses the quantity of waste likely to arise from the Scheme against the capacity of the study area's waste management facilities.
- 13.9.4 The delivery of the mitigation measures set out in the mitigation section of this chapter will support adherence to the requirements of the NN NPS by minimising the volume of waste produced and the volume of waste sent for disposal.
- 13.9.5 In accordance with the requirements of the NN NPS, all material resources used and waste arisings from the Scheme would be managed onsite and offsite in accordance the Preliminary CoCP, Preliminary SWMP, Outline MMP and Construction Logistics Plan.
- 13.9.6 The NN NPS requires the Scheme to minimise the volume of waste produced and to implement sustainable waste management through the

application of the waste hierarchy. The Scheme will apply the waste hierarchy in order to move waste management practices as far up the hierarchy as practicable, minimising disposal and maximising reuse and recycling.

13.10 Summary

13.10.1 A tabular summary of the significance of overall impacts is to be provided in Table 13-17.

Table 13-17 Materials and Waste Effect Summary Table

Impact description	Temporary/ Permanent	Significance of Effect
Depletion of finite material resources e.g. aggregate for construction.	Permanent	Slight Adverse
Depletion of availability of the waste management infrastructure capacity with the study area.	Temporary	Slight Adverse
Transportation of material resources to site.	Permanent	Slight Adverse
Transportation of CD&E waste offsite.	Permanent	Slight Adverse
Depletion of finite material resources e.g. aggregate for construction.	Cumulative	Moderate Adverse
Depletion of availability of the waste management infrastructure capacity with the study area.	Cumulative	Slight Adverse

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