Thames Tideway Tunnel
Thames Water Utilities Limited

Thames Water

Development Consent Order

Application Reference Number: WWO10001

Documents for Certification
September 2014

We, Lindsay Speed and Sarah Fairbrother hereby certify that this is a true copy of the environmental statement referred to in Article 61 (1) (f) of the Thames Water Utilities Limited (Thames Tideway Tunnel) Order 2014.

Lindsay Speed   Sarah Fairbrother

September 2014

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.03**

Volume 3: Project-wide effects assessment appendices

APFP Regulations 2009: Regulation **5(2)(a)**

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Appendix A: Introduction

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Appendix A: Introduction

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Appendix A.1: Development schedule

APFP Regulations 2009: Regulation **5(2)(a)**

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Appendix A: Introduction

A.1 Development Schedule

A.1.1 The project wide assessments undertaken take account of other relevant development projects within the vicinity of the sites which are under construction, permitted but not yet implemented or submitted but not yet determined. In order to identify the relevant developments for consideration the Planning Inspectorate, local authorities, Greater London Authority and Transport for London (TfL) have been consulted on the methodology described in Vol 2 and asked to assist in identifying and verifying the development projects included in the assessment. Schedules are provided in Vols 4 to 27 Appendix N of the resulting development projects in the vicinity of each site, a description of what is proposed and assumptions on phasing. Longer term development projects may be included under both base case, with construction preceding that of the Thames Tideway Tunnel project, and cumulative with construction or operation occurring at the same time as the Thames Tideway Tunnel project.

A.1.2 In addition, a review of the National Infrastructure Plan 2011 and the National Infrastructure Planning website has been undertaken to further inform the project wide effects assessments. The development projects identified as part of this review and which have been included under base case, cumulative or both for the assessment of the proposed development are provided in Vol 3 Table A.1

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Vol 3 Table A.1 Development schedule

Category types:

a. Under construction
b. Permitted but not yet implemented
c. Submitted but not yet determined

IPC / Parliamentary acts/bills	Development description (including planning application number)			Category type (based on 'current' status)	Year specific assumptions			Source of assumption information / Notes	Base case or cumulative dev?
	Appl. No.	Developer	Description		2016 (Project Year 1)	2019 (network-wide peak construction traffic year)	2023 (Year 1 of operation)		
Crossrail		Crossrail Ltd	Crossrail will run 118 km from Maidenhead and Heathrow in the west, through new twin-bore 21 km tunnels under central London connecting key London stations including Paddington, Bond Street, Tottenham Court Road, Liverpool Street and Canary Wharf and on to Abbey Wood and Shenfield in the East Forms a major part of the Mayor's Transport Strategy. Opens in 2018, will connect 37 stations.	A	Under construction	100% complete & operational	100% complete & operational	www.crossrail.co.uk http://www.crossrail.co.uk/railway/getting-approval/crossrail-bill-supporting-documents/ Crossrail project will be completed in 2018.	**2016:** Cumulative **2019 & 2023:** Base case
Thameslink		Network Rail	Upgrade works and expansion to the Thameslink rail network to provide new and longer trains between a wider range of stations to the north and to the south of London. Work includes platform lengthening, station remodelling, new railway infrastructure, and additional rolling stock.	A	Blackfriars station : 100% complete & operational Farringdon station: 100% complete & operational London bridge station: under construction Borough Viaduct station: 100% complete & operational	100% complete & operational	100% complete & operational	http://www.networkrail.co.uk/aspx/1326.aspx http://www.thameslinkprogramme.co.uk/cms/pages/home Blackfriars station & Farringdon station: complete & operational by early 2013. London Bridge station: complete and operational by 2018.	**2016:** Base case = Blackfriars station, Farringdon station & Borough Viaduct station Cumulative = London Bridge station **2019 & 2023:** Base case
Northern Line Extension		TfL	Extension of the Northern Line (Charing Cross Branch) from Kennington to Battersea, with the creation of two new stations: one at Nine Elms near Wandsworth Road and the other at Battersea Power Station. To include the construction of three permanent shafts at Cottingham Road (intervention shaft), Kennington Green (ventilation shaft) and Kennington Park (ventilation shaft). In addition two temporary shafts would be built at Radcot Street and Harmsworth Street near to Kennington Station.	Not submitted	Under construction	100% complete & operational	100% complete & operational	Information provided by TfL in August 2012. In the absence of publically available information, see Assumptions note used by EIA team at the end of the Development Schedule.	**2016:** Cumulative **2019 & 2023:** Base case

IPC / Parliamentary acts/bills	Development description (including planning application number)			Category type (based on 'current' status)	Year specific assumptions			Source of assumption information / Notes	Base case or cumulative dev?
	Appl. No.	Developer	Description		2016 (Project Year 1)	2019 (network-wide peak construction traffic year)	2023 (Year 1 of operation)		
London Olympics	11/90621/OUTODA	ODA	London Olympics 2012 Site under construction, Olympics taking place between 27th July and 12th August. Paralympics taking place 29th August and 9th September. The 2012 Olympic and Paralympic Games will use a mixture of new venues, existing and historic facilities and infrastructure, and temporary facilities. NB. Olympic legacy to continue after 2012. Comprehensive, phased, mixed use development within the future Queen Elizabeth Olympic Park, Stratford, as set out in the Development Specification & Framework. The development comprises residential uses (including student accommodation) and a hotel; business and employment uses within B1 use class; shopping, food and drink and financial and professional services within the A1, A2, A3, A4 and A5 use classes; community, health, education, cultural, assembly and leisure facilities, within the D1 and D2 use classes; new streets and other means of access and circulation, local utilities connections and diversions, construction of covered and uncovered car parking; re-profiling of site levels; the laying out of open space; removal of bridges; demolition and breaking out of roads and hardstanding; new and replacement bridge crossings; and other ancillary supporting infrastructure works and facilities.	A	The Legacy Communities Scheme is a long term regeneration project, which is expected to be developed over a period of 18 years from 2013 to 2031.	The Legacy Communities Scheme is a long term regeneration project, which is expected to be developed over a period of 18 years from 2013 to 2031.	The Legacy Communities Scheme is a long term regeneration project, which is expected to be developed over a period of 18 years from 2013 to 2031.	http://www.london2012.com/index.php http://planningforms.newham.gov.uk/online-applications/simpleSearchResults.do?action=firstPage	Base case / cumulative (depending on element of legacy scheme being considered)
North London (Electricity Line) Reinforcement Project	Planning Inspectorate project	National Grid Electricity Transmission plc	Upgrade of two existing 275kV overhead lines running between Waltham Cross and Tottenham substations (via Brimsdown substation) and its operation at a higher voltage (400kV). The upgrading will involve works at each substation along the route: • The uprating of the existing ZBC overhead electricity line of approximately 14km in length, from Waltham Cross Substation to Tottenham Substation. This will require the existing 275kV wires to be removed and replaced with ones of a higher capacity.	C	Under construction	100% complete & operational	100% complete & operational	Environmental Statement states that the upgrade would take place in two stages during 2015 & 2016. Therefore it has been assumed that construction will continue up until 2016.	**2016:** Cumulative **2019 & 2023:** Base case

IPC / Parliamentary acts/bills	Development description (including planning application number)			Category type (based on 'current' status)	Year specific assumptions			Source of assumption information / Notes	Base case or cumulative dev?
	Appl. No.	Developer	Description		2016 (Project Year 1)	2019 (network-wide peak construction traffic year)	2023 (Year 1 of operation)		
			• An extension to the substation at Waltham Cross in order to provide a new 400kV Gas Insulated Switchgear (GIS) substation and to modify the connection between the overhead line and the new substation. The new substation will replace part of the existing 275kV substation at Waltham Cross. To connect the overhead line to the new substation, two pylons near Waltham Cross substation will be replaced in different positions and one additional pylon will be built.						

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Northern Line Extension – assumptions for Thames Tideway Tunnel EIA

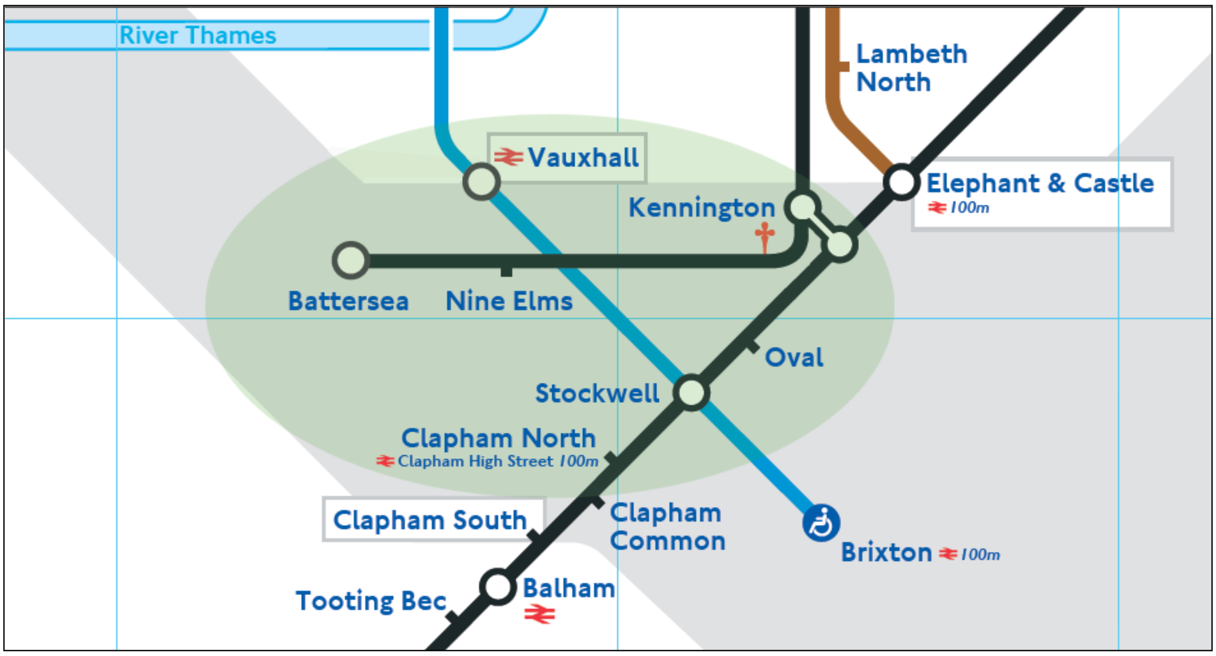
Introduction

A.1.3 This note has been produced to inform Thames Tideway Tunnel EIA specialists of the proposed Northern Line Extension (NLE) development, to be considered in the topic base case and cumulative effect assessments as appropriate.

Overview of NLE project

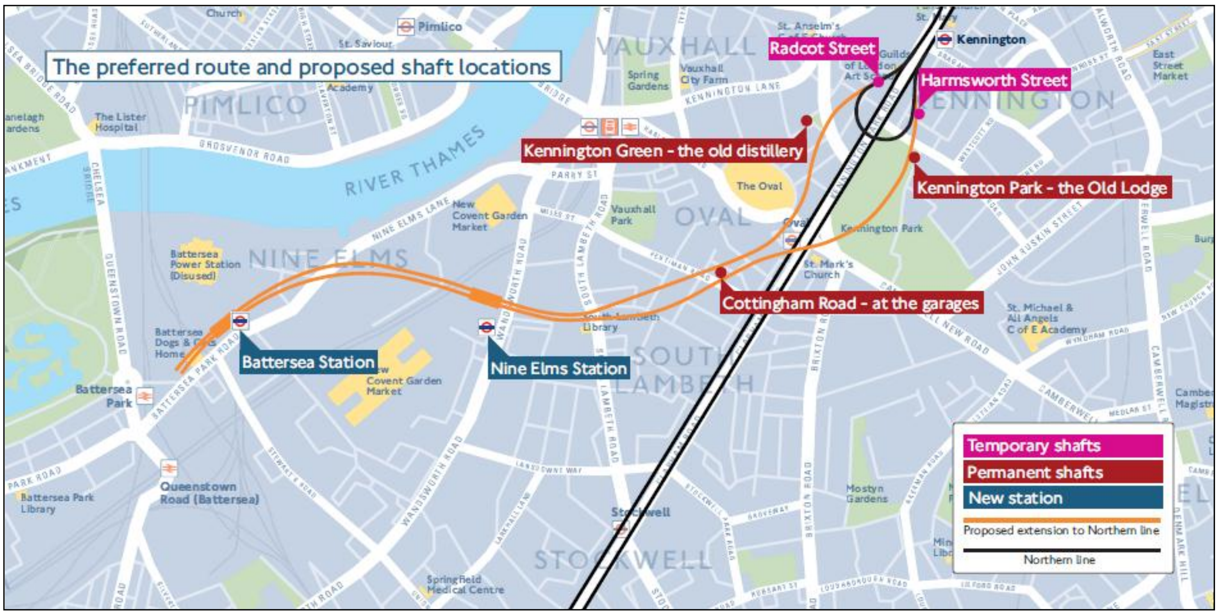
A.1.4 The NLE would extend the Northern Line from Kennington (Charing Cross branch) to Battersea, as shown in Vol 3 Plate A.1 below.

Vol 3 Plate A.1 Tube map showing proposed Northern Line extension



A.1.5 The NLE would include the creation of two new stations: one at Nine Elms near to Wandsworth Road, and the other at Battersea Power Station, as well as the construction of three permanent shafts at Cottingham Road/Claylands Road (intervention shaft), Kennington Green (ventilation shaft) and Kennington Park (ventilation shaft). In addition two temporary shafts would be built at Radcot Street and Harmsworth Street near to Kennington station. The preferred route and proposed shaft locations are shown in Vol 3 Plate A.2 below.

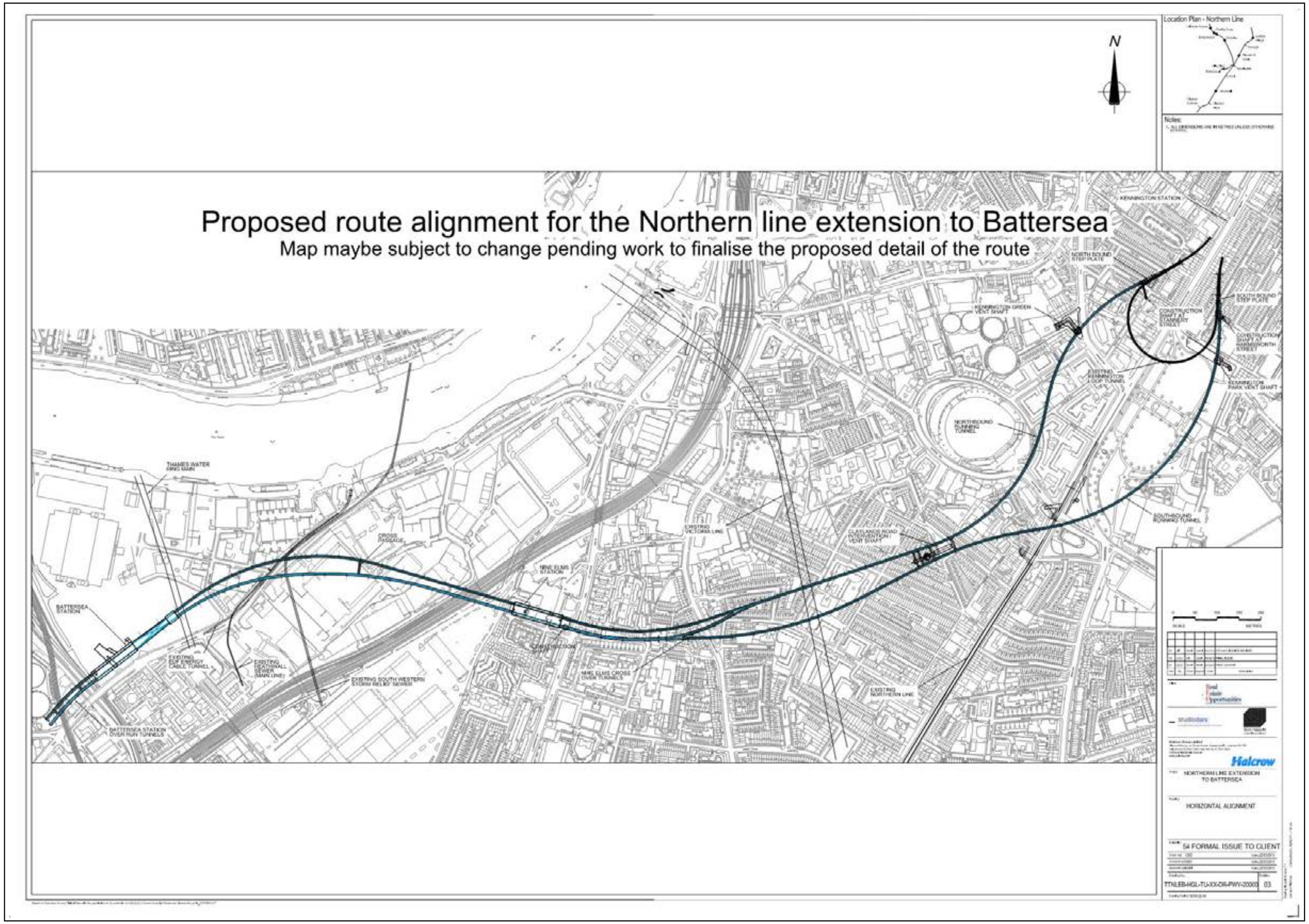
Vol 3 Plate A.2 Preferred route and proposed shaft locations of the Northern Line extension



A.1.6 The NLE would pass through the London Borough (LB) of Wandsworth, LB of Lambeth, and has a temporary shaft within LB of Southwark. It is also close to the City of Westminster, although it is separated by the River Thames.

A.1.7 A detailed proposed route alignment map can be seen in Vol 3 Plate A.3 below.

Vol 3 Plate A.3 Proposed route alignment



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A.1.8 A number of phasing scenarios are currently being considered by the NLE project as there are a number of uncertainties, including the development programme for the redevelopment of Battersea Power Station. However, the most likely scenario is that the NLE project would begin construction in late 2015/early 2016 and last about four years becoming operational in 2019. This is therefore assumed for the purposes of the Thames Tideway Tunnel EIA.

A.1.9 The current assumption for the NLE project (and therefore used for the Thames Tideway Tunnel EIA) is that inbound materials such as tunnel linings, would be brought in by road while excavated material would be removed by river.

A.1.10 To facilitate this, the project would use the Battersea Power Station jetty, which is anticipated to involve moving the existing cranes and installing a conveyor. It is estimated that 100m3 (average) to 2000m3 (maximum) of material would be transported in a 25 hour period (ie, over two tides).

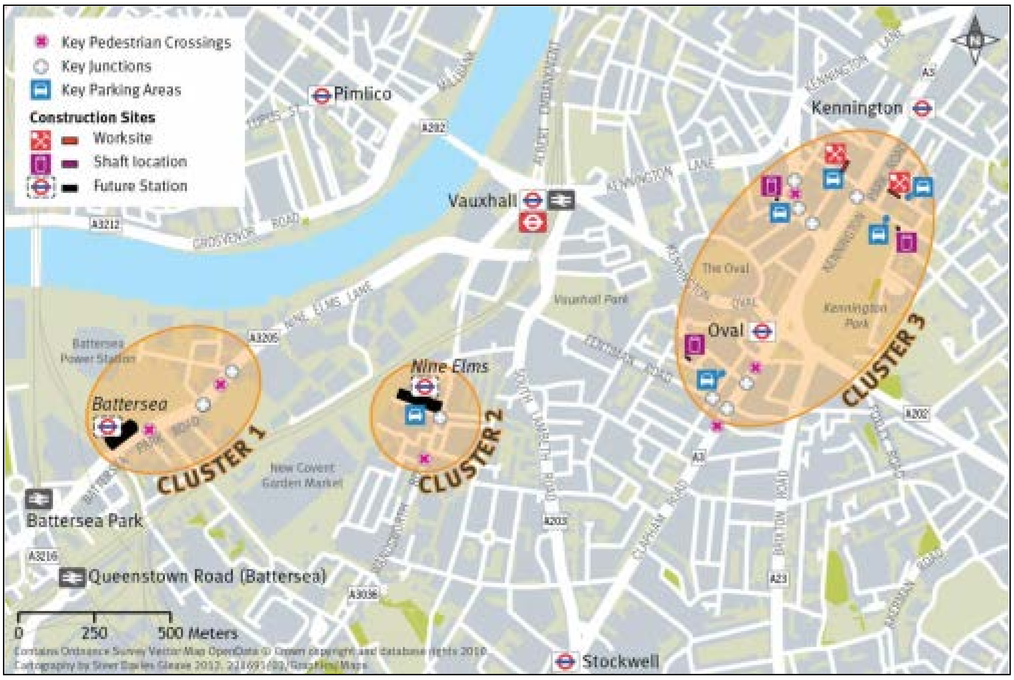
A.1.11 It is however noted that this remains subject to discussions with the Port of London Authority. Additionally, investigations are ongoing as to whether there can be greater use of rail and/or river, as well as the feasibility of on-site manufacturing.

A.1.12 TfL has produced a report outlining the proposed approach to transport and parking impact assessments, in which they break down the NLE construction sites into clusters as follows:

a. Cluster 1 – Battersea Park Road/Nine Elms Lane
   i Battersea Power Station
b. Cluster 2 – Wandsworth Road
   i Nine Elms Station (including Banham site)
c. Cluster 3 – Kennington Park Road
   i Claylands Road (Garages) intervention shaft
   ii Kennington Park (Old Lodge) ventilation shaft
   iii Kennington Green (Distillery) ventilation shaft
   iv Northern site (Radcot Street) temporary grouting shaft
   v Southern site (Harmsworth Street) temporary grouting shaft.

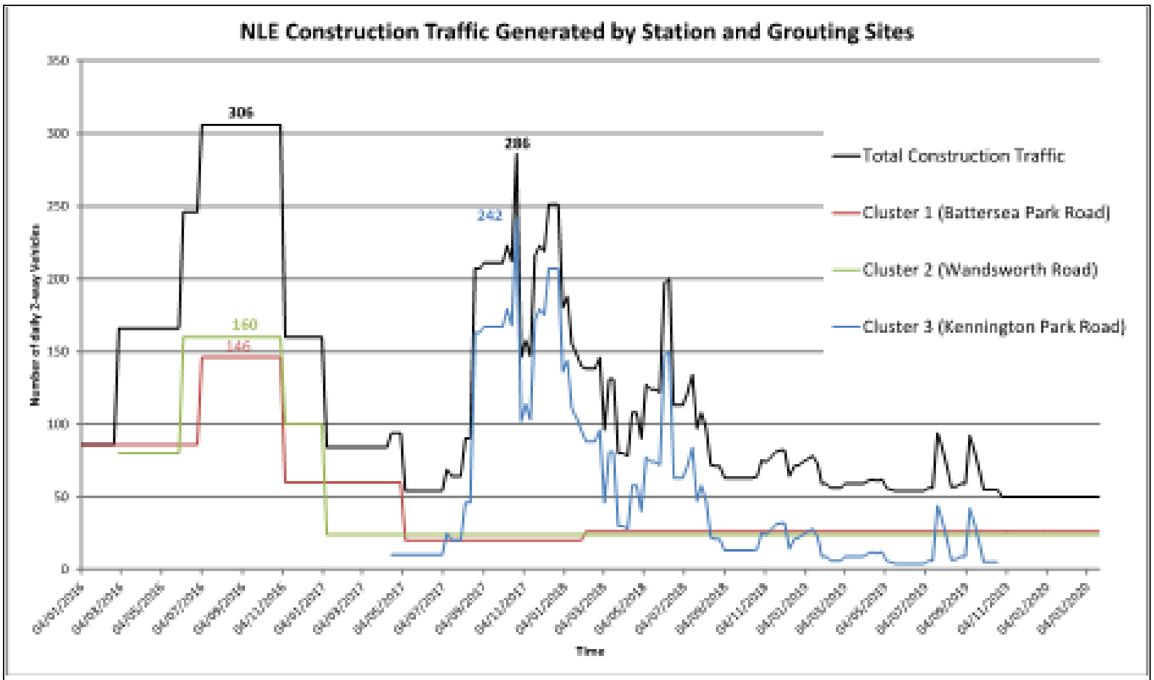
A.1.13 The aforementioned clusters are shown on Vol 3 Plate A.4 below.

Vol 3 Plate A.4 Northern Line Extension construction site clusters



A.1.14 Daily two-way construction traffic, which includes all traffic going in and out of the construction sites in each cluster are shown in Vol 3 Plate A.5 below.

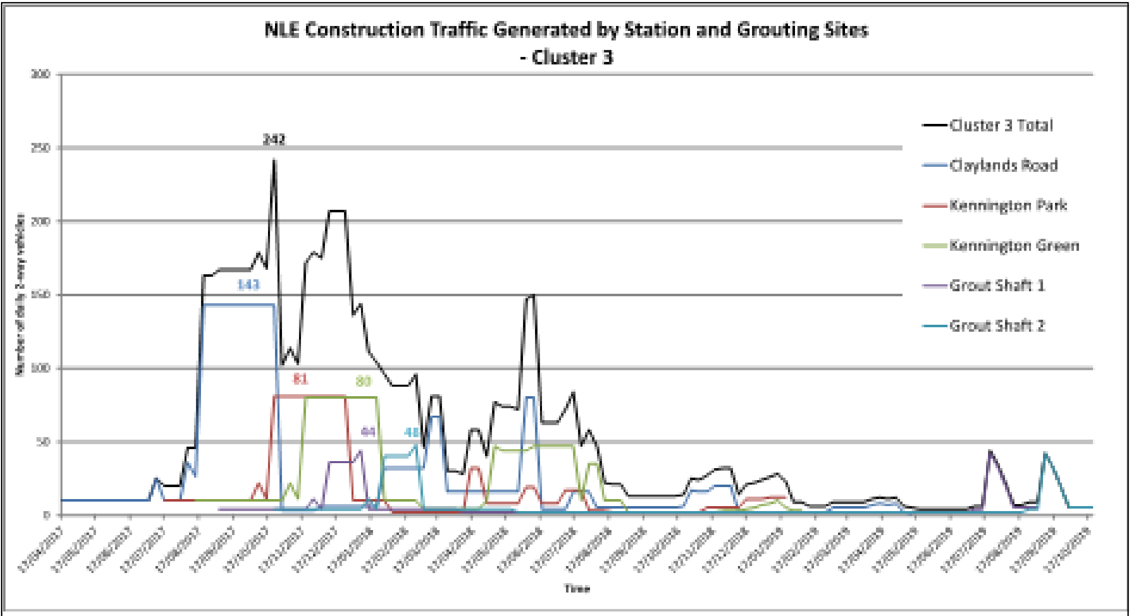
Vol 3 Plate A.5 Daily two-way construction traffic by all clusters



Source: Data provided by Halcrow in April 2012

A.1.15 As cluster 3 includes five separate construction sites, Vol 3 Plate A.6 illustrates the traffic generated by each of these sites, both separately and in total.

Vol 3 Plate A.6 Daily two-way construction traffic in cluster 3



Source: Data provided by Halcrow in April 2012

A.1.16 It has been assumed in the above assessment that construction work would commence on 4 January 2016.

A.1.17 Peak construction activity in term of traffic generation is expected to occur between July and November 2016, with a total of 306 two-way vehicles generated every day.

A.1.18 A secondary peak of construction is expected to take place in November 2017, with a total of 242 two-way daily vehicles.

A.1.19 Of the total outgoing and incoming traffic from/to the construction sites, 30% would have an origin/destination in north London and 70% in south London.

A.1.20 All construction traffic would head to/from the M25 via the most easily accessible arterial routes located within the vicinity of each construction site.

A.1.21 During the construction period it is assumed that construction activity would take place for ten hours during the day, with construction traffic spread out equally across the day.

A.1.22 The main site at Battersea Power Station would not require any diversions, road closures, or parking suspensions; however Kirtling Street would be subject to a high number of vehicle movements.

A.1.23 Road closures/diversions would be required on two small residential streets in the vicinity of Kennington station in order to accommodate the temporary grouting shafts. Buses would be rerouted, and one bus lane may need to be removed in the vicinity of Kennington Green. A small but significant number of parking spaces would need to be suspended, although this will be concentrated around the Kennington Road sites as well as by the proposed Nine Elms station on Wandsworth Road.

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Application Reference Number: WWO10001

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Volume 3: Project-wide effects assessment appendices

Appendix A.2: Carbon footprint assessment

APFP Regulations 2009: Regulation **5(2)(a)**

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A.2 Carbon footprint assessment (carbon model output)

Introduction

A.2.1 In order to evaluate the sustainability of the project, the overall energy demands and Greenhouse Gas emissions have been modelled and evaluated, using two linked models. One model deals with electrical and diesel energy demands from the construction and operational phases of the project; this is referred to as the Energy Model. The other is more detailed and synthesises the outputs of the Energy Model and other significant project activities into Greenhouse Gas emissions; this is known as the Carbon Model. This appendix presents the output from the Carbon Model.

Knowledgebase overview

A.2.2 The Carbon Model has been constructed using Atkins' Carbon Critical Knowledgebase software package. The Carbon Knowledgebase relies on a database of emission factors (carbon factors), which have been used in the Carbon Model. As the quality of these data evolves and understanding of carbon improves, so the variety of elementary carbon data will increase. It is recognised that carbon-related decisions, including the calculation and analysis of carbon, are only as good as the data that underpin them and as such the efficacy, accuracy and quality of these data is fundamental. For this reason the Carbon Knowledgebase was created to store, manage and control fundamental carbon factor information. The Carbon Knowledgebase forms the centralised body of knowledge upon which all carbon calculations and decisions are based.

A.2.3 The overall energy demands and GHG emissions arising from the Thames Tideway Tunnel's construction and operation have been modelled in as much detail as the information emerging from the detailed design of the project allowed. This has not been simply undertaken as an accounting exercise – the real value in undertaking such a detailed modelling exercise is found in the analysis of the model outputs. These outputs have been examined to identify the activities which are the most GHG-intensive, with a view to targeting suitable interventions for mitigation at these areas of potential greatest significance.

A.2.4 The base factors with which the Knowledgebase has been primed have been drawn from a wide range of sources and extensive metadata have been applied so that the user can be assured of their fitness-for-purpose in terms of source, robustness and crucially, their applicability in any given geographical region. Typical units for carbon factors are kgCO_2e per kg of material, kgCO_2e per item, kgCO_2e emitted directly per hour from plant, machinery or vehicles, or kgCO_2e per unit of electrical energy consumed (GJ, kWh etc), where CO_2e is the Carbon Dioxide Equivalent.

A.2.5 The Knowledgebase is a web-based application that allows the team to calculate the carbon footprint of their project, evaluate design options with regards to their comparative carbon footprint and analyse the relative contribution of different carbon sources. It provides facilities to 'mine' a project's design so that the best carbon mitigation strategy can be adopted.

A.2.6 Carbon packages are the fundamental building blocks; they are compiled into design options and quantified so that complex designs can be simply analysed to determine effective carbon mitigation strategies. A further benefit is that simple scenarios can be created quickly using pre-defined high-level packages that represent less granular project components.

A.2.7 As with all carbon accounting methodologies (eg, GHG Protocol) the calculations per CO_2e Package are generally simple (eg, mass or activity multiplied by factor), although the tool provides a customisable calculation engine so that users can define more complex calculations. The interface will generate carbon reports and allow the user to identify the most carbon-intensive packages or materials. By modifying these packages, for instance to substitute road transport with a low-carbon alternative, areas for meaningful interventions are identified. These project-specific 'design iterations' can be saved and revisited as the user requires and therefore appropriate security and auditing mechanisms are an integral aspect of tool integrity.

A.2.8 As with any GHG emission calculation, the mathematics are very simple but rely on robust activity and carbon factor data (e.g. mass quantity of material and the factor in kgCO_2e/kg for that material). The quantity of CO_2e is simply the product of these two values. Carbon factors have been taken from the Carbon Critical Knowledgebase, the same software in which the Carbon Model was constructed.

A.2.9 The Knowledgebase draws on published carbon factors from academic and industrial research. Factors for materials have been primarily taken from the Bath University Inventory of Carbon Emissions (ICE) v2.0; whereas factors for electrical energy generation and all modes of transportation have been taken from Defra's annual Greenhouse Gas Factors for Company Reporting (2011 version).

A.2.10 Factors for plant and machinery are largely taken from the EU EMEP database, formerly CORINAIR.

A.2.11 The full model structure is reproduced below (electronic version only) and summarised at the end of this appendix. The CO_2e emissions are grouped according to site type; with a nested breakdown of emissions due to material, transport / logistics, construction and operation at each site.

Summary

A.2.12 An aggregated summary of output from the carbon model for the preferred scenario (the project, as proposed) is presented in Vol 3 Table A.2 below. This also shows the potential GHG emissions avoided due to various design and construction interventions which have been achieved during the planning phase of the project.

A.2.13 The operational GHG emissions are defined assuming decarbonisation. The GHG emissions for non-decarbonised operation (2023-2143) are approximately 533,000 tCO2e.

Vol 3 Table A.2 Preferred Scenario (decarbonised, with barge)

Project phase	GHG emissions (tCO_2e)	Potential carbon avoided (tCO_2e)
Materials (2016-2023)	702, 882	Up to 199,000 t from decrease in tunnel length
Transport and logistics (2016 – 2023)	28,837	Up to 7,000 t from partial barge transportation
Construction plant and machinery (2016 – 2023)	87,182	Marginal
Operation (2023-2140)	19,133	Up to 3,800 t from renewables if achieved
Total:	**Approx 838,000**	**Up to 210,000**

A.2.14 Full details of the energy and carbon assessment exercise and respective model outputs are contained in the *Energy and Carbon Footprint Report* which accompanies the application.

Carbon model – fully expanded outputs

A.2.15 Fully expanded outputs are provided below.

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Project Name: Thames Tunnel Energy & Carbon Assessment

Print Date: 30/11/2012

Produced By: G M Bollan

Project Notes: None

Section: Carbon Model (Alternative Scenario - Barge)

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Carbon Model (Alternative Scenario - Barge)		838,034,028	838,034,028	838,034,028
Main Sites		496,934,874	496,934,874	496,934,874
Kirtling Street		228,189,392	228,189,392	228,189,392
Construction Phase		228,167,742	228,167,742	228,167,742
Materials	1 Site	192,550,712	192,550,712	192,550,712
Tunnel/ Shaft Rings Carbon Factor: Concrete - Fibre Reinforced Value: 0.48 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 278,219,000 kg Source: Bath ICE (2.0) Region: UK Mass: 278,219,000 kg		133,545,120	133,545,120	133,545,120
Concrete - Ready Mix (2.45 T/m³) Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 64,898,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 64,898,000 kg		10,708,170	10,708,170	10,708,170
Concrete-Batched-Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 17,915,000 kg Source: Bath ICE (2.0) Region: UK Mass: 17,915,000 kg		13,257,100	13,257,100	13,257,100
Concrete-Batched-Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 33,590,000 kg Source: Bath ICE (2.0) Region: UK Mass: 33,590,000 kg		171,309	171,309	171,309
Concrete-Batched-10/20mm Aggregate Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 44,787,000 kg Source: Bath ICE (2.0) Region: UK Mass: 44,787,000 kg		232,892	232,892	232,892

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Grout Batched Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 41,451,000 kg Source: Bath ICE (2.0) Region: UK Mass: 41,451,000 kg		211,400	211,400	211,400
Grout-Batched-Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 10,363,000 kg Source: Bath ICE (2.0) Region: UK Mass: 10,363,000 kg		7,668,620	7,668,620	7,668,620
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 14,385,000 kg Source: Bath ICE (2.0) Region: Global Mass: 14,385,000 kg		26,756,100	26,756,100	26,756,100
Transport Emissions		9,858,140	9,858,140	9,858,140
Waste Disposal		7,233,633	7,233,633	7,233,633
Excavated Material (Barge)	1,541 Barge Movements	3,443	5,306,141	5,306,141
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 117,000 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 130 km Weight: 900 tonne		3,443	3,443	5,306,141
Excavated Material (Road)	19,738 Vehicle Movements	92	1,816,850	1,816,850
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 464 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 29 km Weight: 16 tonne		92	92	1,816,850
Demolition Material (Road)	2,404 Vehicle Movements	46	110,642	110,642
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 232 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 14.5 km Weight: 16 tonne		46	46	110,642
Deliveries		2,624,507	2,624,507	2,624,507
Tunnel / Shaft Rings (Various Sizes) (Road)	13,911 Vehicle Movements	160	2,227,920	2,227,920

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,132.8 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 70.8 km Weight: 16 tonne		160	160	2,227,920
Concrete - Ready Mix (2.45 T/m³) (Road)	4,423 Vehicle Movements	0.57	2,527	2,527
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 2.88 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 0.2 km Weight: 14.4 tonne		0.57	0.57	2,527
Concrete - Batched - Cement (Road)	1,428 Vehicle Movements	54	77,621	77,621
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 274 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 13.7 km Weight: 20 tonne		54	54	77,621
Concrete - Batched - Sand (Road)	1,681 Vehicle Movements	0.79	1,334	1,334
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 4 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 0.2 km Weight: 20 tonne		0.79	0.79	1,334
Concrete Batched 10/20mm (Road)	225 Vehicle Movements	0.79	179	179
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 4 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 0.2 km Weight: 20 tonne		0.79	0.79	179
Concrete Batched 10/20mm (Barge)	78 Barge Movements	585	45,654	45,654
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 19,888 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 22 km Weight: 904 tonne		585	585	45,654
Grout Batched PFA (Road)	531 Vehicle Movements	173	91,889	91,889

Name	Quantity	Single ($kgCO_2e$)	Total ($kgCO_2e$)	Project ($kgCO_2e$)
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,224 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 61.2 km Weight: 20 tonne		173	173	91,889
Grout Batched Sand (Road)	2,085 Vehicle Movements	0.57	1,179	1,179
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 4 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 0.2 km Weight: 20 tonne		0.57	0.57	1,179
Grout Batched Bentonite (Road)	43 Vehicle Movements	642	27,588	27,588
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 4,538 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 226.9 km Weight: 20 tonne		642	642	27,588
Formwork/ Pipe/ Track /Oils (Road)	3,189 Vehicle Movements	23	73,039	73,039
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 162 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 10.8 km Weight: 15 tonne		23	23	73,039
Rebar (Road)	959 Vehicle Movements	56	53,284	53,284
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 393 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 26.2 km Weight: 15 tonne		56	56	53,284
Plant Deliveries (Road)	725 Vehicle Movements	31	22,294	22,294
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 217.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 14.5 km Weight: 15 tonne		31	31	22,294
Plant Use		25,758,891	25,758,891	25,758,891
Fencing		2,254	2,254	2,254
Kirt 1: Tracked Excavator - fence posts	2 No.	305	611	611

Name	Quantity	Single ($kgCO_2e$)	Total ($kgCO_2e$)	Project ($kgCO_2e$)
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 114.5 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 114.5 Litres		305	305	611
Kirt 2: 35kVA Diesel Generator	1 No.	891	891	891
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 334 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 334 Litres		891	891	891
Kirt 3: Circular Saw, Bench Mounted, 660mm Blade	2 No.	71	141	141
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 134.5 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 134.5 kWh		71	71	141
Kirt 4: Cutting Equipment - Diamond Saw	2 No.	14	28	28
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 27 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 27 kWh		14	14	28
Kirt 5: Handheld cordless nail gun, 15 to 50 mm na	2 No.	9.4	19	19
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 18 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 18 kWh		9.4	9.4	19
Kirt 6: Hand-held electric circular saw, 225 mm bl	1 No.	14	14	14
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 27 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 27 kWh		14	14	14
Kirt 7: Dumper 7 t	2 No.	275	550	550

Name	Quantity	kgCO2e Single	Total	Project
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 103 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 103 Litres		275	275	550
Demolition and Site Set Up		111,006	111,006	111,006
Kirt 8: Tracked Excavator, 25 t	1 No.	6,517	6,517	6,517
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 2,443 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 2,443 Litres		6,517	6,517	6,517
Kirt 9: Tracked Excavator, 22 t	2 No.	5,449	10,897	10,897
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 2,042.5 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 2,042.5 Litres		5,449	5,449	10,897
Kirt 10: Dumper 7 t	1 No.	4,124	4,124	4,124
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 1,546 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 1,546 Litres		4,124	4,124	4,124
Kirt 11: Concrete Pump+Cement Mixer tuck	1 No.	11,356	11,356	11,356
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 4,257 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 4,257 Litres		11,356	11,356	11,356
Kirt 12: Compressor 250cfm Compressor, 7 m3/min	1 No.	5,641	5,641	5,641
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 10,752 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 10,752 kWh		5,641	5,641	5,641

Name	Quantity	Single ($kgCO_2e$)	Total ($kgCO_2e$)	Project ($kgCO_2e$)
Kirt 13: 200 kVA Generator	1 No.	0	0	0
Kirt 14: Dewatering pump (diesel, 150mm) 100 kg	1 No.	3,463	3,463	3,463
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 1,298 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 1,298 Litres		3,463	3,463	3,463
Kirt 15: Fuel Browser	1 No.	51	51	51
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 19 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 19 Litres		51	51	51
Kirt 16: Plate compactors Tracked crusher, 47 t	2 No.	8,759	17,518	17,518
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 3,283.5 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 3,283.5 Litres		8,759	8,759	17,518
Kirt 17: Vibrating rollers Roller, 18 t	2 No.	5,907	11,815	11,815
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 2,214.5 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 2,214.5 Litres		5,907	5,907	11,815
Kirt 18: 500 A Arc Diesel Arc Welder Diesel genera	2 No.	611	1,222	1,222
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 229 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 229 Litres		611	611	1,222
Kirt 19: Cutting equipment - diamond saw	2 No.	85	169	169

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 161.5 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 161.5 kWh		85	85	169
Kirt 20: Telescopic Handler/FLT Telescopic handler	1 No.	2,444	2,444	2,444
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 916 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 916 Litres		2,444	2,444	2,444
Kirt 21: Hiab lorry/crane Lorry with lifting boom,	1 No.	253	253	253
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 95 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 95 Litres		253	253	253
Kirt 22: Sump Pump	8 No.	3,173	25,383	25,383
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 6,048 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 6,048 kWh		3,173	3,173	25,383
Kirt 23: Water Settline/Treatment	1 No.	10,153	10,153	10,153
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 19,354 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 19,354 kWh		10,153	10,153	10,153
Jetty Construction		17,100	17,100	17,100
Kirt 24: Compressor 400cfm Compressor, 10.5 m3/min	1 No.	5,659	5,659	5,659
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 10,786 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 10,786 kWh		5,659	5,659	5,659

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Kirt 25: Crawler Crane 50t	1 No.	11,441	11,441	11,441
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 4,289 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 4,289 Litres		11,441	11,441	11,441
Kirt 26: 200 kVA Generator	1 No.	0	0	0
Shaft Sinking by Diaphragm Walling		1,428,729	1,428,729	1,428,729
Kirt 27: Dwall rig	1 No.	60,904	60,904	60,904
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 22,831 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 22,831 Litres		60,904	60,904	60,904
Kirt 28: Slurry treatment plant 1	1 No.	586,634	586,634	586,634
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,118,208 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 1,118,208 kWh		586,634	586,634	586,634
Kirt 29: Waste water treatment plant	1 No.	65,996	65,996	65,996
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 125,798 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 125,798 kWh		65,996	65,996	65,996
Kirt 30: Compressor 400cfm Compressor, 10.5 m3/min	1 No.	16,499	16,499	16,499
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 31,450 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 31,450 kWh		16,499	16,499	16,499
Kirt 31: Dumper 7 t	3 No.	26,811	80,433	80,433

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 10,050.66 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 10,050.66 Litres		26,811	26,811	80,433
Kirt 32: Tunnel ventilation fans	2 No.	82,495	164,991	164,991
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 157,248 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 157,248 kWh		82,495	82,495	164,991
Kirt 33: Dewatering pump Water pump (diesel), 100	4 No.	22,508	90,032	90,032
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 8,437.5 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 8,437.5 Litres		22,508	22,508	90,032
Kirt 34: Long reach tracked excavator, 21 m arm /	2 No.	58,918	117,836	117,836
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 22,086.5 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 22,086.5 Litres		58,918	58,918	117,836
Kirt 35: Tracked excavator fitted with hydraulic r	2 No.	15,888	31,776	31,776
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 5,956 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 5,956 Litres		15,888	15,888	31,776
Kirt 36: Tracked excavator, 25 t	1 No.	42,367	42,367	42,367
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 15,882 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 15,882 Litres		42,367	42,367	42,367
Kirt 37: 100t crawler crane Tracked mobile crane,	2 No.	48,724	97,447	97,447

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 18,265 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 18,265 Litres		48,724	48,724	97,447
Kirt 38: Concrete pump + cement mixer truck (disch	1 No.	73,812	73,812	73,812
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 27,670 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 27,670 Litres		73,812	73,812	73,812
MT Drive: Kirtling St - Carnwath Road		9,385,395	9,385,395	9,385,395
Kirt 39: 100t crawler crane Tracked mobile crane,	1 No.	100,230	100,230	100,230
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 37,573 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 37,573 Litres		100,230	100,230	100,230
Kirt 40: Wheeled mobile telescopic crane 250t mobi	1 No.	2,545	2,545	2,545
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 954 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 954 Litres		2,545	2,545	2,545
Kirt 41: Wheeled mobile telescopic crane 500t,	1 No.	5,941	5,941	5,941
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 2,227 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 2,227 Litres		5,941	5,941	5,941
Kirt 42: Compressor 600cfm Compressor, 17 m3/min	1 No.	52,797	52,797	52,797
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 100,639 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 100,639 kWh		52,797	52,797	52,797

Name	Quantity	kgCO2e Single	Total	Project
Kirt 43: Alimak service hoist	1 No.	28,284	28,284	28,284
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 53,914 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 53,914 kWh		28,284	28,284	28,284
Kirt 44: Dumper 7 t	1 No.	55,153	55,153	55,153
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 20,675 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 20,675 Litres		55,153	55,153	55,153
Kirt 45: Gantry cranes 30t	2 No.	113,137	226,273	226,273
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 215,654.5 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 215,654.5 kWh		113,137	113,137	226,273
Kirt 46: Grout mixer including silos and feeders	1 No.	48,272	48,272	48,272
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 92,013 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 92,013 kWh		48,272	48,272	48,272
Kirt 47: Land conveyor to stockpile	1 No.	75,425	75,425	75,425
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 143,770 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 143,770 kWh		75,425	75,425	75,425
Kirt 48: Loading shovel - Tracked 47t	1 No.	160,013	160,013	160,013
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 59,984 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 59,984 Litres		160,013	160,013	160,013

Name	Quantity	kgCO2e Single	kgCO2e Total	kgCO2e Project
Kirt 49: Loco and bogies for segment transfer	1 No.	106,066	106,066	106,066
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 202,176 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 202,176 kWh		106,066	106,066	106,066
Kirt 50: Manrider basket	1 No.	15,085	15,085	15,085
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 28,754 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 28,754 kWh		15,085	15,085	15,085
Kirt 51: Shaft HAC conveyor	1 No.	56,568	56,568	56,568
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 107,827 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 107,827 kWh		56,568	56,568	56,568
Kirt 52: Stockpiler conveyor	1 No.	90,510	90,510	90,510
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 172,524 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 172,524 kWh		90,510	90,510	90,510
Kirt 53: Sump Pump	4 No.	42,426	169,705	169,705
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 80,870.5 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 80,870.5 kWh		42,426	42,426	169,705
Kirt 54: Telescopic Handler/FLT Telescopic handler	1 No.	32,683	32,683	32,683
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 12,252 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 12,252 Litres		32,683	32,683	32,683

Name	Quantity	Single ($kgCO_2e$)	Total ($kgCO_2e$)	Project ($kgCO_2e$)
Kirt 55: Waste water treatment plant	1 No.	135,764	135,764	135,764
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 258,785 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 258,785 kWh		135,764	135,764	135,764
Kirt 56: Transfer stockpiler/barge	1 No.	0	0	0
Kirt 57: Tunnel ventilation fans	2 No.	169,705	339,410	339,410
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 323,481.5 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 323,481.5 kWh		169,705	169,705	339,410
Kirt 58: Grout mixer including silos and feeders	1 No.	48,272	48,272	48,272
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 92,013 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 92,013 kWh		48,272	48,272	48,272
Kirt 59: Locomotives	5 No.	106,066	530,328	530,328
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 202,176 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 202,176 kWh		106,066	106,066	530,328
Kirt 60: TBM EPDB	1 No.	6,524,211	6,524,211	6,524,211
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 12,436,070 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 12,436,070 kWh		6,524,211	6,524,211	6,524,211
Kirt 61: Tunnel Conveyor	2 No.	226,273	452,547	452,547

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 431,309 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 431,309 kWh		226,273	226,273	452,547
Kirt 63: Tunnel Lighting	1,016 No.	127	129,315	129,315
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 242.61 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 242.61 kWh		127	127	129,315
MT Drive: Kirtling St - Chambers Wharf		12,894,287	12,894,287	12,894,287
Kirt 62: 100t crawler crane Tracked mobile crane,	1 No.	133,641	133,641	133,641
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 50,098 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 50,098 Litres		133,641	133,641	133,641
Kirt 63: Wheeled mobile telescopic crane 250t mobi	1 No.	4,364	4,364	4,364
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 1,636 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 1,636 Litres		4,364	4,364	4,364
Kirt 64: Wheeled mobile telescopic crane 500t,	1 No.	10,185	10,185	10,185
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 3,818 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 3,818 Litres		10,185	10,185	10,185
Kirt 65: Compressor 600cfm Compressor, 17 m3/min	1 No.	70,396	70,396	70,396
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 134,185 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 134,185 kWh		70,396	70,396	70,396

Name	Quantity	kgCO2e Single	Total	Project
Kirt 66: Alimak service hoist	1 No.	37,712	37,712	37,712
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 71,885 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 71,885 kWh		37,712	37,712	37,712
Kirt 67: Dumper 7 t	1 No.	73,538	73,538	73,538
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 27,567 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 27,567 Litres		73,538	73,538	73,538
Kirt 68: Gantry cranes 30t	2 No.	150,849	301,697	301,697
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 287,539 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 287,539 kWh		150,849	150,849	301,697
Kirt 69: Grout mixer including silos and feeders	1 No.	64,362	64,362	64,362
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 122,683 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 122,683 kWh		64,362	64,362	64,362
Kirt 70: Land conveyor to stockpile	1 No.	100,566	100,566	100,566
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 191,693 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 191,693 kWh		100,566	100,566	100,566
Kirt 71: Loading shovel - Tracked 47t	1 No.	213,352	213,352	213,352
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 79,979 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 79,979 Litres		213,352	213,352	213,352

Name	Quantity	kgCO2e Single	kgCO2e Total	kgCO2e Project
Kirt 72: Loco and bogies for segment transfer	1 No.	141,421	141,421	141,421
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 269,568 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 269,568 kWh		141,421	141,421	141,421
Kirt 73: Manrider basket	1 No.	20,113	20,113	20,113
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 38,339 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 38,339 kWh		20,113	20,113	20,113
Kirt 74: Shaft HAC Conveyor	1 No.	75,425	75,425	75,425
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 143,770 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 143,770 kWh		75,425	75,425	75,425
Kirt 75: Stockpiler conveyor	1 No.	120,679	120,679	120,679
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 230,031 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 230,031 kWh		120,679	120,679	120,679
Kirt 76: Sump pump	5 No.	56,568	282,842	282,842
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 107,827.2 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 107,827.2 kWh		56,568	56,568	282,842
Kirt 77: Telescopic Handler/FLT Telescopic handler	2 No.	43,578	87,156	87,156
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 16,336 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 16,336 Litres		43,578	43,578	87,156

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Kirt 78: Waste water treatment plant	1 No.	181,019	181,019	181,019
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 345,047 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 345,047 kWh		181,019	181,019	181,019
Kirt 79: Transfer stockpiler/barge	1 No.	0	0	0
Kirt 80: Dewatering pump Water pump (diesel), 100	8 No.	61,736	493,890	493,890
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 23,143 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 23,143 Litres		61,736	61,736	493,890
Kirt 81: Tunnel ventilation fans	2 No.	226,273	452,547	452,547
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 431,309 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 431,309 kWh		226,273	226,273	452,547
Kirt 82: Grout mixer including silos and feeders	1 No.	64,362	64,362	64,362
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 122,683 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 122,683 kWh		64,362	64,362	64,362
Kirt 83: Locomotives	5 No.	141,421	707,104	707,104
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 269,568 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 269,568 kWh		141,421	141,421	707,104
Kirt 84: TBM EPDB	1 No.	8,698,948	8,698,948	8,698,948

Name	Quantity	kgCO2e Single	Total	Project
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 16,581,427 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 16,581,427 kWh		8,698,948	8,698,948	8,698,948
Kirt 85: Tunnel Conveyor	1 No.	301,697	301,697	301,697
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 575,078 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 575,078 kWh		301,697	301,697	301,697
Kirt 86: Tunnel Lighting	1,516 No.	170	257,271	257,271
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 323.48 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 323.48 kWh		170	170	257,271
MT Secondary Lining: Kirtling St - Carnwath Road		574,785	574,785	574,785
Kirt 87: Agitate concrete trucks	4 No.	31,918	127,671	127,671
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 11,965 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 11,965 Litres		31,918	31,918	127,671
Kirt 88: Compressor 600cfm Compressor, 17 m3/min	1 No.	16,499	16,499	16,499
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 31,450 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 31,450 kWh		16,499	16,499	16,499
Kirt 89: Concrete batching plant 40m³/hr	1 No.	44,194	44,194	44,194
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 84,240 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 84,240 kWh		44,194	44,194	44,194

Name	Quantity	kgCO2e Single	Total	Project
Kirt 90: 200 kVA Generator	1 No.	0	0	0
Kirt 91: Gantry cranes 30t	2 No.	35,355	70,710	70,710
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 67,392 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 67,392 kWh		35,355	35,355	70,710
Kirt 92: Loading shovel - Tracked 47t	1 No.	50,004	50,004	50,004
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 18,745 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 18,745 Litres		50,004	50,004	50,004
Kirt 93: Sump pump	4 No.	13,258	53,033	53,033
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 25,272 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 25,272 kWh		13,258	13,258	53,033
Kirt 94: Telescopic Handler/FLT Telescopic handler	2 No.	10,214	20,428	20,428
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 3,829 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 3,829 Litres		10,214	10,214	20,428
Kirt 95: Waste water treatment plant	1 No.	42,426	42,426	42,426
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 80,870 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 80,870 kWh		42,426	42,426	42,426
Kirt 96: Alimak service hoist	1 No.	8,839	8,839	8,839

Name	Quantity	kgCO2e Single	Total	Project
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 16,848 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 16,848 kWh		8,839	8,839	8,839
Kirt 96: Cherry picker	1 No.	5,957	5,957	5,957
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 2,233 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 2,233 Litres		5,957	5,957	5,957
Kirt 97: Concrete distributor	1 No.	2,357	2,357	2,357
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 4,493 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 4,493 kWh		2,357	2,357	2,357
Kirt 98: Rail mounted concrete pump	2 No.	35,355	70,710	70,710
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 67,392 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 67,392 kWh		35,355	35,355	70,710
Kirt 99: Mini excavator	1 No.	8,512	8,512	8,512
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 3,191 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 3,191 Litres		8,512	8,512	8,512
Kirt 100: Manrider basket	1 No.	4,714	4,714	4,714
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 8,986 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 8,986 kWh		4,714	4,714	4,714
Kirt 101: Pressure washer	1 No.	236	236	236

Name	Quantity	kgCO2e Single	Total	Project
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 449 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 449 kWh		236	236	236
Kirt 102: Tunnel Lighting	1,016 No.	48	48,494	48,494
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 90.98 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 90.98 kWh		48	48	48,494
MT Secondary Lining: Kirtling St - Chambers Wharf		865,094	865,094	865,094
Kirt 103: Agitate concrete trucks	4 No.	47,195	188,778	188,778
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 17,691.75 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 17,691.75 Litres		47,195	47,195	188,778
Kirt 104: Compressor 600cfm Compressor, 17 m3/min	1 No.	24,396	24,396	24,396
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 46,502 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 46,502 kWh		24,396	24,396	24,396
Kirt 105: Concrete batching plant 40m³/hr	1 No.	65,347	65,347	65,347
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 124,560 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 124,560 kWh		65,347	65,347	65,347
Kirt 106: Emergency generator - 200kW	1 No.	0	0	0
Kirt 107: Gantry cranes 30t	2 No.	52,277	104,555	104,555

Name	Quantity	kgCO2e Single	Total	Project
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 99,648 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 99,648 kWh		52,277	52,277	104,555
Kirt 108: Loading shovel - Tracked 47t	1 No.	73,938	73,938	73,938
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 27,717 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 27,717 Litres		73,938	73,938	73,938
Kirt 109: Sump pump	4 No.	19,604	78,416	78,416
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 37,368 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 37,368 kWh		19,604	19,604	78,416
Kirt 110: Telescopic Handler/FLT Telescopic handle	2 No.	15,103	30,205	30,205
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 5,661.5 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 5,661.5 Litres		15,103	15,103	30,205
Kirt 111: Waste water treatment plant	1 No.	62,733	62,733	62,733
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 119,578 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 119,578 kWh		62,733	62,733	62,733
Kirt 112: Alimak service hoist	1 No.	13,069	13,069	13,069
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 24,912 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 24,912 kWh		13,069	13,069	13,069
Kirt 113: Cherry picker	1 No.	8,808	8,808	8,808

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 3,302 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 3,302 Litres		8,808	8,808	8,808
Kirt 114: Concrete distributor	1 No.	3,485	3,485	3,485
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 6,643 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 6,643 kWh		3,485	3,485	3,485
Kirt 115: Rail mounted concrete pump	2 No.	52,277	104,555	104,555
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 99,648 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 99,648 kWh		52,277	52,277	104,555
Kirt 116: Flatbed with Hiab arm	1 No.	4,719	4,719	4,719
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 1,769 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 1,769 Litres		4,719	4,719	4,719
Kirt 117: Mini excavator	1 No.	12,586	12,586	12,586
Diesel Consumption Carbon Factor: Diesel Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 4,718 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 4,718 Litres		12,586	12,586	12,586
Kirt 118: Pressure washer	1 No.	348	348	348
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 664 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 664 kWh		348	348	348
Kirt 119: Tunnel Lighting	1,516 No.	59	89,156	89,156

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 112.1 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 112.1 kWh		59	59	89,156
Site Amenities		480,241	480,241	480,241
Kirt 120: Site Office - Large	1 No.	424,262	424,262	424,262
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 808,704 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 808,704 kWh		424,262	424,262	424,262
Kirt 121: Site lighting - Large	1 No.	29,463	29,463	29,463
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 56,160 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 56,160 kWh		29,463	29,463	29,463
Kirt 122: Security Lighting	1 No.	26,516	26,516	26,516
Electricity Consumption Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 50,544 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 50,544 kWh		26,516	26,516	26,516
Operational Phase		21,650	21,650	21,650
LV Electric: 2020-2024	1 Period	12,885	12,885	12,885
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		9,819	9,819	9,819
Small Power Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		3,066	3,066	3,066
LV Electric: 2025-2029	1 Period	6,897	6,897	6,897

Name	Quantity	kgCO2e Single	Total	Project
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		5,256	5,256	5,256
Small Power Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		1,641	1,641	1,641
LV Electric: 2030-2034	1 Period	1,868	1,868	1,868
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		1,424	1,424	1,424
Small Power Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		445	445	445
Carnwath Road Riverside		128,965,255	128,965,255	128,965,255
Construction Phase		127,514,096	127,514,096	127,514,096
Plant Use		12,452,970	12,452,970	12,452,970
Fencing	1 Activity Type	11,260	11,260	11,260
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 224 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 224 kWh		118	118	118
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 4,177 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 4,177 Litres		11,143	11,143	11,143
Demolition and Site Set Up	1 Activity Type	240,025	240,025	240,025

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 216,272 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 216,272 kWh		113,461	113,461	113,461
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 47,445 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 47,445 Litres		126,564	126,564	126,564
Piling	1 Activity Type	7,867	7,867	7,867
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 2,949 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 2,949 Litres		7,867	7,867	7,867
Shaft sinking by SCL	1 Activity Type	82,388	82,388	82,388
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 63,202 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 63,202 kWh		33,157	33,157	33,157
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 18,455 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 18,455 Litres		49,231	49,231	49,231
Main Tunnel Drive Hurlingham to Acton	1 Activity Type	10,960,139	10,960,139	10,960,139
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 3,523,619 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 3,523,619 kWh		1,848,561	1,848,561	1,848,561
HV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 16,127,175 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 16,127,175 kWh		8,460,639	8,460,639	8,460,639

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 244,017 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 244,017 Litres		650,940	650,940	650,940
Main tunnel secondary lining	1 Activity Type	671,050	671,050	671,050
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 776,796 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 776,796 kWh		407,523	407,523	407,523
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 98,788 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 98,788 Litres		263,527	263,527	263,527
Site amenities	1 Activity Type	480,241	480,241	480,241
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 915,408 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 915,408 kWh		480,241	480,241	480,241
Materials	1 Site	110,115,232	110,115,232	110,115,232
Tunnel/ Shaft Rings Carbon Factor: Concrete - Fibre Reinforced Value: 0.48 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 139,414,000 kg Source: Bath ICE (2.0) Region: UK Mass: 139,414,000 kg		66,918,720	66,918,720	66,918,720
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 37,002,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 37,002,000 kg		6,105,330	6,105,330	6,105,330
Concrete - Batched - Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 15,969,000 kg Source: Bath ICE (2.0) Region: UK Mass: 15,969,000 kg		11,817,060	11,817,060	11,817,060

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Concrete - Batched - Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 29,941,000 kg Source: Bath ICE (2.0) Region: UK Mass: 29,941,000 kg		152,699	152,699	152,699
Concrete - Batched 10/20mm Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 39,922,000 kg Source: Bath ICE (2.0) Region: UK Mass: 39,922,000 kg		207,594	207,594	207,594
Grout - Batched - Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 5,209,000 kg Source: Bath ICE (2.0) Region: UK Mass: 5,209,000 kg		3,854,660	3,854,660	3,854,660
Grout - Batched - Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 20,837,000 kg Source: Bath ICE (2.0) Region: UK Mass: 20,837,000 kg		106,269	106,269	106,269
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 11,265,000 kg Source: Bath ICE (2.0) Region: Global Mass: 11,265,000 kg		20,952,900	20,952,900	20,952,900
Transport Emissions		4,945,894	4,945,894	4,945,894
Waste Disposal		3,325,648	3,325,648	3,325,648
Excavated Material (Barge)	980 Barge Movements	2,818	2,761,852	2,761,852
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 95,760 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 133 km Weight: 720 tonne		2,818	2,818	2,761,852
Excavated Material (Road)	6,125 Vehicle Movements	92	563,796	563,796
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 464 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 29 km Weight: 16 tonne		92	92	563,796
Deliveries		1,620,246	1,620,246	1,620,246

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Tunnel / Shaft Rings (Various Sizes)	6,971 Vehicle Movements	185	1,293,055	1,293,055
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,312 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 82 km Weight: 16 tonne		185	185	1,293,055
Concrete - Ready Mix (2.45 T/m³)	2,528 Vehicle Movements	1.7	4,333	4,333
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 8.64 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 0.6 km Weight: 14.4 tonne		1.7	1.7	4,333
Concrete - Batched - Cement	1,064 Vehicle Movements	44	46,437	46,437
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 220 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 11 km Weight: 20 tonne		44	44	46,437
Concrete - Batched - Sand	151 Vehicle Movements	2.4	359	359
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 12 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 0.6 km Weight: 20 tonne		2.4	2.4	359
Concrete Batched 10/20mm	201 Vehicle Movements	2.4	478	478
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 12 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 0.6 km Weight: 20 tonne		2.4	2.4	478
Concrete Batched 10/20mm (Barge)	87 Barge Movements	553	48,131	48,131
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 18,798 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 26 km Weight: 723 tonne		553	553	48,131

Name	Quantity	kgCO2e Single	kgCO2e Total	kgCO2e Project
Grout Batched PFA	264 Vehicle Movements	178	46,879	46,879
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,256 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 62.8 km Weight: 20 tonne		178	178	46,879
Grout Batched Sand	1,044 Vehicle Movements	1.7	1,771	1,771
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 12 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 0.6 km Weight: 20 tonne		1.7	1.7	1,771
Grout Batched Bentonite	19 Vehicle Movements	658	12,496	12,496
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 4,652 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 232.6 km Weight: 20 tonne		658	658	12,496
Formwork/ Pipe/ Track /Oils	2,056 Vehicle Movements	37	75,867	75,867
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 261 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 17.4 km Weight: 15 tonne		37	37	75,867
Rebar	751 Vehicle Movements	69	52,080	52,080
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 490.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 32.7 km Weight: 15 tonne		69	69	52,080
Plant Deliveries	653 Vehicle Movements	59	38,359	38,359
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 415.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 27.7 km Weight: 15 tonne		59	59	38,359
Operational Phase		1,451,160	1,451,160	1,451,160
LV Electric: 2020-2024	1 Period	863,633	863,633	863,633

Name	Quantity	Single ($kgCO_2e$)	Total ($kgCO_2e$)	Project ($kgCO_2e$)
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 73,000 kWh Source: A New Source Region: UK Electricity: 73,000 kWh		19,637	19,637	19,637
Small Power Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 76,333 kWh Source: A New Source Region: UK Electricity: 76,333 kWh		20,534	20,534	20,534
Ventilation Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 166,667 kWh Source: A New Source Region: UK Electricity: 166,667 kWh		44,833	44,833	44,833
Odour Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 2,894,530 kWh Source: A New Source Region: UK Electricity: 2,894,530 kWh		778,629	778,629	778,629
LV Electric: 2025-2029	1 Period	462,316	462,316	462,316
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 73,000 kWh Source: A New Source Region: UK Electricity: 73,000 kWh		10,512	10,512	10,512
Small Power Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 76,333 kWh Source: A New Source Region: UK Electricity: 76,333 kWh		10,992	10,992	10,992
Ventilation Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 166,667 kWh Source: A New Source Region: UK Electricity: 166,667 kWh		24,000	24,000	24,000
Odour Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 2,894,530 kWh Source: A New Source Region: UK Electricity: 2,894,530 kWh		416,812	416,812	416,812
LV Electric: 2030-2034	1 Period	125,211	125,211	125,211

Name	Quantity	kgCO2e Single	Total	Project
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 73,000 kWh Source: A New Source Region: UK Electricity: 73,000 kWh		2,847	2,847	2,847
Small Power Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 76,333 kWh Source: A New Source Region: UK Electricity: 76,333 kWh		2,977	2,977	2,977
Ventilation Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 166,667 kWh Source: A New Source Region: UK Electricity: 166,667 kWh		6,500	6,500	6,500
Odour Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 2,894,530 kWh Source: A New Source Region: UK Electricity: 2,894,530 kWh		112,887	112,887	112,887
Chambers Wharf		139,780,226	139,780,226	139,780,226
Construction		139,758,577	139,758,577	139,758,577
Materials	1 Site	115,665,327	115,665,327	115,665,327
Tunnel/ Shaft Rings Carbon Factor: Concrete - Fibre Reinforced Value: 0.48 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 121,260,000 kg Source: Bath ICE (2.0) Region: UK Mass: 121,260,000 kg		58,204,800	58,204,800	58,204,800
Imported Fill Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 147,906,000 kg Source: Bath ICE (2.0) Region: UK Mass: 147,906,000 kg		769,111	769,111	769,111
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 64,513,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 64,513,000 kg		10,644,645	10,644,645	10,644,645
Concrete - Batched - Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 19,096,000 kg Source: Bath ICE (2.0) Region: UK Mass: 19,096,000 kg		14,131,040	14,131,040	14,131,040

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Concrete - Batched - Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 35,805,000 kg Source: Bath ICE (2.0) Region: UK Mass: 35,805,000 kg		182,606	182,606	182,606
Concrete Batched 10/20mm Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 47,739,000 kg Source: Bath ICE (2.0) Region: UK Mass: 47,739,000 kg		248,243	248,243	248,243
Grout Batched Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 4,531,000 kg Source: Bath ICE (2.0) Region: UK Mass: 4,531,000 kg		3,352,940	3,352,940	3,352,940
Grout - Batched - Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 18,126,000 kg Source: Bath ICE (2.0) Region: UK Mass: 18,126,000 kg		92,443	92,443	92,443
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 15,075,000 kg Source: Bath ICE (2.0) Region: Global Mass: 15,075,000 kg		28,039,500	28,039,500	28,039,500
Transport Emissions		5,483,325	5,483,325	5,483,325
Waste Disposal		3,893,511	3,893,511	3,893,511
Excavated Material	9,853 Vehicle Movements	87	856,913	856,913
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 438.4 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 27.4 km Weight: 16 tonne		87	87	856,913
Excavated Material (Barge)	602 Barge Movements	4,881	2,938,164	2,938,164
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 165,840 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 120 km Weight: 1,382 tonne		4,881	4,881	2,938,164
Demolition Material	2,404 Vehicle Movements	41	98,433	98,433

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 206.4 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 12.9 km Weight: 16 tonne		41	41	98,433
Deliveries		1,589,814	1,589,814	1,589,814
Tunnel / Shaft Rings (Various Sizes)	6,063 Vehicle Movements	167	1,014,909	1,014,909
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,184 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 74 km Weight: 16 tonne		167	167	1,014,909
Imported Fill (Road)	926 Vehicle Movements	38	34,976	34,976
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 190.4 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 11.9 km Weight: 16 tonne		38	38	34,976
Imported Fill (Barge)	148 Barge Movements	185	27,441	27,441
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 6,300 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 7 km Weight: 900 tonne		185	185	27,441
Concrete - Ready Mix (2.45 T/m³)	4,403 Vehicle Movements	14	60,374	60,374
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 69.12 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 4.8 km Weight: 14.4 tonne		14	14	60,374
Concrete - Batched - Cement	1,192 Vehicle Movements	60	70,941	70,941
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 300 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 15 km Weight: 20 tonne		60	60	70,941

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Concrete - Batched - Sand	1,792 Vehicle Movements	19	34,128	34,128
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 96 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 4.8 km Weight: 20 tonne		19	19	34,128
Concrete Batched 10/20mm	2,389 Vehicle Movements	19	45,497	45,497
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 96 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 4.8 km Weight: 20 tonne		19	19	45,497
Concrete Batched 10/20mm (Barge)	84 Barge Movements	344	28,924	28,924
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 11,700 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 13 km Weight: 900 tonne		344	344	28,924
Grout Batched PFA	235 Vehicle Movements	155	36,347	36,347
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,094 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 54.7 km Weight: 20 tonne		155	155	36,347
Grout Batched Sand	912 Vehicle Movements	14	12,378	12,378
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 96 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 4.8 km Weight: 20 tonne		14	14	12,378
Grout Batched Bentonite	21 Vehicle Movements	633	13,283	13,283
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 4,474 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 223.7 km Weight: 20 tonne		633	633	13,283
Formwork/ Pipe/ Track /Oils	2,102 Vehicle Movements	57	119,021	119,021

Name	Quantity	Single ($kgCO_2e$)	Total ($kgCO_2e$)	Project ($kgCO_2e$)
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 400.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 26.7 km Weight: 15 tonne		57	57	119,021
Rebar	1,005 Vehicle Movements	50	50,512	50,512
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 355.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 23.7 km Weight: 15 tonne		50	50	50,512
Plant Deliveries	778 Vehicle Movements	53	41,083	41,083
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 373.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 24.9 km Weight: 15 tonne		53	53	41,083
Plant Use		18,609,925	18,609,925	18,609,925
Fencing	1 Activity Type	2,204	2,204	2,204
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 224 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 224 kWh		118	118	118
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 782 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 782 Litres		2,086	2,086	2,086
Demolition and Site Set Up	1 Activity Type	235,894	235,894	235,894
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 167,476 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 167,476 kWh		87,861	87,861	87,861

Name	Quantity	Single (kgCO$_2$e)	Total (kgCO$_2$e)	Project (kgCO$_2$e)
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 55,493 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 55,493 Litres		148,033	148,033	148,033
Cofferdam Construction	1 Activity Type	54,248	54,248	54,248
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 20,336 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 20,336 Litres		54,248	54,248	54,248
Shaft sinking by diaphragm walling	1 Activity Type	435,801	435,801	435,801
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 463,792 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 463,792 kWh		243,315	243,315	243,315
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 72,157 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 72,157 Litres		192,486	192,486	192,486
Main tunnel drive - Chambers Wharf to Abbey Mills	1 Activity Type	16,576,165	16,576,165	16,576,165
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,151,208 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 11,151,208 kWh		5,850,147	5,850,147	5,850,147
HV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 18,608,279 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 18,608,279 kWh		9,762,275	9,762,275	9,762,275
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 361,277 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 361,277 Litres		963,743	963,743	963,743

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Main tunnel secondary lining - Chambers Wharf to Abbey Mills	1 Activity Type	775,016	775,016	775,016
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 950,553 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 950,553 kWh		498,679	498,679	498,679
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 103,590 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 103,590 Litres		276,337	276,337	276,337
Main tunnel drive - Kirtling Street to Chambers Wharf	1 Activity Type	2,054	2,054	2,054
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 770 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 770 Litres		2,054	2,054	2,054
Long connection tunnel drive - Greenwich to Chambers Wharf	1 Activity Type	4,108	4,108	4,108
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 1,540 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 1,540 Litres		4,108	4,108	4,108
Site amenities	1 Activity Type	524,435	524,435	524,435
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 999,648 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 999,648 kWh		524,435	524,435	524,435
Operational Phase		21,650	21,650	21,650
LV Electric: 2020-2024	1 Period	12,885	12,885	12,885
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		9,819	9,819	9,819

Name	Quantity	kgCO$_2$e Single	Total	Project
Small Power Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		3,066	3,066	3,066
LV Electric: 2025-2029	1 Period	6,897	6,897	6,897
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		5,256	5,256	5,256
Small Power Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		1,641	1,641	1,641
LV Electric: 2030-2034	1 Period	1,868	1,868	1,868
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		1,424	1,424	1,424
Small Power Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		445	445	445
Foreshore (FS) CSO Sites		114,918,226	114,918,226	114,918,226
Albert Embankment		10,852,873	10,852,873	10,852,873
Operational Phase		44,027	44,027	44,027
LV Electric: 2020-2024	1 Period	26,202	26,202	26,202
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		9,819	9,819	9,819
Small Power Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 59,297 kWh Source: A New Source Region: UK Electricity: 59,297 kWh		15,951	15,951	15,951

Name	Quantity	kgCO2e Single	Total	Project
Hydraulics Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		432	432	432
LV Electric: 2025-2029	1 Period	14,026	14,026	14,026
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		5,256	5,256	5,256
Small Power Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 59,297 kWh Source: A New Source Region: UK Electricity: 59,297 kWh		8,539	8,539	8,539
Hyrdaulics Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		231	231	231
LV Electric: 2030-2034	1 Period	3,799	3,799	3,799
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		1,424	1,424	1,424
Small Power Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 59,297 kWh Source: A New Source Region: UK Electricity: 59,297 kWh		2,313	2,313	2,313
Hydraulics Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		63	63	63
Construction Phase		10,808,847	10,808,847	10,808,847
Materials	1 Site	8,993,055	8,993,055	8,993,055

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Tunnel / Shaft Rings Carbon Factor: Concrete - Fibre Reinforced Value: 0.48 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 581,000 kg Source: Bath ICE (2.0) Region: UK Mass: 581,000 kg		278,880	278,880	278,880
Imported Fill Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 84,960,000 kg Source: Bath ICE (2.0) Region: UK Mass: 84,960,000 kg		441,792	441,792	441,792
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 24,460,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 24,460,000 kg		4,035,900	4,035,900	4,035,900
Grout Batched Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 31,000 kg Source: Bath ICE (2.0) Region: UK Mass: 31,000 kg		22,940	22,940	22,940
Grout Batched Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 126,000 kg Source: Bath ICE (2.0) Region: UK Mass: 126,000 kg		643	643	643
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 2,265,000 kg Source: Bath ICE (2.0) Region: Global Mass: 2,265,000 kg		4,212,900	4,212,900	4,212,900
Transport Emissions		660,299	660,299	660,299
Waste Disposal		533,234	533,234	533,234
Excavated Material (Road)	1,187 Vehicle Movements	92	109,261	109,261
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 464 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 29 km Weight: 16 tonne		92	92	109,261
Excavated Material (Barge)	339 Barge Movements	1,251	423,973	423,973

Name	Quantity	kgCO2e Single	kgCO2e Total	kgCO2e Project
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 42,496 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 128 km Weight: 332 tonne		1,251	1,251	423,973
Deliveries		127,065	127,065	127,065
Tunnel / Shaft Rings (Various Sizes)	29 Vehicle Movements	175	5,064	5,064
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,235.2 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 77.2 km Weight: 16 tonne		175	175	5,064
Imported Fill	532 Vehicle Movements	46	24,485	24,485
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 232 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 14.5 km Weight: 16 tonne		46	46	24,485
Imported Fill (Barge)	243 Barge Movements	157	38,175	38,175
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 5,338 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 17 km Weight: 314 tonne		157	157	38,175
Concrete - Ready Mix (2.45 T/m³)	1,680 Vehicle Movements	11	18,717	18,717
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 56.16 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 3.9 km Weight: 14.4 tonne		11	11	18,717
Grout Batched PFA	7 Vehicle Movements	164	1,146	1,146
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,158 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 57.9 km Weight: 20 tonne		164	164	1,146
Grout Batched Sand	9 Vehicle Movements	11	99	99

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 78 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 3.9 km Weight: 20 tonne		11	11	99
Grout Batched Bentonite	7 Vehicle Movements	81	564	564
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 570 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 28.5 km Weight: 20 tonne		81	81	564
Formwork/ Pipe/ Track /Oils	849 Vehicle Movements	18	15,664	15,664
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 130.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 8.7 km Weight: 15 tonne		18	18	15,664
Rebar	151 Vehicle Movements	52	7,781	7,781
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 364.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 24.3 km Weight: 15 tonne		52	52	7,781
Plant Deliveries	529 Vehicle Movements	29	15,369	15,369
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 205.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 13.7 km Weight: 15 tonne		29	29	15,369
Plant Use		1,155,493	1,155,493	1,155,493
Fencing	1 Activity Type	6,244	6,244	6,244
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 466 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 466 kWh		244	244	244

Name	Quantity	kgCO2e Single	Total	Project
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 2,249 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 2,249 Litres		5,999	5,999	5,999
Demolition and Site Set Up	1 Activity Type	84,308	84,308	84,308
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 57,568 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 57,568 kWh		30,201	30,201	30,201
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 20,283 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 20,283 Litres		54,107	54,107	54,107
Cofferdam Construction	1 Activity Type	74,103	74,103	74,103
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 13,104 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 13,104 kWh		6,875	6,875	6,875
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 25,202 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 25,202 Litres		67,229	67,229	67,229
Shaft sinking by caisson or underpinning	1 Activity Type	471,829	471,829	471,829
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 408,845 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 408,845 kWh		214,488	214,488	214,488
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 96,469 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 96,469 Litres		257,341	257,341	257,341

Name	Quantity	kgCO2e Single	Total	Project
Drive connection tunnel using pipejack	1 Activity Type	310,315	310,315	310,315
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 238,007 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 238,007 kWh		124,863	124,863	124,863
HV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 274,519 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 274,519 kWh		144,018	144,018	144,018
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 15,532 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 15,532 Litres		41,433	41,433	41,433
Site amenities	1 Activity Type	208,694	208,694	208,694
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 397,800 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 397,800 kWh		208,694	208,694	208,694
Blackfriars Bridge		47,351,869	47,351,869	47,351,869
Construction Phase		47,307,842	47,307,842	47,307,842
Materials	1 Site	45,173,713	45,173,713	45,173,713
Imported Fill Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 149,176,000 kg Source: Bath ICE (2.0) Region: UK Mass: 149,176,000 kg		775,715	775,715	775,715
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 85,975,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 85,975,000 kg		14,185,875	14,185,875	14,185,875

Name	Quantity	Single ($kgCO_2e$)	Total ($kgCO_2e$)	Project ($kgCO_2e$)
Grout Batched Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 32,000 kg Source: Bath ICE (2.0) Region: UK Mass: 32,000 kg		23,680	23,680	23,680
Grout Batched Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 126,000 kg Source: Bath ICE (2.0) Region: UK Mass: 126,000 kg		643	643	643
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 16,230,000 kg Source: Bath ICE (2.0) Region: Global Mass: 16,230,000 kg		30,187,800	30,187,800	30,187,800
Transport Emissions		1,016,982	1,016,982	1,016,982
Waste Disposal		709,234	709,234	709,234
Excavated Material	1,884 Vehicle Movements	97	182,987	182,987
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 489.6 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 30.6 km Weight: 16 tonne		97	97	182,987
Excavated Material (Barge)	183 Barge Movements	2,876	526,247	526,247
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 97,712 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 124 km Weight: 788 tonne		2,876	2,876	526,247
Deliveries		307,749	307,749	307,749
Imported Fill (Road)	934 Vehicle Movements	49	45,358	45,358
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 244.8 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 15.3 km Weight: 16 tonne		49	49	45,358
Imported Fill (Barge)	186 Barge Movements	275	51,236	51,236

Name	Quantity	Single ($kgCO_2e$)	Total ($kgCO_2e$)	Project ($kgCO_2e$)
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 9,360 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 13 km Weight: 720 tonne		275	275	51,236
Concrete - Ready Mix (2.45 T/m³)	5,861 Vehicle Movements	23	133,944	133,944
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 115.2 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 8 km Weight: 14.4 tonne		23	23	133,944
Grout Batched PFA	6 Vehicle Movements	159	955	955
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,126 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 56.3 km Weight: 20 tonne		159	159	955
Grout Batched Sand	9 Vehicle Movements	23	204	204
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 160 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 8 km Weight: 20 tonne		23	23	204
Grout Batched Bentonite	6 Vehicle Movements	82	494	494
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 582 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 29.1 km Weight: 20 tonne		82	82	494
Formwork/ Pipe/ Track /Oils	1,082 Vehicle Movements	15	15,833	15,833
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 103.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 6.9 km Weight: 15 tonne		15	15	15,833
Rebar	481 Vehicle Movements	49	23,461	23,461

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 345 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 23 km Weight: 15 tonne		49	49	23,461
Plant Deliveries	557 Vehicle Movements	65	36,264	36,264
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 460.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 30.7 km Weight: 15 tonne		65	65	36,264
Plant Use		1,117,147	1,117,147	1,117,147
Fencing	1 Activity Type	6,244	6,244	6,244
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 466 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 466 kWh		244	244	244
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 2,249 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 2,249 Litres		5,999	5,999	5,999
Demolition and Site Set Up	1 Activity Type	136,236	136,236	136,236
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 99,523 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 99,523 kWh		52,212	52,212	52,212
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 31,498 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 31,498 Litres		84,024	84,024	84,024
Cofferdam Construction	1 Activity Type	114,007	114,007	114,007

Name	Quantity	Single ($kgCO_2e$)	Total ($kgCO_2e$)	Project ($kgCO_2e$)
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 20,160 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 20,160 kWh		10,576	10,576	10,576
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 38,773 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 38,773 Litres		103,431	103,431	103,431
Shaft sinking by caisson or underpinning	1 Activity Type	558,668	558,668	558,668
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 621,712 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 621,712 kWh		326,163	326,163	326,163
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 87,159 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 87,159 Litres		232,505	232,505	232,505
Site amenities	1 Activity Type	301,992	301,992	301,992
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 575,640 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 575,640 kWh		301,992	301,992	301,992
Operational Phase		44,027	44,027	44,027
LV Electric: 2020-2024	1 Period	26,202	26,202	26,202
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 73,000 kWh Source: A New Source Region: UK Electricity: 73,000 kWh		19,637	19,637	19,637
Small Power Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 22,797 kWh Source: A New Source Region: UK Electricity: 22,797 kWh		6,132	6,132	6,132

Name	Quantity	kgCO2e Single	Total	Project
Hydraulics Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		432	432	432
LV Electric: 2025-2029	1 Period	14,026	14,026	14,026
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 73,000 kWh Source: A New Source Region: UK Electricity: 73,000 kWh		10,512	10,512	10,512
Small Power Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 22,797 kWh Source: A New Source Region: UK Electricity: 22,797 kWh		3,283	3,283	3,283
Hyrdaulics Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		231	231	231
LV Electric: 2030-2034	1 Period	3,799	3,799	3,799
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 73,000 kWh Source: A New Source Region: UK Electricity: 73,000 kWh		2,847	2,847	2,847
Small Power Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 22,797 kWh Source: A New Source Region: UK Electricity: 22,797 kWh		889	889	889
Hydraulics Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		63	63	63
Chelsea Embankment		8,217,529	8,217,529	8,217,529
Construction Phase		8,194,426	8,194,426	8,194,426
Materials	1 Site	6,882,206	6,882,206	6,882,206

Name	Quantity	Single ($kgCO_2e$)	Total ($kgCO_2e$)	Project ($kgCO_2e$)
Tunnel / Shaft Rings Carbon Factor: Concrete - Fibre Reinforced Value: 0.48 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 3,187,000 kg Source: Bath ICE (2.0) Region: UK Mass: 3,187,000 kg		1,529,760	1,529,760	1,529,760
Imported Fill Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 78,030,000 kg Source: Bath ICE (2.0) Region: UK Mass: 78,030,000 kg		405,756	405,756	405,756
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 13,861,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 13,861,000 kg		2,287,065	2,287,065	2,287,065
Grout Batched Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 12,000 kg Source: Bath ICE (2.0) Region: UK Mass: 12,000 kg		8,880	8,880	8,880
Grout Batched Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 48,000 kg Source: Bath ICE (2.0) Region: UK Mass: 48,000 kg		245	245	245
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 1,425,000 kg Source: Bath ICE (2.0) Region: Global Mass: 1,425,000 kg		2,650,500	2,650,500	2,650,500
Transport Emissions		557,711	557,711	557,711
Waste Disposal		402,378	402,378	402,378
Excavated Material	632 Vehicle Movements	92	58,175	58,175
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 464 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 29 km Weight: 16 tonne		92	92	58,175
Excavated Material (Barge)	124 Barge Movements	2,776	344,204	344,204

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 94,320 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 131 km Weight: 720 tonne		2,776	2,776	344,204
Deliveries		155,332	155,332	155,332
Tunnel / Shaft Rings (Various Sizes)	159 Vehicle Movements	178	28,378	28,378
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,262.4 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 78.9 km Weight: 16 tonne		178	178	28,378
Imported Fill (Road)	1,023 Vehicle Movements	33	34,094	34,094
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 168 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 10.5 km Weight: 16 tonne		33	33	34,094
Imported Fill (Barge)	86 Barge Movements	422	36,294	36,294
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 14,340 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 20 km Weight: 717 tonne		422	422	36,294
Concrete - Ready Mix (2.45 T/m³)	958 Vehicle Movements	9.1	8,757	8,757
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 46.08 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 3.2 km Weight: 14.4 tonne		9.1	9.1	8,757
Grout Batched PFA	3 Vehicle Movements	178	533	533
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,256 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 62.8 km Weight: 20 tonne		178	178	533
Grout Batched Sand	3 Vehicle Movements	9.0	27	27

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 64 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 3.2 km Weight: 20 tonne		9.0	9.0	27
Grout Batched Bentonite	3 Vehicle Movements	86	258	258
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 608 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 30.4 km Weight: 20 tonne		86	86	258
Formwork/ Pipe/ Track /Oils	681 Vehicle Movements	34	22,818	22,818
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 237 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 15.8 km Weight: 15 tonne		34	34	22,818
Rebar	95 Vehicle Movements	60	5,702	5,702
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 424.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 28.3 km Weight: 15 tonne		60	60	5,702
Plant Deliveries	347 Vehicle Movements	53	18,471	18,471
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 376.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 25.1 km Weight: 15 tonne		53	53	18,471
Plant Use		754,510	754,510	754,510
Fencing	1 Activity Type	3,834	3,834	3,834
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 448 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 448 kWh		235	235	235

Name	Quantity	kgCO2e Single	Total	Project
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 1,349 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 1,349 Litres		3,599	3,599	3,599
Demolition and Site Set Up	1 Activity Type	93,213	93,213	93,213
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 67,021 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 67,021 kWh		35,161	35,161	35,161
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 21,762 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 21,762 Litres		58,052	58,052	58,052
Cofferdam Construction	1 Activity Type	128,827	128,827	128,827
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 22,781 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 22,781 kWh		11,951	11,951	11,951
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 43,813 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 43,813 Litres		116,876	116,876	116,876
Shaft sinking by caisson or underpinning	1 Activity Type	95,431	95,431	95,431
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 86,184 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 86,184 kWh		45,214	45,214	45,214
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 18,825 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 18,825 Litres		50,218	50,218	50,218

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Drive connection tunnel in SCL; Construction of insitu junction with main tunnel form connection tun	1 Activity Type	99,295	99,295	99,295
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 103,219 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 103,219 kWh		54,151	54,151	54,151
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 16,923 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 16,923 Litres		45,144	45,144	45,144
Site amenities	1 Activity Type	333,910	333,910	333,910
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 636,480 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 636,480 kWh		333,910	333,910	333,910
Operational Phase		23,103	23,103	23,103
LV Electric: 2020-2024	1 Period	13,749	13,749	13,749
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		9,819	9,819	9,819
Small Power Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		3,066	3,066	3,066
Hydraulics Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 3,215 kWh Source: A New Source Region: UK Electricity: 3,215 kWh		865	865	865
LV Electric: 2025-2029	1 Period	7,360	7,360	7,360
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		5,256	5,256	5,256

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Small Power Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		1,641	1,641	1,641
Hyrdaulics Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 3,215 kWh Source: A New Source Region: UK Electricity: 3,215 kWh		463	463	463
LV Electric: 2030-2034	1 Period	1,993	1,993	1,993
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		1,424	1,424	1,424
Small Power Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		445	445	445
Hydraulics Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 3,215 kWh Source: A New Source Region: UK Electricity: 3,215 kWh		125	125	125
Heathwall		10,987,308	10,987,308	10,987,308
Construction Phase		10,970,085	10,970,085	10,970,085
Materials	1 Site	9,507,395	9,507,395	9,507,395
Tunnel Shaft Rings Carbon Factor: Concrete - Fibre Reinforced Value: 0.48 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 4,834,000 kg Source: Bath ICE (2.0) Region: UK Mass: 4,834,000 kg		2,320,320	2,320,320	2,320,320
Imported Fill Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 11,786,000 kg Source: Bath ICE (2.0) Region: UK Mass: 11,786,000 kg		61,287	61,287	61,287

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 19,477,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 19,477,000 kg		3,213,705	3,213,705	3,213,705
Grout Batched Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 8,000 kg Source: Bath ICE (2.0) Region: UK Mass: 8,000 kg		5,920	5,920	5,920
Grout Batched Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 32,000 kg Source: Bath ICE (2.0) Region: UK Mass: 32,000 kg		163	163	163
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 2,100,000 kg Source: Bath ICE (2.0) Region: Global Mass: 2,100,000 kg		3,906,000	3,906,000	3,906,000
Transport Emissions		377,091	377,091	377,091
Waste Disposal		170,503	170,503	170,503
Excavated Material (Road)	495 Vehicle Movements	92	45,564	45,564
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 464 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 29 km Weight: 16 tonne		92	92	45,564
Excavated Material (Barge)	104 Barge Movements	1,201	124,939	124,939
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 40,820 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 130 km Weight: 314 tonne		1,201	1,201	124,939
Deliveries		206,589	206,589	206,589
Tunnel / Shaft Rings (Various Sizes)	242 Vehicle Movements	160	38,758	38,758

Name	Quantity	Single kgCO2e	Total kgCO2e	Project kgCO2e
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,132.8 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 70.8 km Weight: 16 tonne		160	160	38,758
Imported Fill	74 Vehicle Movements	54	4,016	4,016
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 273.6 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 17.1 km Weight: 16 tonne		54	54	4,016
Imported Fill (Barge)	34 Barge Movements	3,443	117,073	117,073
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 117,000 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 130 km Weight: 900 tonne		3,443	3,443	117,073
Concrete - Ready Mix (2.45 T/m³)	1,351 Vehicle Movements	4.6	6,175	6,175
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 23.04 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 1.6 km Weight: 14.4 tonne		4.6	4.6	6,175
Grout Batched PFA	2 Vehicle Movements	173	346	346
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,224 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 61.2 km Weight: 20 tonne		173	173	346
Grout Batched Sand	2 Vehicle Movements	4.5	9.0	9.0
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 32 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 1.6 km Weight: 20 tonne		4.5	4.5	9.0
Grout Batched Bentonite	2 Vehicle Movements	81	162	162

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 572 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 28.6 km Weight: 20 tonne		81	81	162
Formwork/ Pipe/ Track /Oils	664 Vehicle Movements	24	15,912	15,912
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 169.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 11.3 km Weight: 15 tonne		24	24	15,912
Rebar	140 Vehicle Movements	56	7,779	7,779
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 393 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 26.2 km Weight: 15 tonne		56	56	7,779
Plant Deliveries	559 Vehicle Movements	29	16,360	16,360
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 207 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 13.8 km Weight: 15 tonne		29	29	16,360
Plant Use		1,085,598	1,085,598	1,085,598
Fencing	1 Activity Type	6,244	6,244	6,244
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 466 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 466 kWh		244	244	244
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 2,249 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 2,249 Litres		5,999	5,999	5,999
Demolition and Site Set Up	1 Activity Type	163,121	163,121	163,121

Name	Quantity	kgCO2e Single	Total	Project
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 117,286 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 117,286 kWh		61,531	61,531	61,531
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 38,083 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 38,083 Litres		101,590	101,590	101,590
Shaft sinking by caisson or underpinning	1 Activity Type	135,212	135,212	135,212
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 100,800 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 100,800 kWh		52,882	52,882	52,882
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 30,863 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 30,863 Litres		82,330	82,330	82,330
Drive connection tunnel using pipejack	1 Activity Type	530,589	530,589	530,589
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 390,510 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 390,510 kWh		204,869	204,869	204,869
HV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 504,720 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 504,720 kWh		264,786	264,786	264,786
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 22,842 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 22,842 Litres		60,933	60,933	60,933
Site amenities	1 Activity Type	250,433	250,433	250,433

Name	Quantity	kgCO2e Single	Total	Project
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 477,360 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 477,360 kWh		250,433	250,433	250,433
Operational Phase		17,223	17,223	17,223
LV Electric: 2020-2024	1 Period	10,250	10,250	10,250
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		9,819	9,819	9,819
Hydraulics Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,605 kWh Source: A New Source Region: UK Electricity: 1,605 kWh		432	432	432
LV Electric: 2025-2029	1 Period	5,487	5,487	5,487
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		5,256	5,256	5,256
Hydraulics Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,605 kWh Source: A New Source Region: UK Electricity: 1,605 kWh		231	231	231
LV Electric: 2030-2034	1 Period	1,486	1,486	1,486
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		1,424	1,424	1,424
Hydraulics Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,605 kWh Source: A New Source Region: UK Electricity: 1,605 kWh		63	63	63
King Edward Memorial Park		22,566,722	22,566,722	22,566,722

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Construction Phase		22,544,346	22,544,346	22,544,346
Materials	1 Site	20,657,798	20,657,798	20,657,798
Imported Fill Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 76,094,000 kg Source: Bath ICE (2.0) Region: UK Mass: 76,094,000 kg		395,689	395,689	395,689
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 61,433,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 61,433,000 kg		10,136,445	10,136,445	10,136,445
Grout Batched Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 34,000 kg Source: Bath ICE (2.0) Region: UK Mass: 34,000 kg		25,160	25,160	25,160
Grout Batched Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 138,000 kg Source: Bath ICE (2.0) Region: UK Mass: 138,000 kg		704	704	704
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 5,430,000 kg Source: Bath ICE (2.0) Region: Global Mass: 5,430,000 kg		10,099,800	10,099,800	10,099,800
Transport Emissions		637,376	637,376	637,376
Waste Disposal		525,982	525,982	525,982
Excavated Material (Road)	1,849 Vehicle Movements	67	123,246	123,246
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 336 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 21 km Weight: 16 tonne		67	67	123,246
Excavated Material (Barge)	111 Barge Movements	3,628	402,736	402,736

Name	Quantity	kgCO$_2$e Single	Total	Project
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 123,284 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 119 km Weight: 1,036 tonne		3,628	3,628	402,736
Deliveries		111,394	111,394	111,394
Imported Fill (Road)	500 Vehicle Movements	41	20,632	20,632
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 208 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 13 km Weight: 16 tonne		41	41	20,632
Imported Fill (Barge)	76 Barge Movements	185	14,091	14,091
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 6,300 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 7 km Weight: 900 tonne		185	185	14,091
Concrete - Ready Mix (2.45 T/m³)	4,199 Vehicle Movements	1.4	5,998	5,998
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 7.2 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 0.5 km Weight: 14.4 tonne		1.4	1.4	5,998
Grout Batched PFA	7 Vehicle Movements	118	827	827
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 836 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 41.8 km Weight: 20 tonne		118	118	827
Grout Batched Sand	9 Vehicle Movements	1.4	13	13
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 10 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 0.5 km Weight: 20 tonne		1.4	1.4	13
Grout Batched Bentonite	7 Vehicle Movements	72	501	501

Name	Quantity	Single (kgCO$_2$e)	Total (kgCO$_2$e)	Project (kgCO$_2$e)
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 506 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 25.3 km Weight: 20 tonne		72	72	501
Formwork/ Pipe/ Track /Oils	1,167 Vehicle Movements	24	28,213	28,213
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 171 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 11.4 km Weight: 15 tonne		24	24	28,213
Rebar	362 Vehicle Movements	28	9,980	9,980
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 195 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 13 km Weight: 15 tonne		28	28	9,980
Plant Deliveries	753 Vehicle Movements	41	31,139	31,139
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 292.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 19.5 km Weight: 15 tonne		41	41	31,139
Plant Use		1,249,172	1,249,172	1,249,172
Fencing	1 Activity Type	6,244	6,244	6,244
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 466 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 466 kWh		244	244	244
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 2,249 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 2,249 Litres		5,999	5,999	5,999
Demolition and Site Set Up	1 Activity Type	158,940	158,940	158,940

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 116,110 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 116,110 kWh		60,914	60,914	60,914
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 36,747 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 36,747 Litres		98,026	98,026	98,026
Cofferdam Construction	1 Activity Type	114,007	114,007	114,007
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 20,160 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 20,160 kWh		10,576	10,576	10,576
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 38,773 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 38,773 Litres		103,431	103,431	103,431
Shaft sinking by diaphragm walling	1 Activity Type	778,474	778,474	778,474
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 866,320 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 866,320 kWh		454,489	454,489	454,489
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 121,452 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 121,452 Litres		323,985	323,985	323,985
Site amenities	1 Activity Type	191,507	191,507	191,507
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 365,040 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 365,040 kWh		191,507	191,507	191,507

Name	Quantity	kgCO2e Single	kgCO2e Total	kgCO2e Project
Operational Phase		22,376	22,376	22,376
LV Electric: 2020-2024	1 Period	13,317	13,317	13,317
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		9,819	9,819	9,819
Small Power Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		3,066	3,066	3,066
Hydraulics Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		432	432	432
LV Electric: 2025-2029	1 Period	7,129	7,129	7,129
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		5,256	5,256	5,256
Small Power Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		1,641	1,641	1,641
Hyrdaulics Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		231	231	231
LV Electric: 2030-2034	1 Period	1,931	1,931	1,931
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		1,424	1,424	1,424

Name	Quantity	kgCO2e Single	Total	Project
Small Power Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		445	445	445
Hydraulics Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		63	63	63
Putney Bridge		5,326,656	5,326,656	5,326,656
Construction Phase		5,304,853	5,304,853	5,304,853
Materials	1 Site	4,277,323	4,277,323	4,277,323
Imported Fill Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 30,738,000 kg Source: Bath ICE (2.0) Region: UK Mass: 30,738,000 kg		159,838	159,838	159,838
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 11,089,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 11,089,000 kg		1,829,685	1,829,685	1,829,685
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 1,230,000 kg Source: Bath ICE (2.0) Region: Global Mass: 1,230,000 kg		2,287,800	2,287,800	2,287,800
Transport Emissions		208,174	208,174	208,174
Waste Disposal		130,599	130,599	130,599
Excavated Material	225 Vehicle Movements	87	19,568	19,568
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 438.4 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 27.4 km Weight: 16 tonne		87	87	19,568
Excavated Material (Barge)	89 Barge Movements	1,248	111,031	111,031

Name	Quantity	kgCO2e Single	Total	Project
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 42,390 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 135 km Weight: 314 tonne		1,248	1,248	111,031
Deliveries		77,575	77,575	77,575
Imported Fill (Road)	389 Vehicle Movements	46	17,903	17,903
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 232 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 14.5 km Weight: 16 tonne		46	46	17,903
Imported Fill (Barge)	78 Barge Movements	222	17,299	17,299
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 7,536 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 24 km Weight: 314 tonne		222	222	17,299
Concrete - Ready Mix (2.45 T/m³)	769 Lorry Movements	12	9,226	9,226
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 60.48 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 4.2 km Weight: 14.4 tonne		12	12	9,226
Formwork/ Pipe/ Track /Oils	721 Lorry Movements	20	14,526	14,526
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 142.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 9.5 km Weight: 15 tonne		20	20	14,526
Rebar	82 Lorry Movements	68	5,547	5,547
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 478.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 31.9 km Weight: 15 tonne		68	68	5,547
Plant Deliveries	467 Lorry Movements	28	13,073	13,073

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 198 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 13.2 km Weight: 15 tonne		28	28	13,073
Plant Use		819,356	819,356	819,356
Fencing	1 Activity Type	1,708	1,708	1,708
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 448 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 448 kWh		235	235	235
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 552 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 552 Litres		1,473	1,473	1,473
Demolition and Site Set Up	1 Activity Type	213,086	213,086	213,086
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 167,552 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 167,552 kWh		87,901	87,901	87,901
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 46,928 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 46,928 Litres		125,185	125,185	125,185
Cofferdam Construction	1 Activity Type	114,007	114,007	114,007
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 20,160 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 20,160 kWh		10,576	10,576	10,576

Name	Quantity	kgCO2e Single	Total	Project
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 38,773 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 38,773 Litres		103,431	103,431	103,431
Piling	1 Activity Type	10,489	10,489	10,489
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 3,932 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 3,932 Litres		10,489	10,489	10,489
Shaft sinking by SCL	1 Activity Type	82,978	82,978	82,978
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 88,704 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 88,704 kWh		46,536	46,536	46,536
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 13,661 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 13,661 Litres		36,442	36,442	36,442
Drive connection tunnel in SCL; Construction of insitu junction with main tunnel form connection tun	1 Activity Type	146,656	146,656	146,656
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 150,097 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 150,097 kWh		78,744	78,744	78,744
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 25,458 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 25,458 Litres		67,912	67,912	67,912
Site amenities	1 Activity Type	250,433	250,433	250,433

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 477,360 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 477,360 kWh		250,433	250,433	250,433
Operational Phase		21,804	21,804	21,804
LV Electric (2020-2024)	1 Operational Phase	12,976	12,976	12,976
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		9,819	9,819	9,819
Small Power Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		3,066	3,066	3,066
Pumping Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 340 kWh Source: A New Source Region: UK Electricity: 340 kWh		91	91	91
LV Electric (2025-2029)	1 Operational Phase	6,946	6,946	6,946
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		5,256	5,256	5,256
Small Power Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		1,641	1,641	1,641
Pumping Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 340 kWh Source: A New Source Region: UK Electricity: 340 kWh		49	49	49
LV Electric (2030-2034)	1 Operational Phase	1,881	1,881	1,881

Name	Quantity	Single (kgCO₂e)	Total (kgCO₂e)	Project (kgCO₂e)
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		1,424	1,424	1,424
Small Power Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		445	445	445
Pumping Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 340 kWh Source: A New Source Region: UK Electricity: 340 kWh		13	13	13
Victoria Embankment		9,615,269	9,615,269	9,615,269
Operational Phase		22,376	22,376	22,376
LV Electric (2020-2024)	1 Operational Phase	13,317	13,317	13,317
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		9,819	9,819	9,819
Small Power Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		3,066	3,066	3,066
Hydraulics Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		432	432	432
LV Electric (2025-2029)	1 Operational Phase	7,129	7,129	7,129
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		5,256	5,256	5,256

Name	Quantity	kgCO2e Single	Total	Project
Small Power Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		1,641	1,641	1,641
Hyrdaulics Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		231	231	231
LV Electric (2030-2034)	1 Operational Phase	1,931	1,931	1,931
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		1,424	1,424	1,424
Small Power Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		445	445	445
Hydraulics Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		63	63	63
Construction Phase		9,592,893	9,592,893	9,592,893
Materials	1 Site	7,955,337	7,955,337	7,955,337
Tunnel/ Shaft Rings Carbon Factor: Concrete - Fibre Reinforced Value: 0.48 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 3,646,000 kg Source: Bath ICE (2.0) Region: UK Mass: 3,646,000 kg		1,750,080	1,750,080	1,750,080
Imported Fill Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 52,904,000 kg Source: Bath ICE (2.0) Region: UK Mass: 52,904,000 kg		275,101	275,101	275,101
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 17,099,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 17,099,000 kg		2,821,335	2,821,335	2,821,335

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Grout Batched Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 16,000 kg Source: Bath ICE (2.0) Region: UK Mass: 16,000 kg		11,840	11,840	11,840
Grout Batched Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 16,000 kg Source: Bath ICE (2.0) Region: UK Mass: 16,000 kg		82	82	82
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 1,665,000 kg Source: Bath ICE (2.0) Region: Global Mass: 1,665,000 kg		3,096,900	3,096,900	3,096,900
Transport Emissions		379,220	379,220	379,220
Waste Disposal		245,716	245,716	245,716
Excavated Material (Road)	407 Vehicle Movements	102	41,339	41,339
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 512 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 32 km Weight: 16 tonne		102	102	41,339
Excavated Material (Barge)	78 Barge Movements	2,620	204,377	204,377
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 89,032 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 124 km Weight: 718 tonne		2,620	2,620	204,377
Deliveries		133,504	133,504	133,504
Tunnel / Shaft Rings (Various Sizes)	182 Vehicle Movements	178	32,483	32,483
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,262.4 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 78.9 km Weight: 16 tonne		178	178	32,483
Imported Fill (Road)	331 Vehicle Movements	50	16,390	16,390

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 249.6 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 15.6 km Weight: 16 tonne		50	50	16,390
Imported Fill (Barge)	66 Barge Movements	275	18,181	18,181
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 9,360 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 13 km Weight: 720 tonne		275	275	18,181
Concrete - Ready Mix (2.45 T/m³)	1,178 Vehicle Movements	18	21,537	21,537
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 92.16 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 6.4 km Weight: 14.4 tonne		18	18	21,537
Grout Batched PFA	3 Vehicle Movements	159	478	478
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,126 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 56.3 km Weight: 20 tonne		159	159	478
Grout Batched Sand	4 Vehicle Movements	18	72	72
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 128 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 6.4 km Weight: 20 tonne		18	18	72
Grout Batched Bentonite	3 Vehicle Movements	82	247	247
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 582 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 29.1 km Weight: 20 tonne		82	82	247
Formwork/ Pipe/ Track /Oils	805 Vehicle Movements	15	12,292	12,292

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 108 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 7.2 km Weight: 15 tonne		15	15	12,292
Rebar	111 Vehicle Movements	56	6,214	6,214
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 396 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 26.4 km Weight: 15 tonne		56	56	6,214
Plant Deliveries	415 Vehicle Movements	62	25,611	25,611
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 436.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 29.1 km Weight: 15 tonne		62	62	25,611
Plant Use		1,258,335	1,258,335	1,258,335
Fencing	1 Activity Type	6,244	6,244	6,244
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 466 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 466 kWh		244	244	244
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 2,249 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 2,249 Litres		5,999	5,999	5,999
Demolition and Site Set Up	1 Activity Type	279,638	279,638	279,638
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 201,062 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 201,062 kWh		105,481	105,481	105,481

Name	Quantity	kgCO2e Single	Total	Project
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 65,286 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 65,286 Litres		174,157	174,157	174,157
Cofferdam Construction	1 Activity Type	85,506	85,506	85,506
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 15,120 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 15,120 kWh		7,932	7,932	7,932
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 29,080 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 29,080 Litres		77,574	77,574	77,574
Shaft sinking by caisson or underpinning	1 Activity Type	454,378	454,378	454,378
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 345,946 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 345,946 kWh		181,490	181,490	181,490
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 102,297 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 102,297 Litres		272,887	272,887	272,887
Drive connection tunnel using pipejack	1 Activity Type	216,510	216,510	216,510
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 166,060 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 166,060 kWh		87,118	87,118	87,118
HV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 191,535 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 191,535 kWh		100,483	100,483	100,483

Name	Quantity	kgCO2e Single	Total	Project
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 10,837 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 10,837 Litres		28,909	28,909	28,909
Site amenities	1 Activity Type	216,060	216,060	216,060
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 411,840 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 411,840 kWh		216,060	216,060	216,060
Other CSO Sites		226,180,927	226,180,927	226,180,927
Abbey Mills		42,340,099	42,340,099	42,340,099
Construction Materials		42,340,099	42,340,099	42,340,099
Materials	1 Site	39,770,397	39,770,397	39,770,397
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 65,032,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 65,032,000 kg		10,730,280	10,730,280	10,730,280
Concrete - Batched - Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 11,058,000 kg Source: Bath ICE (2.0) Region: UK Mass: 11,058,000 kg		8,182,920	8,182,920	8,182,920
Concrete - Batched - Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 20,734,000 kg Source: Bath ICE (2.0) Region: UK Mass: 20,734,000 kg		105,743	105,743	105,743
Concrete Batched 10/20mm Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 27,645,000 kg Source: Bath ICE (2.0) Region: UK Mass: 27,645,000 kg		143,754	143,754	143,754
Grout - Batched - Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 23,000 kg Source: Bath ICE (2.0) Region: UK Mass: 23,000 kg		17,020	17,020	17,020

Name	Quantity	Single ($kgCO_2e$)	Total ($kgCO_2e$)	Project ($kgCO_2e$)
Grout - Batched - Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 94,000 kg Source: Bath ICE (2.0) Region: UK Mass: 94,000 kg		479	479	479
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 11,070,000 kg Source: Bath ICE (2.0) Region: Global Mass: 11,070,000 kg		20,590,200	20,590,200	20,590,200
Transport Emissions		553,914	553,914	553,914
Waste Disposal		411,828	411,828	411,828
Excavated Material	6,208 Vehicle Movements	66	411,828	411,828
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 334.4 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 20.9 km Weight: 16 tonne		66	66	411,828
Deliveries		142,086	142,086	142,086
Concrete - Ready Mix (2.45 T/m³)	4,436 Vehicle Movements	8.3	36,749	36,749
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 41.76 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 2.9 km Weight: 14.4 tonne		8.3	8.3	36,749
Concrete - Batched - Cement	560 Vehicle Movements	49	27,551	27,551
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 248 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 12.4 km Weight: 20 tonne		49	49	27,551
Concrete - Batched - Sand	1,037 Vehicle Movements	12	11,932	11,932
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 58 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 2.9 km Weight: 20 tonne		12	12	11,932

Name	Quantity	kgCO2e Single	kgCO2e Total	kgCO2e Project
Concrete Batched 10/20mm	1,383 Vehicle Movements	12	15,913	15,913
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 58 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 2.9 km Weight: 20 tonne		12	12	15,913
Grout Batched PFA	7 Vehicle Movements	114	796	796
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 804 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 40.2 km Weight: 20 tonne		114	114	796
Grout Batched Sand	8 Vehicle Movements	8.2	66	66
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 58 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 2.9 km Weight: 20 tonne		8.2	8.2	66
Grout Batched Bentonite	7 Vehicle Movements	70	491	491
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 496 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 24.8 km Weight: 20 tonne		70	70	491
Formwork/ Pipe/ Track /Oils	528 Vehicle Movements	31	16,348	16,348
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 219 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 14.6 km Weight: 15 tonne		31	31	16,348
Rebar	738 Vehicle Movements	22	16,590	16,590
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 159 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 10.6 km Weight: 15 tonne		22	22	16,590
Plant Deliveries	369 Vehicle Movements	42	15,651	15,651

Name	Quantity	kgCO2e Single	Total	Project
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 300 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 20 km Weight: 15 tonne		42	42	15,651
Plant Use		2,015,788	2,015,788	2,015,788
Fencing	1 Activity Type	1,708	1,708	1,708
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 448 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 448 kWh		235	235	235
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 552 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 552 Litres		1,473	1,473	1,473
Demolition and Site Set Up	1 Activity Type	94,757	94,757	94,757
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 65,677 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 65,677 kWh		34,455	34,455	34,455
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 22,605 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 22,605 Litres		60,301	60,301	60,301
Shaft sinking by diaphragm walling	1 Activity Type	1,259,942	1,259,942	1,259,942
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,413,530 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 1,413,530 kWh		741,566	741,566	741,566

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 194,323 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 194,323 Litres		518,376	518,376	518,376
Main Tunnel Drive - Chambers Wharf to Abbey Mills	1 Activity Type	19,060	19,060	19,060
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 7,145 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 7,145 Litres		19,060	19,060	19,060
Site amenities	1 Activity Type	640,322	640,322	640,322
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,220,544 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 1,220,544 kWh		640,322	640,322	640,322
Acton Storm Tanks		21,559,096	21,559,096	21,559,096
Construction Phase		20,795,963	20,795,963	20,795,963
Materials	1 Site	19,731,338	19,731,338	19,731,338
Imported Fill Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 900,000 kg Source: Bath ICE (2.0) Region: UK Mass: 900,000 kg		4,680	4,680	4,680
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 12,610,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 12,610,000 kg		2,080,650	2,080,650	2,080,650
Concrete - Batched - Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 8,904,000 kg Source: Bath ICE (2.0) Region: UK Mass: 8,904,000 kg		6,588,960	6,588,960	6,588,960

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Concrete - Batched - Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 16,696,000 kg Source: Bath ICE (2.0) Region: UK Mass: 16,696,000 kg		85,150	85,150	85,150
Concrete Batched 10/20mm Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 22,261,000 kg Source: Bath ICE (2.0) Region: UK Mass: 22,261,000 kg		115,757	115,757	115,757
Grout Batched Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 4,000 kg Source: Bath ICE (2.0) Region: UK Mass: 4,000 kg		2,960	2,960	2,960
Grout Batched Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 16,000 kg Source: Bath ICE (2.0) Region: UK Mass: 16,000 kg		82	82	82
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 5,835,000 kg Source: Bath ICE (2.0) Region: Global Mass: 5,835,000 kg		10,853,100	10,853,100	10,853,100
Transport Emissions		115,593	115,593	115,593
Waste Disposal		19,570	19,570	19,570
Excavated Material	295 Vehicle Movements	66	19,570	19,570
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 334.4 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 20.9 km Weight: 16 tonne		66	66	19,570
Deliveries		96,023	96,023	96,023
Imported Fill	57 Vehicle Movements	18	1,019	1,019
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 126.4 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 7.9 km Weight: 16 tonne		18	18	1,019

Name	Quantity	Single (kgCO$_2$e)	Total (kgCO$_2$e)	Project (kgCO$_2$e)
Concrete - Ready Mix (2.45 T/m³)	875 Vehicle Movements	9.1	7,999	7,999
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 46.08 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 3.2 km Weight: 14.4 tonne		9.1	9.1	7,999
Concrete - Batched - Cement	447 Vehicle Movements	22	9,754	9,754
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 110 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 5.5 km Weight: 20 tonne		22	22	9,754
Concrete - Batched - Sand	835 Vehicle Movements	13	10,601	10,601
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 64 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 3.2 km Weight: 20 tonne		13	13	10,601
Concrete Batched 10/20 mm Aggregate	1,114 Vehicle Movements	9.0	10,080	10,080
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 64 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 3.2 km Weight: 20 tonne		9.0	9.0	10,080
Grout Batched PFA	1 Vehicle Movements	182	182	182
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,288 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 64.4 km Weight: 20 tonne		182	182	182
Grout Batched Sand	1 Vehicle Movements	9.0	9.0	9.0
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 64 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 3.2 km Weight: 20 tonne		9.0	9.0	9.0
Grout Batched Bentonite	1 Vehicle Movements	111	111	111

Name	Quantity	kgCO2e Single	Total	Project
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 788 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 39.4 km Weight: 20 tonne		111	111	111
Formwork/ Pipe/ Track /Oils	544 Vehicle Movements	16	8,883	8,883
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 115.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 7.7 km Weight: 15 tonne		16	16	8,883
Rebar	389 Vehicle Movements	74	28,791	28,791
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 523.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 34.9 km Weight: 15 tonne		74	74	28,791
Plant Deliveries	501 Vehicle Movements	37	18,593	18,593
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 262.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 17.5 km Weight: 15 tonne		37	37	18,593
Plant Use		949,032	949,032	949,032
Fencing	1 Activity Type	2,541	2,541	2,541
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 466 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 466 kWh		244	244	244
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 861 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 861 Litres		2,297	2,297	2,297
Demolition and Site Set Up	1 Activity Type	52,040	52,040	52,040

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 46,054 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 46,054 kWh		24,161	24,161	24,161
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 10,451 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 10,451 Litres		27,879	27,879	27,879
Shaft sinking by caisson or underpinning	1 Activity Type	719,007	719,007	719,007
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 613,267 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 613,267 kWh		321,732	321,732	321,732
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 148,926 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 148,926 Litres		397,275	397,275	397,275
Main Tunnel Drive - Acton to Barn Elms	1 Activity Type	8,488	8,488	8,488
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 3,182 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 3,182 Litres		8,488	8,488	8,488
Site amenities	1 Activity Type	166,955	166,955	166,955
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 318,240 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 318,240 kWh		166,955	166,955	166,955
Operational Phase		763,134	763,134	763,134
LV Electric: 2020-2024	1 Period	454,166	454,166	454,166

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 73,000 kWh Source: A New Source Region: UK Electricity: 73,000 kWh		19,637	19,637	19,637
Small Power Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 50,083 kWh Source: A New Source Region: UK Electricity: 50,083 kWh		13,472	13,472	13,472
Ventilation Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 66,665 kWh Source: A New Source Region: UK Electricity: 66,665 kWh		17,933	17,933	17,933
Odour Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,498,481 kWh Source: A New Source Region: UK Electricity: 1,498,481 kWh		403,091	403,091	403,091
Other Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 120 kWh Source: A New Source Region: UK Electricity: 120 kWh		32	32	32
LV Electric: 2025-2029	1 Period	243,122	243,122	243,122
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 73,000 kWh Source: A New Source Region: UK Electricity: 73,000 kWh		10,512	10,512	10,512
Small Power Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 50,083 kWh Source: A New Source Region: UK Electricity: 50,083 kWh		7,212	7,212	7,212
Ventilation Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 66,665 kWh Source: A New Source Region: UK Electricity: 66,665 kWh		9,600	9,600	9,600

Name	Quantity	Single ($kgCO_2e$)	Total ($kgCO_2e$)	Project ($kgCO_2e$)
Odour Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,498,481 kWh Source: A New Source Region: UK Electricity: 1,498,481 kWh		215,781	215,781	215,781
Other Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 120 kWh Source: A New Source Region: UK Electricity: 120 kWh		17	17	17
LV Electric: 2030-2034	1 Period	65,846	65,846	65,846
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 73,000 kWh Source: A New Source Region: UK Electricity: 73,000 kWh		2,847	2,847	2,847
Small Power Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 50,083 kWh Source: A New Source Region: UK Electricity: 50,083 kWh		1,953	1,953	1,953
Ventilation Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 66,665 kWh Source: A New Source Region: UK Electricity: 66,665 kWh		2,600	2,600	2,600
Odour Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,498,481 kWh Source: A New Source Region: UK Electricity: 1,498,481 kWh		58,441	58,441	58,441
Other Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 120 kWh Source: A New Source Region: UK Electricity: 120 kWh		4.7	4.7	4.7
Barn Elms		4,131,874	4,131,874	4,131,874
Construction Phase		4,110,030	4,110,030	4,110,030
Materials	1 Site	3,005,395	3,005,395	3,005,395

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Imported Fill Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 5,774,000 kg Source: Bath ICE (2.0) Region: UK Mass: 5,774,000 kg		30,025	30,025	30,025
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 7,718,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 7,718,000 kg		1,273,470	1,273,470	1,273,470
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 915,000 kg Source: Bath ICE (2.0) Region: Global Mass: 915,000 kg		1,701,900	1,701,900	1,701,900
Transport Emissions		153,389	153,389	153,389
Waste Disposal		89,666	89,666	89,666
Excavated Material	1,031 Vehicle Movements	87	89,666	89,666
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 438.4 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 27.4 km Weight: 16 tonne		87	87	89,666
Deliveries		63,723	63,723	63,723
Imported Fill	362 Vehicle Movements	53	19,074	19,074
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 265.6 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 16.6 km Weight: 16 tonne		53	53	19,074
Concrete - Ready Mix (2.45 T/m³)	538 Vehicle Movements	23	12,141	12,141
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 113.76 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 7.9 km Weight: 14.4 tonne		23	23	12,141
Formwork/ Pipe/ Track /Oils	507 Vehicle Movements	31	15,698	15,698

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 219 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 14.6 km Weight: 15 tonne		31	31	15,698
Rebar	61 Vehicle Movements	69	4,230	4,230
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 490.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 32.7 km Weight: 15 tonne		69	69	4,230
Plant Deliveries	351 Vehicle Movements	36	12,580	12,580
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 253.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 16.9 km Weight: 15 tonne		36	36	12,580
Plant Use		951,247	951,247	951,247
Fencing	1 Activity Type	2,541	2,541	2,541
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 466 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 466 kWh		244	244	244
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 861 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 861 Litres		2,297	2,297	2,297
Demolition and Site Set Up	1 Activity Type	138,986	138,986	138,986
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 129,763 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 129,763 kWh		68,076	68,076	68,076

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 26,582 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 26,582 Litres		70,910	70,910	70,910
Piling	1 Activity Type	7,867	7,867	7,867
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 2,949 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 2,949 Litres		7,867	7,867	7,867
Shaft sinking by SCL	1 Activity Type	451,753	451,753	451,753
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 354,586 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 354,586 kWh		186,023	186,023	186,023
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 99,614 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 99,614 Litres		265,730	265,730	265,730
Drive connection tunnel in SCL; Construction of insitu junction with main tunnel form connection tun	1 Activity Type	166,448	166,448	166,448
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 127,051 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 127,051 kWh		66,653	66,653	66,653
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 37,410 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 37,410 Litres		99,795	99,795	99,795
Site amenities	1 Activity Type	183,651	183,651	183,651

Name	Quantity	kgCO2e Single	Total	Project
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 350,064 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 350,064 kWh		183,651	183,651	183,651
Operational Phase		21,844	21,844	21,844
LV Electric: 2020-2024	1 Period	13,000	13,000	13,000
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		9,819	9,819	9,819
Small Power Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		3,066	3,066	3,066
Hydraulics Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 429 kWh Source: A New Source Region: UK Electricity: 429 kWh		115	115	115
LV Electric: 2025-2029	1 Period	6,959	6,959	6,959
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		5,256	5,256	5,256
Small Power Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		1,641	1,641	1,641
Hyrdaulics Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 429 kWh Source: A New Source Region: UK Electricity: 429 kWh		62	62	62
LV Electric: 2030-2034	1 Period	1,885	1,885	1,885

Name	Quantity	kgCO2e Single	Total	Project
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		1,424	1,424	1,424
Small Power Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		445	445	445
Hydraulics Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 429 kWh Source: A New Source Region: UK Electricity: 429 kWh		17	17	17
Beckton Sewage Works		32,207,302	32,207,302	32,207,302
Construction Phase		15,746,592	15,746,592	15,746,592
Materials	1 Site	12,500,913	12,500,913	12,500,913
Tunnel/ Shaft Rings Carbon Factor: Concrete - Fibre Reinforced Value: 0.48 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 5,050,000 kg Source: Bath ICE (2.0) Region: UK Mass: 5,050,000 kg		2,424,000	2,424,000	2,424,000
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 28,332,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 28,332,000 kg		4,674,780	4,674,780	4,674,780
Grout Batched Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 133,000 kg Source: Bath ICE (2.0) Region: UK Mass: 133,000 kg		98,420	98,420	98,420
Grout Batched Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 532,000 kg Source: Bath ICE (2.0) Region: UK Mass: 532,000 kg		2,713	2,713	2,713
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 2,850,000 kg Source: Bath ICE (2.0) Region: Global Mass: 2,850,000 kg		5,301,000	5,301,000	5,301,000

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Transport Emissions		233,179	233,179	233,179
Waste Disposal		99,580	99,580	99,580
Excavated Material	2,432 Lorry Movements	41	99,580	99,580
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 206.4 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 12.9 km Weight: 16 tonne		41	41	99,580
Deliveries		133,600	133,600	133,600
Tunnel / Shaft Rings (Various Sizes)	252 Vehicle Movements	164	41,271	41,271
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,158.4 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 72.4 km Weight: 16 tonne		164	164	41,271
Concrete - Ready Mix (2.45 T/m³)	1,955 Vehicle Movements	11	22,339	22,339
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 57.6 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 4 km Weight: 14.4 tonne		11	11	22,339
Grout Batched PFA	17 Vehicle Movements	11	192	192
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 80 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 4 km Weight: 20 tonne		11	11	192
Grout Batched Sand	33 Vehicle Movements	11	373	373
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 80 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 4 km Weight: 20 tonne		11	11	373
Grout Batched Bentonite	14 Vehicle Movements	74	1,033	1,033

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 522 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 26.1 km Weight: 20 tonne		74	74	1,033
Formwork/ Pipe/ Track /Oils	1,142 Vehicle Movements	44	50,616	50,616
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 313.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 20.9 km Weight: 15 tonne		44	44	50,616
Rebar	190 Vehicle Movements	8.5	1,612	1,612
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 60 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 4 km Weight: 15 tonne		8.5	8.5	1,612
Plant Deliveries	876 Vehicle Movements	18	16,162	16,162
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 130.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 8.7 km Weight: 15 tonne		18	18	16,162
Plant Use		3,012,500	3,012,500	3,012,500
Fencing	1 Activity Type	2,253	2,253	2,253
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 385 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 385 kWh		202	202	202
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 769 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 769 Litres		2,051	2,051	2,051
Demolition and Site Set Up	1 Activity Type	111,008	111,008	111,008

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 78,812 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 78,812 kWh		41,346	41,346	41,346
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 26,114 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 26,114 Litres		69,662	69,662	69,662
Shaft sinking by diaphragm walling	1 Activity Type	398,396	398,396	398,396
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 443,352 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 443,352 kWh		232,591	232,591	232,591
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 62,155 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 62,155 Litres		165,805	165,805	165,805
Main tunnel drive	1 Activity Type	1,740,356	1,740,356	1,740,356
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 2,414,024 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 2,414,024 kWh		1,266,445	1,266,445	1,266,445
HV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 473,541 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 473,541 kWh		248,429	248,429	248,429
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 84,526 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 84,526 Litres		225,482	225,482	225,482
Main tunnel secondary lining	1 Activity Type	280,245	280,245	280,245

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 331,597 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 331,597 kWh		173,962	173,962	173,962
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 39,842 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 39,842 Litres		106,283	106,283	106,283
Site amenities	1 Activity Type	480,241	480,241	480,241
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 915,408 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 915,408 kWh		480,241	480,241	480,241
Operational Phase		16,460,710	16,460,710	16,460,710
LV Electric: 2020-2024	1 Period	9,796,307	9,796,307	9,796,307
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 3,600,000 kWh Source: A New Source Region: UK Electricity: 3,600,000 kWh		968,400	968,400	968,400
Small Power Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,800,000 kWh Source: A New Source Region: UK Electricity: 1,800,000 kWh		484,200	484,200	484,200
Ventilation Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 3,337,917 kWh Source: A New Source Region: UK Electricity: 3,337,917 kWh		897,900	897,900	897,900
Odour Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 604,688 kWh Source: A New Source Region: UK Electricity: 604,688 kWh		162,661	162,661	162,661

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Other Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 2,518,620 kWh Source: A New Source Region: UK Electricity: 2,518,620 kWh		677,509	677,509	677,509
Pumping Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 24,556,274 kWh Source: A New Source Region: UK Electricity: 24,556,274 kWh		6,605,638	6,605,638	6,605,638
LV Electric: 2025-2029	1 Period	5,244,120	5,244,120	5,244,120
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 3,600,000 kWh Source: A New Source Region: UK Electricity: 3,600,000 kWh		518,400	518,400	518,400
Small Power Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,800,000 kWh Source: A New Source Region: UK Electricity: 1,800,000 kWh		259,200	259,200	259,200
Ventilation Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 3,337,917 kWh Source: A New Source Region: UK Electricity: 3,337,917 kWh		480,660	480,660	480,660
Odour Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 604,688 kWh Source: A New Source Region: UK Electricity: 604,688 kWh		87,075	87,075	87,075
Other Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 2,518,620 kWh Source: A New Source Region: UK Electricity: 2,518,620 kWh		362,681	362,681	362,681
Pumping Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 24,556,274 kWh Source: A New Source Region: UK Electricity: 24,556,274 kWh		3,536,103	3,536,103	3,536,103
LV Electric: 2030-2034	1 Period	1,420,282	1,420,282	1,420,282

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 3,600,000 kWh Source: A New Source Region: UK Electricity: 3,600,000 kWh		140,400	140,400	140,400
Small Power Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,800,000 kWh Source: A New Source Region: UK Electricity: 1,800,000 kWh		70,200	70,200	70,200
Ventilation Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 3,337,917 kWh Source: A New Source Region: UK Electricity: 3,337,917 kWh		130,179	130,179	130,179
Odour Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 604,688 kWh Source: A New Source Region: UK Electricity: 604,688 kWh		23,583	23,583	23,583
Other Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 2,518,620 kWh Source: A New Source Region: UK Electricity: 2,518,620 kWh		98,226	98,226	98,226
Pumping Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 24,556,274 kWh Source: A New Source Region: UK Electricity: 24,556,274 kWh		957,695	957,695	957,695
Deptford Church Street		11,531,798	11,531,798	11,531,798
Construction Phase		11,509,422	11,509,422	11,509,422
Materials	1 Site	10,497,037	10,497,037	10,497,037
Imported Fill Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 2,917,000 kg Source: Bath ICE (2.0) Region: UK Mass: 2,917,000 kg		15,168	15,168	15,168
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 31,636,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 31,636,000 kg		5,219,940	5,219,940	5,219,940

Name	Quantity	Single ($kgCO_2e$)	Total ($kgCO_2e$)	Project ($kgCO_2e$)
Grout Batched Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 22,000 kg Source: Bath ICE (2.0) Region: UK Mass: 22,000 kg		16,280	16,280	16,280
Grout Batched Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 88,000 kg Source: Bath ICE (2.0) Region: UK Mass: 88,000 kg		449	449	449
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 2,820,000 kg Source: Bath ICE (2.0) Region: Global Mass: 2,820,000 kg		5,245,200	5,245,200	5,245,200
Transport Emissions		284,688	284,688	284,688
Waste Disposal		216,250	216,250	216,250
Excavated Material	3,028 Vehicle Movements	71	216,250	216,250
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 360 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 22.5 km Weight: 16 tonne		71	71	216,250
Deliveries		68,438	68,438	68,438
Imported Fill	183 Vehicle Movements	24	4,415	4,415
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 121.6 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 7.6 km Weight: 16 tonne		24	24	4,415
Concrete - Ready Mix (2.45 T/m³)	2,165 Vehicle Movements	2.3	4,948	4,948
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 11.52 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 0.8 km Weight: 14.4 tonne		2.3	2.3	4,948
Grout Batched PFA	6 Vehicle Movements	146	874	874

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,030 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 51.5 km Weight: 20 tonne		146	146	874
Grout Batched Sand	7 Vehicle Movements	2.3	16	16
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 16 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 0.8 km Weight: 20 tonne		2.3	2.3	16
Grout Batched Bentonite	6 Vehicle Movements	58	349	349
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 412 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 20.6 km Weight: 20 tonne		58	58	349
Formwork/ Pipe/ Track /Oils	642 Vehicle Movements	49	31,178	31,178
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 343.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 22.9 km Weight: 15 tonne		49	49	31,178
Rebar	188 Vehicle Movements	41	7,655	7,655
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 288 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 19.2 km Weight: 15 tonne		41	41	7,655
Plant Deliveries	435 Vehicle Movements	44	19,004	19,004
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 309 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 20.6 km Weight: 15 tonne		44	44	19,004
Plant Use		727,697	727,697	727,697
Fencing	1 Activity Type	6,244	6,244	6,244

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 466 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 466 kWh		244	244	244
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 2,249 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 2,249 Litres		5,999	5,999	5,999
Demolition and Site Set Up	1 Activity Type	256,334	256,334	256,334
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 184,307 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 184,307 kWh		96,691	96,691	96,691
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 59,845 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 59,845 Litres		159,643	159,643	159,643
Shaft sinking by diaphragm walling	1 Activity Type	364,946	364,946	364,946
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 459,200 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 459,200 kWh		240,906	240,906	240,906
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 46,499 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 46,499 Litres		124,041	124,041	124,041
Site amenities	1 Activity Type	100,173	100,173	100,173
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 190,944 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 190,944 kWh		100,173	100,173	100,173

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Operational Phase		22,376	22,376	22,376
LV Electric: 2020-2024	1 Period	13,317	13,317	13,317
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		9,819	9,819	9,819
Small Power Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		3,066	3,066	3,066
Hydraulics Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		432	432	432
LV Electric: 2025-2029	1 Period	7,129	7,129	7,129
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		5,256	5,256	5,256
Small Power Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		1,641	1,641	1,641
Hyrdaulics Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		231	231	231
LV Electric: 2030-2034	1 Period	1,931	1,931	1,931
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		1,424	1,424	1,424

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Small Power Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		445	445	445
Hydraulics Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		63	63	63
Dormay Street		5,783,586	5,783,586	5,783,586
Construction Phase		5,761,742	5,761,742	5,761,742
Materials	1 Site	3,635,035	3,635,035	3,635,035
Imported Fill Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 1,078,000 kg Source: Bath ICE (2.0) Region: UK Mass: 1,078,000 kg		5,606	5,606	5,606
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 9,867,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 9,867,000 kg		1,628,055	1,628,055	1,628,055
Grout Batched Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 137,000 kg Source: Bath ICE (2.0) Region: UK Mass: 137,000 kg		101,380	101,380	101,380
Grout Batched Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 548,000 kg Source: Bath ICE (2.0) Region: UK Mass: 548,000 kg		2,795	2,795	2,795
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 1,020,000 kg Source: Bath ICE (2.0) Region: Global Mass: 1,020,000 kg		1,897,200	1,897,200	1,897,200
Transport Emissions		344,427	344,427	344,427
Waste Disposal		243,983	243,983	243,983

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Excavated Material	2,512 Vehicle Movements	97	243,983	243,983
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 489.6 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 30.6 km Weight: 16 tonne		97	97	243,983
Deliveries		100,444	100,444	100,444
Tunnel / Shaft Rings (Various Sizes)	314 Vehicle Movements	186	58,315	58,315
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,313.6 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 82.1 km Weight: 16 tonne		186	186	58,315
Imported Fill	68 Vehicle Movements	40	2,720	2,720
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 201.6 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 12.6 km Weight: 16 tonne		40	40	2,720
Concrete - Ready Mix (2.45 T/m³)	683 Vehicle Movements	6.6	4,488	4,488
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 33.12 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 2.3 km Weight: 14.4 tonne		6.6	6.6	4,488
Grout Batched PFA	8 Vehicle Movements	178	1,421	1,421
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,256 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 62.8 km Weight: 20 tonne		178	178	1,421
Grout Batched Sand	28 Vehicle Movements	6.5	182	182
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 46 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 2.3 km Weight: 20 tonne		6.5	6.5	182

Name	Quantity	kgCO2e Single	Total	Project
Grout Batched Bentonite	2 Vehicle Movements	95	189	189
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 670 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 33.5 km Weight: 20 tonne		95	95	189
Formwork/ Pipe/ Track /Oils	586 Vehicle Movements	36	21,375	21,375
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 258 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 17.2 km Weight: 15 tonne		36	36	21,375
Rebar	68 Vehicle Movements	63	4,312	4,312
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 448.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 29.9 km Weight: 15 tonne		63	63	4,312
Plant Deliveries	322 Vehicle Movements	23	7,443	7,443
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 163.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 10.9 km Weight: 15 tonne		23	23	7,443
Plant Use		1,782,280	1,782,280	1,782,280
Fencing	1 Activity Type	11,289	11,289	11,289
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 280 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 280 kWh		147	147	147
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 4,177 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 4,177 Litres		11,143	11,143	11,143
Demolition and Site Set Up	1 Activity Type	234,237	234,237	234,237

Name	Quantity	Single	Total	Project
		kgCO2e		
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 205,240 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 205,240 kWh		107,673	107,673	107,673
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 47,445 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 47,445 Litres		126,564	126,564	126,564
Piling	1 Activity Type	9,674	9,674	9,674
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 2,520 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 2,520 kWh		1,322	1,322	1,322
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 3,131 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 3,131 Litres		8,352	8,352	8,352
Shaft sinking by SCL	1 Activity Type	42,177	42,177	42,177
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,036 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 36,036 kWh		18,905	18,905	18,905
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 8,724 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 8,724 Litres		23,272	23,272	23,272
Long connection tunnel drives - Dormay Street	1 Activity Type	975,905	975,905	975,905
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 907,052 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 907,052 kWh		475,858	475,858	475,858

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
HV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 432,562 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 432,562 kWh		226,931	226,931	226,931
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 102,383 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 102,383 Litres		273,117	273,117	273,117
Long connection tunnel secondary linings - Dormay Street	1 Activity Type	56,008	56,008	56,008
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 90,665 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 90,665 kWh		47,565	47,565	47,565
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 3,165 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 3,165 Litres		8,443	8,443	8,443
Site amenities	1 Activity Type	452,988	452,988	452,988
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 863,460 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 863,460 kWh		452,988	452,988	452,988
Operational Phase		21,844	21,844	21,844
LV Electric: 2020-2024	1 Period	13,000	13,000	13,000
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		9,819	9,819	9,819
Small Power Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		3,066	3,066	3,066

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Hydraulics Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 430 kWh Source: A New Source Region: UK Electricity: 430 kWh		116	116	116
LV Electric: 2025-2029	1 Period	6,959	6,959	6,959
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		5,256	5,256	5,256
Small Power Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		1,641	1,641	1,641
Hyrdaulics Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 430 kWh Source: A New Source Region: UK Electricity: 430 kWh		62	62	62
LV Electric: 2030-2034	1 Period	1,885	1,885	1,885
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		1,424	1,424	1,424
Small Power Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		445	445	445
Hydraulics Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 430 kWh Source: A New Source Region: UK Electricity: 430 kWh		17	17	17
Earl Pumping Station		11,380,994	11,380,994	11,380,994
Construction Phase		11,380,193	11,380,193	11,380,193
Materials	1 Site	10,287,723	10,287,723	10,287,723

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Imported Fill Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 4,317,000 kg Source: Bath ICE (2.0) Region: UK Mass: 4,317,000 kg		22,448	22,448	22,448
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 30,995,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 30,995,000 kg		5,114,175	5,114,175	5,114,175
Grout Batched Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 23,000 kg Source: Bath ICE (2.0) Region: UK Mass: 23,000 kg		17,020	17,020	17,020
Grout Batched Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 94,000 kg Source: Bath ICE (2.0) Region: UK Mass: 94,000 kg		479	479	479
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 2,760,000 kg Source: Bath ICE (2.0) Region: Global Mass: 2,760,000 kg		5,133,600	5,133,600	5,133,600
Transport Emissions		365,743	365,743	365,743
Waste Disposal		274,496	274,496	274,496
Excavated Material	3,365 Lorry Movements	82	274,496	274,496
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 411.2 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 25.7 km Weight: 16 tonne		82	82	274,496
Deliveries		91,247	91,247	91,247
Imported Fill	270 Vehicle Movements	30	7,970	7,970
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 148.8 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 9.3 km Weight: 16 tonne		30	30	7,970

Name	Quantity	kgCO2e Single	kgCO2e Total	kgCO2e Project
Concrete - Ready Mix (2.45 T/m³)	2,120 Vehicle Movements	11	22,408	22,408
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 53.28 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 3.7 km Weight: 14.4 tonne		11	11	22,408
Grout Batched PFA	6 Vehicle Movements	155	928	928
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,094 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 54.7 km Weight: 20 tonne		155	155	928
Grout Batched Sand	8 Vehicle Movements	10	84	84
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 74 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 3.7 km Weight: 20 tonne		10	10	84
Grout Batched Bentonite	6 Vehicle Movements	67	404	404
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 476 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 23.8 km Weight: 20 tonne		67	67	404
Formwork/ Pipe/ Track /Oils	592 Vehicle Movements	53	31,261	31,261
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 373.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 24.9 km Weight: 15 tonne		53	53	31,261
Rebar	184 Vehicle Movements	40	7,297	7,297
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 280.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 18.7 km Weight: 15 tonne		40	40	7,297
Plant Deliveries	414 Vehicle Movements	50	20,896	20,896

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 357 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 23.8 km Weight: 15 tonne		50	50	20,896
Plant Use		726,727	726,727	726,727
Fencing	1 Activity Type	6,244	6,244	6,244
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 466 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 466 kWh		244	244	244
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 2,249 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 2,249 Litres		5,999	5,999	5,999
Demolition and Site Set Up	1 Activity Type	255,364	255,364	255,364
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 182,459 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 182,459 kWh		95,722	95,722	95,722
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 59,845 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 59,845 Litres		159,643	159,643	159,643
Shaft sinking by diaphragm walling	1 Activity Type	364,946	364,946	364,946
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 459,200 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 459,200 kWh		240,906	240,906	240,906

Name	Quantity	kgCO2e Single	kgCO2e Total	kgCO2e Project
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 46,499 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 46,499 Litres		124,041	124,041	124,041
Site amenities	1 Activity Type	100,173	100,173	100,173
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 190,944 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 190,944 kWh		100,173	100,173	100,173
Operational Phase		801	801	801
LV Electric: 2020-2024	1 Period	477	477	477
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 20 kWh Source: A New Source Region: UK Electricity: 20 kWh		5.4	5.4	5.4
Hydraulics Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		432	432	432
Other Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 145 kWh Source: A New Source Region: UK Electricity: 145 kWh		39	39	39
LV Electric: 2025-2029	1 Period	255	255	255
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 20 kWh Source: A New Source Region: UK Electricity: 20 kWh		2.9	2.9	2.9
Hyrdaulics Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		231	231	231

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Other Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 145 kWh Source: A New Source Region: UK Electricity: 145 kWh		21	21	21
LV Electric: 2030-2034	1 Period	69	69	69
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 20 kWh Source: A New Source Region: UK Electricity: 20 kWh		0.78	0.78	0.78
Hydraulics Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		63	63	63
Other Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 145 kWh Source: A New Source Region: UK Electricity: 145 kWh		5.7	5.7	5.7
Falconbrook Pumping Station		5,401,774	5,401,774	5,401,774
Construction Phase		5,384,550	5,384,550	5,384,550
Materials	1 Site	4,688,455	4,688,455	4,688,455
Imported Fill Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 1,000,000 kg Source: Bath ICE (2.0) Region: UK Mass: 1,000,000 kg		5,200	5,200	5,200
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 12,827,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 12,827,000 kg		2,116,455	2,116,455	2,116,455
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 1,380,000 kg Source: Bath ICE (2.0) Region: Global Mass: 1,380,000 kg		2,566,800	2,566,800	2,566,800
Transport Emissions		151,641	151,641	151,641

Name	Quantity	Single (kgCO₂e)	Total (kgCO₂e)	Project (kgCO₂e)
Waste Disposal		120,675	120,675	120,675
Excavated Material	1,311 Vehicle Movements	92	120,675	120,675
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 464 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 29 km Weight: 16 tonne		92	92	120,675
Deliveries		30,966	30,966	30,966
Imported Fill	63 Vehicle Movements	50	3,119	3,119
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 249.6 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 15.6 km Weight: 16 tonne		50	50	3,119
Concrete - Ready Mix (2.45 T/m³)	888 Vehicle Movements	4.0	3,551	3,551
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 20.16 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 1.4 km Weight: 14.4 tonne		4.0	4.0	3,551
Formwork/ Pipe/ Track /Oils	366 Vehicle Movements	39	14,204	14,204
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 274.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 18.3 km Weight: 15 tonne		39	39	14,204
Rebar	92 Vehicle Movements	39	3,570	3,570
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 274.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 18.3 km Weight: 15 tonne		39	39	3,570
Plant Deliveries	277 Vehicle Movements	24	6,521	6,521

Name	Quantity	kgCO2e Single	Total	Project
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 166.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 11.1 km Weight: 15 tonne		24	24	6,521
Plant Use		544,454	544,454	544,454
Fencing	1 Activity Type	1,708	1,708	1,708
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 448 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 448 kWh		235	235	235
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 552 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 552 Litres		1,473	1,473	1,473
Demolition and Site Set Up	1 Activity Type	59,470	59,470	59,470
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 50,266 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 50,266 kWh		26,371	26,371	26,371
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 12,408 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 12,408 Litres		33,100	33,100	33,100
Piling	1 Activity Type	11,540	11,540	11,540
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 4,326 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 4,326 Litres		11,540	11,540	11,540
Shaft sinking by SCL	1 Activity Type	82,978	82,978	82,978

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 88,704 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 88,704 kWh		46,536	46,536	46,536
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 13,661 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 13,661 Litres		36,442	36,442	36,442
Drive connection tunnel in SCL; Construction of insitu junction with main tunnel form connection tun	1 Activity Type	263,542	263,542	263,542
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 201,164 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 201,164 kWh		105,535	105,535	105,535
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 59,232 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 59,232 Litres		158,007	158,007	158,007
Site amenities	1 Activity Type	125,216	125,216	125,216
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 238,680 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 238,680 kWh		125,216	125,216	125,216
Operational Phase		17,224	17,224	17,224
LV Electric: 2020-2024	1 Period	10,251	10,251	10,251
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		9,819	9,819	9,819
Hydraulics Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		432	432	432

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
LV Electric: 2025-2029	1 Period	5,487	5,487	5,487
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		5,256	5,256	5,256
Hyrdaulics Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		231	231	231
LV Electric: 2030-2034	1 Period	1,486	1,486	1,486
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		1,424	1,424	1,424
Hydraulics Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,607 kWh Source: A New Source Region: UK Electricity: 1,607 kWh		63	63	63
Greenwich Pumping Station		53,338,497	53,338,497	53,338,497
Construction Phase		53,336,759	53,336,759	53,336,759
Materials	1 Site	41,327,081	41,327,081	41,327,081
Tunnel/ Shaft Rings Carbon Factor: Concrete - Fibre Reinforced Value: 0.48 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 50,453,000 kg Source: Bath ICE (2.0) Region: UK Mass: 50,453,000 kg		24,217,440	24,217,440	24,217,440
Imported Fill Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 794,000 kg Source: Bath ICE (2.0) Region: UK Mass: 794,000 kg		4,129	4,129	4,129
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 28,654,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 28,654,000 kg		4,727,910	4,727,910	4,727,910

Name	Quantity	Single ($kgCO_2e$)	Total ($kgCO_2e$)	Project ($kgCO_2e$)
Concrete Batched Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 3,706,000 kg Source: Bath ICE (2.0) Region: UK Mass: 3,706,000 kg		2,742,440	2,742,440	2,742,440
Concrete Batched Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 6,949,000 kg Source: Bath ICE (2.0) Region: UK Mass: 6,949,000 kg		35,440	35,440	35,440
Concrete Batched 10/20mm Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 9,265,000 kg Source: Bath ICE (2.0) Region: UK Mass: 9,265,000 kg		48,178	48,178	48,178
Grout Batched Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 1,774,000 kg Source: Bath ICE (2.0) Region: UK Mass: 1,774,000 kg		1,312,760	1,312,760	1,312,760
Grout Batched Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 7,095,000 kg Source: Bath ICE (2.0) Region: UK Mass: 7,095,000 kg		36,185	36,185	36,185
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 4,410,000 kg Source: Bath ICE (2.0) Region: Global Mass: 4,410,000 kg		8,202,600	8,202,600	8,202,600
Transport Emissions		1,998,530	1,998,530	1,998,530
Waste Disposal		1,430,050	1,430,050	1,430,050
Excavated Material	20,024 Vehicle Movements	71	1,430,050	1,430,050
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 360 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 22.5 km Weight: 16 tonne		71	71	1,430,050
Deliveries		568,480	568,480	568,480
Tunnel / Shaft Rings (Various Sizes)	2,523 Vehicle Movements	157	394,940	394,940

Name	Quantity	Single (kgCO₂e)	Total (kgCO₂e)	Project (kgCO₂e)
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,107.2 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 69.2 km Weight: 16 tonne		157	157	394,940
Imported Fill	50 Vehicle Movements	17	841	841
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 84.8 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 5.3 km Weight: 16 tonne		17	17	841
Concrete - Ready Mix (2.45 T/m³)	1,962 Vehicle Movements	2.3	4,484	4,484
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 11.52 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 0.8 km Weight: 14.4 tonne		2.3	2.3	4,484
Concrete - Batched - Cement	283 Vehicle Movements	81	22,793	22,793
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 406 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 20.3 km Weight: 20 tonne		81	81	22,793
Concrete - Batched - Sand	348 Vehicle Movements	3.2	1,105	1,105
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 16 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 0.8 km Weight: 20 tonne		3.2	3.2	1,105
Concrete Batched 10/20mm	464 Vehicle Movements	3.2	1,473	1,473
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 16 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 0.8 km Weight: 20 tonne		3.2	3.2	1,473
Grout Batched PFA	97 Vehicle Movements	146	14,125	14,125

Name	Quantity	Single (kgCO$_2$e)	Total (kgCO$_2$e)	Project (kgCO$_2$e)
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,030 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 51.5 km Weight: 20 tonne		146	146	14,125
Grout Batched Sand	361 Vehicle Movements	2.3	817	817
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 16 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 0.8 km Weight: 20 tonne		2.3	2.3	817
Grout Batched Bentonite	16 Vehicle Movements	614	9,831	9,831
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 4,346 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 217.3 km Weight: 20 tonne		614	614	9,831
Formwork/ Pipe/ Track /Oils	1,699 Vehicle Movements	46	77,826	77,826
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 324 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 21.6 km Weight: 15 tonne		46	46	77,826
Rebar	294 Vehicle Movements	40	11,659	11,659
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 280.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 18.7 km Weight: 15 tonne		40	40	11,659
Plant Deliveries	664 Vehicle Movements	43	28,585	28,585
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 304.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 20.3 km Weight: 15 tonne		43	43	28,585
Plant Use		10,011,149	10,011,149	10,011,149
Fencing	1 Activity Type	6,244	6,244	6,244

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 466 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 466 kWh		244	244	244
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 2,249 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 2,249 Litres		5,999	5,999	5,999
Demolition and Site Set Up	1 Activity Type	233,032	233,032	233,032
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 167,552 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 167,552 kWh		87,901	87,901	87,901
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 54,405 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 54,405 Litres		145,131	145,131	145,131
Shaft sinking by diaphragm walling	1 Activity Type	370,718	370,718	370,718
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 376,544 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 376,544 kWh		197,543	197,543	197,543
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 64,918 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 64,918 Litres		173,175	173,175	173,175
Main tunnel drive - Greenwich to Chambers Wharf	1 Activity Type	8,609,616	8,609,616	8,609,616
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 8,046,575 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 8,046,575 kWh		4,221,394	4,221,394	4,221,394

Name	Quantity	kgCO$_2$e Single	Total	Project
HV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 7,752,776 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 7,752,776 kWh		4,067,261	4,067,261	4,067,261
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 120,318 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 120,318 Litres		320,960	320,960	320,960
Main tunnel secondary lining - Greenwich to Chambers Wharf	1 Activity Type	391,338	391,338	391,338
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 615,342 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 615,342 kWh		322,821	322,821	322,821
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 25,685 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 25,685 Litres		68,517	68,517	68,517
Site amenities	1 Activity Type	400,201	400,201	400,201
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 762,840 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 762,840 kWh		400,201	400,201	400,201
Operational Phase		1,737	1,737	1,737
LV Electric: 2020-2024	1 Period	1,034	1,034	1,034
Ventilation Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 2,786 kWh Source: A New Source Region: UK Electricity: 2,786 kWh		749	749	749
Other Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,058 kWh Source: A New Source Region: UK Electricity: 1,058 kWh		285	285	285

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
LV Electric: 2025-2029	1 Period	554	554	554
Ventilation Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 2,786 kWh Source: A New Source Region: UK Electricity: 2,786 kWh		401	401	401
Other Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,058 kWh Source: A New Source Region: UK Electricity: 1,058 kWh		152	152	152
LV Electric: 2030-2034	1 Period	150	150	150
Ventilation Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 2,786 kWh Source: A New Source Region: UK Electricity: 2,786 kWh		109	109	109
Other Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,058 kWh Source: A New Source Region: UK Electricity: 1,058 kWh		41	41	41
Hammersmith Pumping Station		7,760,930	7,760,930	7,760,930
Construction Phase		7,746,595	7,746,595	7,746,595
Materials	1 Site	6,710,007	6,710,007	6,710,007
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 19,681,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 19,681,000 kg		3,247,365	3,247,365	3,247,365
Grout Batched Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 4,000 kg Source: Bath ICE (2.0) Region: UK Mass: 4,000 kg		2,960	2,960	2,960
Grout Batched Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 16,000 kg Source: Bath ICE (2.0) Region: UK Mass: 16,000 kg		82	82	82

Name	Quantity	kgCO2e Single	Total	Project
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 1,860,000 kg Source: Bath ICE (2.0) Region: Global Mass: 1,860,000 kg		3,459,600	3,459,600	3,459,600
Transport Emissions		236,030	236,030	236,030
Waste Disposal		179,229	179,229	179,229
Excavated Material	2,343 Lorry Movements	76	179,229	179,229
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 385.6 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 24.1 km Weight: 16 tonne		76	76	179,229
Deliveries		56,801	56,801	56,801
Concrete - Ready Mix (2.45 T/m³)	1,350 Vehicle Movements	16	21,596	21,596
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 80.64 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 5.6 km Weight: 14.4 tonne		16	16	21,596
Grout Batched PFA	1 Vehicle Movements	173	173	173
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,224 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 61.2 km Weight: 20 tonne		173	173	173
Grout Batched Sand	1 Vehicle Movements	16	16	16
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 112 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 5.6 km Weight: 20 tonne		16	16	16
Grout Batched Bentonite	1 Vehicle Movements	105	105	105

Name	Quantity	kgCO2e Single	Total	Project
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 740 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 37 km Weight: 20 tonne		105	105	105
Formwork/ Pipe/ Track /Oils	433 Vehicle Movements	26	11,111	11,111
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 181.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 12.1 km Weight: 15 tonne		26	26	11,111
Rebar	124 Vehicle Movements	69	8,546	8,546
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 487.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 32.5 km Weight: 15 tonne		69	69	8,546
Plant Deliveries	333 Vehicle Movements	46	15,254	15,254
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 324 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 21.6 km Weight: 15 tonne		46	46	15,254
Plant Use		800,559	800,559	800,559
Fencing	1 Activity Type	2,541	2,541	2,541
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 466 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 466 kWh		244	244	244
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 861 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 861 Litres		2,297	2,297	2,297
Demolition and Site Set Up	1 Activity Type	63,824	63,824	63,824

Name	Quantity	kgCO2e Single	Total	Project
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 46,189 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 46,189 kWh		24,232	24,232	24,232
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 14,842 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 14,842 Litres		39,593	39,593	39,593
Piling	1 Activity Type	7,867	7,867	7,867
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 2,949 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 2,949 Litres		7,867	7,867	7,867
Shaft sinking by SCL	1 Activity Type	159,291	159,291	159,291
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 113,098 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 113,098 kWh		59,333	59,333	59,333
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 37,471 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 37,471 Litres		99,958	99,958	99,958
Drive connection tunnel in SCL; Construction of insitu junction with main tunnel form connection tun	1 Activity Type	400,081	400,081	400,081
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 329,073 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 329,073 kWh		172,638	172,638	172,638
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 85,261 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 85,261 Litres		227,442	227,442	227,442

Name	Quantity	Single (kgCO$_2$e)	Total (kgCO$_2$e)	Project (kgCO$_2$e)
Site amenities	1 Activity Type	166,955	166,955	166,955
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 318,240 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 318,240 kWh		166,955	166,955	166,955
Operational Phase		14,335	14,335	14,335
LV Electric: 2020-2024	1 Period	8,531	8,531	8,531
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 28,500 kWh Source: A New Source Region: UK Electricity: 28,500 kWh		7,667	7,667	7,667
Hydraulics Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 3,215 kWh Source: A New Source Region: UK Electricity: 3,215 kWh		865	865	865
LV Electric: 2025-2029	1 Period	4,567	4,567	4,567
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 28,500 kWh Source: A New Source Region: UK Electricity: 28,500 kWh		4,104	4,104	4,104
Hyrdaulics Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 3,215 kWh Source: A New Source Region: UK Electricity: 3,215 kWh		463	463	463
LV Electric: 2030-2034	1 Period	1,237	1,237	1,237
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 28,500 kWh Source: A New Source Region: UK Electricity: 28,500 kWh		1,112	1,112	1,112
Hydraulics Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 3,215 kWh Source: A New Source Region: UK Electricity: 3,215 kWh		125	125	125

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
King George's Park		21,058,149	21,058,149	21,058,149
Construction Phase		21,036,304	21,036,304	21,036,304
Material	1 Site	20,657,798	20,657,798	20,657,798
Imported Fill Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 76,094,000 kg Source: Bath ICE (2.0) Region: UK Mass: 76,094,000 kg		395,689	395,689	395,689
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 61,433,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 61,433,000 kg		10,136,445	10,136,445	10,136,445
Grout Batched Cement Carbon Factor: Cement - General (UK weighted average) Value: 0.74 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 34,000 kg Source: Bath ICE (2.0) Region: UK Mass: 34,000 kg		25,160	25,160	25,160
Grout Batched Sand Carbon Factor: Sand - General Value: 0.0051 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 138,000 kg Source: Bath ICE (2.0) Region: UK Mass: 138,000 kg		704	704	704
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 5,430,000 kg Source: Bath ICE (2.0) Region: Global Mass: 5,430,000 kg		10,099,800	10,099,800	10,099,800
Transport Emissions		57,569	57,569	57,569
Waste Disposal		34,189	34,189	34,189
Excavated Material	352 Vehicle Movements	97	34,189	34,189
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 489.6 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 30.6 km Weight: 16 tonne		97	97	34,189
Deliveries		23,380	23,380	23,380

Name	Quantity	kgCO2e Single	Total	Project
Imported Fill	4 Vehicle Movements	27	107	107
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 134.4 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 8.4 km Weight: 16 tonne		27	27	107
Concrete - Ready Mix (2.45 T/m³)	502 Vehicle Movements	6.0	3,012	3,012
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 30.24 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 2.1 km Weight: 14.4 tonne		6.0	6.0	3,012
Grout Batched PFA	1 Vehicle Movements	178	178	178
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 1,256 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 62.8 km Weight: 20 tonne		178	178	178
Grout Batched Sand	1 Vehicle Movements	5.9	5.9	5.9
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 42 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 2.1 km Weight: 20 tonne		5.9	5.9	5.9
Grout Batched Bentonite	1 Vehicle Movements	96	96	96
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 676 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 33.8 km Weight: 20 tonne		96	96	96
Formwork/ Pipe/ Track /Oils	296 Vehicle Movements	36	10,797	10,797
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 258 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 17.2 km Weight: 15 tonne		36	36	10,797
Rebar	56 Vehicle Movements	64	3,575	3,575

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 451.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 30.1 km Weight: 15 tonne		64	64	3,575
Plant Deliveries	245 Vehicle Movements	23	5,611	5,611
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 162 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 10.8 km Weight: 15 tonne		23	23	5,611
Plant Use		320,938	320,938	320,938
Fencing	1 Activity Type	1,708	1,708	1,708
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 448 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 448 kWh		235	235	235
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 552 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 552 Litres		1,473	1,473	1,473
Demolition and Site Set Up	1 Activity Type	79,293	79,293	79,293
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 67,021 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 67,021 kWh		35,161	35,161	35,161
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 16,544 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 16,544 Litres		44,133	44,133	44,133
Piling	1 Activity Type	8,918	8,918	8,918

Name	Quantity	kgCO2e Single	Total	Project
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 3,343 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 3,343 Litres		8,918	8,918	8,918
Shaft sinking by SCL	1 Activity Type	103,765	103,765	103,765
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 94,228 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 94,228 kWh		49,434	49,434	49,434
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 20,367 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 20,367 Litres		54,331	54,331	54,331
Drive connection tunnel in SCL; Construction of insitu junction with main tunnel form connection tun	1 Activity Type	2,038	2,038	2,038
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 764 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 764 Litres		2,038	2,038	2,038
Site amenities	1 Activity Type	125,216	125,216	125,216
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 238,680 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 238,680 kWh		125,216	125,216	125,216
Operational Phase		21,844	21,844	21,844
LV Electric: 2020-2024	1 Period	13,000	13,000	13,000
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		9,819	9,819	9,819

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
Small Power Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		3,066	3,066	3,066
Hydraulics Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 430 kWh Source: A New Source Region: UK Electricity: 430 kWh		116	116	116
LV Electric: 2025-2029	1 Period	6,959	6,959	6,959
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		5,256	5,256	5,256
Small Power Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		1,641	1,641	1,641
Hyrdaulics Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 430 kWh Source: A New Source Region: UK Electricity: 430 kWh		62	62	62
LV Electric: 2030-2034	1 Period	1,885	1,885	1,885
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 36,500 kWh Source: A New Source Region: UK Electricity: 36,500 kWh		1,424	1,424	1,424
Small Power Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 11,398 kWh Source: A New Source Region: UK Electricity: 11,398 kWh		445	445	445
Hydraulics Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 430 kWh Source: A New Source Region: UK Electricity: 430 kWh		17	17	17
Cremorne Wharf		8,655,939	8,655,939	8,655,939

Name	Quantity	Single	Total	Project
		kgCO$_2$e		
Construction Phase		8,637,075	8,637,075	8,637,075
Materials	1 Site	7,380,251	7,380,251	7,380,251
Imported Fill Carbon Factor: Aggregate - General Value: 0.0052 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 2,382,000 kg Source: Bath ICE (2.0) Region: UK Mass: 2,382,000 kg		12,386	12,386	12,386
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 13,541,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 13,541,000 kg		2,234,265	2,234,265	2,234,265
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 2,760,000 kg Source: Bath ICE (2.0) Region: Global Mass: 2,760,000 kg		5,133,600	5,133,600	5,133,600
Transport Emissions		178,215	178,215	178,215
Waste Disposal		135,096	135,096	135,096
Excavated Material (Road)	826 Vehicle Movements	82	67,380	67,380
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 411.2 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 25.7 km Weight: 16 tonne		82	82	67,380
Excavated Material (Barge)	56 Barge Movements	1,209	67,716	67,716
Shipping - Bulk Carrier (0-9999dwt) - 60% Laden Carbon Factor Value: 0.02943 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 41,088 tkm Source: Defra - Freight Transport - Maritime Shipping Freight (t.km); Scope 3 (2011 (v1)) Region: UK Distance: 128 km Weight: 321 tonne		1,209	1,209	67,716
Deliveries		43,119	43,119	43,119
Imported Fill	149 Vehicle Movements	28	4,115	4,115

Name	Quantity	kgCO2e Single	Total	Project
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 139.2 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 8.7 km Weight: 16 tonne		28	28	4,115
Concrete - Ready Mix (2.45 T/m³)	938 Vehicle Movements	7.7	7,235	7,235
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 38.88 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 2.7 km Weight: 14.4 tonne		7.7	7.7	7,235
Formwork/ Pipe/ Track /Oils	383 Vehicle Movements	29	11,128	11,128
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 205.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 13.7 km Weight: 15 tonne		29	29	11,128
Rebar	92 Vehicle Movements	60	5,521	5,521
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 424.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 28.3 km Weight: 15 tonne		60	60	5,521
Plant Deliveries	306 Vehicle Movements	49	15,120	15,120
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 349.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 23.3 km Weight: 15 tonne		49	49	15,120
Plant Use		1,078,609	1,078,609	1,078,609
Fencing	1 Activity Type	1,708	1,708	1,708
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 448 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 448 kWh		235	235	235

Name	Quantity	Single (kgCO$_2$e)	Total (kgCO$_2$e)	Project (kgCO$_2$e)
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 552 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 552 Litres		1,473	1,473	1,473
Demolition and Site Set Up	1 Activity Type	134,088	134,088	134,088
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 115,875 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 115,875 kWh		60,790	60,790	60,790
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 27,477 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 27,477 Litres		73,298	73,298	73,298
Piling	1 Activity Type	10,489	10,489	10,489
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 3,932 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 3,932 Litres		10,489	10,489	10,489
Shaft sinking by SCL	1 Activity Type	79,357	79,357	79,357
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 60,984 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 60,984 kWh		31,993	31,993	31,993
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 17,755 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 17,755 Litres		47,363	47,363	47,363
Drive connection tunnel in SCL; Construction of insitu junction with main tunnel form connection tun	1 Activity Type	519,057	519,057	519,057

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 568,287 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 568,287 kWh		298,135	298,135	298,135
Diesel Carbon Factor Value: 2.6676 kgCO2e/litre Lifecycle: Partial process Calculation: Fuel Burnt - Litres (Fuel_litre * CF) Property Calculation: 82,817 litre Source: Defra - Fuel Types (Vol); Scope 1 (2011 (v1)) Region: UK Fuel: 82,817 Litres		220,923	220,923	220,923
Site amenities	1 Activity Type	333,910	333,910	333,910
LV Electric Carbon Factor: Electricity Value: 0.52462 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 636,480 kWh Source: Defra - UK Grid Electricity; Scope 2 (2011 (v1)) Region: UK Electricity: 636,480 kWh		333,910	333,910	333,910
Operational Phase		18,864	18,864	18,864
LV Electric: 2020-2024	1 Period	11,227	11,227	11,227
UPS Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 40,555 kWh Source: A New Source Region: UK Electricity: 40,555 kWh		10,909	10,909	10,909
Hydraulics Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,180 kWh Source: A New Source Region: UK Electricity: 1,180 kWh		317	317	317
LV Electric: 2025-2029	1 Period	6,010	6,010	6,010
UPS Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 40,555 kWh Source: A New Source Region: UK Electricity: 40,555 kWh		5,840	5,840	5,840
Hyrdaulics Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,180 kWh Source: A New Source Region: UK Electricity: 1,180 kWh		170	170	170
LV Electric: 2030-2034	1 Period	1,628	1,628	1,628

Name	Quantity	Single (kgCO2e)	Total (kgCO2e)	Project (kgCO2e)
UPS Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 40,555 kWh Source: A New Source Region: UK Electricity: 40,555 kWh		1,582	1,582	1,582
Hydraulics Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 1,180 kWh Source: A New Source Region: UK Electricity: 1,180 kWh		46	46	46
Shad Thames		1,030,889	1,030,889	1,030,889
Construction Phase		951,930	951,930	951,930
Materials	1 Site	912,300	912,300	912,300
Tunnel/ Shaft Rings Carbon Factor: Concrete - Fibre Reinforced Value: 0.48 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 131,000 kg Source: Bath ICE (2.0) Region: UK Mass: 131,000 kg		62,880	62,880	62,880
Concrete - Ready Mix Carbon Factor: Concrete - RC50 - C50 MPa - Cement Replacement - Fly Ash - 25% Value: 0.165 kgCO2e/kg Lifecycle: Cradle to Gate Calculation: Mass (Mass_kg * CF) Property Calculation: 1,428,000 kg Source: Bath ICE (1.6a) Region: Global Mass: 1,428,000 kg		235,620	235,620	235,620
Rebar Carbon Factor: Steel - Bar and Rod - World Average Recycled Content Value: 1.86 kgCO2e/kg Lifecycle: Partial process Calculation: Mass (Mass_kg * CF) Property Calculation: 330,000 kg Source: Bath ICE (2.0) Region: Global Mass: 330,000 kg		613,800	613,800	613,800
Transport Emissions		39,630	39,630	39,630
Waste Disposal		20,311	20,311	20,311
Excavated Material	237 Vehicle Movements	86	20,311	20,311
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 432 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 27 km Weight: 16 tonne		86	86	20,311
Deliveries		19,319	19,319	19,319

Name	Quantity	Single (kgCO$_2$e)	Total (kgCO$_2$e)	Project (kgCO$_2$e)
Concrete - Ready Mix (2.45 T/m³)	101 Vehicle Movements	16	1,616	1,616
Freight - HGV - Rigid (>17t) - Average UK Load - Diesel Carbon Factor Value: 0.19838 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 80.64 tkm Source: Defra - Freight Transport - Diesel HGV Road Freight: UK Average Vehicle Loads (t.km); Scope 1 or 3 (2011 (v1)) Region: UK Distance: 5.6 km Weight: 14.4 tonne		16	16	1,616
Formwork/ Pipe/ Track /Oils	158 Vehicle Movements	58	9,114	9,114
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 408 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 27.2 km Weight: 15 tonne		58	58	9,114
Rebar	22 Vehicle Movements	32	704	704
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 226.5 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 15.1 km Weight: 15 tonne		32	32	704
Plant Deliveries	143 Vehicle Movements	55	7,885	7,885
Freight - HGV - Articulated (>3.5-33t) - Average UK Load - Diesel Carbon Factor Value: 0.14138 kgCO2e/tkm Lifecycle: Partial process Calculation: Freight - Tonne Kilometre (Weight_tonne * Distance_km * CF) Property Calculation: 390 tkm Source: Defra - Diesel HGV (t-km) (2009) Region: UK Distance: 26 km Weight: 15 tonne		55	55	7,885
Operational Phase		78,959	78,959	78,959
LV Electric (2020-2024)	1 Operational Phase	46,991	46,991	46,991
Pumping Carbon Factor: TT Electricity 2020-2024 Decarbonisation Value: 0.269 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 174,688 kWh Source: A New Source Region: UK Electricity: 174,688 kWh		46,991	46,991	46,991
LV Electric (2025-2029)	1 Operational Phase	25,155	25,155	25,155
Pumping Carbon Factor: TT Electricity 2025-2029 Decarbonisation Value: 0.144 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 174,688 kWh Source: A New Source Region: UK Electricity: 174,688 kWh		25,155	25,155	25,155
LV Electric (2030-2034)	1 Operational Phase	6,813	6,813	6,813

Name	Quantity	kgCO$_2$e Single	Total	Project
Pumping Carbon Factor: TT Electricity 2030-2035 Decarbonisation Value: 0.039 kgCO2e/kWh Lifecycle: Partial process Calculation: Electricity Used - kWh (Electricity_kwh * CF) Property Calculation: 174,688 kWh Source: A New Source Region: UK Electricity: 174,688 kWh		6,813	6,813	6,813

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A.3 Excavated material and waste strategy

A.3.1 The following report has its own table of contents

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.03**

Volume 3: Project-wide effects assessment appendices

Appendix A.3: Excavated materials and waste strategy

APFP Regulations 2009: Regulation **5(2)(a)**

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Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 3 Appendices: Project-wide effects assessment

Appendix A.3: Excavated material and waste strategy

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Executive summary

EX 1 Introduction

EX 1.1 The *Excavated material and waste strategy* (*EM&W strategy*):

a. develops the approach for the control and sustainable management of excavated materials and waste that would be produced throughout the construction and operational phases of the Thames Tideway Tunnel project.

b. sets out how the approach is consistent with the guidance in the *National Policy Statement for Waste Water (NPS)* to implement sustainable waste management through the application of the waste hierarchy

c. demonstrates that the management of the excavated material and waste would not have an adverse effect on the capacity of existing waste management facilities to deal with other waste arisings in the area.

EX 1.2 The *EM&W strategy* forms Appendix A.3 to Volume 3 Project-wide effects assessment of the *Environmental Statement*.

EX 1.3 The *EM&W strategy* includes details of the anticipated volumes of excavated material and waste, both at the project wide level and also on a site by site basis. The volumes of excavated material to be removed from each of the sites and the volume of waste generated forms an important part of the assessment of likely significant effects described in the *Environmental Statement*[i]. The project wide excavated material and waste volumes are summarised in Vol 3 Section 1.6. Within the site specific volumes of the *Environmental Statement* (Volumes 4 to 27) approximate excavated material and waste volumes are presented in Section 3.

EX 2 Types and quantities of excavated material and waste

EX 2.1 The main tunnel of the Thames Tideway Tunnel project would be approximately 7.2m in diameter, up to 75m deep, and 25km long. The construction of the tunnel would require the excavation of a large volume of material. There are four proposed tunnel drive sites and associated shafts which would produce over 70% of the excavated materials: these are Carnwath Road Riverside, Kirtling Street, Chambers Wharf and Greenwich Pumping Station.

EX 2.2 An estimated 4.7million tonnes of material would be excavated over the construction lifespan of the Thames Tideway Tunnel project. The

[i] The process of excavating and removing of the material from the CSO and main tunnel sites is what has been assessed within the *Environmental Statement*. For example the volume of excavated material sets the barge and lorry movements and the duration and type of plant used to excavate the material has informed the noise assessment.

proposed length of the tunnel means that the in situ geology varies along the length of the tunnel. The excavated materials would therefore vary as the tunnel construction progresses, from west to east, through clays to sands and gravels and then chalk.

EX 2.3 In addition to excavated material, a range of waste would be generated during the construction phase. This includes:

a. Construction related waste; this includes waste such as imported fill, concrete, grout and concrete tunnel linings. It has been estimated that around 50,000t of waste would be produced during the construction of the tunnel.

b. Demolition waste, it has been estimated that 137,000t of demolition waste would be generated through the demolition of buildings and structures.

c. Hazardous waste from demolition and construction equipment maintenance such as oil and grease and associated maintenance waste from generators, it is estimated that 7,000t of hazardous waste would be produced during the project.

d. Vegetation waste from site clearance, estimated to be 390t of vegetation and tree related waste.

e. Welfare waste generated by staff on site, it is estimated that 2,000t of welfare waste would be generate during the project.

f. Waste electrical and electronic equipment which is estimated to be less than 25t over the life of the project.

EX 2.4 This gives an overall estimated arising of 4.9million tonnes. Plate EX 1 shows a breakdown of the total arisings for excavated and non-excavated material.

EX 3 Objectives and targets

EX 3.1 The *EM&W strategy* develops the strategic direction and approach to the management of waste and excavated materials, in line with legislative, policy, environmental and corporate requirements. The *EM&W strategy* covers excavated materials and waste that would arise through:

a. site demolition and clearance activities prior to excavation

b. shaft excavation and construction

c. tunnel excavation and construction

d. combined sewer overflow (CSO) interception works

e. tunnel operations.

EX 3.2 The majority of the material to be removed from Thames Tideway Tunnel project sites would be excavated material, for which beneficial uses would be sought.

EX 3.3 In order to set a clear vision and provide strategic direction for the Thames Tideway Tunnel project, a number of high-level waste related objectives have been developed. Thames Water policy, the legislative and policy context and the overall sustainability objectives of the Thames Tideway Tunnel project have informed the identification of these objectives.

EX 3.4 The *Sustainability statement* sets out an overarching objective to minimise waste arisings and its impacts on the environment and communities and to promote re-use, recovery, recycling and beneficial use.

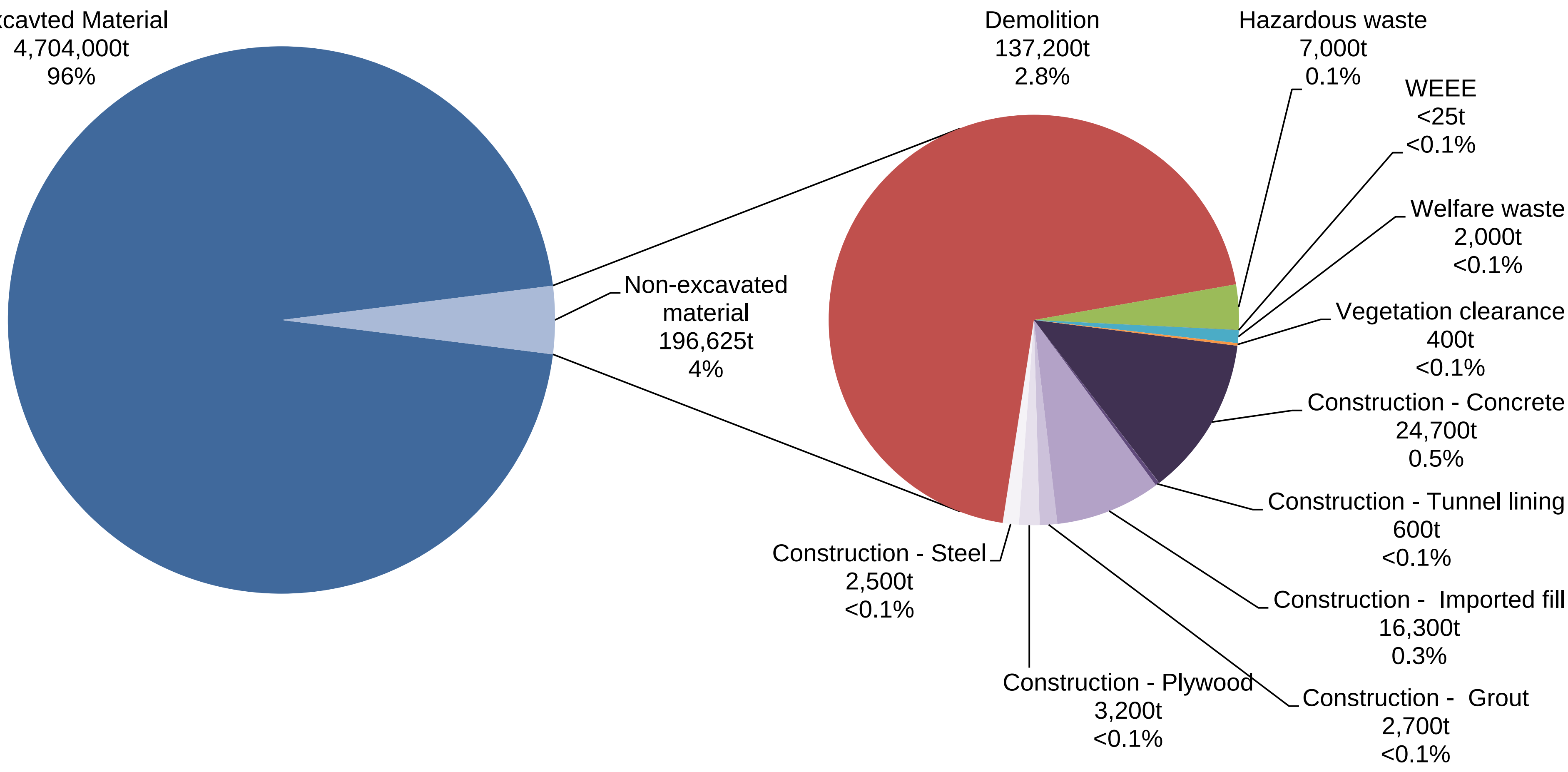
EX 3.5 To support the delivery of this overarching objective, three objectives have been identified which relate to the management of excavated material and waste:

a. **Objective W1**: To minimise waste to landfill by prioritising prevention and seeking to maximise reuse and recycling

b. **Objective W2:** To maximise beneficial use of excavated material arising from tunnel construction.

c. **Objective W3:** To minimise the impact of excavated material and waste on the environment and communities.

Plate EX 1 A summary of the estimated excavated and non-excavated material generated (tonnes) during the construction phase of the tunnel[ll]



[ll] Tonnages to the nearest 25t

EX 3.6 The achievement of the objectives would be assessed using specific targets, set out below. It is Thames Waters intention that reporting progress towards these targets would be undertaken by the project every six months.

a. divert at least 80% of construction and demolition waste from landfill

b. beneficially use a minimum of 85% of clean excavated material with an aspiration to beneficially use 100% of clean excavated material.

c. all of the receptor sites used for the Thames Tideway Tunnel project excavated material would be assessed against the *EMOA* perform no worse than those sites on the preferred receptor site list (at the time of submission of the application).

d. all Thames Tideway Tunnel project construction sites have a *SWMP* which is updated quarterly

EX 3.7 This *EM&W strategy* gives due consideration to the relevant legislative provisions and local/regional policy guidance for waste management, including:

a. the revised *Waste Framework Directive*, which clarifies the definition of waste and puts a greater emphasis on the use of the waste hierarchy in waste management decision-making.

b. National policy which provides the framework for strategic waste management decision-making, involving sustainable development, the waste hierarchy, self-sufficiency and the proximity principle, all of which form key elements to the national waste management plan for England, which currently comprises the *Waste Strategy 2007* and *Planning Policy Statement 10*.

c. the *NPS* which is a framework document for planning decisions on nationally significant waste water infrastructure.

d. at the regional level, the *London Plan 2011*, and individual local authority planning frameworks, which all establish relevant regional and local waste policies.

EX 3.8 The *EM&W strategy* would be reviewed regularly during the construction phase and when the tunnel is operational.

EX 4 Management of excavated material and construction phase wastes

EX 4.1 All excavated material and waste would be managed through the application of the waste hierarchy, preventing/minimising the generation of waste and by using it as a resource wherever possible.

EX 4.2 All excavated material and waste produced on site would be managed in accordance with the *CoCP,* which sets out a series of measures to protect the environment and limit disturbance from construction activities as far as is reasonably practicable.

EX 4.3 Prior to commencement of construction TWUL or their agent would prepare an overarching *Project wide WMP*, which would be secured through an application requirement placed on the *CoCP,* to ensure a consistent approach to managing the excavated materials and waste at individual construction sites. The *Project wide WMP* will provide a central location for all Thames Tideway Tunnel project waste information. The *Project wide WMP* would:

a. record Thames Water's (or their agent) responsible person, as well as the responsible person for each site

a. record the waste types generated by the entire project

b. provide details of all waste prevention/minimisation actions

c. provide project-wide waste forecasts for each waste type

d. provide a complete register of all approved waste carriers and receptor sites for the project

e. summarise the information relating to waste transactions from each site

EX 4.4 The Government have recently identified the *Site Waste Management Plans Regulations 2008* in their red tape review and are considering removing the legal requirement for *SWMPs*. Regardless of whether the legal requirement for *SWMPs* is removed, the use of *SWMPs* would still be considered good practice[III] and has therefore been adopted by the Thames Tideway Tunnel project.

EX 4.5 Individual *SWMP* would be used to control the on-site management of waste and would comprise a live reporting tool rather than a static document. *SWMPs* provide a framework to facilitate good practice on construction sites, as well as recording and monitoring environmental performance, meeting regulatory controls and reducing waste disposal costs. Information from the *SWMPs* would be used to produce the *Project wide WMP.*

EX 4.6 As the excavated material is by far the largest material stream associated with the construction of the Thames Tideway Tunnel project, a detailed *EMOA* has been undertaken to identify the potential preferred options for the management of the excavated material. The assessment provides a systematic and transparent approach for assessing the management options for reuse, treatment and/or disposal of the excavated materials arising from the project during its construction phase.

EX 4.7 The *Planning stage preferred list* demonstrates that facilities can be identified which meet Thames Water's requirements with respect to delivery, sustainability considerations and environmental protection. However inclusion on the planning stage preferred list does not guarantee the use of a receptor site, as this could:

a. prejudice any future procurement activities; and

[III] Good practices are approaches and methods that have been proven to work well and produce good results. It would include following industry standards such as *SWMPs*, *CL:AIRE* CoP, and WRAP protocols. The term good practice has been used as approaches are constantly evolving and being updated. The *EM&W strategy* would be reviewed to ensure the most appropriate practices are adopted when construction commences.

b. potentially rule out alternative receptor sites which perform as well or better than those on the *planning stage preferred list* and may become available prior to the Thames Tideway Tunnel project construction work commencing.

EX 4.8 Only receptor sites that meet or exceed the performance of the planning stage preferred options would be used for the management of clean excavated material. The need for new receptor sites to be assessed using the methodology is detailed in the *EMOA*. An agreement with the EA would stipulate that the EA approve the final list of receptor sites.

EX 5 Operational waste

EX 5.1 Once operational the tunnel would intercept overflows and in doing so it is anticipated that sewage-derived litter in the tidal reaches of the River Thames (tidal Thames) would reduce from approximately 10,000 tonnes per annum at present to approximately 600 tonnes per annum. In addition it is anticipated that there would be a small amount of waste produced during routine maintenance. Maintenance waste includes oils and lubricants from equipment, granular carbon from odour control units, and general debris and other articles that enter the existing sewer system.

EX 5.2 At present, when the capacity of London's sewers is exceeded during periods of heavy rainfall, the mixture of sewage and rainwater ('storm sewage') overflows into the tidal Thames, generally through combined sewer overflow(s) (CSOs).

EX 5.3 During the operational phase, the increased volumes of sewage captured within the main tunnel would lead to a corresponding increase in the solid waste arisings at the Beckton Sewage Treatment Works. This additional waste would be inseparable from the existing solid waste stream and so would be dealt with in accordance with Thames Water's existing (and future) waste management procedures for sewage wastes.

EX 6 Delivery mechanisms

EX 6.1 The management of excavated materials and waste on site would be undertaken by the contractor(s) and would be overseen by Thames Water Utilities Limited (or their agent). It is anticipated that the delivery of the measures outlined in this strategy would be secured through the following mechanisms:

a. a requirement imposed by the Development Consent Order to carry out the project in accordance with the *Code of Construction Practice (CoCP)*

b. an agreement with the Environment Agency.

EX 6.2 It is anticipated that the measures set out in the *CoCP* (Section 10) for the management of excavated material and waste at construction sites would be secured via a requirement to comply with the CoCP which would form part of the Development Consent Order.

EX 6.3 It is anticipated that the process for the final selection of receptor sites for the beneficial use of excavated material and the monitoring and reporting against excavated material and waste objectives would be delivered via an agreement with the EA.

EX 6.4 Table EX.1 shows the mechanisms for delivering the measures relating to excavated materials and waste.

Table EX.1 Delivery mechanisms for the management of excavated material and waste

Deliverable	Summary	Delivery mechanism	Responsibility
On site management of waste and excavated material	The *CoCP* sets out measures to protect the environment and limit disturbance from construction activities, including waste and excavated material management. Measurers relating to on site management of waste and excavated materials include: • compliance with the project wide waste management plan and the relevant site waste management plan(CoCP Section 10.1.3 and 10.1.4) • the development of demolition reuse plans (CoCP Section 10.1.11) • measures relating to the on site management of excavated material (CoCP Section 10.1.2 and 10.1.3).	Compliance with the *CoCP* is to be secured through a requirement imposed on the application	TWUL or their agent /Contractor
Selection of suitable receptor sites for excavated materials	All of the receptor sites used for the excavated materials arising from the construction activities would be assessed against the EMOA and would perform no worse than those sites on the preferred receptor site list . The EA would agree the inclusion of new receptor sites for the excavated material.	agreement with the Environment Agency (EA).	TWUL or their agent
Monitoring waste objectives against targets	Reporting of progress towards targets would be undertaken through the production of a biannual report.	agreement with the Environment Agency (EA).	TWUL or their agent

1 Introduction

1.1.1 This *Excavated materials and waste strategy (EM&W strategy)* sets out the overall approach and objectives for managing materials generated as a result of the construction and operation of the Thames Tideway Tunnel project, and sets out appropriate waste management practises.

1.1.2 The *EM&W strategy*:

a. explains the approach for the control and sustainable management of excavated materials and waste

b. sets out how the approach is consistent with the guidance in the *National Policy Statement for Waste Water* (*NPS*) on implementing sustainable waste management through the application of the waste hierarchy

c. demonstrates that the management of the excavated material and waste would not have an adverse effect on the capacity of existing waste management facilities to deal with other waste arisings in the area.

1.1.3 The *EM&W strategy* forms Appendix A.3 to Vol 3 Project-wide effects assessment of the *Environmental Statement*.

1.1.4 The EM&W strategy includes details of the anticipated volumes of excavated material and waste, both at the project wide level and also on a site by site basis. The volumes of excavated material to be removed from each of the sites and the volume of waste generated forms an important part of the assessment of likely significant effects described in the *Environmental Statement*. The project wide excavated material and waste volumes are summarised in Vol 3 Section 1.6. Within the site specific volumes of the *Environmental Statement* (Volumes 4 to 27) approximate excavated material and waste volumes are presented in Section 3.

1.1.5 The *CoCP*, and the measures therein, would form a requirement of the application for development consent (the ‘application’). This would provide the mechanism for delivery of the on-site excavated material and waste management measures.

1.1.6 Reporting of excavated materials and waste would be undertaken through the production of a biannual report. The obligation to undertake this would fall on Thames Water Utilities Limited (TWUL) and would be secured via an agreement with the Environment Agency (EA).

1.1.7 An obligation of the agreement with the EA would also include the agreement of new receptor sites for the excavated material. Any new receptor site would having followed the methodology set out in the *Excavated material options assessment* (*EMOA*) (Vol 3 Appendix A.4) and perform at least as well as those sites identified on the existing preferred list.

1.1.8 The *EM&W strategy* contains the following sections:

a. ***Section 1 – Introduction***: summarises the key drivers behind the strategy.

b. **Section *2 – Legislation and policy context*:** summarises the key legislative and policy at a national, regional and local level influencing *waste management* for the Thames Tideway Tunnel project*.*

c. ***Section* 3 – *Thames Tideway Tunnel project objectives*:** sets out the objectives, measures and targets of the strategy.

d. ***Section 4*** – ***Stakeholder engagement***: provides a summary of the responses to the phase two consultation and the s48 publicity exercise against the key themes raised in the responses.

e. **Section 5 – *Construction phase: Excavated material arisings***, details how excavated material has been minimised through tunnel design and the expected material arisings.

f. **Section 6 – *Construction phase: Management of excavated material*** provides the results of the *Excavated materials options assessment (EMOA)* and the control mechanisms which would be put in place. The full *EMOA* can be found in Vol 3 Appendix A.4 [of the *Environmental Statemen*t].

g. **Section 7 – *Construction phase: Non excavated material arisings***: estimates the non excavated waste arisings.

h. **Section 8 – *Construction phase: Site waste management***, provides information relating to the control of waste management during the construction phase through the use of a *Project wide waste management plan (Project wide WMP)* supported by individual *Site waste management plans (SWMP)* for each construction site.

i. **Section 9 – *Impacts on regional waste infrastructure***: assesses the impacts of Thames Tideway Tunnel project waste arisings on regional waste infrastructure.

j. **Section 10 – *Review and monitoring of this EM&W strategy***: sets out the mechanisms for reviewing and monitoring the *EM&W strategy*.

k. **Section 11 – *Roles and responsibilities***: outline of the Thames Tideway Tunnel project roles and responsibilities for waste management.

l. **Section 12 – *Operational phase***: estimates the waste arisings during the operational phase and summarises the control mechanisms which would be used.

m. **Section 13 – *Conclusion*:** explains how the *EM&W strategy* is consistent with the guidance in the *NPS*.

1.2 Thames Tideway Tunnel project overview

1.2.1 At present, when the capacity of London's sewers is exceeded during periods of heavy rainfall, the mixture of sewage and rainwater ('storm sewage') overflows into the tidal Thames, generally through combined sewer overflow(s) (CSOs). The Thames Tideway Tunnel project would control, store and divert the most polluting CSO discharges for treatment at Beckton STW, which would reduce the frequency of CSO discharges and would greatly reduce the incidence of sewage-derived litter in the tidal Thames.

1.2.2 The main tunnel is proposed to be approximately 7.2m in diameter, up to 75m deep and 25km long. In general, the tunnel would to follow the route of the River Thames so that it can be connected to the CSOs that are located along the riverbanks. The construction of the tunnel would require the excavation of a large volume of material. There are four tunnel drive sites and associated shafts which would be producing over 70% of the excavated materials: these are Carnwath Road Riverside, Kirtling Street, Chambers Wharf and Greenwich Pumping Station.

1.2.3 It is estimated that approximately 4.7million tonnes of excavated material would be produced from the construction of the tunnel and around 187,000t of construction and demolition related waste would be generated from the construction sites.

1.2.4 In Thames Water's Environmental Policy there is a commitment:

a. "To minimise waste arisings and its impacts on the environment and communities" (Thames Water Utilities Ltd, 2010)[1].

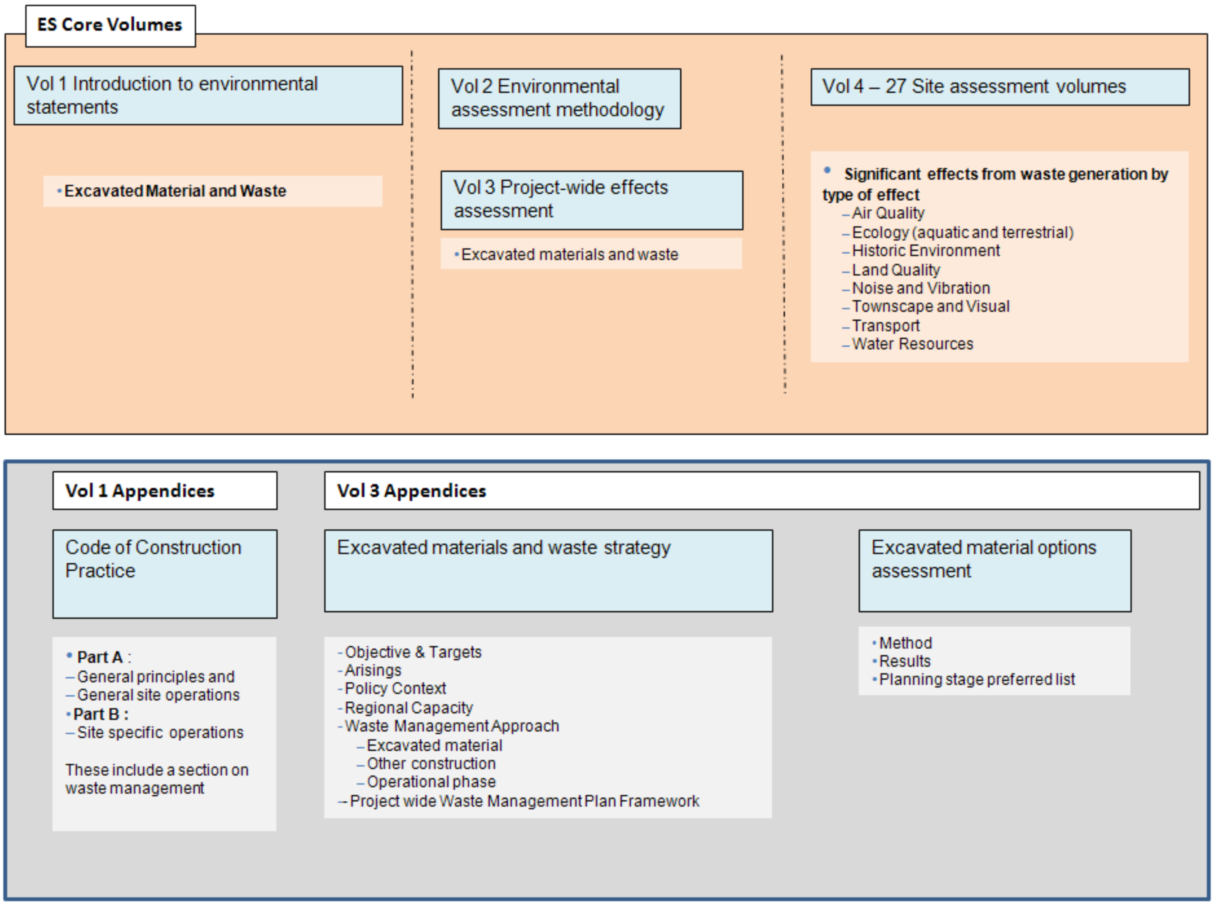
1.2.5 The *EM&W strategy* has been developed to support this commitment and provide the strategic direction for waste management to ensure that the legislative, policy, financial and corporate drivers are met.

1.2.6 This *EM&W strategy* provides a framework for the management of excavated materials and waste that would be produced throughout the construction and operational phases of the project. This includes excavated materials and waste that would arise through:

a. site demolition and clearance activities prior to excavation
b. shaft excavation and construction
c. tunnel excavation and construction
d. CSO interception works
e. tunnel operations.

1.2.7 Plate 1.1 shows where information relating to waste management and waste effects can be found in the *Environmental Statement* documents, including the *EM&W strategy*

Plate 1.1 Inclusion of waste related matters in the Environmental Statement



1.2.8 Table 1.1 shows the different documents related to excavated materials and waste management, the purpose of the document and who would be responsible for each document.

Table 1.1 Documents relating to excavated materials and waste management

Document	Purpose of the document	Responsibility
EM&W strategy	Describes the approach to the control and sustainable management of excavated materials and waste that would be produced throughout the construction and operational phases of the Thames Tideway Tunnel project	Thames Water
EMOA	Sets the criteria for assessing the suitability of receptor sites that could receive excavated material from the main tunnel and demonstrates that there is currently sufficient capacity to manage the excavated material in a sustainable manner.	Thames Water
CoCP	Sets out measures to protect the environment and limit disturbance from construction activities, including measures to ensure the sustainable management of	Thames Water

Document	Purpose of the document	Responsibility
	excavated materials and waste.	
Project wide WMP	Project wide record of personnel responsible for waste and excavated material. Project wide record of arisings, carriers and destinations. Record of waste hierarchy consideration.	Thames Water
SWMP	Site specific record of personnel responsible for waste and excavated material. Site specific record of arisings, carriers and destinations. Record of waste hierarchy consideration.	Contractor
Materials Management Plan (MMP)	Record of clean excavated material receptor site including material tracking.	Contractor

1.3 Consultation

1.3.1 The draft *EM&W strategy* was consulted on during the phase two consultation between 4 November 2011 and 10 February 2012 a summary of the consultation responses can be found in Section 4. Annex G provides the detailed responses and further explanation of how the consultation comments have been addressed in the *EM&W strategy*.

1.4 Thames Water policy

1.4.1 The approach to waste management taken in the *EM&W strategy* reflects Thames Water's corporate policies with respect to the environment and waste. Thames Water's key environmental policy documents are summarised below.

Thames Water Corporate Responsibility Report

1.4.2 The Thames Water *Corporate Responsibility Report 2009/2010* states that Thames Water will continue to focus on how to become the water sector leader on environmental protection and sustainability. To do this, Thames Water:

"will work to eliminate waste, reduce the use of natural resources, operate more efficiently, continually improve performance, build employee pride, meet the expectations of stakeholders."

1.4.3 The report also states that Thames Water's approach:

"is likely to include a focus on core issues related to people (health, safety, wellbeing, skills, ethics and employee engagement), the planet (environmental protection, natural resource management, climate change and zero waste), and the strength and reliability of performance now and into the future."

1.5 Thames Water Environmental Policy

1.5.1 Thames Water's *Environmental Policy (*Thames Water Utilities Ltd, October 2010) sets out the company's approach to environmental responsibility as part of a wider commitment to sustainability and good corporate citizenship.

1.5.2 Thames Water's sustainability principles are:

a. "protecting and enhancing the natural and built environments, whether they are directly or indirectly impacted by Thames Water's activities

b. making effective and efficient use of natural resources, including water, land and raw materials

c. minimising Thames Water's impact on climate change through energy avoidance, efficiency, renewables, emissions reduction and good carbon management, while ensuring Thames Water adapts to the inevitable impacts of climate change on the organisation's assets and operations

d. minimising the generation of waste and making effective and efficient use of unavoidable waste" (Thames Water Utilities Ltd, 2010)[2].

1.5.3 The Thames Water *Environmental Policy* states that the company will use the sustainability principles to help plan and operate in a sustainable way. When implementing environmental responsibilities with respect to waste, the environmental policy commits Thames Water to:

a. *"*reducing the volume of waste Thames Water produces and maximising avoidance, reuse and recycling of waste through proactive waste management

b. ensuring the beneficial reuse of sewage sludge*."*

1.5.4 The policy and the sustainability principles are reflected within Part A and B of this *EM&W strategy,* as they relate to waste management and protection of the environment.

2 Legislative and policy context

2.1 Introduction

2.1.1 The *EM&W strategy* is underpinned by the legislative provisions and policy guidance for waste management described in this section (with further detail is provided in Annex A). The *EMOA* (Volume 3 Appendix A.4) for identifying the preferred waste management option(s) for excavated material arising through the main tunnel is also informed by these legislative and policy requirements.

2.2 Waste definition

2.2.1 Waste is defined in Article 1 (a) of the European Union Waste Framework Directive (*Waste FD*) as: "Any substance or object…..which the holder discards or intends or is required to discard." (*revised Waste Framework Directive 2008/98/EC.* European Union. December 2008). The main aims of the *Waste FD* are the protection of human health and the environment (further information on the *Waste FD* and waste definition is provided in Annex A and Annex A.2).

2.2.2 Once a material has been classified as waste, it remains waste until it is fully recovered. This is the case even if a subsequent holder uses it.

2.2.3 It is anticipated that the Thames Tideway Tunnel project would generate the following during construction:

a. excavated materials

b. construction related wastes

c. demolition waste

d. hazardous waste

e. waste electronic and electrical equipment (WEEE)

f. welfare waste

g. vegetation waste through site clearance

2.2.4 and during operation:

a. waste associated with maintenance of the tunnel

b. residues from the Beckton Sewage Treatment Works (STW)

2.2.5 Excavated material derived from the tunnel construction would fall into two categories:

a. **Waste** – material which poses an unacceptable risk to human health/environment and/or material which is geotechnically unsuitable for any use and/or material which is surplus to requirements, and/or needs treatment to be reused.

b. **Non-waste** – material which is suitable for reuse (in terms of human health/environmental risk and geotechnical suitability) and there is certainty of use (e.g. there is an outlet which requires the material and there is a contract/agreement in place, and reuse is allowed under the application).

2.2.6 For the management of excavated material there are two protocols that provide regulatory approved frameworks to ensure materials are not considered to be waste:

a. the Contaminated Land: Applications in Real Environments (CL:AIRE) *Definition of Waste: Development Industry Code of Practice*

b. the Waste & Resources Action Programme (WRAP) aggregates protocols.

2.2.7 The *CL:AIRE Code of Practice for the Definition of Waste (CoP)* serves the following purposes:

a. It sets out good practice to:

   i assess on a site specific basis whether excavated materials are classified as waste or not

   ii determine on a site specific basis when treated excavated waste can cease to be waste for a particular use.

b. It provides an auditable system to demonstrate decisions on waste definition and the reuse of material as non-waste.

2.2.8 Application of the *CL:AIRE CoP* and the reuse of material as non-waste would be the preferred option based on the waste hierarchy. All of the clean excavated material from the Thames Tideway Tunnel project has the potential not to be classified as waste. Where the requirements of the *CL:AIRE CoP* are not met at the receptor site it is likely that the excavated material would be classified as waste. TWUL or their agent would still seek to identify beneficial uses for the excavated material irrespective of whether it is classified as waste or not. Further information on the *CL:AIRE CoP* is provided in Annex A.

2.2.9 The Waste & Resource Action Programme (WRAP) aggregates protocol also provides a framework to demonstrate that after treatment material does not have to enter waste management controls. Further information is provided in Annex A.

2.3 Legislation

Waste Framework Directive 2008/98/EC

2.3.1 Article 4 of the revised Waste Framework Directive 2008/98/EC (*Waste FD*). European Union (December 2008) sets out the waste hierarchy to ensure that waste is dealt with in the priority order of prevention, preparing for reuse, recycling, other recovery (for example, energy recovery) and disposal as shown in Plate 2.1.

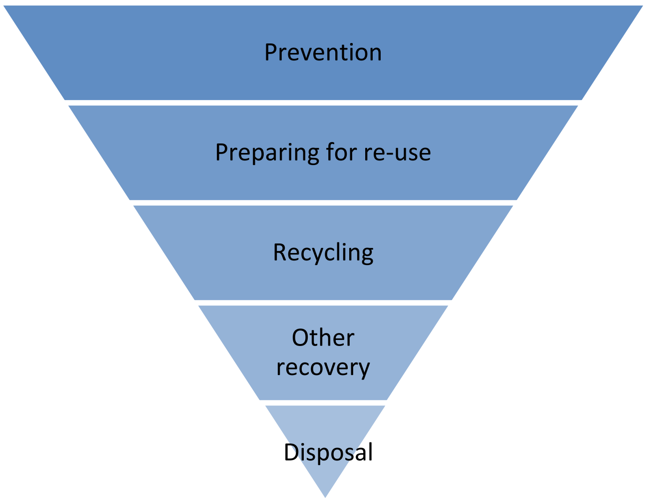
2.3.2 The *Waste FD* states that when applying the waste hierarchy measures should be taken to encourage the options that deliver the best overall environmental outcome. This may require specific waste streams departing from the hierarchy where this is justified by life-cycle thinking on the overall impacts of the generation and management of such waste.

2.3.3 Article 4 also states that when applying the waste hierarchy the following should also be taken into account: ‘the general environmental protection principles of precaution and sustainability, technical feasibility and economic viability, protection of resources as well as overall environmental, human health, economic and social impacts’.

2.3.4 The *Waste FD* also includes recycling and recovery targets for certain waste streams. For construction and demolition waste, the *Waste FD* target to recover at least 70% of construction and demolition waste by 2020 needs to be achieved.

2.3.5 The *Waste Regulations (England and Wales) 2011* transpose the Waste FD into UK legislation. In the regulations the waste hierarchy is for the first time directly enshrined in English law. The regulations require an establishment or undertaking (including waste operators, carriers and producers) to “take all such measures available to it as are reasonable in the circumstances” to apply the waste hierarchy in order to move waste management practices as far up the hierarchy as possible.

Plate 2.1 Waste hierarchy



2.3.6 Section 34 of the *Environmental Protection Act 1990* defines the legal framework for duty of care for waste. Businesses have a legal responsibility to ensure that they produce, store, transport and dispose of their business waste without harming the environment. This is called duty of care. The new *Waste Regulations (England and Wales) 2011* replace the *Environmental Protection (Duty of Care) Regulations 1991* and introduce a new waste carrier and broker regime. This would impact on anyone who moves or arranges the movement of waste, for example waste transfer notes need to include a statement that the waste hierarchy had been considered. Further information on the regulations is provided in Annex A.

2.3.7 The requirement to prepare, update and implement a *SWMP* is set out in the *Site Waste Management Plan Regulations 2008*, which came into effect on 6 April 2008. In accordance with these regulations, any client (in this case, Thames Water[IV]) intending to carry out a construction or demolition project on a site, with an estimated cost greater than £300,000 must, before work begins, prepare a *SWMP*. A greater level of detail is required for projects that cost more than £500,000. *SWMPs* apply to all aspects of construction work, including preparatory work such as demolition and excavation. The offences under the Regulations relate to the failure to have a *SWMP* and the failure to keep and produce a *SWMP*. The Environment Agency and the local authorities have the powers to enforce the *SWMP Regulations*. There is no legal requirement for *SWMPs* to be approved by the enforcing authorities. Further details relating to *SWMPs* are provided in Section 8.

2.3.8 The Government has identified this legislation in its red tape review and are considering removing the legal requirement for *SWMPs*. Consultation will be carried out in December 2012 with the aim of removing the requirement of *SWMPs* in October 2013.

2.3.9 Regardless of whether the legal requirement for *SWMPs* is removed, the use of *SWMPs* is outlined in the National Policy Statement and would be considered good practice. For these reasons the use of *SWMPs* (as detailed in the *CoCP*) would be secured via a requirement imposed on the application.

2.4 National policy

The NPS for Waste Water

2.4.1 The *National Policy Statement for Waste Water* (Defra, 2012)[3] *(NPS*) sets out Government policy for the provision of major waste water infrastructure It will be used as the primary basis for deciding the applications for waste water developments that fall within the definition of Nationally Significant Infrastructure Projects (NSIP), as defined in the *Planning Act 2008* ('the Act'). The Government has recently determined through an order made under Section 14(3) of the Act that the Thames Tideway Tunnel project is an NSIP.

2.4.2 The *NPS* is intended to be a self contained and complete set of policies for all nationally significant waste water projects, including the construction of the Thames Tideway Tunnel project. The *NPS* makes clear that it has taken into account of all other relevant national planning policy and confirms the need for the Thames Tideway Tunnel project which is considered crucial in order to meet our obligations under the *Urban Waste Water Directive*.

2.4.3 Section 4 of the *NPS* sets out the government policy on hazardous and non hazardous waste and details the factors for examination and determination of applications.

[IV] This *EM&W strategy* assumes that Thames Water will have oversight and control of the construction operations. It is acknowledged that a special purpose vehicle may be set up to manage the Thames Tideway Tunnel project.

2.4.4 The relevant factors are described in Section 4.14 of the *NPS* which sets out what the applicant should address and what the decision maker should consider in relation to waste management. These matters relate to implementation of sustainable waste management through the waste hierarchy and that during construction, excavated soils and subsoil's will, where possible, be re-used on site. The arrangements that are proposed for managing any waste produced will be detailed in a *Site waste management plan*. An assessment of the impact of the waste arising from the development on the capacity of waste management facilities to deal with other waste arising in the area for at least five years of operation will also be carried out. The decision maker should consider the extent to which an effective system for managing hazardous and non-hazardous waste arising from the construction, operation and decommissioning of the proposed development has been proposed. It should be satisfied that:

a. Any such waste will be properly managed, both on-site and off-site.

b. The waste from the proposed facility can be dealt with appropriately by the waste infrastructure which is, or is likely to be, available.

c. Adequate steps have been taken to minimise the volume of waste arisings, and of the volume of waste arisings sent to disposal, except where that is the best overall environmental outcome.

2.4.5 Table 2.1 summarises how the guidance in the *NPS* related to managing excavated material and waste has been addressed for the Thames Tideway Tunnel project. The delivery mechanisms for the management of excavated material and waste are summarised in Table 2.2.

Table 2.1 Guidance in the *NPS* and how it has been addressed

Guidance in the NPS	How the guidance is addressed	Location in EM&W strategy
The applicant should set out the arrangements that are proposed for managing any waste produced and prepare a Site Waste Management Plan. **The decision maker** should be satisfied that any such waste will be properly managed both on-site and off-site.	The Thames Tideway Tunnel project would be a large construction project with at least 24 sites that would produce excavated material and waste. As a result, a single *Site waste management plan (SWMP)* would be insufficient to provide an effective system for managing the excavated material and waste that would be generated by the project. Therefore, to ensure the proper management of excavated materials and waste on-site: a. An overarching *Project wide waste management plan* (*Project wide WMP*) would be used to ensure a consistent approach to managing the excavated materials and waste at individual construction sites b. This would be supported by individual *SWMPs* for each construction site which would be used to control the on-site management of excavated materials and waste. The *Project wide WMP* and the individual *SWMPs* have been designed to ensure that waste would be managed in accordance with the waste hierarchy.	Section 8 with templates provided in Annex E
	To ensure the proper management of clean excavated materials off site: a. All potential receptor sites for excavated material would be assessed using the *EMOA* and only receptor sites that meet or exceed the performance of the planning stage preferred options would be used for the management of clean excavated material. b. A minimum of 85% of clean excavated material would be beneficially used[V] To ensure the proper management of waste off site: a. The *SWMP* process would identify waste prevention, reuse and recycling activities and identify waste management infrastructure with appropriate permits which would be used for the management of the waste. The *CoCP* requires *SWMPs* to prepared and implemented for all construction sites. b. At least 80% of construction and demolition waste would be diverted from landfill.	Section 3

[V] Beneficial use is the use of material for a positive purpose including recycling, use in industrial processes, use in development, land remediation, habitat creation and landfill restoration.

Guidance in the NPS	How the guidance is addressed	Location in EM&W strategy
The arrangements described by the **applicant** and the *Management Plan* should include information on the proposed waste recovery and disposal system for all waste generated by the development.	The *EM&W strategy* describes the approach for the control and sustainable management of excavated materials and waste that would be produced throughout the construction and operational phases of the Thames Tideway Tunnel project.	
	It is estimated that 96% (4.7million tonnes) of the material generated during the construction phase would be excavated materials. As part of developing *SWMPs* the application of the *CL:AIRE CoP* [VI] of practice would be considered to determine whether the Thames Tideway Tunnel project excavated materials could be directly used, as direct use of materials would be the preferred option in terms of the waste hierarchy.	Section 8
	The *EMOA* details the process by which suitable potential receptor sites for this material, have been/would be identified. Only receptor sites that meet or exceed the performance of the planning stage preferred options would be used for the management of excavated material.	Section 6 and the full *EMOA* (see Vol 3 Appendix A.4).
	The remaining 4% (0.2million tonnes) of the material generated during the construction phase comprises of construction, demolition and hazardous waste, waste electrical and electronic equipment (WEEE), welfare waste and vegetation waste would be managed using the *Project wide WMP* and the individual *SWMPs*, which have been designed to ensure that waste would be managed in accordance with the waste hierarchy.	Section 8
	During the operational phase, the increased volumes of sewage captured within the main tunnel would lead to a corresponding increase in the solid waste arisings at the Beckton Sewage Treatment Works. This additional waste would be inseparable from the existing solid waste stream and so would be dealt with in accordance with Thames Water's existing (and future) waste management procedures for sewage wastes.	Section 12

[VI] The voluntary CL:AIRE *Definition of Waste Code of Practice* (CoP) provides a regulator approved framework to determine on a site by site basis whether excavated materials are classified as waste or not and determine when treated excavated waste can cease to be waste for a particular use.

Guidance in the NPS	How the guidance is addressed	Location in EM&W strategy
The applicant should provide an assessment of the impact of the waste arising from the development on the capacity of waste management facilities to deal with other waste arising in the area for at least five years of operation. **The decision maker** should be satisfied that the excavated material and waste from the project can be dealt with appropriately by the waste infrastructure which is or is likely to be available and would not have an adverse effect on the capacity of existing waste management facilities to deal with other waste arisings in the area.	The *EM&W strategy* assesses the potential impact of the Thames Tideway Tunnel project waste arisings on the waste management infrastructure of London, the South East and the East of England. It concludes that: a. the 17 receptor sites on the planning stage preferred list and the reserve list have a combined capacity of approximately 77million tonnes (of which only 7million tonnes is currently captured in the EA capacity data). This demonstrates there is capacity for the beneficial use of excavated material. b. the *SWMP* system would require construction and demolition (C&D) waste to be treated and recovered where practical. The 187,000t of C&D would represent approximately 2.7% of the 7million tonne treatment capacity in London and 0.3% of the treatment capacity within the South East and East of England. c. the exact quantity of waste that would be classified as hazardous is still to be determined. The worst case assumption is that all 62,000t of made ground is sufficiently contaminated to be classified as hazardous waste. Disposing of this waste would require approximately 4% of the current hazardous waste landfill capacity in London, the South East of England and the East of England. d. approximately 2,000t of welfare waste would be generated over the six year construction period. This is a relatively small tonnage when compared to the 8.5million tonnes of municipal and commercial and industrial waste produced in London per annum, for which there is 11.7million tonnes of permitted recycling, treatment and disposal capacity in London alone. e. the vegetation waste which would be produced from site clearance is approximately 0.07% of the material composted in London during 2010. The assessment presented in the *EM&W strategy* concludes that there is sufficient regional capacity to accommodate the Thames Tideway Tunnel project excavated material and wastes without having an impact on overall regional capacity. The additional operational Thames Tideway Tunnel project solid waste arisings at Beckton STW would be Thames Water's responsibility and be treated using existing or future treatment sludge treatment capacity.	Section 9 Section 12

Guidance in the NPS	How the guidance is addressed	Location in EM&W strategy
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 this is the best overall environmental outcome.	**Minimising the volume of waste arisings** Minimising the production of excavated material and waste has been considered throughout the design process for the Thames Tideway Tunnel project. The proposed tunnel route to Abbey Mills is the shortest route of the route options considered, with an estimated reduction of excavated material of between 354,000m^3 and 476,000m^3 compared to the previously identified alternatives. The tunnel construction would involve the factory production of precast concrete tunnel linings, as this approach should generate less waste than if the casting of the tunnel linings waste carried out on site. These measures demonstrate that steps have been taken to minimise the volume of waste produced, contributing to the delivery of the *NPS*.	Section 5
The decision maker should be satisfied that adequate steps are taken to minimise the volume of waste arisings and that the volume of waste that is sent for disposal is minimised and that it is sent there on the basis that it is the best overall environmental outcome.	**Minimising the volume of waste sent for disposal** The *SWMP* system requires that the waste hierarchy is applied to the management of waste at all construction sites, with the purpose of maximising prevention, reuse and recycling and minimising the quantity of waste sent for disposal. In addition at least 80% of construction and demolition waste would be diverted from landfill.	Section 8
	Ensuring best overall environmental outcome In order to minimise the environmental effects of excavated material, the *EMOA* process provides the mechanism through which the TWUL or their agent would assess the 'best overall environmental outcome' for the management of the material. The *EMOA* is designed to identify receptor sites which would beneficially use the excavated material in a sustainable manner, therefore only receptor sites that meet or exceed the performance of the planning stage preferred options would be used for the management of excavated material. In addition a minimum of 85% of clean excavated material would be beneficially used.	Section 6 and the full *EMOA* (see Vol 3 Appendix A.4).

Guidance in the NPS	How the guidance is addressed	Location in EM&W strategy
The applicant should demonstrate that all waste produced by the facility will be managed in accordance with the waste hierarchy and that during construction, excavated soils and subsoils will, where possible, be re-used on site e.g. for the balancing of cut and fill	The *EMOA* process identifies suitable receptor sites for the treatment, handling or use of Thames Tideway Tunnel project excavated material taking into consideration the application of the waste hierarchy. The *Project wide WMP* has been developed to provide an overarching framework to provide a consistent approach to managing the excavated materials and waste at individual construction sites which would be controlled by the *SWMPs.* The proposed *SWMPs* would require the identification of waste prevention, reuse (including cut and fill options) and recycling opportunities to help ensure waste is managed in accordance with the waste hierarchy.	Section 6 and the full *EMOA* (see Vol 3 Appendix A.4). Section 8
The decision maker may wish to include a condition on revision of waste management plans at reasonable intervals when giving consent.	It is proposed that the review of the *Project wide WMP* be undertaken by TWUL or their agent. It is proposed that the *Project wide WMP* be reported biannually to the EA. During construction SWMPs for each site would be reviewed and updated quarterly by the contractor.	Section 8 Section 10

Table 2.2 Guidance Delivery mechanisms for the management of excavated material and waste

Deliverable	Summary	Delivery mechanism	Responsibility
On site management of waste and excavated material	The *Code of construction practice* (CoCP) sets out measures to protect the environment and limit disturbance from construction activities, including waste and excavated material management. Measurers relating to on site management of waste and excavated materials include: • compliance with the project wide waste management plan and site waste management plan(CoCP Section 10.1.3 and 10.1.4) • the development of demolition reuse plans (CoCP Section 10.1.11) • measures relating to the on site management of excavated material (CoCP Section 10.1.2 and 10.1.3).	Compliance with the *CoCP* is to be secured through a requirement imposed on the application	TWUL or their agent /Contractor
Selection of suitable receptor sites for excavated materials	All of the receptor sites used for the excavated materials arising from the construction activities would be assessed against the EMOA and would perform no worse than those sites on the preferred receptor site list. The EA would agree the inclusion of new receptor sites for the excavated material.	Agreement with the Environment Agency (EA).	TWUL or their agent
Monitoring waste objectives against targets	Reporting of progress towards targets would be undertaken through the production of a biannual report.	Agreement with the Environment Agency (EA).	TWUL or their agent

2.4.6 Section 104 (2) of the Planning Act 2008 indicates that the decision maker must have regard to any NPS that has effect and to any other matters that it thinks are both important and relevant to its decision. This may require some consideration of the *National Planning Policy Framework* (*NPPF*), published on 27 March 2012. The *NPPF* now replaces the majority of the Planning Policy Guidance Notes and Planning Policy Statements, with the exception of a small number of documents including PPS 10: *Planning for Sustainable Waste* (2011).

The *NPPF* does not contain specific policies for NSIPs to which particular considerations apply. Para. 3 states that applications for development consent for NSIPs "*are determined in accordance with the decision-making framework set out in the Planning Act 2008 and relevant national policy statements for major infrastructure, as well as any other matters that are considered both important and relevant (which may include the National Planning Policy Framework). National policy statements form part of the overall framework of national planning policy, and are a material consideration in decisions on planning applications*".

2.4.7 In preparing local plans, the *NPPF* (para. 162) states that: *"authorities should work with other authorities and providers to assess the quality and capacity of infrastructure for transport, water supply, wastewater and its treatment*", and to *"take account of the need for strategic infrastructure including nationally significant infrastructure within their areas".*

2.4.8 In other words, the *NPPF* does not set policies or tests for wastewater NSIPs. It does advise, however, that planning authorities must take into account plans for nationally significant infrastructure when preparing plans and states that policies in a National Policy Statement shall be material considerations in the determination of town and country planning applications.

2.4.9 While PPS 10 was not cancelled by the publication of the *NPPF*, its direct relevance to the application proposals is limited by the fact that the NPS itself contains advice on waste management (as set out above).

2.4.10 The overall objective of government policy in relation to waste is to protect human health and the environment by producing less waste and by using it as a resource wherever possible. By means of more sustainable waste management, moving the management of waste up the 'waste hierarchy' of prevention, preparing for re-use, recycling, other recovery, and disposing only as a last resort, the Government aims to break the link between economic growth and the environmental impact of waste. Annex F of PPS 10 considers London and, in *GOL Circular 1/2000 Strategic Planning in London*, provides advice and guidance on the planning arrangements that apply in London. It states that:

2.4.11 *"In doing so, the SDS [Spatial Development Strategy] is expected to reflect the importance of taking a strategic approach to London's waste management and disposal, such as the need to develop sustainable and practical solutions, the specific duty to promote transportation on the River Thames, and the implications for areas outside the capital".*

2.4.12 In setting out the key planning objectives, *PPS10* advises that planning authorities should prepare and deliver strategies that:

a. drive waste management up the hierarchy and look to disposal, including landfill as the last option;

b. provide a framework for greater community responsibility for their own waste and enable sufficient and timely provision of waste management facilities to meet the needs of their communities;

c. help implement the national waste strategy, supporting targets and are compliant with relevant legislation and regulations;

d. help secure the recovery or disposal of waste without endangering human health and without harming the environment, and enabling it to be disposed of in one of the nearest appropriate installations;

e. reflect concerns and interests of a wide range of stakeholders including communities, waste disposal authorities and business and encourage competitiveness;

f. protect Green Belts but recognise that the particular locational needs of waste management facilities, together with the wider environmental and economic benefits of sustainable waste management, are material considerations that should be given significant weight in determining whether proposals should be given planning permission; and

g. ensure the design and layout of new facilities support sustainable waste management.

2.4.13 *PPS10* confirms the importance of the waste hierarchy, the treatment, handling or use of Thames Tideway Tunnel project excavated material and waste would be managed in accordance with the waste hierarchy. There are a number of measures that would be implemented for the Thames Tideway Tunnel project including a *Project wide WMP* and *SWMPs* help ensure waste is managed in accordance with the waste hierarchy.

2.4.14 PPS10 sets out the Government's objectives for sustainable waste management, the *EMOA* process provides a mechanism through which TWUL or their agent would assess the 'best overall environmental outcome' for the management of excavated material. The *EMOA* is designed to identify receptor sites which would beneficially use the excavated material in a sustainable manner.

2.4.15 There is sufficient regional capacity to accommodate the Thames Tideway Tunnel project excavated material and wastes without having an impact on overall regional capacity thus satisfying *PPS10* that waste should be disposed of in one of the nearest appropriate installations. There are also a number of both permitted and exempt sites that accept process and recycle construction materials in and around London that TWUL or their agent will consider using.

2.4.16 The EM&W strategy demonstrates that the approach taken by TWUL would contribute to the delivery of the *PPS10* and *NPS* requirements.

2.4.17 Another relevant national planning context document for the project is *Defra's Waste Review 2011.*

2.4.18 The review looks at all aspects of waste policy and delivery in England and has been guided by the waste hierarchy, which are both a guide to sustainable waste management and a legal requirement. In driving waste up the waste hierarchy, it must be ensured that the UK meets its EU obligations and targets on waste management.

2.5 Regional planning policy

2.5.1 At regional level, the *London Plan 2011* sets out the Mayor's spatial planning framework for London, which aims to promote an attractive, well designed and greener city. The *London Plan 2011* was published in July 2011 and aims to make London more self sufficient in terms of waste management as the capital has a history of exporting a large quantity of waste to the surrounding counties. The key policies to this effect are:

a. 5.16 *Waste Self-Sufficiency*:

   i manage as much of London's waste within London as practicable, working towards managing the equivalent of 100% of London's waste within London by 2031

   ii exceeding recycling and reuse levels in construction, excavation and demolition (CE&D) waste of 95%by 2020.

b. 5.20 *Aggregate:*

   i achieve recycling and reuse levels of CDE of 95% by 2020.

2.5.2 The key policies in the *London Plan 2011* relating to this project are detailed in Annex B.1

2.6 Local planning policy

2.6.1 The application will be judged by the decision maker primarily on the policies in the *NPS*. The Planning Inspectorate must also have regard to any *Local Impact Report* prepared by affected local planning authorities.

2.6.2 The local planning authorities potentially directly affected by the construction of the Thames Tideway Tunnel project are the London Boroughs of Hammersmith and Fulham, Tower Hamlets, Lambeth, Lewisham, Newham, Southwark, Ealing, Hounslow, Richmond upon Thames, Wandsworth, the Royal Borough of Greenwich, the Royal Borough of Kensington and Chelsea, the City of Westminster Council and the City of London Corporation.

2.6.3 The main waste related policy areas in the local planning framework of the local planning authorities are summarised in Annex B.2.

2.6.4 The main policy objectives do not add materially to those set by national and regional policy, and comprise the following:

a. Sustainable development – addresses the appropriate siting of developments in relation to the surrounding land uses and services.

b. Sustainable waste management – ensuring that developments have sustainable facilities for managing waste in place, minimising waste generation in their jurisdiction and using more sustainable modes of transport for moving waste.

c. Waste management facilities – waste developments must comply with *PPS10* and *National Waste Strategy* (proximity principle, the waste hierarchy and self sufficiency).

d. Environmental nuisance – operators of all developments should ensure that facilities do not cause a nuisance to neighbouring land uses and users. This mainly covers dust, noise and vibration that will arise from the construction phase, transport to site and operation.

e. Demolition waste – the local authorities encourage the reuse of demolition and construction waste and on-site segregation to maximise recovery.

f. Controlling potential polluting uses – there are a number of criteria that potentially polluting developments must meet before they are permitted. The criteria relate to operating procedures and design measures that have been put in place to prevent pollution. Pollution is determined as anything that has a negative impact on its environs.

2.6.5 In many cases, where a local or regional authority does not have a specific policy relating to one of the objectives listed above, they do have policies that reflect the principle in question and/or they reflect the issues as part of more generic policies.

2.7 Summary of policy principles

2.7.1 The main policy principles which need to be considered in the management of wastes and excavated materials arising from the Thames Tideway Tunnel project are:

a. compliance with relevant legislative requirements

b. alignment with *NPS* guidance:

  i to protect human health and the environment by producing less waste and by using it as a resource wherever possible

  ii implementation of a sustainable outcome through application of the waste hierarchy

  iii demonstrate that the end use of the waste is the best overall environmental outcome

  iv waste will be properly managed, both on-site and off-site

c. follow good practice in the preparation and implementation of *SWMPs*

d. alignment with local/regional policy requirements for waste management:

  i ensure that all efforts are made to move the management of waste up the waste hierarchy ii have regard to the proximity principle when identifying end uses for excavated material

iii reduce the amount of waste generated in London that is exported to the surrounding waste authorities

iv minimise the environmental impact of storing, transporting, processing and the end uses associated with managing waste.

3 Thames Tideway Tunnel project objectives

3.1 Introduction

3.1.1 There are a number of drivers for sustainable waste management that have guided the development of the *EM&W strategy*, these drivers include:

a. compliance with legislative requirements

b. consistency with the *NPS* and other national, regional and local policies

c. consistency with corporate policy

d. need for a project of national significance to demonstrate good practice

e. minimising the environmental effects of the project (during construction and operational phases)

f. economic construction and operation of the project. The cost of managing waste is rising year-on-year and this is a strong driver for waste prevention and the diversion of material from landfill.

3.1.2 This section sets out how the above drivers have been translated into the objectives for the Thames Tideway Tunnel project and how the objectives would be delivered and measured.

3.2 Thames Tideway Tunnel project objectives and their delivery

3.2.1 In order to set a clear vision and provide simple high-level direction a number of high-level waste related objectives have been developed. Thames Water policy, the legislative and policy context and the overall sustainability objectives of the Thames Tideway Tunnel project form the basis of these objectives.

3.2.2 The *Sustainability statement* sets out an overarching objective to minimise waste arisings and its impacts on the environment and communities and to promote re-use, recovery, recycling and beneficial use.

3.2.3 To support the delivery of this objective the *EM&W strategy* objectives are:

a. **Objective W1**: To minimise waste to landfill by prioritising prevention and seeking to maximise reuse and recycling

b. **Objective W2**: To maximise beneficial use of excavated material arising from tunnel construction.

c. **Objective W3**: To minimise the impact of excavated material and waste on the environment and communities.

3.2.4 Each of the objectives would be delivered by a number of measures, and achievement of the objectives would be assessed using specific reporting targets. Reporting against these targets to the EA would be undertaken on a six monthly basis, this would be secured through an obligation under an agreement with the EA.

3.2.5 During the operational phase, waste generated as a result of the Thames Tideway Tunnel project would become part of Thames Water's operations[VII] and would be dealt with in accordance with Thames Water's waste management procedures. Section 12 details proposed operational waste management practices.

Objective W1: To minimise waste to landfill by prioritising prevention and seeking to maximise reuse and recycling

3.2.6 Minimising waste to landfill for the Thames Tideway Tunnel project means making the most efficient use of resources, by minimising demand for primary resources and maximising the reuse, recycling and recovery of resources instead of treating them as 'waste' with no innate value. In order to minimise waste to landfill, resources would need to be managed efficiently and opportunities to reduce wastage and recover value from materials would need to be explored. This approach is consistent with the Government's Waste Review (2011), which aims to ensure that the right steps towards creating a 'zero waste' economy are taken, where resources are fully valued, and nothing of value gets thrown away.

3.2.7 However, any waste management solution is likely to result in a small amount of waste from which no value can be obtained and this would need to be landfilled. The Government again recognises this in its Waste Review (2011) which states "absolute prevention of waste is in many areas unrealistic, prioritising prevention while seeking to re-use and recycle as much as possible of the waste which does arise is however important"

3.2.8 This objective has partly been achieved through design measures that minimise the volume of excavated material (see Section 5.2).

3.2.9 During the construction phase of the Thames Tideway Tunnel data on the how the project is performing against the objective would be collected by the on site contractor(s) through the production of SWMPs (which would be secured as a requirement of the application via the *CoCP)*. The SWMPs, which are based on materials management good practice on large infrastructure projects, would include:

a. where practicable opportunities for the use of materials with recycled content during construction would be adopted (*CoCP* Section 10.1.6c)

b. through segregation, maximise opportunities for the potential for reusing and recycling (*CoCP* Section 10.1.6f)

c. the preparation of a demolition reuse plan before demolition to maximise the recovery of material for subsequent high-grade/value applications (*CoCP* Section 10.1.11)

d. an end of life plan is developed and agreed six months before practical completion for all temporary site infrastructures to maximise reuse and recycling opportunities (*CoCP* Section 10.1.9)

[VII] This *EM&W strategy* assumes that once operational, the Thames Tideway Tunnel will be operated and controlled by Thames Water and that Thames Water's corporate policies and procedures will be used to manage waste arising from the Thames Tideway Tunnel project.

e. site workers would be provided with training in on site waste management and recycling procedures. (*CoCP* Section 10.1.6g)

Target

3.2.10 The target used to report progress against objective W1 would be to divert at least 80% of construction and demolition waste from landfill with an aspiration to divert 95% of construction and demolition waste from landfill.

3.2.11 The aspiration to divert construction and demolition waste is limited to 95% because it is considered likely, that for a project of this scale, a proportion of the waste would need to be landfilled as it would be impracticable and uneconomic to treat a small proportion of material in any other way. For example it may be most appropriate to dispose of some hazardous wastes to landfill.

Objective W2: Maximise beneficial use of excavated material arising from tunnel construction

3.2.12 It is necessary to consider overall sustainability and the waste hierarchy with respect to the management of the excavated material because it is by far the largest material stream associated with the Thames Tideway Tunnel project. The *EMOA* provides the mechanism through which TWUL or their agent would assess the 'best overall environmental outcome'.

3.2.13 Beneficial use is the use of the material for a positive purpose which could include recycling, use in industrial processes, use in development, land remediation, habitat creation and quarry and landfill site restoration. The *EMOA* beneficial use test[VIII], which has incorporated comments from the EA, requires that the material is needed for the proposed purpose and that it would be managed in a manner that should not harm the environment or human health.

3.2.14 The objective would be delivered by the following measures:

a. The *CL:AIRE CoP* would be used on a site by site basis to determine whether excavated material are classified as waste or not and determine when treated excavated waste can cease to be waste for a particular use, where appropriate (*CoCP* Section 10.1.6aii).

b. The application of the waste hierarchy to deliver the best overall environmental outcome, taking account of life-cycle thinking on the overall impacts of the generation and management of such waste, where appropriate, in line with *Waste FD* (10.1.6ai).

c. Excavated material would be managed at receptor sites which meet or exceed the performance of those receptor sites on the planning stage preferred list as identified through the *EMOA* (in agreement with the EA via an obligation of an agreement).

[VIII] See Volume 3 Appendix A.4 Annex B (para B.9.37)– Detailed assessment assumption, Evaluation indicator 12 – Waste hierarchy

Targets

3.2.15 The targets used to assess the delivery of objective W2 would be:

a. beneficially use a minimum of 85% of clean excavated material with an aspiration to beneficially use 100% of clean excavated material.

b. all of the receptor sites used for the Thames Tideway Tunnel project excavated material would be assessed against the *EMOA* (Volume 3 Appendix A.4) perform no worse than those sites on the preferred receptor site list.

Objective W3: Minimise the impact of excavated material and waste on the environment and communities

3.2.16 A key tenet of all waste legislation and policy is the protection of the environment and human health as reflected in the *NPS*. A large volume of excavated material and waste would be produced by the Thames Tideway Tunnel project sites and if handled inappropriately it could have an adverse effect on local communities and the environment. The management of the Thames Tideway Tunnel project sites and handling any materials and wastes arising from the project would be undertaken in such a way that any potential impacts are minimised. The objective would be delivered by the following measures which are incorporated in the *CoCP*:

a. The *Project wide WMP* would provide appropriate control throughout the project lifespan taking account of local waste management capacity (*CoCP* Section 10.1.3)

b. Individual *SWMPs* would be used to ensure construction and demolition waste would be effectively managed (*CoCP* Section 10.1.4)

Targets

3.2.17 The targets used to assess the delivery of objective W3. would be:

a. All of Thames Tideway Tunnel project construction sites have a SWMP which is updated quarterly.

4 Stakeholder engagement on the EM&W strategy

4.1.1 There have been three opportunities, phase one and two consultation and Section 48 publicity exercise, for stakeholders to provide feedback on the EM&W strategy, Table 4.1 lists the stakeholders who commented on the EM&W strategy and provides a summary of the themes that were raised from the consultation.

Table 4.1 A summary of the key themes that were raised during the consultation

Consultation responses - key themes	Respondents											
	City of Westminster	City of London	GLA	English Heritage	Environment Agency	LB Lambeth	LB Newham	LB Southwark	LB Wandsworth	London Councils	Port of London Authority	Western Riverside Waste Authority	RSPB
Setting targets			✓		✓	✓		✓	✓	✓			
Maximising the use of river/barge	✓	✓								✓	✓	✓	
Conforming to the waste hierarchy – using reused and recycled materials, maximising beneficial use, re-use and recycling	✓		✓		✓								✓
Effective management of materials and waste on construction sites			✓		✓								
Consideration to the end destination for spoil/arisings (*EMOA*)		✓		✓	✓		✓						✓

4.1.2 The *EM&W strategy* seeks to address the comments received from the consultation exercises. Table 4.2 provides a summary of the responses to the consultation comments against the key themes raised during the consultation. Detailed responses to the individual comments can be found in Annex G of the *EM&W strategy*.

Table 4.2 Summary of responses to consultation comments raised during phase two consultation

Key themes from phase two consultation	Summary of responses to consultation comments	Where responses are addressed
Setting targets, related to: ▪ landfill diversion target ▪ beneficial use target	Specific targets for the Thames Tideway Tunnel project have been set with regards to the diversion of waste from landfill, the beneficial use of clean excavated material, the use of the *EMOA* and *SWMPs* and the movement of material by barge. The reporting targets would be used to show progress against the delivery of the three *EM&W strategy* objectives to reporting progress towards these targets would be undertaken by the project every six months. These targets are also incorporated within the *Sustainability statement* for the project, The three *EM&W strategy* objectives and associated targets are: **Objective W1: To minimise waste to landfill by prioritising prevention and seeking to maximise reuse and recycling** a. Divert at least 80% of construction and demolition waste from landfill. **Objective W2: Maximise beneficial use of excavated material arising from tunnel construction** a. Beneficially use a minimum of 85% of clean excavated material. b. all of the receptor sites used for the Thames Tideway Tunnel project excavated material would be assessed against the *EMOA* perform no worse than those sites on the preferred receptor site list. **Objective W3: Minimise the impact of excavated material and waste on the environment and communities** a. All of Thames Tideway Tunnel project construction sites have a	Section 3

Key themes from phase two consultation	Summary of responses to consultation comments	Where responses are addressed
	SWMP which is updated quarterly. The *Project wide WMP* & *SWMP* approach would be used to monitor whether the project targets are being met. TWUL or their agent would report on progress against the delivery of the objectives.	Full details of the *Project wide WMP* and individual *SWMPs* are described in Section 8 and templates provided in Annex E. Section 10 of the *EM&W strategy* provides details on the review and monitoring.
Maximising the use of river/barge, related to committing to transporting all waste arisings away from the sites by river.	The transport of excavated materials and waste from sites is addressed in *Transport strategy*[4] and therefore outside the scope of the *EM&W strategy.*	Full details regarding the use of the river to transport materials is included within the *Transport strategy*
Conforming to the waste hierarchy, related to using reused and recycled materials in construction, maximising beneficial use, re-use and recycling over the course of the project and minimising disposal to landfill.	The *Waste Regulations 2011* require waste operators, carriers and producers to apply the waste management hierarchy. The *CoCP* contains a range of measures to ensure compliance with the regulations and the application of the waste hierarchy. The measures include: a. The use of recovered materials or materials with a recycled content would be considered through the procurement process, where suitability and cost criteria are met. In addition opportunities for using materials with recycled content where practicable would be considered during construction of the Thames Tideway Tunnel project (*CoCP* Section 10.1.6c). b. The *CL:AIRE CoP* would be used to determine whether the Thames Tideway Tunnel project excavated material could be directly used, as direct use of material would be the preferred option based in terms of the waste hierarchy (*CoCP* Section 10.1.6ai). .	Further information on the *CL:AIRE CoP* is provided in Section 2

Key themes from phase two consultation	Summary of responses to consultation comments	Where responses are addressed
	c. The *Project wide WMP* and *SWMPs* would be used to identify waste prevention, reuse and recycling opportunities to help ensure waste is managed in accordance with the waste hierarchy. Opportunities for the reuse and recycling of waste both onsite or offsite would be investigated and implemented, where practicable, as part of the *Project wide WMP* and SWMP process (*CoCP* Section 10.1.3 and 10.1.4). In addition to the measures in the CoCP the *EMOA* process identifies suitable receptor sites for the treatment, handling or use of Thames Tideway Tunnel project excavated material taking into consideration the application of the waste hierarchy (compliance with this would be via an obligation in an agreement with the EA).	The *EMOA* is appended to Vol 3 as Appendix A.4. Full details of the *Project wide WMP* and individual *SWMPs* are described in Section 8 and templates provided in Annex E.
Effective management of materials and waste on construction sites, related to: ▪ the use of local permitted and exempt facilities. ▪ segregation of different waste types on site. ▪ supporting the use of a standard SWMP template across all sites.	An overarching *Project wide WMP* informed by *SWMP* for each site would be prepared At the preconstruction phase, the *SWMP* would set out actions to minimise waste and would provide a forecast of waste arisings. The *SWMPs* would also detail the waste carriers who would remove waste and indentify anticipated destinations. Once the construction phase commences, *SWMPs* would specify the types of waste removed from site, by whom, and where they were taken to. The *project-wide WMP* and *SWMPs* would be used to assess performance of the sites and the project as a whole against the forecast arisings and performance indicators.	Full details of the *Project wide WMP* and individual *SWMPs* are described in Section 8 and templates provided in Annex E.
Consideration has been given to the end destination for spoil/arisings (*EMOA*), related to:	The *EMOA* process identifies suitable receptor sites for the treatment, handling or use of Thames Tideway Tunnel project excavated material taking into consideration the application of the waste hierarchy. The research undertaken for the *EMOA* provides strong evidence that	The *EMOA* is appended to Vol 3 as Appendix A.4.

Key themes from phase two consultation	Summary of responses to consultation comments	Where responses are addressed
▪ environmental objectives including enhancement alongside protection. ▪ further consideration for the use of spoil as aggregate material. ▪ welcoming the commitment to finding beneficial uses for excavated material.	there is sufficient capacity for use of clean excavated material at reuse and restoration sites within London and the South East. The *EMOA* has been designed to allow for new receptor sites to be evaluated against the same objectives when they are identified in the future. Only those sites that meet or exceed the performance of the sites on the planning stage preferred list[IX] would be used for the receipt and management of excavated material. Approval of any new receptor sites would be sought from the Environment Agency and secured as an obligation of an agreement.	

[IX] The planning stage preferred list is a list of the receptor sites that have performed sufficiently well, against the full set of evaluation criteria in the *EMOA*, to demonstrate their suitable to accept excavated material from the Thames Tideway Tunnel project.

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5 Construction phase: Excavated material arisings

5.1 Introduction

5.1.1 The NPS (Section 4.14.5) states that the applicant should seek to minimise the volume of waste produced and that the decision maker should be satisfied that adequate steps have been taken to minimise the volume of waste arisings (Section 4.14.6).

5.1.2 This section describes the excavated materials arisings that would be generated during the construction phase of the Thames Tideway Tunnel project and sets out:

a. an explanation of how tunnel design has minimised the quantities of excavated materials while delivering the project objectives

b. a description of the estimated type and quantity of arisings

5.2 Minimising excavated material arisings through tunnel design and construction

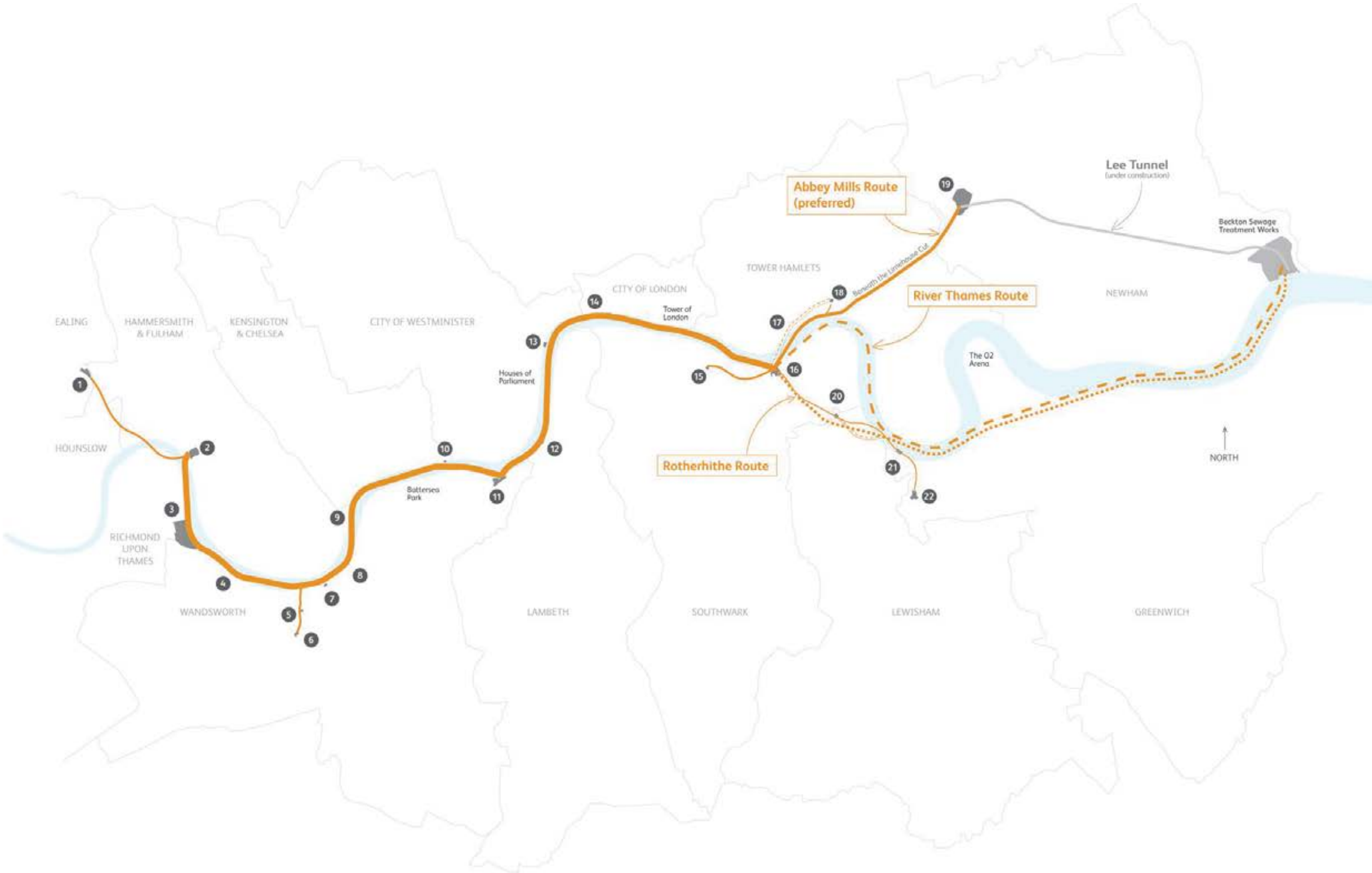
5.2.1 During 2009/2010, a range of routes were considered for the main storage and transfer tunnel. Three routes were put forward at the phase one consultation stage as presented in Plate 5.1

5.2.2 The three tunnel routes were compared against each other using a range of criteria from the five disciplines of engineering, planning, environment, community and property, using professional judgement to balance the issues and compare the effects of the tunnel routes, and their associated construction sites.

5.2.3 The proposed Abbey Mills route is 9km and 6.7km shorter than the River Thames and Rotherhithe routes respectively. This means that the Abbey Mills route would generate less excavated material, require less material for its construction and need less energy in its construction.

5.2.4 The estimated reduction in excavated material as a result of the selected Thames Tideway Tunnel project route is between 354,000m^3 and 476,000m^3.

Plate 5.1 Thames Tideway Tunnel project routes



5.2.5 In addition with regards to tunnel construction the Thames Tideway Tunnel project would involve the factory production of precast concrete tunnel linings as this approach should generate less waste than if the casting of the tunnel linings waste carried out on site.

5.2.6 Furthermore as the project evolves further analysis of the potential waste prevention measures would be undertaken by the contractor(s) as part of developing *SWMPs*.

5.2.7 These approaches help to demonstrate that steps have been taken to minimise the volume of waste arisings, contributing to the delivery of the NPS.

5.3 Arisings

5.3.1 A summary of excavated materials arisings that would be generated during the construction phase of the project for each site is presented in Plate 5.2 and Table 5.1. A further breakdown of the tonnages of excavated material generated by site is presented in Table C.2.

5.3.2 Plate 5.2 demonstrates that the drive sites Carnwath Road Riverside, Kirtling Street, Chambers Wharf and Greenwich Pumping Station would produce the largest quantities of excavated materials. The quantities from these drive sites account for over 70% of the excavated material generated during the construction of the project.

5.3.3 Soil conditioners and other additives would be added to assist in the tunnel construction process using tunnel boring machines. The type and amount of additives would depend on the ground conditions and type of tunnel boring machine used. The use of soil conditioners and other additives affect the engineering properties of the excavated material but are assumed to not fundamentally change the excavated material constituents and would be considered as inert.

5.3.4 In addition the excavated material would have small quantities of tunnel boring machine oils and greases from mechanical parts. It is also assumed that the presences of oils and greases would not change the classification of the excavated material. When the contractor(s) is appointed and the TBM and additive supplier are selected a detailed submission of the additives and their environmental impact would be assessed to confirm the above assumptions.

Plate 5.2 Estimated excavated material arisings by site and material type

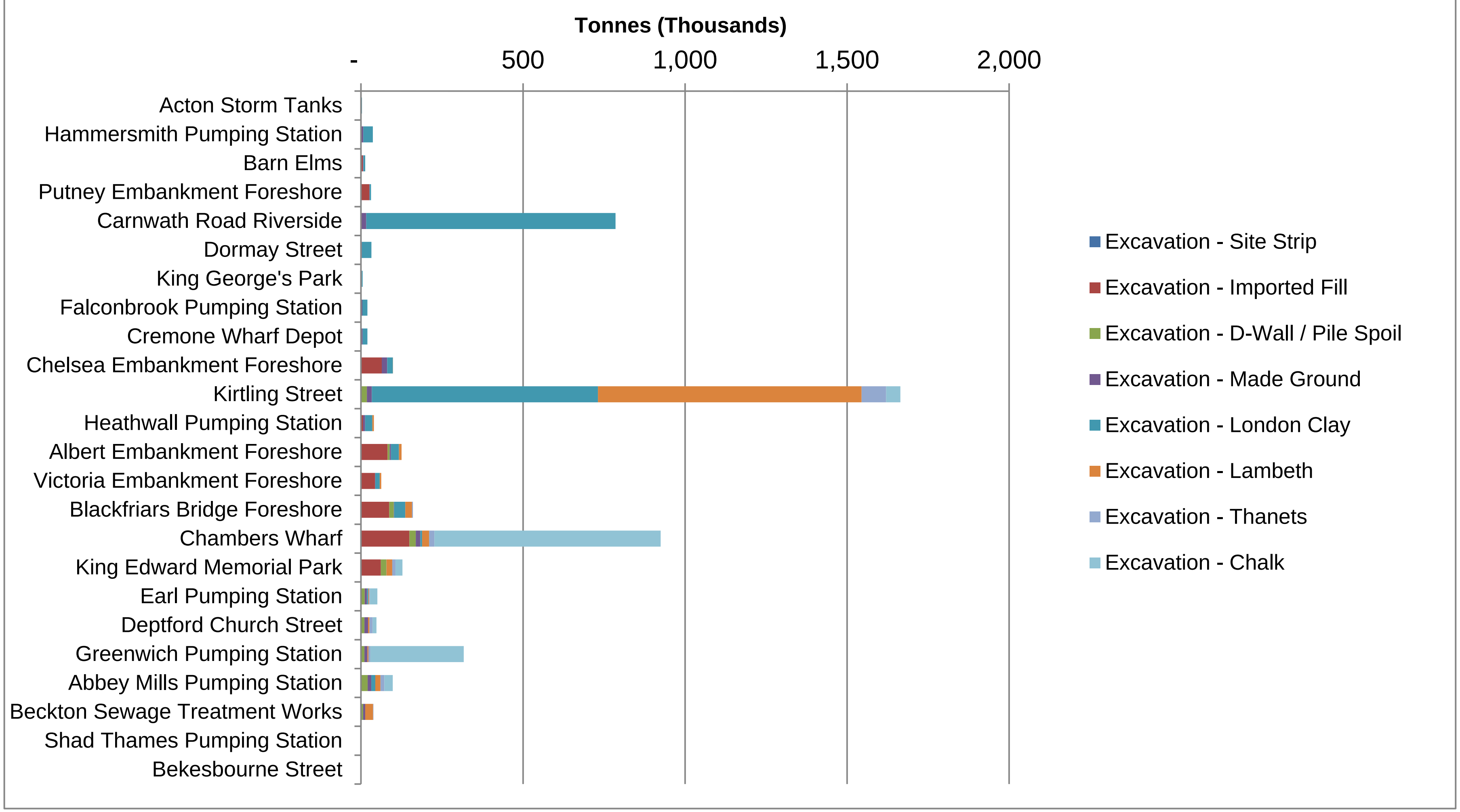


Table 5.1 Summary of excavated material arisings

Material	Description	Volume in situ ('000 m3)	Volume excavated ('000 m3)	Weight excavated ('000 tonnes)
Site strip	This material is generally soft material, eg topsoil and vegetation, but can include materials such as concrete hard standings. It is removed from site so that the works are undertaken on a sound surface.	6	7	12
Imported fill	This material would generally be imported crushed angular fill. Could be inert demolition arisings or similar, which is later re excavated.	261	314	523
Diaphragm wall/pile spoil	This material would constitute the undisturbed materials, along with bentonite.	64	77	129
Made ground/ superficial deposits	There is no typical description for this material. Site investigation is required at each site to determine the nature of the material.	70	84	141
London Clay	Fine sandy silty clay to silty clay predominantly* excavated by tunnel boring machine.	854	1,452	1,708
Sands from the Thanet Groups	Materials from the Thanet geological group predominantly* excavated by tunnel boring machine. Thanet Group comprises fine grained sands with higher clay / silt content in the lower sequence	68	96	137
Clays and sands from the Lambeth Group	Materials from the Lambeth geological group predominantly* excavated by tunnel boring machine. Lambeth Group comprises highly variable sediments of clay, sands, pebble beds and shelly beds. Lambeth Group comprises highly variable sediments of clay, sands, pebble beds and shelly beds.	471	801	942
Chalk	Chalk predominantly* excavated by tunnel boring machine and mechanical excavation (likely to have high moisture content).	556	890	1,112
Total excavated materials		**2,352**	**3,721**	**4,704**
** some material would be excavated during the shaft sinking process at the CSO interception shafts.*				

5.3.5 Excavation increases the volume of material. It is therefore necessary to use a bulking factor to determine the volume of material that would be created by excavation. It is also possible to estimate the tonnage that would require transporting based on the density of the material excavated. A detailed description of the anticipated materials, bulking factors and densities are provided in Annex A.1 of the *EMOA* (available in Vol 3 Appendix A.4).

5.4 Consistency with the NPS

5.4.1 The *NPS* requires the Thames Tideway Tunnel project to minimise the volume of waste produced. Minimising the production of excavated material and waste has been considered throughout the design process.

5.4.2 The proposed route is the shortest route, with an estimated reduction of excavated material of between 354,000m^3 and 476,000m^3.

5.4.3 The tunnel construction would involve the factory production of precast concrete tunnel linings, which is considered to be good practice with respect to minimising tunnel lining concrete waste.

5.4.4 These approaches demonstrate that steps have been taken to minimise the volume of waste produced, consistent with the guidance in the *NPS*. Furthermore as the project evolves further analysis of the potential waste prevention measures would be undertaken by the contractor(s) as part of developing *SWMPs*.

6 Construction phase: Management of excavated material

6.1 Introduction

6.1.1 Control of waste management on each site would be the responsibility of the appointed contractor(s) at that site and would be managed through compliance with this *EM&W strategy* and the *CoCP*. Full details on the *Project wide WMP* and the *SWMPs* can be found in Section 8.

6.1.2 Section 4.14.5 of the NPS states that the applicant should seek to set out the arrangements that are proposed for managing any waste produced and include information on the proposed waste recovery and disposal system for all waste generated by the development. It also states that the applicant must demonstrate that all waste produced by the development will be managed in accordance with the waste hierarchy.

6.1.3 Section 4.16.6 of the NPS states that the decision maker should be satisfied that adequate steps have been taken to minimise the volume of waste arisings sent to disposal, except where that is the best overall environmental outcome.

6.1.4 This section concentrates on the sustainable management of excavated materials. It explains the detailed assessment of the *EMOA* that has been used to identify the preferred options for the excavated materials and so demonstrates that the arrangements for managing the excavated material are consistent with the guidance in the *NPS*.

6.2 Storage of excavated material

6.2.1 The storage and management of the excavated material at each site would be the responsibility of the relevant contractor.

6.2.2 It is envisaged that the excavated material would be stored on the construction sites for a minimum practical time period of up to three days before being transported off site to the appropriate end use.

6.2.3 Each construction site would have a dedicated area for the handling and storage of excavated material. The construction site layout and design in terms of handling and storing excavated material would be dependent on the type and quantity of material that is being stored and removed.

6.2.4 The size of the handling and storage areas for excavated materials on the construction sites have been calculated based on assumptions related to tunnelling rates (production rates), working hours, bulking and dewatering requirements, and maximum material storage time.

6.2.5 The tunnel drive sites would require excavated material handling facilities, especially where the tunnel is driven through chalk, as (this requires the use of slurry Tunnel Boring Machines (TBMs). Where a slurry TBM is required, the excavated material would be removed by a pump and then transported out of the tunnel in a pipeline. The site layout and design for drive sites supporting slurry TBMs would include a processing plant to dewater the slurry for transport off site.

6.3 Removal of excavated material

6.3.1 The *Transport strategy* proposes that excavated material would be removed from site by barge from the three main drive sites (Chambers Wharf, Carnwath Road and Kirtling Street). In addition cofferdam infill would be imported and later removed by barge from eight additional CSO sites on the foreshore. These CSO sites are:

a. Putney Embankment Foreshore

b. Chelsea Embankment Foreshore

c. Heathwall Pumping Station

d. Albert Embankment Foreshore

e. Victoria Embankment

f. Blackfriars Bridge Foreshore

g. Chambers Wharf

h. King Edward Memorial Park Foreshore

6.3.2 The excavated material from these CSO foreshore sites would be removed by marine transport, unless the contractor has identified a suitable beneficial reuse location that is accessible by road.

6.4 Excavated materials options assessment (*EMOA*)

6.4.1 To identify preferred options for the management of the excavated material, a detailed *EMOA* has been undertaken.

6.4.2 The aims of the *EMOA* are to:

a. Identify suitable potential receptor sites for the treatment, handling or use of Thames Tideway Tunnel project excavated material taking into consideration:

  i the sustainability of potential receptor sites based on environmental, social and economic factors, as well as the viability in relation to handling the excavated material from the Thames Tideway Tunnel project sites

  ii the application of the waste hierarchy

  iii the life-cycle of the excavated material at the receptor site in the assessment of impacts.

b. Determine the potential capacity for the treatment, handling and use of Thames Tideway Tunnel project excavated material.

c. Provide an evaluation process that will be used to support the application for development consent (the 'application'), which will subsequently be used to evaluate tenders for the treatment, handling and use of the excavated material, to ensure that sustainability is taken into consideration during the procurement process.

d. Provide information to support the application process by demonstrating that there is sufficient capacity at receptor sites for managing excavated materials.

e. Provide transparency for the application process through a clear and documented options assessment.

6.4.3 The assessment methodology for the *EMOA* applies a sustainability appraisal, developed in conjunction with the EA through a series of workshops. The *EMOA* assumes that the excavated material would be segregated at source (eg clay and sands would remain separated from the point of excavation until acceptance at a receptor site). While the objective would be to separate the materials (sands, clays, etc), the tunnel boring method would inevitably lead to a degree of mixing at a number of locations.

6.4.4 The options assessment has been undertaken prior to obtaining consent for the project and before construction contractors have been appointed, in order to provide confidence that a sustainable solution can be delivered for all of the Thames Tideway Tunnel project excavated material. This means, that given the timescales involved, the assessment methodology needs to be flexible and take account the uncertainty associated with a number of factors, such as:

a. the exact volume and nature of material arisings are likely to change

b. specific receptor sites may cease to be viable by the time the project receives approval and/or over the construction period of the project

c. new receptor sites may become available throughout this period.

6.4.5 The assessment has taken a phased approach and at each stage the least preferred receptor sites have been eliminated until the final most viable and sustainable receptor sites have been identified to form the planning stage preferred list. Inclusion of a receptor site on the planning stage preferred list does not guarantee that the site would ultimately form part of a contract for the use of Thames Tideway Tunnel project material. The final solution would be procured through a formal tendering procedure. The receptor sites on the planning stage preferred list demonstrate the potential capacity to manage the excavated material in a sustainable manner, which accords with the guidance in the *NPS* [5] related to waste management.

6.4.6 The assessment is based on the consistent assessment of receptor sites against evaluation objectives agreed with the EA, whereby the same objectives are used at each stage in the assessment process. The *EMOA* evaluation objectives set the context for the *EMOA* and set out the key characteristics of the preferred receptor sites. The objectives have been developed to reflect Thames Water's aspirations for the management of excavated material in line with good practice, as well as reflecting the policy context within the *NPS* and other national and regional policies.

The objectives for the *EMOA* are closely linked to those objectives detailed in Section 3.

6.4.7 The options assessment evaluation objectives as presented in Table 6.1 address environmental issues, social issues, operational issues (including costs and reliability of delivery) and policy issues.

Table 6.1 Summary of the *EMOA* evaluation objectives

Evaluation objectives	
1.	To ensure prudent use of land and other resources
2.	To reduce climate change impacts
3.	To protect local amenity
4.	To conserve landscapes and townscapes
5.	To protect to protect quality of and access to open space
6.	To protect water quality
7.	To protect biodiversity
8.	To protect cultural heritage
9.	To provide employment opportunities
10.	To minimise the costs associated with the management of excavated material
11.	To ensure operational suitability of the receptor site
12.	To conform to waste hierarchy
13.	To conform to proximity principle
14.	To conform to sustainable transport policy
15.	To conform to health and safety good practice

6.4.8 The full methodology and results of the *EMOA* are set out in the *EMOA* report which can be found in Vol 3 Appendix A.4.

6.4.9 The *EMOA* identified a long list of 247 possible receptor sites across 13 business sectors. These receptor sites are primarily landfills and quarries in need of material for restoration (150 options) and recyclers (52 options).

6.4.10 The receptor sites on the long list were assessed against a series of operational viability indicators related to:

a. the ability of the receptor site to accept the volumes and generation rates of the excavated material, and

b. whether the receptor site possesses the necessary planning consents and permits.

6.4.11 This viability test determined that 34 of the 247 long list receptor sites passed through the assessment and onto a viable list.

6.4.12 The receptor sites on the viable list were subsequently assessed against all of the evaluation objectives and awarded a red (adverse), amber (neutral), or green (beneficial) grade against each objective. Only 28 receptor sites preformed sufficiently well based on the number of red grades and professional judgement as to whether any individual red grade (or combination of grades) made a particular receptor site unsuitable for inclusion on the short list.

6.4.13 Based on information provided by the operators, all the receptor sites taken through to the short list were understood to be able to meet the criterion of accepting at least 200,000t of excavated material over the project's lifetime.

6.4.14 The 28 sites which progressed to the short list were then re-interviewed and/or the appropriate planning consents and environmental permits were reviewed. Following this exercise 14 receptor sites were found to have issues which would make the sites unviable for use by the Thames Tideway Tunnel project based on current information.

6.4.15 The remaining 14 sites underwent the detailed assessment. Following this assessment all 14 sites were taken through to the *Planning stage preferred list*.

6.4.16 Three receptor sites which have the potential to become viable in the future have been placed on the reserve list. These receptor sites could be reconsidered and taken forward through the process if their circumstances change.

6.4.17 It is considered unlikely that only one receptor site would be used to accept the Thames Tideway Tunnel project excavated material. Therefore a combination of receptor sites would form the final solution with respect to end/beneficial uses for the Thames Tideway Tunnel project excavated material. No single receptor site on the planning stage preferred list is currently permitted to accept all of the Thames Tideway Tunnel project material based on the anticipated timing and volume of material produced.

6.4.18 The 14 receptor sites on the *Planning stage preferred list* are shown in Table 6.2 and in summary:

a. All of the sites are located within 90km of the drive sites and all but two of the sites accessed by road are within 30km of the drive sites.

b. All but two of the receptor sites would accept all of the main excavated material from the Thames Tideway Tunnel project sites (although some of the sites have expressed a preference for the chalk to be mixed with other materials).

c. Four of the receptor sites have planning consent up to 2019. However, three receptor sites are consented to complete restoration during 2021 and seven are currently consented to accept material beyond 2021.

Table 6.2 Planning stage preferred list

Site ID	Name	Location (county)	Transport mode	End date	Total restoration material required by site ('000 tonnes)	Permitted capacity ('000 tpa)	Total excavated material that could be accepted[a] ('000 tonnes)	Summary of suitability
BOU	Bournewood Inert Landfill Site	Kent	Road	January 2018	2,091	200	263	The receptor site can take 6% of the Thames Tideway Tunnel project excavated material and is close to the main tunnel drive sites. It is only accessible by road.
CEM. 7	Barrington Landfill	Cambridgeshire	Rail	2018	1,476	700	1,306	Barrington Quarry has the potential to receive 28% of the Thames Tideway Tunnel project excavated material in the short term (up to 2018), with potential to accept material beyond 2018 if further restoration is required and appropriate consents are obtained.
RSP	RSPB - Wallasea Island (Wallasea Wetland Creation Project)	Essex	Marine transport (Ship)	2019	9,300	3,000	4,402	Wallasea is a long distance from the main tunnel drive sites and can only be accessed by marine transport. However, it could take 94% of the Thames Tideway Tunnel project excavated material at the required throughput and would have a beneficial long term biodiversity impacts.

Site ID	Name	Location (county)	Transport mode	End date	Total restoration material required by site ('000 tonnes)	Permitted capacity ('000 tpa)	Total excavated material that could be accepted[a] ('000 tonnes)	Summary of suitability
SUM	Summerleaze - Denham Quarry	Buckinghamshire	Road	2021	792	Up to a maximum of 715	707	Denham Quarry could accept 15% of Thames Tideway Tunnel project excavated material by road.
VEO. 1	Veolia Essex - Rainham Landfill	Essex	Road and marine transport (Barge)	2018	2,091	700	1,306	Rainham Landfill could take 28% of the Thames Tideway Tunnel project excavated material. The receptor site is located close to the main tunnel drive sites and has good marine transport and road access.
WRG. 3	Calvert Landfill	Buckinghamshire	Rail	2047	24,600	1,000	2,919	Calvert Landfill has sufficient capacity to accept 62% of the Thames Tideway Tunnel project excavated material. It would also be operational throughout the timescales of the Thames Tideway Tunnel project. It is only accessible by rail and is only permitted to accept 1million tpa.
WRG. 5	Sutton Courtenay	Oxfordshire	Rail	2031	2,460	600 but only 400 available for Thames Tideway Tunnel project	1,565	Sutton Courtenay landfill has sufficient capacity to accept a 33% of the Thames Tideway Tunnel project material. It would also be operational throughout the Thames Tideway Tunnel project. It is only accessible by rail and is permitted

Site ID	Name	Location (county)	Transport mode	End date	Total restoration material required by site ('000 tonnes)	Permitted capacity ('000 tpa)	Total excavated material that could be accepted[a] ('000 tonnes)	Summary of suitability
						material.		to accept 600,000tpa but the operator has indicated that only 400,000tpa would be made available for Thames Tideway Tunnel project material.
CEM. 1	Borough Green Quarry	Kent	Road	2042	5,000	450	1,715	Borough Green Quarry can take 36% of the Thames Tideway Tunnel project excavated material and is close to the main tunnel drive sites. It is accessible by road.
CEM. 6	Kingsmead Quarry	Berkshire	Road	2042	5,000	400	1,565	Kingsmead Quarry is not yet receiving material for restoration and requires the necessary permits. The receptor site would be able to accept 33% of the Thames Tideway Tunnel project excavated material by road.
RAR	Little Belhus Landfill	Essex	Road	2021	923	200	900	Little Belhus Landfill can accept 19% of the Thames Tideway Tunnel project excavated material. It is only accessible by road with limitations on movements. The receptor site is currently operating under exemptions however an environmental permit has been

Site ID	Name	Location (county)	Transport mode	End date	Total restoration material required by site ('000 tonnes)	Permitted capacity ('000 tpa)	Total excavated material that could be accepted[a] ('000 tonnes)	Summary of suitability
								applied for.
HAN. 1	Shipton on Cherwell Quarry	Oxfordshire	Rail	2022	2,706	250	1,108	Shipton on Cherwell Quarry is not yet receiving material for restoration. However it has the ability to receive 24% of the Thames Tideway Tunnel project excavated material. It is only accessible by rail but infrastructure is required to enable this.
SUM. 2	East Burnham Quarry	Berkshire	Road	2021	750	150	750	East Burnham Quarry is only accessible by road; however it is on average 34km from Thames Tideway Tunnel project main drive sites. It would not receive chalk material but would be able to receive all other material throughout the Thames Tideway Tunnel project lifespan, which equals to 16% of the Thames Tideway Tunnel project excavated material.
LAF.4	Tyttenhanger Quarry	Hertfordshire	Road	2032	11,000	600	2,107	Tyttenhanger Quarry can receive 45% of the Thames Tideway Tunnel project excavated materials. It is only accessible by road and is limited to receive 600,000tpa.

Site ID	Name	Location (county)	Transport mode	End date	Total restoration material required by site ('000 tonnes)	Permitted capacity ('000 tpa)	Total excavated material that could be accepted[a] ('000 tonnes)	Summary of suitability
WES	Cliffe Pools	Kent	Marine transport (Barge)	2042	2,340	3,650[b]	2,340	Cliffe Pools can receive 50% of the Thames Tideway Tunnel project material but requires the necessary permits. It would not accept chalk material. The receptor site is accessible by marine transport (barge).

a. Based on the Thames Tideway Tunnel project excavated material production profile and the years the receptor site would be operational
b. Receptor site has planning consent which allows 10,000t per day, 365 days a year.

6.4.19 Further information on the on the current planning stage preferred list can be found in Vol 3 Appendix A.4.

6.4.20 The *Planning stage preferred list* demonstrates that facilities can be identified which meet Thames Water's requirements with respect to delivery, sustainability considerations and environmental protection. However inclusion on the planning stage preferred list does not guarantee the use of a receptor site, as this could:

a. prejudice any future procurement activities; and

b. potentially rule out alternative receptor sites which perform as well as those on the *planning stage preferred list* and may become available prior to the Thames Tideway Tunnel project construction work commencing.

6.4.21 TWUL or their agent would ensure that the final location(s) and end use(s) for the material would perform as well as those receptor sites identified on the *Planning stage preferred list*. Approval of the final list of receptor sites would be provided by the Environment Agency as an obligation of an agreement.

6.5 Excavated hazardous waste

6.5.1 It is anticipated that hazardous waste is likely to be found on some of the sites. This is likely to be confined to the made ground, at each of the previously developed sites, and very little or no hazardous waste is expected within the foreshore sites and greenfield sites.

6.5.2 Based on the results of the land quality assessment for the *Environmental Statement* it is anticipated that contaminated soils may be present at the following sites:

a. Putney Embankment Foreshore (off site)

b. Carnwath Road Riverside

c. Dormay Street

d. Cremorne Wharf

e. Kirtling Street

f. Heathwall Pumping Station

g. Earl Pumping Station

h. Abbey Mills Pumping Station.

6.5.3 The *CoCP* (Part A, Section 9) sets out the approach to identifying contamination and ascertaining the most suitable management procedures including handling of hazardous waste. At this stage it is not possible to be definitive about the quantities of made ground that may be classified as hazardous waste. In order to allow the impacts on hazardous waste infrastructure to be assessed (para. 9.4.5), a worst case scenario has been considered. This scenario assumes that all made ground from the eight sites listed in para 6.5.2 would be classified as hazardous. It is estimated that approximately 62,000t of made ground waste would be generated (detailed tonnages are provided in Annex D.3). While assuming this material would all be hazardous waste, is considered to be a substantial over estimate, it provide a tonnage for comparison with regional capacity.

6.5.4 On site hazardous material would be kept separate from other materials. This material would be removed from site and treated in accordance with legislative requirements.

6.5.5 It is also possible that asbestos could be present in made ground material on the construction sites. If it is suspected that asbestos material is present, it would be dealt with appropriately, in full accordance with the relevant regulations, as detailed in para 8.4.9 to 8.4.16.

6.6 Consistency with the NPS

6.6.1 The *NPS* advises that the arrangements of the proposed waste recovery and disposal system for all excavated material and waste generated by the development should be described. It also advises that excavated material and waste would be managed in accordance with the waste hierarchy.

6.6.2 Section 5 of this *EM&W strategy* sets out how waste prevention has been incorporated in the design of the tunnel to minimise the volume of excavated material produced.

6.6.3 The *EMOA* process identifies suitable receptor sites for the treatment, handling or use of Thames Tideway Tunnel project excavated material and by incorporating a beneficial use test it aims of ensure that all excavated material is put to beneficial use. This is reflected in the target of beneficially using a minimum of 85% of clean excavated material with an aspiration to beneficially use 100% of clean excavated material.

6.6.4 The *EMOA* details the process by which potentially suitable receptor sites for the management of excavated material, have been/would be identified. Only receptor sites that meet or exceed the performance of the planning stage preferred options would be used for the management of excavated material. Approval of the final list of receptor sites would be provided by the Environment Agency. This process provides an effective system to control the management of 96% (4.7million tonnes) of the material generated during the construction period.

6.6.5 These measures demonstrate that Thames Tideway Tunnel project excavated material would be managed in accordance of the waste hierarchy.

7 Construction phase: Non excavated material arisings

7.1 Introduction

7.1.1 This section details the non excavated material that would be generated during the construction phase of the project. This is waste associated with the construction phase of the tunnels, interception chambers and above-ground structures which includes:

a. construction waste

b. demolition waste

c. hazardous waste

d. waste electrical and electronic equipment (WEEE)

e. welfare waste

f. vegetation waste from site clearance.

7.2 Arisings

Construction waste

7.2.1 During the construction phase, the following waste is likely to be generated:

a. excess concrete

b. damaged concrete tunnel segments, and temporary linings at junctions and shaft connections

c. imported fill

d. tunnel grout in the batching plant, grout pipes and general spillage

e. spent (generally plywood) forms.

7.2.2 It is assumed that a percentage of the materials used on site would be wasted. WRAP have developed civil engineering wastage estimates[6] and these have been applied to construction materials to produce an estimated wastage tonnage. The WRAP reference data is for general civil engineering works and good practice performance has been assumed based on the scale of the Thames Tideway Tunnel project.

7.2.3 It is estimated that approximately 50,000t of non excavated construction related waste would be generated throughout the construction phase of the project. Further details relating to this estimate can be found in Annex D.

Demolition waste

7.2.4 Demolition of buildings and structures would be required at a number of sites to enable tunnel and shaft construction. Demolition waste could include:

a. brick
b. glass
c. made ground/asphalt
d. plasterboard
e. ceramics
f. concrete/hardstanding
g. metal
h. plastics
i. asbestos.

7.2.5 It is estimated that approximately 137,000t of non excavated demolition waste would be generated throughout the construction phase of the project. Annex D.2, Table D.3 provides a summary of the sites where demolition activities are anticipated.

Hazardous waste

7.2.6 It is anticipated that there would be small quantities of hazardous waste, such as oils/diesel, packaging/absorbents etc. contaminated with hazardous substances, WEEE, demolition waste containing asbestos, fluorescent tubes, batteries, oil filters, waste paint and solvents.

7.2.7 Asbestos may be present in any of the buildings identified for demolition, particularly buildings which date from the 1950s to the mid 1980s. Annex D.2 Table D.3 provides a summary of the sites where demolition activities are anticipated and identifies those sites on which asbestos is most likely to be present due to the age of the buildings to be demolished.

7.2.8 Based on current Thames Water data from the Lee Tunnel, it is estimated that hazardous waste arisings would comprise approximately 0.15% of total waste and excavated material arisings. The Thames Tideway Tunnel project works are similar to the Lee Tunnel and therefore, it is estimated that approximately 7,000t of hazardous waste would be produced over the construction period.

Waste electrical and electronic equipment

7.2.9 It is likely that there would be a small amount of WEEE produced at the offices based at the construction sites due to replacement of key and broken equipment.

7.2.10 Annex D.4 sets out of key assumptions in estimating the tonnage of WEEE waste. The estimates are based on the number of office staff that would be based at each of the construction site. Each office based staff would have a laptop and share a printer between four members of staff. There is also a replacement programme of every two years for the laptop and three years for the printer.

7.2.11 It is estimated that during the demolition and construction period there would be less than 25t of WEEE waste.

Welfare waste

7.2.12 Waste would be produced at the construction sites from the site offices and mess rooms. This waste would, in general, be domestic in nature and include paper, packaging and food waste. Any sewage from the sites would be managed through the existing sewer system.

7.2.13 Annex D.5, Table D.4, provides estimates of the tonnage of welfare waste generated by the Thames Tideway Tunnel project, based on an estimate of the number of staff that would be working at each of the construction sites.

7.2.14 The estimated figures have been calculated using the assumption that an average office worker produces approximately 200kg of waste per year (WRAP, 2012)[7].

7.2.15 The total estimated waste generated from all construction sites would be in total of between 1,800 and 2,000t over the life of the project based on the number of months the site is operational.

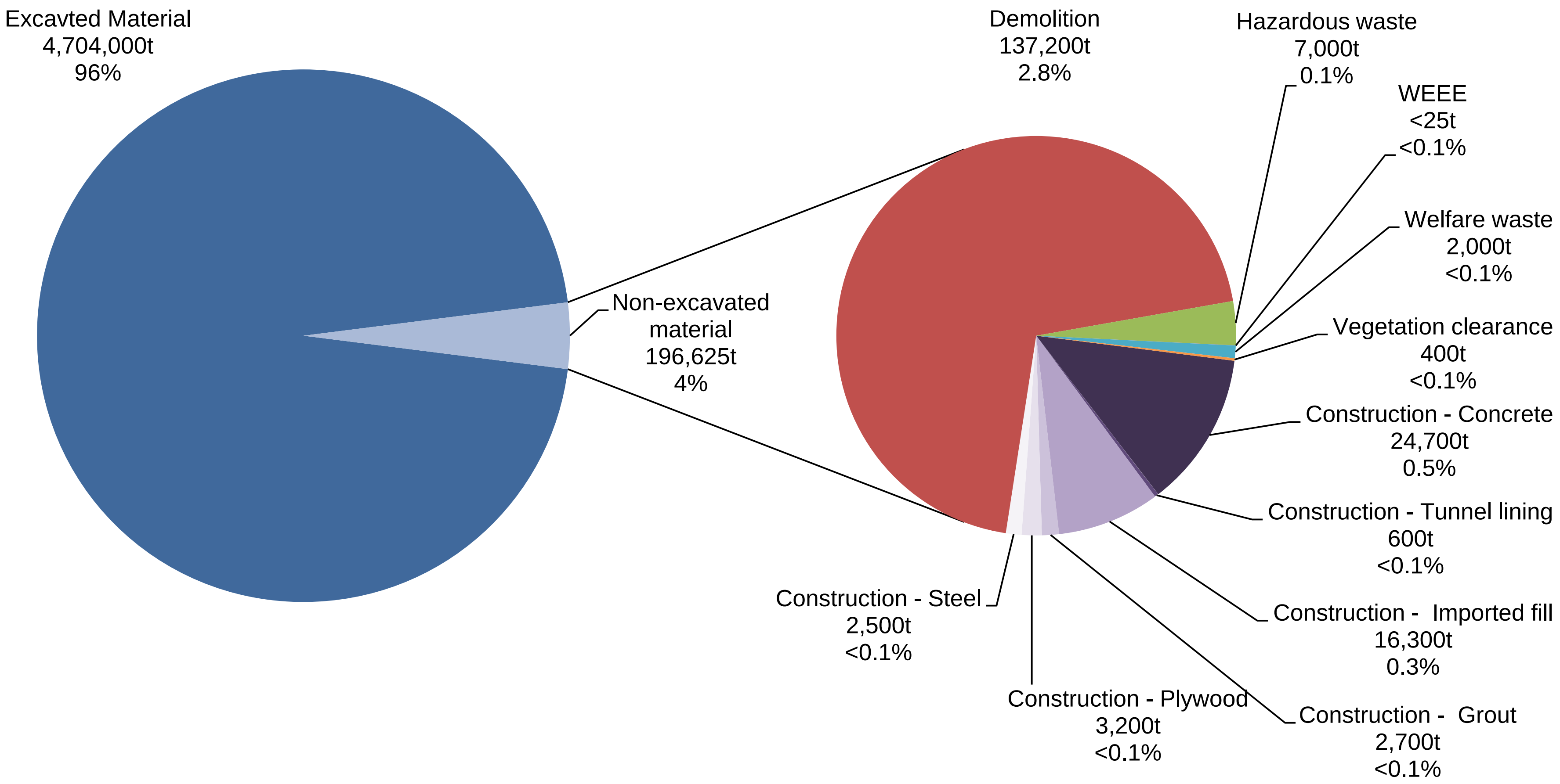
Vegetation waste from site clearance

7.2.16 The demolition and site clearance plans for all proposed sites have been reviewed in combination with the arboricultural reports assessed to determine the likely volume of vegetation related waste which may be generated. It is estimated that approximately 390t of such waste would be generated during site preparation and clearance. Further details relating to the method used to estimate these waste arisings is given in Annex D.6.

7.3 Total arisings

7.3.1 The estimated quantities of non excavated material generated during the construction of the tunnels, shafts, interception chambers and above-ground structures, as detailed above, are summarised in Plate 7.1. It also shows the proportion of non excavated material to relation to the total quality of excavated and non excavated material produced by the Thames Tideway Tunnel project.

Plate 7.1 A summary of the estimated excavated and non-excavated material generated (tonnes) during the construction phase of the tunnel[x]



[x] Tonnages to the nearest 25t

8 Construction phase: Site waste management

8.1 Introduction

8.1.1 Sections 4.14.5 of the NPS states that the applicant should set out the arrangements that are proposed for managing any waste produced and prepare a Site Waste Management Plan. The *NPS* also advises the applicant to demonstrate that all waste produced by the facility will be managed in accordance with the waste hierarchy and that during construction, excavated soils and sub soils will, where possible, be re-used on site e.g. for the balancing of cut and fill. Section 4.16.6 of the NPS states that the decision maker must be satisfied that any such waste will be properly managed, both on-site and off-site.

8.1.2 This section explains the systems that would be put in place to manage excavated material and waste during the construction phase of the Thames Tideway Tunnel project.

8.1.3 This section also explains the delivery mechanisms for the management of construction phase excavated materials and waste.

8.1.4 All excavated material and waste would be managed in accordance with legislative requirements.

8.2 Code of Construction Practice

8.2.1 All works would be undertaken in accordance with the Thames Tideway Tunnel project *Code of Construction Practice (CoCP).* The *CoCP* is provided in Vol 1 Appendix A of the *Environmental Statement*. Compliance with the *CoCP* is to be secured through a requirement imposed on the application.

8.2.2 The *CoCP* sets out measures to protect the environment and limit disturbance from construction activities, including waste and excavated material management. The objectives of the *CoCP* are:

a. to set out the standards and procedures for managing the impact of site activities during the construction of the Thames Tideway Tunnel project

b. to identify the main responsibilities of the client and contractors employed during the implementation of the scheme

c. to assure all stakeholders that the project aims to ensure that all construction impacts will be managed appropriately.

8.2.3 The *CoCP* comprises two parts: Part A and Part B. Part A includes information on general principles and general site operations, and Part B details site specific principles and individual requirements for each site.

8.2.4 The *CoCP* has a specific section relating to waste management (Part A Section 10) that requires:

a. compliance with the application of the waste hierarchy (*CoCP* Section 10.1.5)

b. compliance with the *Project wide WMP* (*CoCP* Section 10.1.3)

c. the production of a *SWMP* for each site (*CoCP* Section 10.1.4

d. the development of demolition reuse plans (*CoCP* Section 10.1.11).

8.3 Project wide waste management plan and Site waste management plans

Project wide WMP

8.3.1 Prior to commencement of construction TWUL or their agent would prepare an overarching *Project wide WMP* to ensure a consistent approach to managing the excavated materials and waste at individual construction sites. The *Project wide WMP* will provide a central location for all Thames Tideway Tunnel project waste information and would be reported on to the EA on a biannual basis. The *Project wide WMP* would be supported by individual *SWMPs* for each construction site and would:

a. record TWUL or their agent's responsible person, as well as the responsible person for each site

b. record the waste types generated by the entire project

c. provide details of all waste minimisation actions

d. provide project-wide waste forecasts for each waste type

e. provide a complete register of all approved waste carriers and receptors sites for the project

f. summarise the information relating to waste transactions from each site.

8.3.2 Plate 8.1 provides further detail about the information held in the *Project wide WMP* and the individual *SWMPs*, and the relationships between the documents.

8.3.3 Waste management services would be procured as appropriate and all centrally procured services would be recorded in the *Project wide WMP* and set out in the *SWMP*.

8.3.4 The TWUL or their agent and the appointed contractor(s) would take all reasonable steps to ensure that all waste from the site is dealt with in accordance with the dut*y of* care, and materials would be handled efficiently and that waste would be managed appropriately.

8.3.5 A template *Project wide WMP* can be found in Annex E. This version of the template incorporates comments from the *EA* on an earlier version of the template. The template is being provided voluntarily at this stage so that stakeholders have an indication of the proposed content. If application consent is obtained, the template would be reviewed prior to construction commencing to ensure it is still consistent with good practice and the EA would be consulted on any proposed changes and approval of the final template would be sought from the EA.

SWMPs

8.3.6 Excavation and construction works would take place on all CSO interception sites and drive sites. All sites would require a SWMP to be prepared and implemented.

8.3.7 The *CoCP* requires the preparation and use of *SWMPs* on all sites. The remainder of this section and Section 8.4 provides the detail on how individual *SWMPs* would be developed and maintained.

8.3.8 *SWMPs* set a framework to facilitate good practice on construction sites and are an important tool for improving environmental performance, meeting regulatory control and reducing waste disposal costs.

8.3.9 As currently required by the *Site Waste Management Plans Regulations 2008*, the *SWMPs* for the Thames Tideway Tunnel project would set out the roles and responsibilities with respect to waste management at each site.

8.3.10 The Government has identified this legislation in its red tape review and are considering removing the legal requirement for *SWMPs*. Regardless of whether the legal requirement for *SWMPs* is removed, the use of *SWMPs* is specified in the NPS and would be considered good practice. For these reasons the use of *SWMPs* is incorporated into the *CoCP*. The preparation and use of SWMPs is consistent with the guidance provided in the NPS.

8.3.11 At the preconstruction phase, the *SWMP* would set out actions which have been taken to minimise waste and would provide a forecast of waste arisings. The *SWMPs* would also detail the waste carriers that would be used to remove waste from each site, and the anticipated destinations for those materials.

8.3.12 Once the construction phase commences, the *SWMPs* would record all waste transactions. The *SWMP* would specify the types of waste were removed from site, by whom, and where they were taken to. The performance indicators would reflect the targets and objectives of this *EM&W strategy* and would include total waste arisings and percentage of construction, demolition and excavated material recovered, as well as overall diversion from landfill.

8.3.13 TWUL or their agent would review progress towards these targets every six months. If the progress suggests that the targets may not be achieved, TWUL or their agent would agree actions with the contractor(s) to ensure that the targets are achieved. TWUL or their agent would share the findings of the review on a six monthly basis, in the form of a written report, with the EA, the GLA and 14 local authorities across which the Thames Tideway Tunnel project extends. The EA would be responsible for the approval of the biannual reports under the terms of the agreement between TWUL and the EA.

8.3.14 In order to ensure all the construction sites achieve the same standards, a *SWMP* template would be used at all sites. The template provided in Annex E would help the project to identify waste prevention, reuse and recycling opportunities to ensure waste is managed in accordance with the waste hierarchy. This version of the template incorporates comments from the EA on an earlier version of the template. The template is being provided voluntarily at this stage so that stakeholders have an indication of the proposed content. If application consent is obtained, the template would be reviewed prior to construction commencing to ensure it is still consistent with good practice and the EA would be consulted on any proposed changes and approval of the final template would be sought from the EA.

8.3.15 The template would be based on good practice and would be a live reporting tool rather than a static document. The template would be prefilled with project-wide requirements, such as information relating to waste minimisation actions undertaken at the design stage, waste types to be recorded, and any centrally contracted or recommended waste carriers or receptor sites.

Plate 8.1 Information included in the Project wide waste management plan and Site waste management plans

	Responsible Persons	Project Detail	Waste Prevention Actions	Forecast Waste Types and Arisings	Waste Carriers	Plan Waste Destinations	Actual Waste Movements	KPIs
Project wide waste management plan	**Provides all project waste information in one location, monitors performance against KPIs**							
Project Specified Information	Thames Water; Person who drafted plan	Summary of all site locations	Actions undertaken at design stage to minimise waste; Actions to be taken by all sites to minimise waste	Waste types to be reported	Carriers contracted at project level; or project recomendations	Receptor sites contracted at project level;or project recomendations		Project-wide KPIs
Information from SWMPs	List of responsible person for each site	Summary of site costs	Summary of site specific actions	Total forecast arisings for each waste type based on site specific estimates	All carriers specified for each site	All receptor sites identified for the project	Summary of all transactions	Overall project performance against KPIs and forecasts
Site waste management plans	**Provides all waste information relating to an individual site, allows site specific performance to be monitored**							
Project Specified Information	Client: Thames Water		Actions undertaken at design stage to minimise waste at this site; Actions to be taken by all sites	Waste types specified by project to enable collation of data	Carriers contracted at project level	Receptor sites contracted at project level		KPIs will be specified at a project level
Site Specific Information	Principal Contractor; Person who drafted plan	Site location; Site layout; Site costs	Site specific actions	Forecast arisings for each waste type	Carriers specified for wastes arising from site	All receptor sites identified for wastes arising from site	Record of all waste transactions including: carrier; waste description; tonnage; destination; confirmation of receipt	Performance against project and site specific KPIs and forecasts

Review of Site waste management plans

8.3.16 The site contractor(s) would be responsible for filling in the *SWMP* template for their individual sites. The completed *SWMP* would be reviewed by TWUL or their agent and agreed with the contractor prior to any works commencing on the construction site.

8.3.17 Once the *SWMP* has been agreed between TWUL or their agent and the contractor, the site specific information would be included in the relevant sections of the *Project wide WMP*.

8.3.18 The *SWMPs* would be produced by the contractor for review by TWUL or their agent at agreed gateways[XI], in line with existing Thames Water procedures. These gateways are set out in Plate 8.2.

Plate 8.2 SWMP gateways

Indicative Thames Tideway Tunnel project gateways	Thames Tideway Tunnel project stage	Level of information required for *SWMP*
Gateway 1	Preliminary design	Preliminary estimates
Gateway 2	Contractor tendering process	Development of proposals
Gateway 3	Commencement of contract	Actual strategy detailed
	Commencement of works	Actual waste types and figures reported
	Regular updates	Actual waste types and figures reported
Gateway 4	Sign off of *SWMP*	Monitoring and sign-off of *SWMP*

[XI] A gateway is a term that Thames Water use to describe a stage in their decision making process.

8.3.19 Once the *SWMP* is approved, it would be the responsibility of the contractor(s) to ensure that all operators and contractors associated with the construction site adopt and comply with the approved *SWMP* and *SWMP Regulations* as detailed in Section 2.3.

8.3.20 The *SWMPs* would be continually updated by the contractor(s) and would be kept in a location and state such that they can be referenced when required. The *SWMP* would include a record of the types and quantities of waste that are:

a. reused (and whether on or off site)

b. recycled (and whether on or off site)

c. recovered (and whether on or off site). The type of recovery may include physical sorting, chemical or biological treatment, composting, incineration with energy recovery, remedial treatment of soil, etc

d. sent to landfill

e. otherwise disposed off (including burning without recovery and where it is not possible to record known quantities of mixed waste that are destined for the other points covered above).

8.3.21 Updated *SWMPs* would be issued, by the contractor(s), to TWUL or their agent quarterly following commencement of the works for review, acceptance and inclusion in the *Project wide WMP*. An agreed and approved *SWMP* would require signatures by both the contractor and by TWUL or their agent.

8.3.22 The Regulations require that, within three months of the end of works on the construction site, the final *SWMP* must be produced (following updating the information and review by TWUL or their agent). The final *SWMP* would include:

a. confirmation that the *SWMP* has been monitored on a regular basis

b. all waste tonnages input and updated

c. an explanation of any differences between the first draft of the plan and the actual performance

d. an estimate of the cost savings that have been achieved by completing and implementing the plan.

8.3.23 The final construction site *SWMPs* would then be combined within the *Project wide WMP* and a final *Project wide WMP* would be produced.

8.4 On site waste management practices

8.4.1 The *CoCP* requires the preparation and use of *SWMPs* on all sites. This section provides further details on how individual *SWMPs* would be developed and maintained in relation to the waste hierarchy and specific waste streams. This section is designed to provide guidance to the contractors on the preparation of the SWMPs.

Waste hierarchy

8.4.2 The contractors would be required to manage all waste in accordance with the waste hierarchy. The *SWMP* provides a means of recording training provided to site workers in waste prevention, reuse and recycling procedures.

8.4.3 The prevention of waste is the preferred option in terms of the waste hierarchy. Therefore contractor(s) would be required through the *SWMPs* to identify actions with respect to waste prevention/minimisation at all sites. These would include the use of innovative design and procurement (through the procurement of appropriate quantities of materials and the selection of material and goods which increase the potential for the reuse and recovery).

8.4.4 Opportunities for the reuse of waste both onsite or offsite would be investigated and implemented where practicable as part of the *SWMP* process. Where reuse is not possible opportunities to recycle wastes would be considered.

8.4.5 Opportunities for the use of material with recycled content during construction would be investigated and used where the practicable based on suitability for use and cost as part of the *SWMP* process.

Waste segregation

8.4.6 The segregation of different waste types would be maximised on each site by establishing a designated waste management compound, or 'zone', with sufficient space for the siting of a number of recycling/recovery skips dedicated to different waste types. This zone would be separate from the excavated material area.

8.4.7 Where there is insufficient space on site to allow for the segregation of different waste types, the contractor(s), when producing the *SWMPs* would be required to identify options that allow the maximum segregation of waste through a combination of onsite and offsite segregation.

Construction and demolition wastes

8.4.8 The immediate reuse of construction and demolition related materials at the sites where they would be generated are unlikely to be a viable option due to space constraints and nature of the project. The *CoCP* and the *SWMPs* require the contractor(s) to:

a. maximise opportunities for the potential for reusing and recycling of all waste (including construction and demolition material) on site (*CoCP* Section 10.1.6f)

b. consider the use of material from other projects in London to infill the cofferdams at foreshore sites, where possible (*CoCP* Section 10.1.6aiv).

c. reuse temporary structures, including hoardings and office facilities, where possible (*CoCP* Section 10.1.9).

d. where demolition is required, prepare and complete a demolition waste reuse plan for each site to maximise reuse opportunities for these materials (*CoCP* Section 10.1.11).

e. use of the Waste and Resources Action Programme (WRAP) [XII] aggregate quality protocol[XIII] for construction and demolition material where appropriate (*CoCP* Section 10.1.6aiii).

f. use local permitted and exempt sites that accept, process and recycle construction materials where appropriate (*CoCP* Section 10.1.6av).

Hazardous waste (including asbestos containing waste)

8.4.9 It is anticipated that hazardous waste, such as oils/diesel, packaging/absorbents etc. contaminated with dangerous substances, WEEE, demolition waste containing asbestos, fluorescent tubes, batteries, oil filters, waste paint and solvents would be generated during the construction phase.

8.4.10 All hazardous materials generated would be kept safe and secure in dedicated storage receptacles of an appropriate design in accordance with the *Hazardous Waste Regulations (2005*).

8.4.11 The waste would be removed from site and treated in accordance with legislative requirements.

Asbestos

8.4.12 During alteration, demolition works and excavation work the risk of asbestos would be managed to comply with the regulations and codes of practice.

8.4.13 The *Control of Asbestos Regulations 2012 (SI/2012/632*) and associated approved codes of practice (or relevant updates) would be complied with, and asbestos inspection, survey sampling and analysis would be carried out in accordance with *Asbestos: The Survey Guide*, *Health and Safety Executive guidance HSG264 (2010).*

8.4.14 Measures for managing asbestos in the alteration, demolition and excavation works would include:

a. employing competent specialist contractors to carry out alteration and demolition works

b. contractors implementing a procedure for dealing with potentially suspect materials exposed requiring sampling and analysis by an independent specialist consultant

c. all locations of asbestos containing materials would be clearly labelled

d. formal exchange of information before start of work, including relevant information from the Asbestos Register to clearly identify location of asbestos-containing materials

[XII] This programme aims to help the UK government to meet national and international commitments and to support resource efficiency in the UK. This is achieved by helping businesses and individuals within the UK to benefit from reducing waste, develop sustainable products and use resources in an efficient way.

[XIII] WRAP aggregate quality protocol provides a control process for which the producer of the construction and demolition material can reasonably state and demonstrate that the product has been fully recovered and is no longer a waste. It also ensures that recovered material has met the quality and standards, thus ceasing to be a waste. Once the material has been through the protocol and met the standards, it can then be used as a product.

e. method statements for any works in the vicinity of asbestos-containing materials to avoid any disturbance to such materials.

8.4.15 Additionally measures for managing work involving asbestos-containing materials encountered in construction would include:

a. appointment of a specialist consultant independent of the asbestos treatment contractor

b. all locations of asbestos-containing materials would be clearly labelled

c. ensuring any work with asbestos-containing materials is notified to the Health and Safety Executive

d. ensuring any work with asbestos-containing materials is carried out by licensed specialist asbestos treatment contractors in accordance with the *Control of Asbestos Regulations 2012 (SI/2012/632)*

e. method statements defining detailed control measures to be produced by the specialist asbestos treatment contractor and approved by the Client/independent specialist consultant

f. air sample monitoring of work to ensure required air quality standards are achieved.

8.4.16 Transport of asbestos-containing materials would need to be undertaken in accordance with the *Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009* (SI 2009/1348). Disposal of asbestos-containing materials to permitted waste sites would be in accordance with the *Hazardous Waste (England and Wales) (Amendment) Regulations*.

Waste electrical and electronic equipment

8.4.17 The contractor would be required to maximise opportunities for the potential for reusing and recycling of all waste this would include WEEE waste generated at the construction sites. Where practical this would be managed through either take-back or other electrical recycling or reuse schemes.

8.4.18 There would be a programmed replacement timetable for the electrical items (for example, two years for laptops and three years for printers) and it is anticipated that the manufacturer/supplier would oversee a take back scheme.

8.4.19 All the take back and electrical recycling or reuse schemes would be registered as a WEEE compliant scheme (in accordance with the *WEEE Regulations*) and there would be a full audit trial to ensure electrical and electronic equipment is reused or recycled.

Welfare waste

8.4.20 The *CoCP* requires the contractor(s) to maximise the opportunities for recycling this would include the recycling of waste from the site offices and canteen areas on all construction sites.

8.4.21 The majority of welfare waste expected would be paper and card from the offices based at the sites. Food waste would also be sourced from the canteens. Other key materials anticipated would include plastics and metals.

8.4.22 The key recycling containers anticipated would be for: paper and card, plastics and metals.

8.4.23 It is anticipated that the food waste from the canteens would be segregated, so that it can be treated separately (whether it is composting or sent for anaerobic digestion treatment). All separated food waste would be treated in compliance with *Animal By-Products Regulations (ABPR*).

8.4.24 The recycling systems would be designed to minimise the non recyclable element of the waste that would require treatment and disposal.

Vegetation waste from site clearance

8.4.25 The greatest possibility for recycling organic wastes from the clearance of vegetation would be the recycling of green waste into compost. Where possible, trees (removed during site clearance) could also chipped and used as mulch. All vegetative waste would be diverted from landfill unless the material contains invasive plants.

8.4.26 Where invasive species such as Japanese Knotweed are identified during site preparation theses species would be actively treat. This results in minimising the amount of waste generated that contains invasive plants or their seeds, roots and rhizomes (underground root-like stems) (set out in the *CoCP* Part A, Section 11.4). Any waste taken off site would be taken by a licensed waste carrier and go to a suitably authorised landfill site.

8.5 Consistency with the NPS

8.5.1 The *NPS* explains that details should be provided as to:

a. the arrangements proposed for managing any waste produced and the preparation of a Site waste management plan.

b. how excavated material and waste would be managed in accordance with the waste hierarchy.

8.5.2 The Thames Tideway Tunnel project would be a large project with numerous sites that would produce excavated material and waste. As a result, a single *SWMP* would be insufficient to provide an effective system for managing the excavated material and waste that would be generated by the project. Therefore:

a. an overarching *Project wide WMP* would be used to ensure a consistent approach to managing the excavated materials and waste at individual construction sites

b. supported by individual *SWMPs* for each construction site which would be used to control the on site management of excavated materials and waste and would require the identification of waste prevention, reuse and recycling opportunities to help ensure waste is managed in accordance with the waste hierarchy.

8.5.3 Together the *Project wide WMP* and individual *SWMPs* have been designed to ensure that waste would be managed in accordance with the waste hierarchy, to ensure that the requirements of the *NPS* are met. The *Project wide WMP* and *SWMPs* would be delivered through the *CoCP* (Section 10.1.3).

9 Impacts on regional waste infrastructure

9.1 Introduction

9.1.1 Section 4.14.5 of the *NPS* states that the applicant should include an assessment of the impact of the waste arising from development on the capacity of waste management facilities to deal with other waste arising in the area for at least five years of operation

9.1.2 The *NPS* (Section 4.14.6) requires the decision maker to be satisfied that:

a. the waste from the proposed facility can be dealt with appropriately by the waste infrastructure which is, or is likely to be, available; and

b. 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.

9.1.3 This section reviews the available data on current arisings and outlines the likely impact of the Thames Tideway Tunnel project arisings on the infrastructure of London, the South East and the East of England.

9.2 Background

9.2.1 The Mayor's *Business Waste* Strategy, Making Business Sense of Waste, reports that in 2008 the London area generated 20million tonnes of waste, consisting of:

a. 4million tonnes of Local Authority Collected Municipal waste

b. 6.5million tonnes of Commercial and Industrial waste

c. 9.5million tonnes of Construction, Demolition and Excavation CDE[XIV] waste.

9.2.2 Overall, 61% of this total waste was reused, recycled or composted; however, this is largely due to 82% of the CDE waste stream being reused.

9.3 Excavated material

Regional CDE arisings

9.3.1 In the Mayor's Business Waste Strategy it is estimated that CDE annual waste arisings in London will rise from 9.7million tonnes per annum to 11.1million tonnes per annum between 2010 and 2031. The projected tonnages up to 2022 which covers the period when the Thames Tideway Tunnel project would be producing CDE wastes are shown in Table 9.1.

9.3.2 The Mayor's Business Waste Strategy states that projected growth of CDE waste in London will be driven partly by waste generated by major

[XIV] The Mayor's Business Waste Strategy for London refers to Construction, Demolition and Excavation (CD&E) waste with the abbreviation CDE. In this Section the term CDE is used to refer to CD&E waste.

infrastructure projects in the capital, including Crossrail and the proposed Thames Tideway Tunnel project, which is covered in the Mayor's projected arisings.

9.3.3 Details of some anticipated major projects in and around London are given in Annex F, these include:

a. Crossrail
b. Lee Tunnel
c. Docklands Light Rail expansion
d. Olympic Park Legacy
e. Three Mill Island
f. Redevelopment of Battersea Power Station & Northern Line Extension
g. The Tower, One St George Wharf
h. Northern Line Extension to Nine Elms
i. American Embassy
j. High Speed 2
k. National Grid Cable Tunnels

9.3.4 Based on current information these projects could produce over 18million tonnes of excavated material over the period from 2012 to 2026. However this does include an estimated 9.3million tonnes of CDE material from the Crossrail project, which is included in the Mayor's projected arisings.

Table 9.1 Projected London CDE arisings ('000s tonnes) 2010 to 2022 based on Making Business Sense of Waste: The Mayor's Business Waste Strategy for London

Year	CDE arisings	CDE reused/ recycled	CDE landfilled
2010	9,753	7,997	1,756
2011	9,842	8,070	1,772
2012	9,931	8,143	1,788
2013	10,023	8,226	1,797
2014	10,113	8,293	1,820
2015	10,203	8,366	1,837
2016	10,295	8,442	1,853
2017	10,349	8,486	1,863
2018	10,403	8,530	1,873
2019	10,458	8,576	1,882
2020	10,512	9,986	526
2021	10,567	10,039	528
2022	10,609	10,079	530

9.3.5 The South East and East of England regional plans[XV] did not provide overall CDE waste arisings or projections of future tonnages.

Regional CDE landfill deposits

9.3.6 In term of disposal the Environment Agency's *Waste to Landfill: Indicator One for London report for 2010* (EA, 2012)[8]states that "In 2008 approximately 3.3million tonnes of construction and demolition waste went to landfill. In 2007 approximately 28% of this waste was landfilled within London but in 2008 this had fallen to only 16% or 530,000t. 766,000t went to landfill in the East of England and the remaining 1.6million tonnes to landfill in the South East."

9.3.7 Environment Agency (EA) data (EA, 2012)[9] for 2010 show that;

a. 3.3million tonnes of CDE waste were landfilled in the East of England

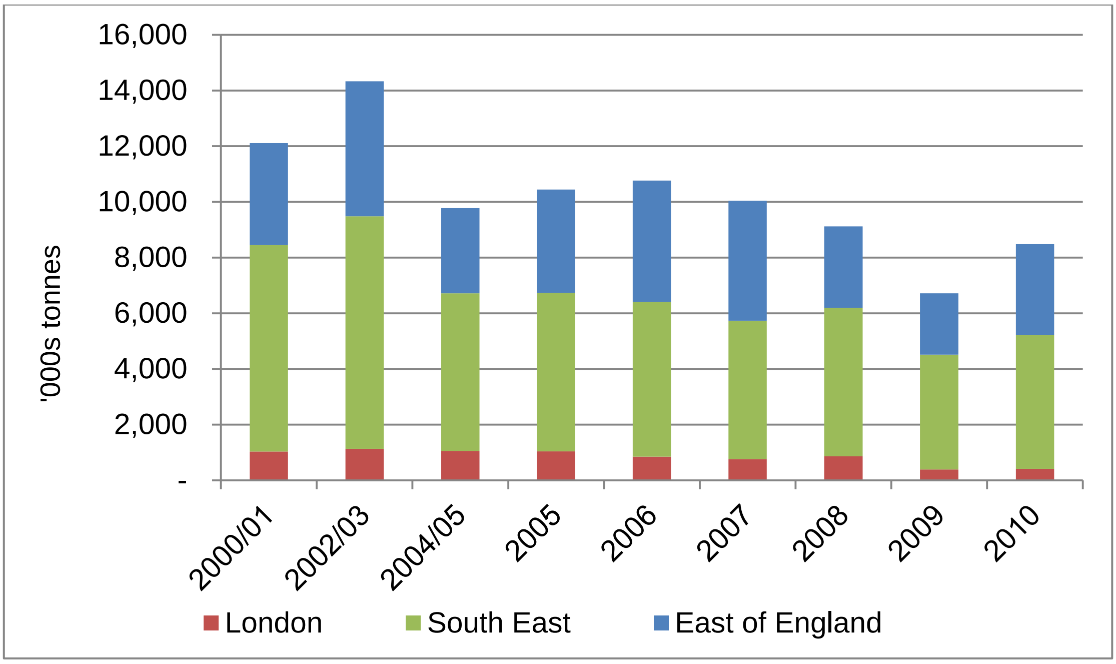
b. 4.8million tonnes of CDE wastes were landfilled in the South East of England

c. 0.4million tonnes of CDE waste were landfilled in London.

9.3.8 This amounts to a total of approximately 8.5million tonnes of CDE waste landfilled across London, South East of England and East of England in 2010.

9.3.9 Plate 9.1 shows the declining trend in the tonnage of CDE waste landfilled across London, South East of England and East of England between 2000/2001 and 2010.

Plate 9.1 Landfill deposits of CDE waste in London, South East of England and East of England 2000/2001 to 2010 (EA, 2012)[10]



[XV] It should be noted that regional plans are still part of the statutory development plan, although the government intends to abolish them (outside of London).

Regional CDE treatment and disposal capacity

9.3.10 In 2010 the EA reported (EA, 2012)[11] that the currently permitted inert and CDE waste landfill capacity was:

a. 8.9million tonnes in the East of England

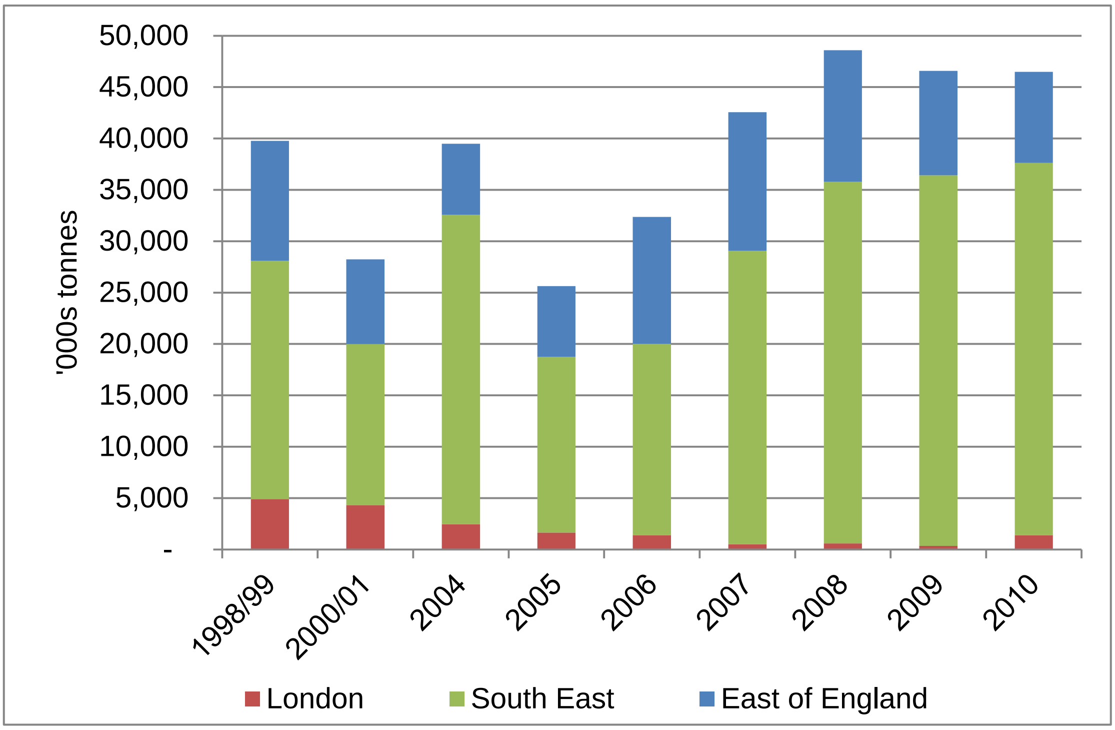
b. 36.2million tonnes in the South East of England

c. 1.3million tonnes in London.

9.3.11 This gives a total permitted landfill capacity for inert and CDE waste of approximately 46.4million tonnes in 2010.

9.3.12 The past trends for inert landfill capacity show that over the last 10 years the capacity has never fallen below 25million tonnes and since 2007, the annual capacity has not fallen below 40million tonnes, as shown in Plate 9.2 .

Plate 9.2 Inert waste landfill capacity in London, South East of England and East of England 2000/2001 to 2010 (EA, 2012)[12]



9.3.13 CDE treatment facilities perform activities such as sorting, screening and crushing. In 2010, the EA reported that permitted treatment capacities for CDE waste were:

a. 18million tonnes per annum in the East of England

b. 33million tonnes per annum in the South East of England

c. 7million tonnes per annum in London.

9.3.14 This gives a total permitted treatment capacity for CDE waste in the region of 58million tonnes in 2010.

9.3.15 Planning authorities are required to consider capacity for inert waste disposal and recycling capacity but not reuse or restoration capacity. As a consequence, there are no reliable published estimates of the capacity for reuse and/or restoration of clean excavated soils and other materials.

9.3.16 There are also limited published estimates for CDE waste managed through activities which are exempt from environmental permitting. However the Communities and Local Government '*Construction demolition and excavation waste survey*' (Communities and Local Government, 2007)[13] estimates that of the 86% of CDE waste recycled in 2005, 26% was spread on exempt sites as shown in Table 9.2.

Table 9.2 Estimate of CDE arisings recycled, spread on exempt land and used and disposed of at landfills in 2005 ('000 tonnes)

	Recycled		Spread on exempt land		Used disposed of at landfill	
	Tonnage	Percentage	Tonnage	Percentage	Tonnage	Percentage
London Total	4,846	60%	2,041	26%	1,147	14%

9.3.17 The *EMOA* has assessed approximately 247 potential options for managing the excavated material from the Thames Tideway Tunnel project. There are currently 17 options on the planning stage preferred list and reserve list. In total, these sites have a combined capacity of approximately 77million tonnes. This includes:

a. approximately 7million tonnes inert capacity at permitted facilities (which would be included in the EA capacity data)

b. 64.5million tonnes capacity which is currently excluded from EA landfill data. This capacity includes restoration of landfills and sites which have yet to obtain environmental permits.

9.3.18 It is estimated that the construction of the Thames Tideway Tunnel project would produce 4.7million tonnes of excavated materials and waste during the construction phase between 2016 and 2021, as shown in Table 9.3 with a peak annual tonnage of 1.9million tonnes in 2018.

Table 9.3 Estimated excavated material production profile ('000 tonnes)

	Year						Total
	2016	2017	2018	2019	2020	2021	
Total Thames Tideway Tunnel project excavated material production profile (tonnes)	63	550	1,940	1,850	145	155	4,703

9.3.19 The EA *State of the Environment* reports for the South East of England, East of England and London all stress that inert landfill capacity within the area is limited. However, it is worth noting that over the past 10 years at least 6million tonnes of CDE wastes have been landfilled each year and inert licensed landfill capacity has remained above 25million tonnes throughout this period, with the capacity since 2007 remaining above

40million tonnes. This reflects the continuing creation of inert landfill capacity through aggregate production throughout the region.

9.3.20 If it is assumed that the permitted inert landfill capacity remains at 40million tonnes and all the Thames Tideway Tunnel project material were to be landfilled it would use between 0.2% and 4.75% of the available capacity in any given year.

9.3.21 However, it is not anticipated that significant quantities of the excavated material from the construction of the Thames Tideway Tunnel project would be disposed of within voids at permitted landfills because:

a. A large amount of the capacity at the options on the planning stage preferred list and reserve list, are not included in the current EA capacity data as it includes restoration of quarries and landfill sites and sites which are yet to obtain environmental permits.

b. There is strong evidence based from the research undertaken for the *EMOA* that there is sufficient capacity within London and the South East for the beneficial use of the excavated material.

9.3.22 In addition the Thames Tideway Tunnel project has set a reporting target to beneficially use a minimum of 85% of clean excavated material an aspiration to beneficially use 100% of clean excavated material (see Section 3.2). This would be secured via an obligation in an agreement with the EA.

9.3.23 Therefore by managing excavated material using the *EMOA* process means that Thames Tideway Tunnel project should not have a substantive impact on regional inert landfill capacity.

9.3.24 In addition to the Thames Tideway Tunnel project, there are other ongoing and proposed developments in the South East region that might give rise to large amounts of waste. This could have implication for the potential facilities for managing the excavated material from the construction of the Thames Tideway Tunnel project and also on waste management facilities in the area. Known large projects are summarised in Table F.1.

9.3.25 Based on current information these projects could produce over 18million tonnes of excavated material over the period from 2012 to 2026. However this does include an estimated 9.3million tonnes of CDE material from the Crossrail project, which is included in the Mayor's projected arisings. This is equivalent to 19% of the currently permitted inert waste landfill capacity, if the material from the Crossrail project is excluded as it is being beneficially used at Wallasea Island.

9.3.26 The *EM&W strategy* sets out an approach to enable C&D wastes from the construction of the Thames Tideway Tunnel project to be managed at the nearest appropriate location. This may mean that some C&D wastes would be delivered to waste management facilities outside London. However, the *EM&W strategy* has set a target to beneficially use a minimum 85% of the clean excavated material and divert at least 80% of C&D waste from landfill. TWUL or their agent will to report progress towards these targets every six months. This would include provision of a written report following each progress review to the EA, the GLA and 14 local authorities across which the Thames Tideway Tunnel project extends. The report would summarise progress towards the targets including any action(s) identified to ensure targets are achieved. It is therefore considered unlikely that large volumes of Thames Tideway Tunnel project C&D wastes would be sent to inert landfills in the area. Therefore the Thames Tideway Tunnel project is unlikely to exceed the levels anticipated within the planning framework for the area. The impact of Thames Tideway Tunnel project waste arisings on regional apportionment is discussed further in Annex F.

9.4 Construction and demolition material

9.4.1 It is estimated that 187,000t of construction and demolition waste (C&D waste) would be generated throughout the construction phase of the project (Section 7). This waste would be managed in accordance with the *Site Waste Management Plan 2008* and the contractor would be required as part of the SWMP process to consider opportunities to reuse the material on site where possible or reuse/ recycle off site making use of local facilities where possible.

9.4.2 It is assumed that a large proportion of the construction and demolition waste would be managed through the network of C&D waste treatment facilities in London.

9.4.3 The 187,000t of C&D waste would represent approximately 2.7% of the 7million tonne treatment capacity in London and 0.3% of the treatment capacity within the South East and East of England (see Section 9.3).

9.4.4 As stated in Section 9.1, 82% of the London CDE waste stream is currently reused and it is anticipated that this reuse rate would be achieved or exceeded by Thames Tideway Tunnel project (based on the objectives and targets given in Section 3). Therefore it is estimated that up to 34,200t could require disposal. This is just 2.6% of the 1.3million tonne inert landfill in London and 0.8% of the 45.1million tonne landfill capacity in the South East and East of England.

9.4.5 This assessment demonstrates the management of the C&D waste from the Thames Tideway Tunnel project would not have adverse effect on the capacity of existing waste management facilities to deal with other waste arisings in the area.

9.5 Hazardous waste

9.5.1 As outlined in Section 6.5, the quantity of excavated material that would be classified as hazardous waste is still to be determined. Therefore to assess the potential impact on regional capacity, a ‘worst case’ scenario has been used. Under this scenario all the made ground from each of the previously developed sites is considered to be hazardous waste. Using this assumption, it is estimate that 62,000t of contaminated made ground would be generated. WEEE would be recycled at appropriately licensed facilities and is not included within these total arisings.

9.5.2 Current annual capacity for hazardous waste, within London, the South East and the East of England, based on EA data from 2010 data is shown in Table 9.4.

Table 9.4 Hazardous waste landfill capacity in the South East region ('000tpa) (EA, 2009)[14]

Region	Merchant hazardous landfills		Landfill with separate cells	
	Number	Annual capacity	Number	Annual capacity
London	1	150	0	0
South East of England	1	70	7	810
East of England	1	249	6	291
Total	**3**	**469**	**13**	**1,101**

9.5.3 Under the worst case assumption detailed above, this would equate to approximately 4% of the current annual capacity.

9.5.4 This assessment demonstrates the management of hazardous waste from the Thames Tideway Tunnel project would not have adverse effect on the capacity of existing waste management facilities to deal with other waste arisings in the area. This assessment demonstrates the management of hazardous waste from the Thames Tideway Tunnel project would not have adverse effect on the capacity of existing waste management facilities to deal with other waste arisings in the area.

9.5.5 Table 9.5 shows that the average annual arisings of hazardous C&D and asbestos waste, between 2006 and 2010, in the South East region has been approximately 280,000tpa. This is 18% of the current annual capacity and so demonstrates considerable excess capacity.

9.5.6 This assessment demonstrates the management of hazardous waste from the Thames Tideway Tunnel project would not have adverse effect on the capacity of existing waste management facilities to deal with other waste arisings in the area.

Table 9.5 South East region hazardous C&D and asbestos waste arisings 2006 – 2010 ('000 tonnes) (EA, 2010)[15]

EWC chapter	17	EWC chapter description		C&D waste and asbestos		
Region	**2006**	**2007**	**2008**	**2009**	**2010**	**5 year average**
London	101	101	206	73	124	121
South East of England	100	106	107	96	65	95
East of England	70	86	57	42	58	63
Total	**271**	**293**	**370**	**211**	**247**	**279**

9.6 Welfare waste

9.6.1 The total estimated waste generated from all construction sites would be in total of between 1,800 and 2,000t over the life of the project based on the number of months the site is operational. This is a small tonnage in comparison with the tonnages of municipal and C&I wastes arising in 2010 (8.5million tonnes per annum (Defra, 2010[16] and Defra, 2011[17]). For London, the South East and East of England the total MSW and C&I arisings are estimated to be 26.4million tonnes.

9.6.2 EA data for 2010 gives the permitted capacity to recycle, treat and dispose of these wastes in London as 11.7million tonnes[18]. For London, the South East and East of England the total non-hazardous landfill capacity for 2010 is estimated to be 87.3million tonnes and treatment capacity (including incineration) is estimated to be 13.6million tonnes.

9.6.3 Welfare wastes arising from the Thames Tideway Tunnel project would not impact on infrastructure capacity in the region and would not have adverse effect on the capacity of existing waste management facilities to deal with other waste arisings in the area.

9.6.4 The *SWMP* process would ensure that welfare waste would be managed through the existing network of commercial and industrial recycling facilities in London.

9.7 Vegetation waste

9.7.1 During site clearance it is estimated that approximately 390t of vegetation waste would be generated.

9.7.2 The EA state that 525,000t of compost were produced in London during 2010 (EA, 2010)[19], the vegetation waste which would be produced from site clearance is approximately 0.07% of this figure and is therefore unlikely to have an adverse impact on regional infrastructure capacity.

9.7.3 However, it should be noted that the London Mayor (in the *Mayor's Business Waste Strategy for London Nov 2011 (GLA, 2011)*[20]) identifies an infrastructure capacity gap of 648,000t by 2015 and 819,000t by 2020 for composting and anaerobic digestion. The waste compositions utilised within the Strategy illustrates that the food waste is a large proportion of organics waste, therefore new infrastructure required will need to target the treatment of this food waste stream.

9.8 Consistency with the NPS

9.8.1 The *NPS* advises that excavated material and waste arisings from the Thames Tideway Tunnel project should not have an adverse effect on the capacity of existing waste management facilities to deal with other waste arisings in the area. The assessment, presented in Sections 9.1 to 9.7, concludes that there is sufficient regional capacity to accommodate the Thames Tideway Tunnel project excavated material and wastes without having an adverse effect on overall regional capacity because:

a. the 17 receptor sites on the planning stage preferred list and the reserve list have a combined capacity of approximately 77million tonnes (of which only 7million tonnes is currently captured in the EA capacity data). This demonstrates there is capacity for the beneficial use of excavated material.

b. the *SWMP* system would require construction and demolition (C&D) waste to be treated and recovered where practical. The 187,000t of C&D would represent approximately 2.7% of the 7million tonne treatment capacity in London and 0.3% of the treatment capacity within the South East and East of England.

c. the exact quantity of waste that would be classified as hazardous is still to be determined. The worst case assumption is that all 62,000t of made ground is sufficiently contaminated to be classified as hazardous waste. Disposing of this waste would only require approximately 4% of the current hazardous waste landfill capacity in London, the South East of England and the East of England.

d. approximately 2,000t of welfare waste would be generated over the 6 year construction period. This is a small tonnage compared to the 8.5million tonnes of municipal and commercial and industrial waste produced in London per annum, for which there is 11.7million tonnes of permitted recycling, treatment and disposal capacity in London alone.

e. the vegetation waste which would be produced from site clearance is approximately 0.07% of the material composted in London during 2010.

9.8.2 Table 9.6 provides a summary of Thames Tideway Tunnel project arisings in relation to regional waste arisings and waste management capacity.

Table 9.6 Thames Tideway Tunnel project excavated material and wastes in relation to regional waste arisings and capacity

Waste type	Thames Tideway Tunnel project estimated arisings (‘000 tonnes)	Regional arisings (‘000tpa)	Regional capacity (‘000 tonnes) (Thames Tideway Tunnel arisings as a % of the regional capacity provided in bracketso)		
			Landfill	Treatment	As yet unpermitted
Excavated material	4,700	21,000[a]	46,400[b] (10.5%)	58,000[c] (8.4%)	64,500[d] (7.5%)
Construction and demolition	187				
Excavated hazardous waste	62[e]	280[f]	1,570[g] (4.4%)		-
Non excavated hazardous waste	7[h]				-

Waste type	Thames Tideway Tunnel project estimated	Regional arisings (‘000tpa)	Regional capacity (‘000 tonnes) (Thames Tideway Tunnel arisings as a % of the regional capacity provided in bracketso)		
Vegetation	0.4	3,915[i]	87,317[j] (<0.01%)	1,799[k] (0.02%)	-
Welfare waste	2	26,414[l]	87,317[m] (<0.01%)	13,620[n] (0.01%)	-

a. CDE arisings from London, South East and East of England

b. Total permitted landfill capacity for inert and CDE waste in the region in 2010

c. Total permitted treatment for 2010 taken from EA permitted capacity

d. Estimated from Thames Tideway Tunnel project planning stage preferred list and reserve list receptor sites

e. This is the ‘worst case’ scenario that all the made ground from each of the previously developed sites is considered to be hazardous waste as detailed in Section 9.5

f. Hazardous C&D arisings including asbestos for London, South East and East of England 2010 EA data excludes oils and greases

g. Hazardous Landfill capacity for London, South East and East of England 2009 EA data

h. Estimated based on Lee Tunnel hazardous waste arisings Thames Waste data

i. Estimated as 14% of C&I wastes and 16% of MSW based on Defra data

j. Non-hazardous landfill capacity for London, South East and East of England 2010

k. Composting throughput for London, South East and East of England 2010

l. C&I and MSW arisings for London, South East and East of England 2010

m. Non-hazardous landfill capacity for London, South East and East of England 2010

n. Treatment throughput and incinerator capacity for London, South East and East of England 2010

o. The % figure is the arising by waste type as a % of the regional capacity in each column (figures for excavated material and C&D waste have been combined when calculating the % as have the hazardous waste types).

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10 Review and monitoring of this EM&W strategy

10.1.1 The *EM&W strategy* is a working document and would be reviewed by Thames Water for the duration of the project and following the application approval and updated as required.

10.2 Project wide WMP and SWMP templates

10.2.1 As highlighted in Section 8, templates for the *Project wide WMP* and *SWMP* are provided, in Annex E, voluntarily at this stage so that stakeholders have an indication of the proposed content.

10.2.2 The templates provided incorporate comments from the EA on an earlier version of the template.

10.3 Monitoring progress of EM&W strategy objectives

10.3.1 Achievement of the *EM&W strategy* objectives would be assessed using the following targets , as set out in Section 3:

a. divert at least 80% of construction and demolition waste from landfill;

b. beneficially use a minimum of 85% of clean excavated material

c. all of the receptor sites used for the Thames Tideway Tunnel project excavated material will have been assessed against the *EMOA* and be equivalent to those sites on the preferred receptor site list

d. All of Thames Tideway Tunnel project construction sites have a *SWMP* which is updated quarterly.

10.3.2 TWUL or their agent would review progress towards these targets every six months. If the progress suggests that one or more may not be achieved, TWUL or their agent would agree action(s) with the contractor(s) to ensure that the targets are achieved.

10.3.3 TWUL or their agent would share the findings of the review on a six monthly basis, in the form of a written report, with the EA, the GLA and 14 local authorities across which the Thames Tideway Tunnel project extends. The EA would be responsible for the approval of the biannual reports under the terms of the agreement between TWUL and the EA.

10.4 Delivery mechanism

10.4.1 The management of excavated materials and waste would be undertaken by the contractor(s) and would be overseen by Thames Water Utilities Limited (or their agent). The delivery of the measures outlined in this strategy would be secured via two different routes:

a. compliance with the CoCP via a requirement imposed on the application

b. through an agreement with the Environment Agency.

10.4.2 The measures for the management of excavated material and waste at construction sites would be secured via compliance with the Code of Construction Practice through a requirement imposed on the application.

10.4.3 The selection of receptor sites for the beneficial use of excavated material and the monitoring and reporting against excavated material and waste objectives would be delivered via a side agreement with the EA. Table EX.1 shows the mechanisms for delivering the measures relating to excavated materials and waste.

Table 10.1 Delivery mechanisms for the management of excavated material and waste

Deliverable	Summary	Delivery mechanism	Responsibility
On site management of waste and excavated material	The *Code of construction practice* (CoCP) sets out measures to protect the environment and limit disturbance from construction activities, including waste and excavated material management. Measurers relating to on site management of waste and excavated materials include: • compliance with the project wide waste management plan and site waste management plan(CoCP Section 10.1.3 and 10.1.4) • the development of demolition reuse plans (CoCP Section 10.1.11) • measures relating to the on site management of excavated material (CoCP Section 10.1.2and 10.1.3).	Compliance with the *CoCP* is to be secured through a requirement imposed on the application	TWUL or their agent /Contractor
Selection of suitable receptor sites for excavated materials	All of the receptor sites used for the excavated materials arising from the construction activities would be assessed against the EMOA and would perform no worse than those sites on the preferred receptor site list. The EA would agree the inclusion of new receptor sites for the excavated material.	Side agreement with the Environment Agency (EA).	TWUL or their agent
Monitoring waste objectives	Reporting of progress towards targets would be undertaken through the production of a	Side agreement with the	TWUL or their agent

Deliverable	Summary	Delivery mechanism	Responsibility
against targets	biannual report.	Environment Agency (EA).	

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11 Roles and responsibilities

11.1.1 This section sets out the roles and responsibilities of those involved in the construction of the Thames Tideway Tunnel project related to excavated material and waste management.

11.2 Governance

11.2.1 This *EM&W strategy* assumes that the construction of the Thames Tideway Tunnel project would be undertaken by Thames Water using a contractor(s). It is assumed that Thames Water would have oversight of the entire project.

11.2.2 It is assumed that the contractor(s) would be responsible for the management of subcontractors, and that waste services would either be procured by the contractor(s) or on a site-by-site basis as appropriate.

11.3 Thames Water

11.3.1 Thames Water would:

a. ensure compliance with the following:
   - i duty of care and other legislative requirements
   - ii planning and permit conditions
   - iii *CoCP*
   - iv *Project wide WMP* and *SWMP*
   - v *EM&W strategy and EMOA*

b. provide the strategic objectives and corporate vision

c. ensure that engagement with stakeholders and regulators, on waste management issues, is undertaken

d. set waste management performance indicators and standards through *Project wide WMP*

e. monitor and record waste management performance indicators through *Project wide WMP*.

11.4 Contractor(s)

11.4.1 The contractor(s) would:

a. comply/ensure compliance with duty of care and other legislative requirements

b. comply/ensure compliance with the, Thames Tideway Tunnel project's *CoCP, Project wide WMP* and *SWMPs.*

c. use the *EMOA* methodology to identify appropriate receptor sites of the excavated material

d. ensure that performance indicators and standards as required by the Thames Water are met

e. ensure that there is a secure waste compound where segregated materials for on-site reuse or off-site recycling can be safely stored

f. ensure the timely removal of excavated materials and wastes from Thames Tideway Tunnel project construction sites

g. monitor the general site conditions in terms of waste management

h. ensure that all site workers are provided with appropriate training in on site waste management and recycling procedures.

11.5 Engagement with external bodies

11.5.1 The EA has been a key stakeholder in the *EMOA,* with the *EMOA* methodology being developed in consultation with the EA through a series of working group workshops.

11.5.2 The *EMOA* evaluation objectives and evaluation indicators were also developed in consultation with and agreed with the EA.

11.5.3 The EA have indicated that they consider that the *EMOA* provides a systematic approach for identifying potential suitability receptor sites for the excavated material from the Thames Tideway Tunnel project.

11.5.4 TWUL or their agent would ensure through the *CoCP* that the final location(s) and end use(s) for the material would perform as well as those receptor sites identified on the *Planning stage preferred list*. Approval of the final list of receptor sites would be sought from the Environment Agency and secured via an agreement.

11.5.5 In addition the EA were consulted on the *Project wide WMP* and *SWMP* templates and the current versions of the templates incorporate comments from the EA. If application consent is obtained, the template would be reviewed prior to construction commencing to ensure it is still consistent with good practice and the EA would be consulted on any proposed changes and approval of the final template would be sought from the EA.

11.5.6 Thames Waters intend to report progress towards these reporting targets every six months. TWUL or their agent would share the findings of the review on a six monthly basis, in the form of a written report, with the EA, the GLA and 14 local authorities across which the Thames Tideway Tunnel project extends. The EA would be responsible for the approval of the biannual reports under the terms of the agreement between TWUL and the EA.

12 Operational phase

12.1 Thames Tideway Tunnel project maintenance arisings

12.1.1 Once the Thames Tideway Tunnel project is operational, it would be necessary to carry out routine maintenance at three to six-monthly intervals at all sites. Such maintenance would consist of general inspection, lubrication and testing of the mechanical and electrical equipment. It is unlikely that any waste would be generated during these maintenance intervals. Although the occasional removal of debris trapped in interception chambers and high level structures within the shaft may be required. This is estimated to be less than one skip of debris at each site per annum, which would equal to approximately 1,000tpa[XVI].

12.1.2 It is anticipated that the tunnel system would be self-flushing and that most of the accumulated sediment and debris would be progressively flushed during each storm event towards the Tideway Pumping Station at Beckton STW. Small grit and debris would pass through the pumps and larger solids would be trapped by screens and removed by clamshell grab following each storm event. A provisional estimate of the material removed as a result of the Thames Tideway Tunnel from the screens at Beckton STW is approximately 2,500tpa.

12.1.3 An inspection and maintenance schedule for the main tunnel is planned once every ten years. It is expected that during this period settled solids would need to be removed from the tunnel. Due to the variable quantity and characteristics of the CSO wastewater, the amount of solid accumulation is difficult to estimate at this time. There is a provisional estimate of approximately 5,000m^3. It is anticipated that most of this material would accumulate in the eastern section of the tunnel.

12.1.4 The ventilation and odour control facilities for the tunnel system would require spent filter media to be changed. This depends on the frequency of operation and the level of odour control required. It is estimated that the activated carbon filter media would be replaced:

a. on a 3 to 5 year cycle at active ventilation facilities which operate continuously; and

b. on a 5 to 10 year cycle at the passive filters which operate infrequently.

12.1.5 For the Thames Tideway Tunnel project, it is estimated that the amount of spent filter media would be about 40t every 3 to 5 years at the active ventilation plant and 35t every 5 to 10 years at the passive ventilation sites. In conjunction with this, 35t of spent media would be removed from the Lee Tunnel active ventilation plant facilities once every three years.

[XVI] Based on the 24 Thames Tideway Tunnel project sites generating approximately 40t of debris per site per annum.

12.2 Beckton Sewage Treatment Works

Waste

12.2.1 The operation of the tunnel system would increase the volume of solid waste arisings at Beckton STW. Waste produced at Beckton STW comprises the residues remaining after treatment of the sewage by the works. The waste includes:

a. grit, which is currently sent to landfill

b. rags and other solids (oversize screenings), which are currently sent to landfill

c. sewage sludge, which is currently used to produce energy in the onsite sludge-powered generator. The residual waste produced from this treatment is made up of ash.

12.2.2 Based on a comparison of treated volumes, the solid waste arisings at Beckton STW are estimated to increase by approximately three per cent as a result of the future operation of the Thames Tideway Tunnel project. These arisings would be dealt with by the existing (and proposed) STW processes as part of the normal STW waste stream (and would be indistinguishable from it – see below).

12.2.3 A more detailed estimate for waste arisings at Beckton STW would be made once composition data and detail regarding management processes have been obtained. This will be included in subsequent versions of the *EM&W strategy*.

12.2.4 Sewage sludge is the main residual solid waste produced as a result of the sewage treatment process. At present, all sewage sludge treated by Thames Water is put to beneficial use, with 72% treated and recycled to agricultural land as a nutrient-rich fertiliser (known as biosolids). The remainder is used to generate renewable energy to help power Thames Water sites, or used in land restoration.

12.2.5 Thames Water *Corporate Responsibility Report 2011/2012* states that during 2011, 259,384 tonnes of dry solids were produced and 100% of this was beneficially used, sending none to landfill.

Sludge strategy

12.2.6 The sewage sludge produced at Beckton STW would be covered by Thames Water's 25-year *Sludge Strategy*, which is based on an assessment of a range of treatment options which have helped identify a preferred list for each sludge area in the Thames Water region.

12.2.7 The *Sludge Strateg*y states that:

"In the medium term, from 2010 to 2015, Thames Water will:

a. work to ensure they can maintain the recycling to agricultural land outlet where suitable land is available

b. maximise energy recovery and reduce the quantity of sewage sludge recycled by reducing the amount of solids within the product." (*25-year Sludge Strategy.* Thames Water. December 2008.)

12.2.8 In the long term, from 2015 to 2035, the strategy states that:

12.2.9 "Thames Water will:

a. continue to implement a sustainable sludge strategy, maximising beneficial use and considering issues of acceptability, energy, transport, odour, nutrients and local constraints*."*

Management

12.2.10 By the time the Thames Tideway Tunnel project would be operational, the following management arrangements would be used for the solid waste produced at Beckton STWs:

a. Grit arisings would continue to be washed and recycled back into aggregate wherever possible or disposed of accordingly.

b. As part of the preliminary and primary treatment at Beckton STW, a fat, oil and grease removal plant would treat materials.

c. It is envisaged that raw sewage solids would be sent to the proposed anaerobic digestion plants at Beckton STW and Riverside STW.

d. Any other organic matter not treated at the anaerobic digestion plants would be dried into sludge cakes. These cakes would continue to be incinerated to generate renewable energy.

e. Screening wastes would be managed to try to avoid disposal to landfill where possible.

12.3 Sewage derived litter

12.3.1 Overflows from the combined sewers cause solid sewage and related material to be deposited on the foreshore of the River Thames. The Thames Tideway Tunnel project would lead to a substantial reduction in the deposits on the foreshore.

12.3.2 The *Thames Tideway Strategic Study* estimated that overflows from the combined sewers deposit approximately 10,000t of sewage-derived solid material into the Thames annually.

12.3.3 It is estimated that the Thames Tideway Tunnel project would reduce the volume of materials discharged to the river by 94%. This is equivalent to a reduction of litter discharged to the river from 10,000tpa to 600tpa.

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13 Conclusion

13.1.1 The *EM&W strategy* describes the system developed by TWUL for the sustainable management of excavated material and waste from the Thames Tideway Tunnel project. The approach is consistent with the guidance in the *National Policy Statement for Waste Water (NPS)* in relation to implementing sustainable waste management through the application of the waste hierarchy. Table 2.1 in Section 2 summarises how the approach is consistent with the guidance in the *NPS* relating to managing excavated material and waste for the Thames Tideway Tunnel project.

13.1.2 The construction of the Thames Tideway Tunnel project would generate an estimated 4.9 million tonnes of excavated materials and waste. 96% (4.7 million tonnes) of the material generated during the construction phase would be excavated materials.

13.1.3 To ensure that this excavated material is managed in a sustainable manner, a bespoke *Excavated materials options assessment (EMOA)* has been developed, in consultation with the Environment Agency. The *EMOA* allows the assessment of suitable potential receptor sites for the treatment, handling or use of Thames Tideway Tunnel project excavated material. It assesses environmental, social, operational (including costs and reliability of delivery) and policy issues.

13.1.4 The *EMOA* has identified suitable potential receptor sites for the treatment, handling or use of Thames Tideway Tunnel project excavated material and by incorporating a beneficial use test it aims of ensure that all excavated material is put to beneficial use.

13.1.5 The 17 receptor sites on the *Planning stage preferred list* and the reserve list have a combined capacity of approximately 77million tonnes. This demonstrates there is capacity for the beneficial use of excavated material. Only receptor sites that meet or exceed the performance of the planning stage preferred options would be used for the management of excavated material(approval of the final list of receptor sites would be sought from the Environment Agency; this would be an obligation in an agreement with the EA).

13.1.6 The *EM&W strategy* has also identified:

a. a series of measure that would ensure compliance with the waste hierarchy

b. a system that would allow the effective management of excavated material and waste

c. the monitoring and review of progress towards the delivery of the *EM&W strategy* objectives

13.1.7 All works would be undertaken in accordance with the Thames Tideway Tunnel project *Code of Construction Practice (CoCP).* Compliance with the *CoCP* is to be secured through a requirement imposed on the application.

13.1.8 The CoCP has a specific section relating to waste management (Part A Section 10).

13.1.9 The overarching *Project wide WMP* would ensure a consistent approach to managing the excavated materials and waste at individual construction sites. The *Project wide WMP* would provide a central location for all Thames Tideway Tunnel project waste information.

13.1.10 TWUL or their agent would use an overarching *Project wide WMP* supported by individual *SWMPs* to control the on site management of excavated materials and waste.

13.1.11 The *Project wide WMP* and the individual *SWMPs* have been designed to ensure that excavated material and waste would be managed in accordance with the waste hierarchy.

13.1.12 With regards to monitoring TWUL or their agent would review progress towards the *EM&W strategy* targets every six months. If the progress suggests that one or more may not be achieved, TWUL or their agent would agree action(s) with the contractor(s) to ensure that the targets are achieved.

13.1.13 TWUL or their agent would share the findings of the review on a six monthly basis, in the form of a written report, with the EA, the GLA and 14 local authorities across which the Thames Tideway Tunnel project extends. The EA would be responsible for the approval of the biannual reports under the terms of the agreement between TWUL and the EA.

13.1.14 During the operational phase, the increased volumes of sewage captured within the main tunnel would lead to a corresponding increase in the solid waste arisings at the Beckton Sewage Treatment Works. This additional waste would be inseparable from the existing solid waste stream and so would be dealt with in accordance with Thames Water's existing (and future) waste management procedures for sewage wastes.

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Annex A: National legislation and policy

A.1 Waste Framework Directive

A.1.1 The original EU *Waste Frame Directive, 75/442/EEC*, established the general framework for the management of waste across the EU. It has subsequently been review and update on a number of occasions with the latest revision in 2008, Directive 2008/98/EC (Waste FD). This revision replaced and repealed the previous versions and consolidated within its text the directives on waste oils and hazardous waste.

A.1.2 The overarching aim of the Waste FD is given in Article 1:

"This Directive lays down measures to protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste and by reducing overall impacts of resource use and improving the efficiency of such use." (*Waste Framework Directive 2008/98/EC*. European Union. December 2008.)

A.1.3 The Waste FD defines certain key terms which underpin all EU and UK environmental legislation, including the definitions of:

a. waste and what properties of a waste make it a hazardous waste

b. materials which are not waste and are therefore excluded from the Directive scope

c. the terms 'reuse', recycling', 'recovery' and 'disposal'

d. the 'waste hierarchy'.

A.1.4 To achieve its aim, it requires that member states:

a. ensure proper recovery and disposal of waste without damage to human health or the environment

b. ensure that the cost of disposal is borne by the waste holder in accordance with the polluter pays principle

c. prepare and adhere to the *WMP*

d. ensure that waste carriers are registered.

A.1.5 The new features of the Waste FD are that it:

a. sets new recycling targets to be achieved by the Member States by 2020, including recycling rates of 50% for household and similar waste, and 70% for construction and demolition waste

b. strengthens provisions on waste prevention through an obligation for Member States to develop national waste prevention programmes and a commitment from the EU Commission to report on prevention and set waste prevention objectives

c. sets a clear, five-step 'hierarchy' of waste management options according to which prevention is the preferred option, followed by reuse, recycling, and other forms of recovery, and with safe disposal as the last recourse

d. clarifies a number of important definitions, such as recycling, recovery and waste itself.

A.1.6 The Waste FD has been transposed into English legislation by the *Waste (England and Wales) Regulations 2011*, which came into force in March 2011.

A.1.7 The *Waste (England and Wales) Regulations 2011* address the requirements of the Waste FD and amend existing waste legislation through the following measures:

a. enshrines the waste hierarchy within English legislation rather than guidance

b. sets out the scope for national WMPs, including their extent, which is now the seaward edge of territorial waters

c. requires businesses to confirm that they have applied the waste management hierarchy when transferring waste, and include a declaration on their waste transfer note or consignment note. If a business has an environmental permit for an operation which generates waste, it will have to apply the waste management hierarchy. This will be a condition of new environmental permits, and will be added to existing permits when they are reviewed

d. introduces a two-tier system for waste carrier and broker registration, including a new concept of a waste dealer

e. makes amendments to hazardous waste controls

f. excludes some categories of waste from waste controls such as waste waters which are covered by the Urban Waste Water Treatment Directive.

A.2 Definition of waste

A.2.1 Waste is defined in Article 3 (1) of the Waste FD as: "any substance or object which the holder discards or intends or is required to discard." (*Waste Framework Directive 2008/98/EC*. European Union. December 2008.)

A.2.2 However, within Article 2 of the Waste FD there is a list of materials which are always excluded from the definition of waste and therefore are excluded from the controls on waste in the Waste FD. These materials include:

a. gaseous effluents

b. uncontaminated subsoil which is reused for construction purposes on the site of production

c. contaminated soils which remain in situ.

A.2.3 A number of materials are excluded from the scope of the directive, so far as they are covered by other EU directives, including:

p. wastewaters

d. mines and quarrying wastes.

A.2.4 Once a material has been classified as a 'waste', it must undergo some form of physic-chemical treatment to allow it to re-enter the chain of utility as a non-waste. To prevent abuses of this system, a number of Environment Agency approved protocols or codes of practice exist, each one generally covering a single material type or process which, if followed, allows 'waste' to become 'non-waste'. Once a material is non-waste, the legal requirements for the handling, storage, and use of that material change.

A.2.5 Non-waste is therefore material which the holder does not intend to be discarded and, when reused, would pose an acceptable or negligible risk to human health and the environment. As a non-waste, it must be suitable for use without any further treatment, there must be certainty of use and material should be used in the quantities necessary for that use and no more.

A.2.6 In summary, material derived from the Thames Tideway Tunnel project would fall into two categories:

a. Waste – material which poses an unacceptable risk to human health/ environment and/or material which is geotechnically unsuitable for any use and/or material which is surplus to requirements.

b. Non-waste – material which is suitable for reuse (in terms of human health/environmental risk and geotechnical suitability) and there is certainty of use (there is an outlet which requires the material and there is a contract/agreement in place and reuse is allowed under the planning permission).

Soil

A.2.7 The voluntary *CL:AIRE Definition of Waste Code of Practice* (CoP) provides a regulator approved framework to determine on a site by site basis whether excavated materials are classified as waste or not and determine when treated excavated waste can cease to be waste for a particular use. The *CL:AIR*E guidance states that if materials are dealt with in accordance with the *CL:AIRE CoP* the EA considers that those materials are unlikely to be waste if they are used for the purpose of land development. Land development includes redevelopment, remediation and regrading.

A.2.8 The *CL:AIRE CoP* relates to excavated material including: Soil both top soil and sub-soil, parent material and underlying geology; ground based infrastructure that is capable of reuse within earthworks projects, e.g. road base, concrete floors; made ground; source segregated aggregate material arising from demolition activities such as crushed brick and concrete, to be used on the site of production within earthworks projects or as sub-base or drainage materials; and stockpiled excavated materials that include the above. The Thames Tideway Tunnel project excavated materials are included on this scope.

A.2.9 The *CL:AIRE CoP* can be used for the direct transfer of clean naturally occurring materials to another development site. Clean naturally occurring materials include: soil, both top soil and subsoil; parent material; clays, silts, sands and gravels; underlying geology and made ground consisting of those materials. Under the *CL:AIRE CoP* waste, as defined within the Waste FD, can cease to be waste following suitable physic-chemical treatment to reduce contamination loads to an acceptable level. The *CL:AIRE CoP* provides a robust legal framework to demonstrate that a material is no longer waste and can re-enter the chain of utility.

A.2.10 Article 3 of the Waste FD, defines waste as:

A.2.11 "Waste' is any substance or object which the holder discards or intends or is required to discard."

A.2.12 Therefore, under this definition, the key issue is discarding the material in question. Once a material has been classified as waste, it remains waste until it is fully recovered. This is the case even if a subsequent holder uses it. The *CL:AIRE CoP* sets out a number of factors for determining whether the material is waste.

a. factor 1: protection of human health and protection of the environment

b. factor 2: suitability for use, without further treatment

c. factor 3: certainty of use

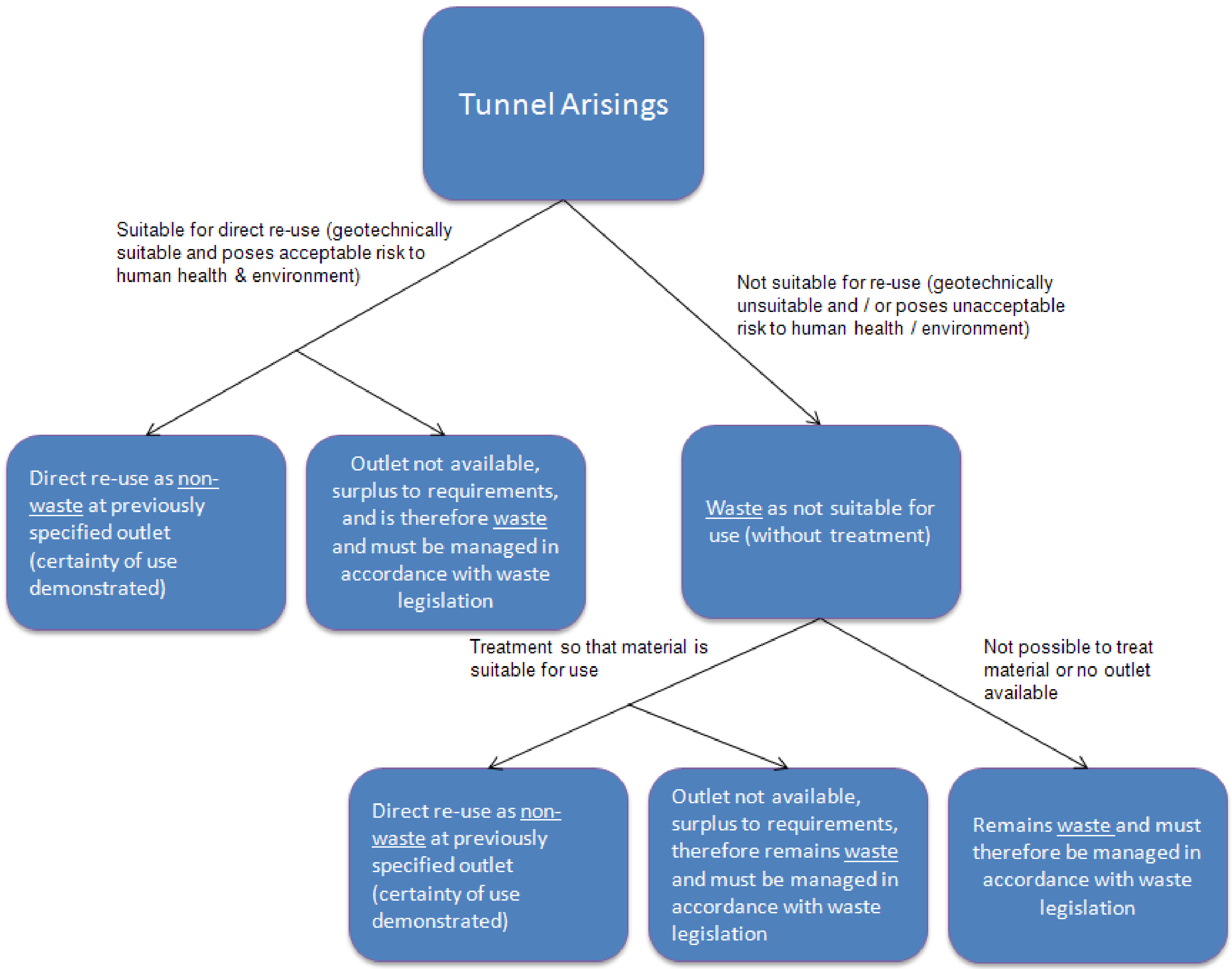
d. factor 4: quantity of material.

A.2.13 A *Materials Management Plan* (*MMP*) needs to be produced and signed by a Qualified Person to demonstrate that these factors have been considered and that a correct determination has been made in relation to the nature of materials.

A.2.14 Material which is surplus to an outlet's reuse requirements and/or remains unsuitable for use (poses an unacceptable risk to human health/environment and/or is geotechnically unsuitable) following treatment would remain waste and therefore be subject to waste legislation requirements.

A.2.15 This is summarised in the flow diagram Plate A.1.

Plate A.1 Material management options



Aggregates and demolition wastes

A.2.16 WRAP's aggregate quality protocols also provide a framework to demonstrate that the production of aggregates from inert CDE waste can make those materials in to a non-waste after some form of physic-chemical treatment.

A.2.17 The purpose of the WRAP quality protocols[21] is to provide a uniform control process for producers, from which they can reasonably state and demonstrate that their product has been fully recovered and is no longer a waste. It also provides purchasers with a quality-managed product to common standards, which increases confidence in performance. Also, the framework created by the protocol provides a clear audit trail for those responsible for ensuring compliance with waste management legislation.

A.3 National Waste Strategy

A.3.1 In 2007, Defra published the *Waste Strategy for England*. This document had the aim of increasing resource efficiency, while reducing levels of waste arisings and decoupling waste from economic growth. This is to be achieved through the application of the waste hierarchy at all stages of a product's lifecycle, and the strategy has an emphasis on producer responsibility for the resources they use and the waste they generate.

A.3.2 It has been assumed that any policy changes in the *Waste Review 2011* take precedence over the *Waste Strategy 2007* policies until the *National Waste Management Plan* for England has been developed which will replace *Waste Strategy 2007*.

A.4 Waste Review 2011

A.4.1 Defra carried out a review of waste policies in England which was published in June 2011. The review looks at all aspects of waste policy and delivery in England. Its main aim is to ensure that the right steps towards creating a 'zero waste' economy are taken, where resources are fully valued, and nothing of value gets thrown away.

A.4.2 The review was been guided by the waste hierarchy, which is both a guide to sustainable waste management and a legal requirement. In driving waste up the waste hierarchy, it must be ensured that the UK meets its EU obligations and targets on waste management.

A.4.3 Progress would be assessed against a number of EU targets which are focussing on specific areas. For construction and demolition waste, the Waste FD target to recover at least 70% of construction and demolition waste by 2020 needs to be achieved.

A.4.4 The waste review also acknowledges that there will be some types of waste for which landfill remains the best or least worse option, including some inert materials and waste to restore quarries and mineral workings.

Annex B: Regional and local waste policy

B.1 Waste policy in London

B.1.1 The regional policies dealing with waste issues that are likely to affect the proposed development are described in the *London Plan 2011.* (Greater London Authority 2011). Table B.1 below details the relevant waste policies in the *London Plan 2011*.

Table B.1 Relevant waste policies in the London Plan 2011

Policy	Description
Policy 5.16, *Waste Self Sufficiency*	A. The Mayor will work with London boroughs and waste authorities, the London Waste and Recycling Board (LWaRB), the EA, the private sector, voluntary and community sector groups, and neighbouring regions and authorities to: • manage as much of London's waste within London as practicable, working towards managing the equivalent of 100 per cent of London's waste within London by 2031 • create positive environmental and economic impacts from waste processing • work towards zero biodegradable or recyclable waste to landfill by 2031. B. This will be achieved by: • minimising waste • encouraging the reuse of and reduction in the use of materials • exceeding recycling/composting levels in municipal solid waste (MSW) of 45 per cent by 2015, 50 per cent by 2020, and aspiring to achieve 60 per cent by 2031 • exceeding recycling/composting levels in commercial and industrial waste of 70 per cent by 2020 • exceeding recycling and reuse levels in CE&D waste of 95 per cent by 2020 • improving London's net self-sufficiency through reducing the proportion of waste exported from the capital over time • working with neighbouring regional and district authorities to co-ordinate strategic waste management across the greater South East of England.
Policy 5.17, *Waste Capacity*	A. The Mayor supports the need to increase waste processing capacity in London. He will work with London boroughs and waste authorities to identify opportunities for introducing new waste capacity, including strategically important sites for waste management and treatment, and resource recovery parks/consolidation centres, where recycling, recovery and manufacturing activities can co-locate. B. Proposals for waste management should be evaluated against the

Policy	Description
	following criteria: • locational suitability • proximity to the source of waste • the nature of activity proposed and its scale • a positive carbon outcome of waste treatment methods and technologies (including the transportation of waste, recyclates and waste-derived products) resulting in greenhouse gas savings, particularly from treatment of waste-derived products to generate energy • the environmental impact on surrounding areas, particularly noise emissions, odour and visual impact and impact on water resources • the full transport impact of all collection, transfer and disposal movements, particularly maximising the potential use of rail and water transport using the Blue Ribbon Network. The following will be supported: • developments that include a range of complementary waste facilities on a single site • developments for manufacturing related to recycled waste • developments that contribute towards renewable energy generation, in particular the use of technologies that produce a renewable gas • developments for producing renewable energy from organic/biomass waste. C. Wherever possible, opportunities should be taken to provide combined heat and power and combined cooling heat and power. D. Developments adjacent to waste management sites should be designed to minimise the potential for disturbance and conflicts of use. E. Suitable waste and recycling storage facilities are required in all new developments.
Policy 5.18, *Construction, excavation and demolition*	A. New CE&D waste management facilities should be encouraged at existing waste sites, including safeguarded wharves, and supported by: • using mineral extraction sites for CE&D recycling • ensuring that major development sites are required to recycle CE&D waste on site, wherever practicable, supported through planning conditions. B. Waste should be removed from construction sites, and materials brought to the site by water or rail transport, wherever that is practicable.
Policy 5.19, *Hazardous Waste*	A. The Mayor will prepare a hazardous waste strategy for London and will work in partnership with the boroughs, the EA, industry, and neighbouring authorities to identify the capacity gap for dealing with hazardous waste and to provide and maintain direction on the need for hazardous waste management capacity. B. Pending outcome of the work proposed in Para. A of this policy,

Policy	Description
	development proposals that would result in the loss of existing sites for the treatment and/or disposal of hazardous waste should not be permitted unless compensatory site provision has been secured in accordance with Policy 5.17H.
Policy 5.22, *Hazardous Substances*	A. The Mayor will work with all relevant partners to ensure that hazardous substances, installations and materials are managed in ways that limit risks to London's people and environment. B. When assessing developments near hazardous installations: • site specific circumstances and proposed mitigation measures should be taken into account when applying the Health and Safety Executive's *Planning Advice Developments near Hazardous Installations* (PADHI) methodology • the risks should be balanced with the benefits of development and should take account of existing patterns of development.

B.2 Local planning policy

B.2.1 The main waste related policy areas in the local planning framework of the local planning authorities (including the London Boroughs (LB) of Hammersmith and Fulham, Tower Hamlets, Lambeth, Lewisham, Newham, Southwark, Ealing, Hounslow and Richmond upon Thames, the Royal Borough of Kensington and Chelsea, the City of Westminster Council, the Royal Borough of Greenwich, the LB of Wandsworth and the City of London Corporation) that are potentially affected by the Thames Tideway Tunnel project are summarised in Table B.2 below.

Table B.2 Summary of the main topic areas relevant to this *EM&W strategy*

Policy objective	Number of local authorities	Description of policy field
Sustainable development	11	The local authorities look to improve the sustainability of developments through measures such as cutting waste and reducing their impact on the environment, both on a local and the global scale. Sustainable development policies also address the sensible siting of developments in relation to the surrounding land uses and services. There are three main aspects to sustainable development: Environmental, social and economic. Many of the councils have set criteria for developments to meet before they will be considered for planning consent, either their own criteria or criteria determined by an external body, such as BREEAM.
Amenity	7	The local authorities wish to protect and improve the amenity of their jurisdiction through developments, bringing a net improvement to the local area in the terms of amenity. Amenity in these policies constitutes aspects of the natural, built and open environments. The developments should also have 'design and access statements', where appropriate. One of the main aspects to local amenity is the protection and improvement of the area in terms of recreational use, e.g. any time people spend outside the workplace. All aspects of the development should be compared against amenity.
Environmental nuisance	5	All developments should ensure that they do not cause a nuisance to neighbouring land uses and users. This mainly covers dust, noise and vibration that would arise from the construction phase, transport to site and operation. Although this applies to impacts on all land uses and users, it is particularly relevant to sensitive receptors.
Sustainable waste management	11	The strategies set out by the local authorities in order to deal with their apportionment of London's waste are centred on promoting sustainable behaviour during development. This ensures that developments have sustainable facilities for managing waste in place, minimising waste generation in their jurisdiction and using more sustainable modes of transport for moving waste.

Policy objective	Number of local authorities	Description of policy field
		Local authorities also support the *National Waste Strategy*, e.g., proximity principle, waste hierarchy, self-sufficiency, etc, and will manage waste to best practicable environmental option (BPEO). Part of this strategy must be the protection of waste sites and the provision of sites that can meet the needs of the local area in order to reduce the amount of waste that is going to landfill. In some cases, this will involve co-operation with other local authorities.
Waste management facilities	6	Waste developments must comply with the criteria set out by the local authorities. These criteria ensure that waste developments comply with BPEO and the *National Waste Strategy* (proximity principle, waste hierarchy and self-sufficiency). There must be provision by the LA for waste facilities in their area that comply with these criteria. Any new waste development must comply with other planning policies and must be in keeping with the surrounding land uses, e.g. not near sensitive receptors.
Demolition waste	2	The local authorities will encourage the reuse of demolition and construction waste. It is also encouraged that waste should be segregated on site to ensure that as much of the waste materials can be recovered. This may be imposed through planning conditions.
Controlling of potential polluting uses	5	There are a number of criteria that are set down by local authorities that developments that have the potential to pollute must meet before they are permitted. The criteria relate to their operating procedure and design measures that have been put in place to prevent pollution. Pollution is determined as anything that has a negative impact on its environs. This can include, noise, light, dust, vibration, traffic liquid spills, soil pollution, odour and hazardous materials.
Flooding	3	Developments must demonstrate how they will minimise or reduce the impact of flooding on people, property and the environment. This also includes flood defence developments.
Use of water routes	5	Water routes can be used if they are essential to the movement of goods. Any infrastructure which is required in connection with the movements of goods by water must

Policy objective	Number of local authorities	Description of policy field
		be in keeping with the local settings and should not have a detrimental impact on the environment. The riverside local authorities will actively encourage the uses of waterways for bulky materials and freight. This is part of the Blue Ribbon Network initiative, namely: 1) developments on the network should enhance the waterfront environment and amenity; 2) aquatic and riparian habitat will be protected and enhanced; 3) landscape character will be enhanced; 4) access to the river for ....freight will be protected and improved.
Brownfield sites	5	Brownfield sites must be analysed for contamination and any contamination that is discovered must be mitigated prior to development. This may be subject to planning conditions. This is done in order to protect future users of the sites. The regeneration of brownfield sites will be encouraged and will be the preferred option over Greenfield proposals. New developments on brownfield sites will have to compliment land uses that are already present.
Environmental impacts	6	Developments must be efficient in the use of natural resources and must not compromise the natural environment. Sites meeting the local authority's criteria (and EC directive 97/11/EC) will have to demonstrate their suitability through an environmental impact assessment. Waste sites must be environmentally acceptable. Developments must meet planning policies on a national and local scale.
Safeguarded sites	3	Various sites in the boroughs have been safeguarded for other types of development (housing, employment, business use) and new developments cannot compromise these areas. Similarly, certain areas are safeguarded for waste facilities.

Annex C: Excavated materials

C.1 Excavated materials definitions

Made ground

C.1.1 There is no typical description for this material. Site investigation is required at each site to determine the nature of the material.

London Clay

C.1.2 Stiff to very stiff, silty to locally sandy clay, with regular spaced nodular horizons (up to 500mm thick) of medium strong calcareous mudstone. Sand particle inclusions are fine to medium.

Thanet Sand

C.1.3 Dense to very dense silty fine sand, becoming locally clayey with depth. Contains a basal gravel bed, the Bullhead Bed, typically up to 0.5m thick, comprising a clayey, fine, medium and coarse, subangular to angular flint gravel.

Lambeth Beds

C.1.4 Stiff to hard, clay, with shell debris, occasional layers of strong limestone, local fine to medium sand inclusions and gravel. Gravel is rounded, weathered flint.

Chalk

C.1.5 Weak to moderately weak, low to medium density white chalk with nodular flint horizons (average 100mm thick) and marl seams (2mm to 20mm thick).

C.2 Assumed density and bulking factors

C.2.1 The following densities and bulking factors in Table C.1 have been assessed and these figures have been used to estimate the excavated material. These figures are based on a review of estimates and actual data from previous similar projects, such as Crossrail and the Channel Tunnel.

Table C.1 Density and bulking factors for excavated material

Stratum	Bulk density t/m3	Typical bulking factors		
		Shaft excavation	Earth pressure balance machine	Smart tunnel boring machine
Made ground	1.7	1.2		
London Clay	2	1.4	1.7	
Lambeth Group	2.1	1.4	1.7	

Stratum	Bulk density t/m3	Typical bulking factors		
		Shaft excavation	Earth pressure balance machine	Smart tunnel boring machine
Thanet Sand	1.8	1.1	1.4	1.4
Chalk (Seaford Member)	2	1.4	1.6	1.6

C.3 Estimated excavation materials by construction site based on live candidate scheme

C.3.1 Table C.2 presents the estimated tonnes of excavated materials generated for each Thames Tideway Tunnel project construction site.

Table C.2 Estimated tonnes of excavated materials generated for each site during Thames Tideway Tunnel project construction phase

Sites	Site strip	Imported fill	Diaphragm wall/Pile spoil	Made ground	London Clay	Lambeth	Thanets	Chalk – tunnel	Chalk – shafts
Acton Storm Tanks	-	-	-	1,262	1,930	-	-	-	-
Hammersmith Pumping Station	330	-	-	6,781	29,378	-	-	-	-
Barn Elms	413	5,500	-	1,401	5,743	-	-	-	-
Putney Embankment Foreshore	-	25,714	-	794	4,619	-	-	-	-
Carnwath Road Riverside	1,350	-	-	14,677	769,411	-	-	-	-
Dormay Street Site	385	-	-	2,425	29,368	-	-	-	-
King George’s Park	240	-	-	1,966	2,990	-	-	-	-
Falconbrook Pumping Station	240	-	-	4,169	15,578	-	-	-	-
Cremone Wharf Depot Site	350	-	-	4,520	15,116	-	-	-	-
Chelsea Embankment Foreshore	83	63,995	-	16,696	17,741	436	-	-	-
Kirtling Street	1,920	-	16,142	15,387	697,682	813,491	76,027	43,791	-
Heathwall Pumping Station	247	6,422	-	5,825	22,345	5,026	-	-	-
Albert Embankment Foreshore	130	82,013	6,419	3,996	24,624	7,914	-	-	-
Victoria Embankment	-	43,244	-	750	13,564	4,737	-	-	-

Sites	Site strip	Imported fill	Diaphragm wall/Pile spoil	Made ground	London Clay	Lambeth	Thanets	Chalk – tunnel	Chalk – shafts
Foreshore									
Blackfriars Bridge Foreshore	150	87,164	13,967	1,140	34,282	20,880	2,656	-	-
Chambers Wharf	1,400	147,906	19,773	13,793	5,863	21,498	16,286	671,953	26,240
King Edward Memorial Park Foreshore	390	60,898	16,730	-	258	18,064	10,063	-	21,408
Earl Pumping Station	490	-	10,763	7,300	4,032	2,211	2,715	-	22,969
Deptford Church Street Site	480	-	10,133	11,053	-	4,466	9,655	-	12,042
Greenwich Pumping Station	1,100	-	9,709	9,034	-	3,017	6,276	275,339	12,528
Abbey Mills Pumping Station	1,200	-	19,446	11,174	12,440	15,812	11,979	-	26,115
Beckton STW Works	825	-	5,743	6,350	-	24,586	919	-	-
Shad Thames Pumping Station	-	-	-	-	555	-	-	-	-
Bekesbourne Street	384	-	-	160	137	-	-	-	-
Total	**12,106**	**522,856**	**128,825**	**140,652**	**1,707,657**	**942,138**	**136,576**	**991,084**	**121,302**

Annex D: Non excavated material arisings

D.1 Construction wastes

D.1.1 During the construction phase, the following types of waste are likely to be generated:

a. excess concrete in concrete mixers, pumping lines and general spillage

b. damaged concrete tunnel linings and temporary linings at junctions and shaft connections. Sprayed concrete lining materials

c. imported fill

d. tunnel grout in the batching plant, grout pipes and general spillage

e. spent (generally plywood) forms.

D.1.2 The information on waste figures from similar construction work is limited. The WRAP (Waste and Resources Action Programme) have various guidelines and tools to assist in managing and minimising waste. In the Designing Out Waste Tools for Civil Engineering and Building various benchmark figures for wastage rates are provided.

D.1.3 The WRAP data relates to civil engineering work in general. The amount of wastage associated with the Thames Tideway Tunnel project construction would be at the lower end of the estimates due to the type and scale of construction. An example is that the concrete pours are large and so the fixed wastage of concrete in pump lines and part loads is a much smaller percentage than more normal pour sizes. The Thames Tideway Tunnel project would involve the factory production of precast concrete tunnel linings and, as it would be a large-scale construction project, it is considered that this would be good practice with respect to waste minimisation.

D.1.4 Therefore the good rates from the WRAP data have been taken and adjusted where considered appropriate. Table D.1 shows the WRAP reference data and the wastage rates assumed for Thames Tideway Tunnel project.

Table D.1 Wastage rates for the main construction materials

Material type	Sub category	Comparable WRAP reference data		Thames Tideway Tunnel project value	Notes
		Baseline wastage rate	Good wastage rate		
Imported fill	Cofferdam	10%	5%	2.5%	Wrap value is for general fill. Volumes of imported fill are much larger than a normal site and wastage rate will be lower.
	Backfill to structures, sub base, etc	10%	5%	5%	This will be similar to normal site wastage rate.
Concrete	General	4%	2%	2%	Use general concrete rates
	Diaphragm Wall			2%	Use general concrete rates
	Piles	5	2.5%	2.5%	Consistent value in WRAP Data for piles.
	Sprayed Concrete Linings (Shotcrete)			10%	General wastage in the spraying process, mainly in rebound materials but also some in junctions and enlargements.
	Shaft and Tunnel Secondary Linings	4%	2%	2%	Use general concrete rates
	Interception chambers, culverts, valve Chambers, River Walls	4%	2%	2%	Use general concrete rates
Steel reinforcement	For concrete structures	15%	5%	2.5%	Large quantities of reinforcement required and will all be scheduled as curt and bent bar delivered to site. Lower than normal wastage rates.

Material type	Sub category	Comparable WRAP reference data		Thames Tideway Tunnel project value	Notes
		Baseline wastage rate	Good wastage rate		
Grout materials	Cement ,pfa, sand, bentonite	-	-	2%	No direct value in WRAP data.
Precast concrete	Tunnel and Shaft Linings	-	-	0.1%	Tunnel and shaft linings damage on site that makes unit unusable is extremely rare.
MEICA equipment	Penstocks, Flap valves	-		0%	Requirements will be fully scheduled for onsite delivery.
	Manhole and opening covers, Cast or made iron units	-	-	0%	Requirements will be fully scheduled for onsite delivery.
	Electrical Cabinets, kiosks, carbon filters,, general building services	3%	1%	1%	Value for cables/pipework only. Values given are from WRAP Building Data for Building services
Granite facing blocks	For river walls in heritage areas	-	-	2.5%	
Structural steel	For Structures	1%	0%	1%	Value taken from WRAP Building Data. All steel will be fully fabricated before arrival on site for assembly, the building to house air management plant and equipment. No onsite fabrication.
Steel sheet piling	For cofferdams, temporary and permanent	1%	0%	0%	Value taken from WRAP Building Data.
TBM consumables	Tailskin Grease, Mechanical oils and greases, spoil	-	-	-	Wastage rate will be included in material supplies.

Material type	Sub category	Comparable WRAP reference data		Thames Tideway Tunnel project value	Notes
		Baseline wastage rate	Good wastage rate		
	conditioners.				
Reinstatement work	Footways and paved areas.	3%	2%	2%	Value taken from WRAP Building Data.

D.1.5 The wastage rates given in Table D.2 have been used to estimate a waste tonnage for each material by applying the percentage wastage to the total volume of each material required for the Thames Tideway Tunnel project. This calculation estimates that 50,000t of construction waste will be generated during tunnel construction. Table D.2 details the estimated quantities of non excavated construction related waste that would be generated throughout the construction phase of the project.

D.1.6 Table D.1 includes concrete from the following:

a. diaphragm wall and pile construction

b. tunnel and shaft secondary lining

c. sprayed concrete linings

d. interception chambers and culverts.

D.1.7 It also includes tunnel and shaft annulus grout which comprises cement, pulverised fuel ash, sand and bentonite. Other materials include plywood formwork and structural steel (rebar).

Table D.2 Estimated tonnages of construction waste arisings during tunnel construction (2016–2022) based on candidate scheme updated May 2012

Sites	Concrete rings	Imported fill	Grout	Concrete	Other	Total
Acton Storm Tanks	-	23	-	1,396	227	1,646
Hammersmith Pumping Station	-	-	-	964	111	1,076
Barn Elms	-	144	-	293	99	536
Putney Embankment Foreshore	-	768	-	287	139	1,194
Carnwath Road Riverside	139	-	630	3,288	590	4,648
Dormay Street	6	27	15	271	112	431
King George's Park	-	1	-	184	65	251
Falconbrook Pumping Station	-	25	-	607	89	722
Cremone Wharf Depot	-	60	-	576	92	727
Chelsea Embankment Foreshore	3	1,951	1	348	138	2,441
Kirtling Street	278	-	1,254	3,328	838	5,699
Heathwall Pumping Station	5	295	1	430	152	882
Albert Embankment Foreshore	1	2,124	4	653	184	2,965

Sites	Concrete rings	Imported fill	Grout	Concrete	Other	Total
Victoria Embankment Foreshore	4	1,323	2	342	162	1,832
Blackfriars Bridge Foreshore	-	3,729	4	1,719	343	5,795
Chambers Wharf	121	3,698	548	3,343	690	8,400
King Edward Memorial Park Foreshore	-	1,902	4	1,229	311	3,446
Earl Pumping Station	-	108	3	620	158	888
Deptford Church Street	-	73	3	633	167	875
Greenwich Pumping Station	50	20	215	971	365	1,621
Abbey Mills Pumping Station	-	-	3	2,630	356	2,989
Beckton STW Works	5	-	16	567	243	830
Shad Thames Pumping Station	-	-	-	29	32	61
Bekesbourne Street	-	-	-	7	9	16
Total	**612**	**16,270**	**2,704**	**24,714**	**5,673**	**49,974**

D.1.8 There would be waste produced through the reinstatement works that would be carried out once the construction of the tunnel has been completed. It is anticipated that the waste produced from the reinstatement works would be similar in nature to the construction waste.

D.2 Demolition waste

D.2.1 It is estimated that 137,000t of demolition waste will be generated by site clearance (excluding vegetation) and removal of building. Table D.3 provides a summary of the sites where demolition would be undertaken and highlights the sites where there is a high risk of asbestos being present based on the age of the buildings to be demolished. Buildings which date from the 1950s to the mid 1980s have been identified as being at high risk of containing asbestos.

Table D.3 Summary of demolition activities on each site

Sites	Demolition activity	Risk of asbestos being present
Acton Storm Tanks	Partial demolition of two existing storm tanks and removal of fencing	
Hammersmith	Demolition of the section of the existing site	

Sites	Demolition activity	Risk of asbestos being present
Pumping Station	pumping station boundary wall would be required.	
Barn Elms	Existing changing facilities to be demolished.	High risk
Putney Embankment Foreshore	Partial demolition of sections of existing slipway and walls prior to permanent works	
Carnwath Road Riverside	Demolition of existing above-ground two storey structures, including existing business units on Carnwath Road Industrial Estate	High risk
Dormay Street	Demolition of existing buildings, weighbridge and walls on the worksite	High risk
King George's Park	Gate and railings to be removed and then reinstated.	
Falconbrook Pumping Station	Existing disused toilet block and a disused pumping station would be demolished. The below-ground structures would need to be removed.	High risk
Waste Transfer Facility (replaces Cremorne Wharf Foreshore)	The existing waste transfer facility would be demolished both above ground structures (buildings and concrete slabs) and below ground structures and foundations.	
Chelsea Embankment Foreshore	Removal of stone parapets and existing brick outfall apron	
Kirtling Street	The existing buildings on the worksite would be demolished including concrete ramps.	High risk
Heathwall Pumping Station Site	Portacabin and above ground wall structures to be removed. Below ground structures such as concrete culvert and reinforced slabs to be removed.	
Albert Embankment Foreshore	Removal of ladder, parapet and two concrete bed scour protection aprons	
Victoria Embankment Foreshore	Steps to be demolished. Stone parapet on listed embankment to be demolished.	
Blackfriars Bridge Foreshore	The existing pump house, constructed in the 1940's, is to be demolished. Also parts of the existing pedestrian ramp, stairs and riverwall would be demolished.	
Chambers Wharf	The existing building on the worksite would be demolished. Includes existing jetty and building housing electrical equipment to be removed. 3 basement areas and a void containing electrical services to be removed. Additionally an 'existing	High risk

Sites	Demolition activity	Risk of asbestos being present
	mound' of building and demolition waste already on site to be removed.	
King Edward Memorial Park Foreshore	There is no major demolition works anticipated at this site, although the park furniture would need to be temporarily removed.	
Earl Pumping Station	Removal of depot building, canopy and two smaller buildings.	High risk
Deptford Church Street	Removal of wall.	
Abbey Mills Pumping Station	No structures to be removed.	
Beckton STW	No structures to be removed.	
Shad Thames Pumping Station	Removal of existing facility and two associated floor slabs adjacent to building.	High risk

D.3 Hazardous waste

D.3.1 It is anticipated that there would be small quantities of hazardous waste, such as oils/diesel, packaging/absorbents etc. contaminated with hazardous substances, WEEE, demolition waste containing asbestos, fluorescent tubes, batteries, oil filters, waste paint and solvents.

D.3.2 Asbestos may be present in any of the buildings identified for demolition, particularly buildings which date from the 1950s to the mid 1980s. Table D.3 provides a summary of the sites where demolition activities are anticipated and identifies those sites on which asbestos is most likely to be present due to the age of the buildings to be demolished.

D.3.3 Based on current Thames Water data from the Lee Tunnel, it is estimated that hazardous waste arisings would comprise approximately 0.15% of total waste and excavated material arisings. Therefore, it is estimated that approximately 7,000t of hazardous waste would be produced over the construction period.

D.4 Waste electrical and electronic equipment

D.4.1 It is anticipated that there will be waste arisings from electrical, electronic equipment (known as WEEE) from the office based activities. All office based staff require laptops and printers for the six year period based on site.

D.4.2 There are 1,065 office based staff that will all require a laptop which will be replaced every two years.

D.4.3 The office based staff would also require printers, which we have assumed will be one printer between four people and replaced every three years.

D.4.4 In total during the demolition and construction period it is estimated that approximately less than 25t of WEEE waste (using standard average weights for laptops and printers).

D.5 Welfare waste

D.5.1 Waste would be produced at the construction sites from the site offices and mess rooms. This waste would, in general, be domestic in nature and include paper, packaging and food waste.

D.5.2 Table D.4, provides estimates of the tonnage of welfare waste generated by the Thames Tideway Tunnel project, based on an estimate of the number of staff that would be working at each of the construction sites (based on the Candidate Scheme).

D.5.3 The estimated figures have been calculated using the assumption that an average office worker produces approximately 200kg[XVII] of waste per staff member per year (WRAP, 2012)[22]. The estimated staff numbers have been provided by the Thames Tideway Tunnel project team.

Table D.4 Estimated tonnages of welfare waste produced at each site per annum

Sites	Total no of staff	Waste generation (tpa)
Acton Storm Tanks	40	8
Hammersmith Pumping Station	45	9
Barn Elms	40	8
Putney Embankment Foreshore	50	10
Carnwath Road Riverside	289	58
Dormay Street	92	18
King Georges Park	40	8
Falconbrook Pumping Station	40	8
Re-Cycling Centre (replaces Cremorne Wharf Foreshore)	65	13
Chelsea Embankment Foreshore	65	13
Kirtling Street	426	85
Heathwall Pumping Station	40	8
Albert Embankment Foreshore	65	13
Victoria Embankment Foreshore	65	13
Blackfriars Bridge Foreshore	70	14
Chambers Wharf	289	58

[XVII] A good-practice office produces fewer than 200kg of waste per staff member per year.

Sites	Total no of staff	Waste generation (tpa)
King Edward Memorial Park Foreshore	40	8
Earl Pumping Station	40	8
Deptford Church Street	40	8
Greenwich Pumping Station	289	58
Abbey Mills Pumping Station	45	9
Beckton Sewage Treatment works	65	13
Total	**2,240**	**448**

D.5.4 In total over the total construction period it is estimated that approximately 1,995t of welfare waste will be produced over the Thames Tideway Tunnel project sites (taking into account the operational period for each site).

D.6 Vegetation waste from site clearance

D.6.1 Tree surveys have been undertaken to determine the number of trees to be removed or pruned as part of the site clearance works. These surveys have been reviewed to determine the estimated volume of vegetation to be removed from the Thames Tideway Tunnel project sites. An estimate of the volume of wood to be removed has been calculated based on the recorded circumference and height of each tree. Based on this calculation it is estimated that 500m^3 of vegetative waste would be produced during site clearance works.

D.6.2 Some trees will be denser than others, depending on species. It should be noted that tree trimming waste volumes would be dependent on the time of year that works are undertaken and the level of foliage.

D.6.3 An average density of 783kg/m^3 has been used based on wet wood densities reported in the Engineering Toolbox (The Engineering Toolbox, 2012)[23]. This gives an estimated 391t of vegetative waste.

Annex E: Project waste management plan and Site waste management plan template

E.1 Project wide waste management plan

Introduction

E.1.1 This outline *Project wide waste management plan (Project wide WMP)* provides an overarching framework for the *Site waste management plans (SMWP)* that will be prepared and implemented for each of the Thames Tideway Tunnel project CSO sites and drive sites.

E.1.2 The *Project wide WMP* has been prepared to provide consistent information to the management of materials and wastes produced at the Thames Tideway Tunnel project construction sites. It will assist with the monitoring of the *SWMPs* and the *EM&W strategy* objectives.

E.1.3 This version of the template incorporates comments from the EA on an earlier version. The template is being provided voluntarily at this stage so that stakeholders have an indication of the proposed content. If application consent is obtained, the template would be reviewed prior to construction commencing to ensure it is still consistent with good practice and the EA would be consulted on any proposed changes and approval of the final template would be sought from the EA (and secured via anagreement).

E.1.4 The *Project wide WMP* will be adhered to, implemented and updated by the appointed contractor(s).

E.1.5 The plan provides overall information on roles and responsibilities, project wide waste actions, a summary of the overall waste arisings and progress to achieving the targets. It also contains project wide information that will be applicable to all Thames Tideway Tunnel project CSO sites and main tunnel drive sites.

E.1.6 A template *SWMP* has been developed that would be used at all sites (see Annex E.2).

E.1.7 The template would help the project to identify waste prevention, reuse and recycling opportunities to help ensure waste is managed in accordance with the waste hierarchy. This version of the template incorporates comments from the EA on an earlier version of the template. The template is being provided voluntarily at this stage so that stakeholders have an indication of the proposed content. If application consent is obtained, the template would be reviewed prior to construction commencing to ensure it is still consistent with good practice and the EA would be consulted on any proposed changes. Approval of the final template would be sought from the EA.

E.1.8 The *SWMPs* and sections of the *Project wide WMP* will be transposed into an Excel spreadsheet to provide a live reporting tool.

E.1.9 Plate 8.1rovides information about the information that will be held in the *Project wide WMP* and the *SWMPs* and the relationship between the two documents.

E.1.10 The *CoCP* sets out a series of objectives and measures to be applied throughout the construction period at all Thames Tideway Tunnel project construction sites and should be referred to in conjunction with the *Project wide WMP*.

Responsibilities

E.1.11 This section sets out the key roles and responsibilities for managing the *Project wide WMP* and *SWMP* for the Thames Tideway Tunnel project.

General waste management responsibilities

Contractor(s)

E.1.12 In terms of general waste management on site, the contractor's responsibilities will include but will not be limited to the following:

a. ensure compliance with Duty of Care requirements

b. provide an area for a secure waste compound where segregated materials for on-site reuse or off-site recycling can be safely stored

c. management of the waste compound

d. monitor the general site conditions in terms of waste management. Ensure the trade contractors keep their work areas safe and tidy

e. where waste generation levels are in excess of anticipated levels as a result of improper storage and/or damage to raw materials, the contractor shall investigate and identify remedial actions as appropriate

f. carry out reviews of the operations and documentation of waste management for the project

g. ensure correct segregation of waste at the waste compound and on site

h. ensure regular training on both waste management and materials handling for all contract and sub-contract staff, and to highlight project expectations

i. ensure that waste management best practise is upheld at all times

j. ensure that wastes are correctly categorised, described and managed

k. manage and monitor waste streams and quantities to ensure maximum reuse and recycling potential

l. respond to and resolve waste incidents on site.

Waste contractor

E.1.13 In terms of general waste management on site, the waste contractors responsibilities will include but will not be limited to the following:

a. supply and management of appropriate containers, weighbridge systems and labour at the site's waste compound

b. inform the contractor if wastes are not being appropriately segregated

c. maintain legal compliance (including maintenance of records)

d. comply with the requirements of Duty of Care

e. arrange and deliver skips/containers ensuring that there is sufficient capacity available to meet the sites requirements at any given time

f. ensure wastes are handled, transferred and transported so as to avoid loss or escape.

Site waste management plan responsibilities

TWUL or their agent

E.1.14 The client's responsibilities with regards to the *SWMP* will include but will not be limited to the following:

a. to appoint a contractor

b. to give reasonable direction to any contractor so far as necessary to enable the contractor to comply with the *SWMP Regulations*

c. work with the design team, contractors and sub-contractors to rationalise the project design and help eliminate waste at source

d. ensuring that waste minimisation opportunities are developed as far as is practicable

e. ensure that opportunities for recycling and reuse of waste across the stages and sites of the project are identified and promoted

f. reviewing, revising and refining the *SWMP* as necessary to ensure that any changes in respective roles and responsibilities are clearly communicated

g. agreeing and approving the *SWMP*

h. ensuring that the *Waste Management Plan* and *Site Waste Management Plans* are implemented and adhered to.

Contractor

E.1.15 The contractor's responsibilities with regards to the *SWMP* will include but will not be limited to the following:

a. overall responsibility for the content and actions of the *SWMP*

b. nominate on site waste management coordinator (see E.1.16)

c. reviewing, revising and refining the *SWMP* as necessary to ensure that any changes in respective roles and responsibilities are clearly communicated

d. responsible for the implementation, maintenance and compliance with all actions contained within the *SWMP*

e. maintain documentation relating to the transfer of waste, collation of data for waste materials produced, its destination and regular analysis / reporting of data

f. ensure that all workers on site are made aware of the requirements of the *SWMP* and their responsibilities within it.

On site waste management coordinator

E.1.16 The on site waste management coordinator's responsibilities with regards to waste management on site will include but will not be limited to the following:

a. implement the *SWMP*

b. monitor waste generation on site and produce appropriate reports

c. engage with the waste management contractor

d. monitor and possibly enforcing waste segregation on site

e. encourage suggestions for improving waste management activities on site.

f. administrative and planning duties associated with the *SWMP*

g. increase awareness of the *SWMP* and engage with the workforce, for example through the use of toolbox talks

h. monitor the effectiveness of the *SWMP*.

Waste contractor

E.1.17 The waste contractor's responsibilities with regards to the *SWMP* will include but will not be limited to the following:

a. report information on waste production and recycling quantities on a weekly and monthly basis, as agreed with the contractor.

E.1.18 Table E.1 provides a summary of the roles and responsibilities of personal at all the Thames Tideway Tunnel project sites.

Table E.1 Summary of roles and responsibilities for all Thames Tideway Tunnel project sites

Site number	Thames Tideway Tunnel project site name	Site Address	Contractor	Person responsible for waste management at the site	SWMP author	On site waste management coordinator

Project details

E.1.19 This section provides a summary of all the Thames Tideway Tunnel project site locations and a summary of the estimated waste management costs for the project.

Table E.2 Summary of site information for all Thames Tideway Tunnel project sites

Thames Tideway Tunnel project site name	Site number	Site address	Estimated costs	Actual costs	Estimated tonnage	Actual tonnage	Start date	Completion date
Total								

Waste actions

E.1.20 This section provides a summary of actions associated with waste management identified when planning and implementing the *SWMPs* for all Thames Tideway Tunnel project sites. It provides a means of maintaining a record of the actions and identifying actions that could be translated to other sites.

Table E.3 Summary of waste actions for all Thames Tideway Tunnel project sites

Action	Applicable sites	Action owner	Waste stream	EWC code	Material type	Intended results	Estimated cost savings	Waste reduced	
								m^3	t

Forecast of waste types and quantities

E.1.21 This section provides a summary of the types and quantities of waste that are expected to be generated at all Thames Tideway Tunnel project sites. It provides a means to effectively monitor waste generation levels.

Table E.4 Summary of estimated waste types and quantities for all Thames Tideway Tunnel project sites

Thames Tideway Tunnel project site name	Forecast quantities for non hazardous (inert)		Forecast quantities hazardous		Forecast quantities non hazardous (non inert)		Total (m^3)	Total (t)
	m^3	t	m^3	t	m^3	t		

Waste carriers information

E.1.22 This section provides a list of waste carriers that have been contracted at a project level and can be used on Thames Tideway Tunnel project sites. It provides a means to ensure that the waste carriers used on the Thames Tideway Tunnel project are valid.

E.1.23 Waste carriers information is also detailed on a site specific basis and recorded in the *SWMPs*.

Table E.5 Summary of waste carrier's information used on Thames Tideway Tunnel project sites

Waste carriers name	Contact details	Registration number	Expiry date	Information checked with the Environment Agency (name/date)	TT sites which have used this waste carrier. (Provide the TT site name)

Waste management facilities information

E.1.24 This section provides a list of the waste management facilities that have been contracted at a project level.

E.1.25 Information on waste management facilities will be detailed on a site specific basis and recorded in the *SWMPs*.

Table E.6 Summary of waste management facilities information used during the Thames Tideway Tunnel project.

Name of facility	Type of facility	Facility address (including postcode)	Permit / exemption number	Permitted waste types

Actual waste movements

E.1.26 This section provides a summary of actual waste movements for all Thames Tideway Tunnel project sites. It provides a means to effectively monitor actual waste generation levels.

Table E.7 Summary of actual waste movements for all Thames Tideway Tunnel project sites

Thames Tideway Tunnel project site name	Actual waste quantities for non hazardous (inert)		Actual waste quantities hazardous		Actual waste quantities non hazardous (non inert)		Total (m^3)	Total (t)
	m^3	t	m^3	t	m^3	t		

Reporting

E.1.27 This section provides a summary of the overall forecasted waste and actual waste arisings for all Thames Tideway Tunnel project sites.

E.1.28 It will be used to compare the forecasted and actual waste arisings for all Thames Tideway Tunnel project sites.

Table E.8 Summary of forecasted and actual waste arisings from all Thames Tideway Tunnel project sites

		Waste and material arisings		Waste sent offsite		Materials kept onsite		Sent to landfill		Diverted from landfill		Cost of waste disposal (offsite)	
Forecast (F)/Actual (A)		**F**	**A**	**F**	**A**	**F**	**A**	**F**	**A**	**F**	**A**	**F**	**A**
Unit (tonnes)		**t**	**t**	**t**	**t**	**t**	**t**	**t**	**t**	**t**	**t**	**£**	**£**
Class [insert class]	Non hazardous (inert)												
	Hazardous												
	Non hazardous (non inert)												
Assigned waste stream [insert waste types & EWC codes]	Inert - Soil & stones 17 05 04												
	Non Haz (Non Inert) – Iron and steel 17 04 05												
	Segregated Haz - Soil & stones 17 05 03*												

		Waste and material arisings		Waste sent offsite		Materials kept onsite		Sent to landfill		Diverted from landfill		Cost of waste disposal (offsite)	
	Metals												
	Biodegradable kitchen and canteen wastes 20 10 08												
Total													

		Re-used				Recycled				Recovery			
		off-site		on-site		off-site		on-site		off site		on-site	
Forecast (F) /Actual (A)		F	A	F	A	F	A	F	A	F	A	F	A
Unit (tonnes)		t	t	t	t	t	t	t	t	t	t	t	t
Class	Non hazardous (inert)												
	Hazardous												
	Non hazardous (non inert)												
	Inert - Soil & stones 17 05												

		Re-used				Recycled				Recovery			
Assigned waste stream [insert waste types & EWC codes]	04												
	Non Haz (Non Inert) – Iron and steel 17 04 05												
	Segregated Haz - Soil & stones 17 05 03*												
	Metals												
	Biodegradable kitchen and canteen wastes 20 10 08												
Total													

Key Performance Indicators (KPIs)

E.1.29 This section details the performance of the Thames Tideway Tunnel project.

Table E.9 Summary of forecasted and actual waste arisings from all Thames Tideway Tunnel project sites

	Excavated material				Non excavated material			
	Forecast		Actual		Forecast		Actual	
	m^3	t	m^3	t	m^3	t	m^3	t
Total excavated material								
Total non excavated material								
Total recycled/reused								
% Diverted from landfill								
% Beneficial use								
% Recycled								
% Reused on site								
% Reused off site								

Comparison of forecast and actual waste streams

E.1.30 This section details the reasons for the difference between forecast and actual figures to understand any variance between these and implications / benefits for this project / future stages or future projects, together with lessons learnt and any cost savings / increases.

	Reasons
Explanation for deviations from original / previous plan	
Lessons learnt	
Details of any cost savings made or increases to costs	
Revisions to plan (revision number, date, details)	

Training

E.1.31 This section provides details on the central communications and training that has been carried out on all Thames Tideway Tunnel project sites.

E.1.32 This includes training on the *SWMP*, roles and responsibilities, Duty of Care, waste procedures on site, hazardous waste and materials storage.

Table E.10 Summary of training carried out on Thames Tideway Tunnel project sites

Name	Company	Date	Trainer	Type of training	Date next training due

Monitoring and measurement

E.1.33 This *Project wide WMP* will be updated [*insert timescale*]

E.1.34 Throughout the project the contractor would be responsible for reviewing the performance of all parties which are involved in the management of waste at the sites.

E.1.35 The results of audits and inspections, waste data and the outcome of any incidents or complaints will feed into regular reviews. The results of these reviews should be communicated to the site team and where appropriate the client.

E.1.36 The individual Thames Tideway Tunnel project *SWMP* will be updated as required to provide a current overview of how work is progressing against the waste estimates contained in the plan

E.2 Site waste management plan

Site information

Site Name	
Site Number	
Site Address / Location	
Site Location Description	
Estimated costs	
Client	
Contractor	
Start Date	dd/mm/yy
Completion Date	dd/mm/yy

Responsibilities

	Name	Company	Contact details
Client			
Contractor			
Person responsible for waste management at the site			
Person responsible for completing the SWMP			
On site waste management coordinator			
Person responsible for document control			

Where will the SWMP be kept? (A copy should be kept on site)

Electronic based copy	
Paper based copy	

Has a *Materials Management Plan* (*MMP*) been produced for the site?

Yes ☐ No ☐

If yes where is it saved?

Electronic based copy	
Paper based copy	

Declaration statement:

The client and contractor will take reasonable steps to ensure waste duty of care is complied with, materials are handled efficiently and waste is managed appropriately.

Contractor

Signature	
Print Name	
Organisation	
Date	

Client

Signature	

Print Name	
Organisation	
Date	

Designing out waste measures / Site waste management plan checklist

Question		Stage			Comment
		Pre Start	Contract	Post Completion	
1	Has a careful evaluation of materials been made so that over-ordering and site wastage is reduced and has the project programme been developed to facilitate waste minimisation?	☐	☐		
2	Has full consideration been given to the use of secondary and recycled materials	☐	☐		
3	Is unwanted packaging to be returned to the supplier for recycling or re-use?	☐	☐		
4	Can unused materials be returned to the purchaser or used on another job?	☐	☐		
5	Has disposal of liquid wastes such as wash-down water and lubricants been considered?	☐	☐		
6	Where relevant, has discharge consent been obtained from the Environment Agency?		☐		
7	Has agreement been sought from the local water company for trade effluent discharge?		☐		
8	Have opportunities been considered for re-use of materials on-site?	☐	☐		
9	Have opportunities been considered for re-use of materials off-site?	☐	☐		

Question		Stage			Comment
		Pre Start	Contract	Post Completion	
10	Have opportunities been considered for on-site processing and re-use of materials (recycling)?	☐	☐		
11	Have opportunities been considered for off-site reprocessing of materials?	☐	☐		
12	Have you identified the most appropriate sites for disposal of residual waste (non-hazardous and hazardous)?	☐	☐		
13	Are there opportunities for reducing disposal costs from waste materials which may have a commercial value?	☐	☐		
14	Do any of the planned waste management activities require an Environmental Permit (waste management licence) or an exemption to be registered?	☐	☐		
15	Have targets been set for the different types of waste likely to arise from the project?		☐		
16	Have relevant sub-contractors producing significant waste streams been identified and trained?		☐		
17	Has an area of the site been designated for waste management, including segregation of waste?		☐		
18	Have measures been put in place to deal with expected (and unexpected) hazardous waste?		☐		
19	Have toolbox talks been planned for all site personnel about waste management on-site?		☐		

Question		Stage			Comment
		Pre Start	Contract	Post Completion	
20	Has the client signed/accepted the *SWMP*?		☐		
21	Are selected waste materials segregated to allow best value to be obtained from good waste management practices? As a minimum segregate into: WOOD; METALS; PACKAGING (paper & card); HAZARDOUS; MIXED (non-hazardous); INERT		☐		
22	Are containers/skips clearly labelled to avoid confusion?		☐		
23	Is the waste being stored securely to prevent any losses (or unauthorised additions) particularly hazardous substances?		☐		
24	Are the Duty of Care procedures complied with, including retention of transfer notes and checking authorisation of registered carriers, registered exempt sites and permitted (licensed) waste management facilities?		☐		
25	Are checks made that waste is received at the intended site?		☐		
26	During site operations, are barriers to good waste management practice considered and noted for incorporation into the post-completion review?		☐		
27	Have copies of all relevant Duty of Care documentation and other waste related legal documents been obtained and filed?			☐	

Question	Stage			Comment
	Pre Start	Contract	Post Completion	
28 Has a final report on the use of recycled and secondary materials, waste reduction, segregation, recovery and disposal, with costs and savings identified, (completion report) been completed?			☐	
29 Have key waste management issues and lessons learned been identified for communication to others for action on future projects?			☐	

Waste actions

Use the table below to record decisions for onsite waste actions identified when planning and implementing the SWMP for the site. This might include waste prevention and reduction and waste and recovery actions.

Waste action	Action taken	Action owner	Waste stream	EWC code	Material type	Intended results	Estimated cost savings	Waste reduced	
								m^3	t

Forecast of waste types and quantities

Estimate the types and quantities of waste that are expected to be generated on this site.

CD&E activity	Waste stream	Material type	Further description of the waste	EWC code	Forecast quantities						Forecast provided by
					Reused/recycled on site		Reused/recycling off site		Sent off site		
					m^3	t	m^3	t	m^3	t	

Specify waste carriers

Record the waste carriers you intend to use. This should be updated if there are any changes.

Name	Contact details (address including postcode)	Registration number	Expiry date	Information checked with the Environment Agency (name/date)

Specify waste management facilities

Record the waste management facilities you intend to use

Name	Address	Type of facility	% reused	% recycled	% recovery	% disposal	Overall diverted from landfill	Information checked with the Environment Agency (name/date)	Permit / exemption number	Location of relevant documentation

Have you registered with the Environment Agency as a hazardous waste producer? Yes ☐ No ☐

If yes, please provide your hazardous waste registration number, issue date and expiry date

If no, ensure you register with the Environment Agency as a hazardous waste producer

Planned waste destinations

This allows you to match up your forecast waste streams with expected waste management facilities (entered in 'specify waste carriers' and ‘specify waste management facilities)

Waste sent off site	Proposed destination	Forecast quantities		% diverted from landfill	Comments
		m^3	t		

Waste retained onsite	Forecast quantities		Comments
	m^3	t	

Actual waste movements

This is where you should record your actual waste movements once the construction team has mobilised on site

CD&E activity	Waste stream	Material type	Detailed description	EWC code	Off site carrier	Off site desti-nation	WTN refer-ence	Reuse	Recycling	Recovery	Disposal	Date of move-ment	Waste totals				
													m^3	t	Actual cost	£/ m^3	£/ t

SWMP training

Everyone on site should receive the relevant training on

- The SWMP
- Roles and responsibilities
- Waste procedures on site
- Hazardous waste
- Duty of care
- Materials storage

What forms of training are being used on site?

Induction ☐

Tool box talks ☐

Workshops ☐

Other ☐

Do you have a training log? Yes ☐ No ☐

If yes where is it kept?

If no, please use the attached table to create a training log

SWMP communication

How are you communicating the SWMP?

Meetings ☐

Posters ☐

Feedback from staff ☐

Training Log

Name	Company	Date	Trainer	Type of training (e.g. hazardous waste, waste minimisation)	Date next training due

Summary of KPIs

This is a summary table of the performance of the site

	Excavated material				Non excavated material			
	Forecast		Actual		Forecast		Actual	
	m^3	t	m^3	t	m^3	t	m^3	t
Total excavated material								
Total non excavated material								
Total recycled/reused								
% Diverted from landfill								
% Beneficial use								
% Recycled								
% Reused on site								
% Reused off site								

Comparison of forecast and actual waste streams

E.2.1 This section details the reasons for the difference between forecast and actual figures to understand any variance between these and implications / benefits for this project / future stages or future projects, together with lessons learnt and any cost savings / increases.

	Reasons
Explanation for deviations from original / previous plan	
Lessons learnt	
Details of any cost savings made or increases to costs	
Revisions to plan (revision number, date, details)	

Reporting
This is where the forecasted quantities are compared with the actual quantities.

	Waste and material arisings		Waste sent offsite		Materials kept onsite		Sent to landfill		Diverted from landfill		Cost of waste disposal (offsite)	
Forecast (F) /Actual (A)	F	A	F	A	F	A	F	A	F	A	F	A
Unit (tonnes)	t	t	t	t	t	t	t	t	t	t	£	£
Class [insert class]												
Assigned Waste Stream [insert waste types & EWC codes]												
Total												

	Re-used				Recycled				Recovery			
	off-site		on-site		off-site		on-site		off site		on-site	
Forecast (F) /Actual (A)	F	A	F	A	F	A	F	A	F	A	F	A
Unit	t	t	t	t	t	t	t	t	t	t	t	t
Class [insert class]												
Assigned Waste Stream [insert waste types & EWC codes]												
Total												

Guidance for completing the SWMP

Guidance would be developed for completing the SWMP

Relevant sections of the European Waste Catalogue will be included for quick reference and standard materials densities will also be included

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Annex F: Regional construction, demolition and excavation arisings and infrastructure

F.1 CDE waste arisings from large infrastructure projects

F.1.1 In addition to the Thames Tideway Tunnel project, there are other ongoing and proposed developments in the South East region that might give rise to large amounts of waste. This could have implication for the potential facilities for managing the excavated material from the Thames Tideway Tunnel project and also on waste management facilities in the area. Known large projects are summarised in Table F.1. This list of projects has been produced through discussion with Planning Authorities in the London and South East Region as well as Development Agency websites.

Table F.1 A summary of large developments that are taking place in London prior to and beyond 2021

Project name	Location	Construction period	Quan-tities	Notes	Source
Crossrail	Maidenhead in the west to Abbey Wood in the east	2008-2018	9.3million tonnes CDE material	Rail link for London and the South East	Excavated Material and Waste Management Strategy, Feb 2005
Lee Tunnel	Abbey Mills Pumping Station near Stratford	2012-2014	1.5million tonnes excavated material		Lee Tunnel and Beckton Sewage Treatment Works Extension: Waste Management Strategy, May 2008
Docklands Light Rail expansion	Borough of Newham	2012-2020	Unknown	Beckton to Royal Victoria in the West also extension into Barking and Dagenham	http://developments.dlr.co.uk/home/
Olympic Park Legacy	Stratford	2013-2018	Unknown	Removal of temporary venues and completion of residential	http://www.legacycompany.co.uk/

Project name	Location	Construction period	Quan-tities	Notes	Source
				units	
Three Mill Island	Bromley-by-Bow	Unknown	0.6million tonnes (TT estimate) – excavations and materials	Large scale redevelopment of land close to Abbey Mills	http://www.towerhamlets.gov.uk/idoc.ashx?docid=dd6b117f-c16c-4965-8e21-6050340a5d12&version=-1.
Redevelopment of Battersea Power Station & Northern Line Extension	Wandsworth	Unknown	1.2million tonnes	Scheme still in planning for a mixed-use development	Battersea Power Station Outline Planning Application, 2009
The Tower, One St George Wharf	Vauxhall	2011-2014	0.03million tonnes (TT estimate)	High-rise residential building with potential to use water.	http://www.thetower-onestgeorgewharf.co.uk/index.cfm?articleID=1
Northern Line Extension to Nine Elms	Nine Elms	For proposed completion 2019	0.8million tonnes	Scheme was highlighted in Chancellor's 2011 Autumn Budget and subject to consents.	Northern Line Tube Extension Preliminary environmental assessment' December 2008 FINAL REPORT
American Embassy	Nine Elms	2013 for completion in 2017	Unknown		http://www.newusembassy-london.co.uk/embassy.php
High Speed 2	West London	2017 for proposed completion 2026	3.7million tonnes	The scheme has been received Government backing and currently is at public consultation stage.	Review of HS2 London to West Midlands *Appraisal of Sustainability*, A report to Government by HS2 Ltd, Jan 2012

Project name	Location	Construction period	Quan-tities	Notes	Source
National Grid Cable Tunnels	Willesden – Hackney; Kensal Green – Wimbledon	2014-2018	0.4million tonnes	Two tunnels with a total length of 33km between 3m and 4m wide.	http://londonpowertunnels.com/index.html

F.1.2 Where appropriate m^3 have been converted to tonnes using the bulking factor of 1.24.

F.1.3 In 2010 the EA reported that the currently permitted inert and CDE waste landfill capacity, in the South east region, was in the region of 46.4million tonnes.

F.1.4 These projects could produce approximately 18million tonnes of excavated material over the period 2012 – 2026, which is equivalent to 39% of the currently permitted inert waste landfill capacity.

F.2 Impact on regional self-sufficiency and apportionment

F.2.1 The *London Plan 2011* has set a target to improve the net self-sufficiency for the capital's waste management. Policy 5.16 aims to "Manage as much of London's waste within London as practicable, working towards managing the equivalent of 100% of London's waste within London by 2031" (GLA, 2011)[24].

F.2.2 The Environment Agency's Waste to Landfill: Indicator One for London report for 2010 (EA, 2012)[25] states that 'In 2008 approximately 3.3million tonnes of construction and demolition waste went to landfill. In 2007 approximately 28% of this waste was land-filled within London but in 2008 this had fallen to only 16%, 530,000t. 766,000t went to landfill in the East of England and 1,582,000t to landfill in the South East.' The targets for CDE self-sufficiency are based on a target to exceed recycling and reuse levels for CDE waste of 95%.

F.2.3 The landfill capacity in the region is limited, with approximately seven years in the South East (Government Office for the South East, 2009)[26].

F.2.4 The *South East Plan* and the *East of England Plan* state in their respective Policy W3 that the waste authorities that surround London[XVIII] are expected to continue importing waste from London and, therefore, to make capacity allocation in their WDPDs. In line with the *London Plan 2011*.

[XVIII] In terms of these two plans, these authorities are as follows: Berkshire Unitaries, Oxfordshire, Buckinghamshire, Milton Keynes, 'Bedfordshire and Luton', 'Cambridgeshire and Peterborough', Hertfordshire, Norfolk, Suffolk, 'Essex and Southend', Thurrock, 'Kent and Medway', Surrey, 'East Sussex, Brighton and Hove', West Sussex and 'Hampshire, Portsmouth, Southampton and New Forest National Park'.

These waste authorities have confirmed that the WDPDs take into account the volumes of waste that will be exported from London.

F.2.5 Annex B sets out the regional policies on self-sufficiency, waste apportionment and provisions for export and import of London's waste. London has set targets for increasing self sufficiency and the South East and East of England have made provision for a decreasing quantity of London's waste in their Plans. The South East and East of England have not made specific provision for London's CDE waste.

F.2.6 The *EM&W strategy* and the *EMOA* set out an approach to enable CDE wastes from the Thames Tideway Tunnel project to be managed at the nearest appropriate location. This may mean that excavated material is delivered to receptor sites outside London. However, the *EM&W strategy* has set a target to beneficially use a minimum 85% of the clean excavated material and divert at least 80% of C&D waste from landfill. It is considered unlikely that large volumes of Thames Tideway Tunnel project CDE wastes would be sent to inert landfills in the area. Therefore the Thames Tideway Tunnel project is unlikely to exceed the levels anticipated within the planning framework for the area.

Annex G: Summary of phase two and Section 48 consultation responses

G.1.1 Thames Tideway Tunnel project phase two consultation was undertaken between 4 November 2011 and 10 February 2012 and provided a second opportunity for the Thames Tideway Tunnel project team to gather feedback under Section 48 (s48) of the *Planning Act 2008*.

G.1.2 A summary of the consultation responses is provided in Section 4. Detailed responses to the individual consultation responses and s48 comments are provided in Table G.1.

G.1.3 The *EM&W strategy* has addressed and incorporated the comments received during the phase two and s48 consultations.

Table G.1 Summary of Thames Tideway Tunnel project phase two and Section 48 consultation comments

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
City of Westminster Council	CWEST-048	Yes	The city council wish to see all possible waste arisings occurring as a result of the proposed development transported away from the site by river, and where possible beneficial re-use of materials should be considered.	The mode of transport of excavated materials and waste from sites is addressed in *Transport strategy* and therefore outside the scope of the EM&W strategy. Opportunities for the reuse of waste both onsite or offsite would be investigated and implemented where practicable as part of the *SWMP* process. Where reuse is not possible opportunities to recycle wastes would be considered.
City of Westminster Council	CWEST-049	Yes	The city council wish to maximise the re-use and recycling of construction, excavation and demolition	All waste would be managed in accordance with legislative requirements and the waste hierarchy. To ensure the proper management of excavated materials and waste on site:

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
			waste in line with emerging *City Management Plan* policy 3.21 Construction, excavation and demolition waste, and to ensure that contaminated land is identified and remediated in line with emerging *City Management Plan policy*	A *Project wide waste management plan* would be developed to ensure consistent management of excavated materials and waste across all construction sites. An individual *SWMP* would be produced for and used on each construction site. Site workers would be provided with appropriate training in on site waste management and recycling procedures. All these measures are incorporated in the Thames Tideway Tunnel project *CoCP*, which sets out measures to protect the environment and limit disturbance from construction activities. Compliance with the *CoCP* is to be secured through a requirement imposed on the application.
City of London Corporation	LBCOL-85.0	Yes	Maximum use should be made of the River for transport of waste and construction materials. Although this is not a tunnelling site the City Corporation would like confirmation that the excavated materials from the tunnelling sites will be dealt with in a sustainable manner. The *Excavated Materials Options Assessment* sets a	The transport of excavated materials and waste from sites is addressed in *Transport strategy*[27] and therefore beyond the remit of the *EM&W strategy.* All works would be undertaken in accordance with the Thames Tideway Tunnel project *CoCP*, which sets out measures to protect the environment and limit disturbance from construction activities. To ensure the proper management of excavated materials and waste on site: A *Project wide waste management plan* would be developed to ensure consistent management of excavated materials and waste across all construction

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
			suitable framework although the environmental objectives should include enhancement alongside protection. Details of the options selected should form part of the final proposal.	sites. An individual *SWMP* would be produced for and used on each construction site. The *EMOA* process identifies suitable receptor sites for the treatment, handling or use of Thames Tideway Tunnel project excavated material taking into consideration the application of the waste hierarchy. The evaluation objectives in the *EMOA* do consider enhancement opportunities as well as protection.
GLA	GLA-073	Yes	The project will result in the excavation of a large amount of tunnel spoil. Earlier comments have already indicated an imperative to ensure that the vast majority of this is transported using water transport. In parallel with this, further consideration is required to identify the most beneficial use for the spoil and whether it is suitable for a positive use as aggregate material. In particular it would be beneficial to examine whether any of the early shaft excavation material or excavation material from other	The *EMOA* details the process by which potentially suitable receptor sites, for the management of excavated material have been/would be identified. Only receptor sites that meet or exceed the performance of the planning stage preferred options would be used for the management of excavated material. The development of *SWMPs* requires the potential to reuse material from other projects in London to infill the cofferdams on foreshore sites to be considered subject to meeting the delivery requirements in the *Transport Strategy*.

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
			projects, notably Crossrail or National Grid Tunnelling, could be used as infill material for the cofferdam sites in the River.	
GLA	GLA-074	Yes	The landfill diversion target of 90% is considered appropriate to begin with, however it is suggested that a reuse and recycling target of 95% should be implemented by 2020 at the latest for the project as a whole. This will bring the project target in line with the *London Plan 2011* target which is important given that this project will generate a significant percentage of London's annual Construction, Demolition and Excavation (CDE) waste.	Targets have been set to allow the assessment of the objectives in the *EM&W strategy*. These relate to the diversion of waste from landfill, the beneficial use of clean excavated material, the use of the *EMOA* and *SWMPs* and the movement of material by barge. The objectives and targets are detailed in Section 3. Whilst it would be possible to set targets for each stage of the waste hierarchy this would remove the flexibility for contractors to provide innovation and apply the most appropriate end uses for different waste streams. A target has been set to divert at least 80% of construction and demolition waste from landfill with an aspiration of diverting 95%. Similar projects such as the Lee Tunnel set a landfill diversion target of 75% and a beneficial use target of 80%. In line with other major projects where targets have been set and then exceeded it is anticipated that the Thames Tideway Tunnel project would also where possible endeavour to achieve as much diversion from landfill as possible and beneficially use as much of the excavation material as possible.

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
GLA	GLA-075	Yes	The Mayor welcomes the use of the Waste Hierarchy as a guide for this strategy. He would however like to see more emphasis on waste reduction and over the course of the project, would like to see ambitious targets set for limiting the amount of waste generated in the first place. Further detail on how the Waste Hierarchy will inform the pre-construction stages of the overall project and the individual site projects - e.g. the planning and design, through to material specification and procurement stages.	Minimising the production of excavated material and waste has been considered throughout the design process. A *SWMP*, using a standard template, would be prepared and implemented at all construction sites. At the preconstruction phase, the *SWMP* would set out actions to minimise waste and would provide a forecast of waste arisings. The proposed *SWMP* would require the identification of waste prevention, reuse and recycling opportunities to help ensure waste is managed in accordance with the waste hierarchy.
GLA	GLA-076	Yes	The use of reused and recycled materials in construction should be an integral consideration right from the design stage onwards through specification, contract and construction. It is suggested that a target for the	Contractor(s) would be required to where practicable adopt opportunities for the use of material with recycled content during construction of the Thames Tideway Tunnel project. This would be delivered through the *SWMPs* which is a requirement of the *CoCP.* At this stage it is envisaged that contractor(s) would need to demonstrate how they would maximise the

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
			use of reused and recycled materials is set from the outset in order to drive the work of the various contractors. The *Site Waste Management Plan* monitoring process could be used to understand if this target was being planned for and met by the individual site contractors.	use of reused and recycled materials. Given the variety and complexity of the sites it is not considered appropriate at this stage to set a global target but use the *SWMPs* to maximise such activity.
GLA	GLA-077	Yes	In respect of demolition waste, surveys of existing buildings or infrastructure, to identify potentially reusable and recyclable materials, are carried out well in advance of demolition. Further, arrangements should be put in place to allow for such materials to be recovered prior to demolition.	*SWMPs* would be used to identify waste prevention, reuse and recycling opportunities to help ensure waste is managed in accordance with the waste hierarchy. Opportunities for the reuse and recycling of waste both onsite or offsite would be investigated and implemented, where practicable, as part of the *SWMP* process.
GLA	GLA-078	Yes	Para 5.4.12 of the Waste Strategy says that 'Contractors would be encouraged to improve segregation of different waste types on site". This should be strengthened	This section has been revised and strengthened. It is a requirement of the *SWMP*, through segregation, to maximise opportunities for the potential for reusing and recycling.

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
			to become a requirement unless demonstrably impossible due to site constraints.	
			Para 5.4.16 of the Waste Strategy states that contractors would be encouraged to make use of local permitted and exempt facilities that accept, process and recycle construction materials. This should be a firm requirement.	*SWMPs* would be used to identify waste prevention, reuse and recycling opportunities to help ensure waste is managed in accordance with the waste hierarchy. Opportunities for the reuse and recycling of waste both onsite or offsite would be investigated and implemented, where practicable, as part of the *SWMP* process. Consideration would be given to the selection of material and goods used on the Thames Tideway Tunnel project which would minimise the amount of waste generated and increase the potential for the reuse and recovery
			Special consideration should be given to the potential for recycled material content in concrete used for the project, given that concrete is the most significant material being used. The potential for use of cement and aggregate substitutes, such as China Clay sand and incinerator ash, should be looked at well in advance and should be built	It is a requirement (on the *CoCP*) of the *SWMP*, through segregation, to maximise opportunities for the potential for reusing and recycling. Maximising opportunities would need to consider the on-site treatment of excavated material and using this as fill material. The suggestion of setting a 70% recycling target for welfare waste is noted. However the 70% target suggested would be consistent with the *Waste FD*

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
			into specifications and contracts with the contractor, where appropriate. On-site treatment of excavated material, for use as fill material, should be explored in sites where there may be space available. A target of 70% recycling is suggested for welfare waste, with appropriate facilities and monitoring procedures put in place.	target for the re-use, recycling and other material recovery of non-hazardous construction and demolition waste by 2020. The recycling of welfare waste would better aligned to the *Waste FD* target for re-use and the recycling of municipal waste which is set at a minimum of 50% by 2020. Through the production of a SWMP all excavated material and waste would be managed through segregation, to maximise opportunities for the potential for reusing and recycling. Therefore contractors would be required to identify measures to maximise the recycling of welfare waste through the *SWMP* process. At this stage there is the potential that a 50% or 70% target could artificially constrain the level of recycling and hence limit the application of the waste hierarchy.
English Heritage		No	English Heritage welcomes the inclusion of the objectives to conserve landscape and townscape and to protect heritage for the *EMOA* in Table 4.2 on page 25.	Comment noted.

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
English Heritage		No	English Heritage notes that para. 4.3.22 on page 25 states that the shortlisted receptor sites for utilisation of the excavated materials will be included in the waste strategy once they have been finalised. We would welcome an opportunity to review these for historic environment implications when they become available.	Details of the planning stage preferred list can be found in Section 6.4 and the full *EMOA* report can be found in Vol 3 Appendix A.4.
Environment Agency		No	The statement in the Executive Summary that the excavated waste would generally be categorised as non waste is incorrect and misleading. Statement is currently too simplistic and requires clarification	Comment has been noted and text revised
Environment Agency		No	The WFD mandates that the waste hierarchy be followed, rather than just placing greater emphasis on it as stated	*SWMPs* would be used to identify waste prevention, reuse and recycling opportunities to help ensure waste is managed in accordance with the waste hierarchy.
Environment		No	We would prefer to see a	*SWMPs* would be used to identify waste prevention,

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
Agency			stronger commitment towards recycling from contractors.	reuse and recycling opportunities to help ensure waste is managed in accordance with the waste hierarchy. An individual *SWMP* would be produced for and used on each construction site. Site workers would be provided with appropriate training in on site waste management and recycling procedures.
Environment Agency		No	Statement on non waste needs to be checked. A *Materials Management Plan* would need to be in place to classify as non waste	The statement on non waste within the EM&W strategy has been checked. A *Materials Management Plan* is a requirement of the *CL:AIRE CoP* and would be developed if there are opportunties to apply the *CL:AIRE CoP* . This is addressed in Annex A.2 where the requirements for a *Material Management Plan* are detailed.
Environment Agency		No	Quotes 90% recovery target	A recovery target has not been set for the Thames Tideway Tunnel project. The targets that were detailed in the consultation draft of the EM*&W strategy* have been refined and developed further, more information on targets can be found in Section 3.
Environment Agency		No	We support the provision of training of site workers on recycling procedures. Maximising awareness	An individual *SWMP* would be produced for and used on each construction site. Site workers would be provided with appropriate training in on site waste management and recycling procedures.

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
Environment Agency		No	We support the use of a standard SWMP template across all sites. The template will help the project to identify waste reuse opportunities between different phases/sites which might be undertaken by different contractors.	A *SWMP*, using a standard template, would be prepared and implemented at all construction sites. At the preconstruction phase, the *SWMP* would set out actions to minimise waste and would provide a forecast of waste arisings.
LB Lambeth		No	The council recommend that the maximum amount of waste and spoil material being transferred away from the site be by the river.	The transport of excavated materials and waste from sites is addressed in Transport strategy and therefore outside the scope of the EM&W strategy.
LB Newham		No	End destination for spoil/arisings This relates predominately to the Abbey Mills site but will also be relevant to Beckon. Specific locations for disposal of tunnelling arisings have been identified at this stage – but a review of possibilities has been undertaken. This review refers to 98 options for landfills and quarries needing material for restoration and 35	The *EMOA* process identifies suitable receptor sites for the treatment, handling or use of Thames Tideway Tunnel project excavated material taking into consideration the application of the waste hierarchy. The research undertaken for the *EMOA* provides strong evidence that there is sufficient capacity for use of clean excavated material at reuse and restoration sites within London and the South East. The *EMOA* has been designed to allow for new receptor sites to be evaluated against the same objectives when they are identified in the future.

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
			options for recycling, however taking the volume of material into account (a min of 200,000t), this reduced to 15 end site options. Obviously we would prefer for a sustainable process/end location as possible but appreciate this detail has yet to be finalised.	
LB Southwark		No	The lack of a formal commitment on the part of Thames Water to achieving the 90% target for transportation of waste by barge is a serious cause for objection.	The transport of excavated materials and waste from sites is addressed in *Transport strategy* and therefore outside the scope of the EM&W strategy.
LB Wandsworth		No	Waste Strategy – a definition for 'zero waste' is sought as there will clearly be a lot of waste created. In what sense is excavated material non waste? Excavated material not re used on site would be controlled waste. In appendix 3.1 of the draft waste strategy it would be useful to add the estimated quantities and	Objective W1 has been rephrased to provide clarity and is now "to minimise waste to landfill by prioritising prevention and seeking to maximise reuse and recycling". This does not change the approach for the Thames Tideway Tunnel project which still aims to making the most efficient use of resources, by minimising demand for primary resources and maximising the reuse, recycling and recovery of resources instead of treating them as 'waste' with no innate value. The *CL:AIRE CoP* would be used on a site by site

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
			expected treatment routes for each type of waste by EWC code	basis to determine whether excavated material are classified as waste or not and determine when treated excavated waste can cease to be waste for a particular use, where appropriate. The direct use of material would be the preferred option in terms of the waste hierarchy and would reduce the limited burden that would be placed on the available waste infrastructure.
London Councils		No	London Councils welcomes TW's approach in setting targets for the use of barges and its plans to use barges to remove 90% of spoil from the three main drive sites and for 66% of all excavation material.	The transport of excavated materials and waste from sites is addressed in *Transport strategy* and therefore outside the scope of the EM&W strategy.
Port of London Authority		No	The PLA notes and welcomes the commitment given within this consultation stage the transport of excavated material by water – although is disappointed to note that this commitment appears to relate only to material excavated from the tunnels rather than all excavation works associated with the project. The PLA	The *EMOA* process provides the mechanism through which the Thames Tideway Tunnel project would assess the 'best overall environmental outcome' for the management of the excavated material. It is designed to find beneficial uses for all the excavated material and therefore prevent excavated material being sent for disposal. The *EM&W strategy* addresses the management of excavated material and waste which would include any wastes associated with the excavation works. The transport of excavated materials and waste from

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
			further understands that as with the Lee Tunnel project, the excavated material generated by the scheme will be put to beneficial reuse	sites is addressed in Transport strategy and therefore outside the scope of the EM&W strategy.
Port of London Authority			The PLA can only find one reference in Section 48 publicity to the project committing to beneficial re-use of the excavated materials and this is caveated by reference to it being wherever possible. The PLA does not believe that this represents a sufficient commitment for a scheme of this scale and impact - particularly in relation to the impact on the Transport Strategy. The PLA believes that a firm and binding commitment should be contained within the submitted application.	Beneficial use is the use of the material for a positive purpose which could include recycling, use in industrial processes, and use in development, land remediation, habitat creation and quarry and landfill restoration. The *EMOA* beneficial use test requires that the material is required for the proposed purpose and that it would be managed in a manner that should not harm the environment or human health. TWUL has an overall objective to 'maximise the beneficial use of excavated material arising from tunnel construction this would be delivered through two reporting targets (which would be secured via an agreement with the EA): • to beneficially use a minimum of 85% of clean excavated material with an aspiration to beneficially use 100% of clean excavated material; and • all receptor sites used for the Thames Tideway Tunnel project excavated material assessed against the *EMOA* and the assessment agreed with the EA.

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
				The *EMOA* process identifies suitable receptor site for the treatment, handling and use of Thames Tideway Tunnel project excavated material taking into account consideration the application of the waste hierarchy. The assessment is designed to provide a systematic approach for assessing the most suitable management options for the reuse, treatment and/or disposal of the excavated materials that will arise from the project during the construction phase.
Marine Management Organisation (MMO)			Possible dredging has been mentioned at a number of sites. Should the dredged material be disposed of at sea this will also require a marine license and the sediment would need to be sampled and analysed in line with the Ospar guidelines to ensure compliance with Ospar.	Excavated material produced by the construction of the Thames Tideway Tunnel project is not considered to be dredging material. Should dredging material be disposed on at sea the sediment would be sampled and a marine license obtained in line with Ospar guidelines.
RSPB	RSPB - 012		The RSPB recognises that this proposal will generate 3.7million m^3 of excavated material and the legal requirement to follow the waste hierarchy. Given the nature of the project and the location of the excavation	The *EMOA* process identifies suitable receptor sites for the treatment, handling or use of Thames Tideway Tunnel project excavated material taking into consideration the application of the waste hierarchy.

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
			sites, opportunities to reduce and reuse materials within the project will be limited. Under the waste hierarchy opportunities for recycling should be explored and any residual material recovered in preference to sending to landfill. The RSPB considers it very important that any recovery offers genuine environmental, social and economic benefits.	
RSPB	RSPB - 014		We welcome the commitment to finding a beneficial use for as much of the excavated material as possible, and would welcome firm proposals for the planned end use of excavated material.	The *EMOA* details the process by which potentially suitable receptor sites, for the management of excavated material have been/would be identified. Only receptor sites that meet or exceed the performance of the planning stage preferred options would be used for the management of excavated material.
RSPB	RSPB - 016		We note that the Draft Waste Strategy which has been released as part of the Stage Two Public Consultation does not yet provide a list of preferred receptor sites for the Thames Tideway Tunnel	Some further information was provided by the RSPB following the update of the *EMOA* in August 2012. RSPB have also brought forward the Cliffe Pools site which is on the planning stage preferred list. There is ongoing contact with the RSPB. Details of the planning stage preferred list can be found in Section 6.4 and the full *EMOA* report can be

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
			project excavated material. We understand that this preferred list of receptor sites for this excavated material will be included in this Waste Strategy once they have been finalized. We would welcome an opportunity to comment on this preferred list prior to the submission of the application in 2012	found in Vol 3 Appendix A.4.
RSPB	RSPB - 017		In order to enable Thames Water to make further decision on the suitability of Wallasea Island, we are able to provide additional required information on request.	The *EMOS* that has been developed for Wallasea Island has been discussed with RSPB. Some further information was provided by the RSPB following the update of the *EMOA* in August 2012.
City of London Corporation			Require confirmation that the excavated materials from the tunnelling sites will be dealt with in a sustainable manner. The Excavated Materials Options Assessment sets a suitable framework, although the environmental objectives should include enhancement alongside protection. Details of	The *EMOA* process identifies suitable receptor site for the treatment, handling and use of Thames Tideway Tunnel project excavated material taking into account consideration the application of the waste hierarchy. The assessment is designed to provide a systematic approach for assessing the most suitable management options for the reuse, treatment and/or disposal of the excavated materials that will arise from the project during the construction phase. For those sites that have progressed on to the

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
			the options selected should form part of the final proposals.	planning stage preferred list an Excavated Materials Options Suitability report has been produced providing more detail on the receptor sites. Further information on enhancement has been provided where enhancement of the receptor site would result following the use of Thames Tideway Tunnel project excavated material at the site. The planning stage preferred list is included in Section 6. The *Planning stage preferred list* demonstrates that facilities can be identified which meet Thames Water's requirements with respect to delivery, sustainability considerations and environmental protection. However inclusion on the planning stage preferred list does not guarantee the use of a receptor site, as this could: a. prejudice any future procurement activities; and b. potentially rule out alternative receptor sites which perform as well as those on the *planning stage preferred list* and may become available prior to the Thames Tideway Tunnel project construction work commencing. TWUL or their agent would ensure that the final location(s) and end use(s) for the material would perform as well as those receptor sites identified on the *Planning stage preferred list*. Approval of the final list of receptor sites would be sought from the

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
				Environment Agency (as a obligation of an agreement).
City of London Corporation			Any proposed recovery should offer genuine environmental, social and economic benefits.	The assessment methodology for the *EMOA* applies a sustainability appraisal, developed in conjunction with the Environment Agency through a series of workshops. The assessment is based on a consistent assessment of receptor sites against evaluation objectives agreed with the EA. The objectives have been developed to reflect Thames Water's aspirations for the management of excavated material in line with good practice, as well as reflecting the policy context within the NPS and other national and regional policies.
City of London Corporation			Excavated material should be taken to Maplin by rail via Shoeburyness to firm the fill for reclaiming the co-ordinated Thames Estuary development.	We have been in contact with a number of developments within the Thames Estuary including: • DP World – London Gateway • London Thames Gateway Development Corporation • Thurrock Thames Gateway Development Corporation • Environment Agency Flood Protection We have also been in contact with operators who run the following sites: Metrotidal development, Rainham, Pitsea, Barling Marsh, Mucking, Sheerness,

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
				Rushenden, Cliffe Pools. All the above sites have been through the *EMOA* process and two are on the planning stage preferred list and one of them is on our reserve list.
Crown Estates		No	No comments on waste	
Highways Agency		No	No comments on waste	
LB Ealing		No	No comments on waste	
LB Hammersmith and Fulham		No	No comments on waste	
LB Hounslow		No	No comments on waste	
LB Lewisham		No	No comments on waste	
LB Richmond		No	No comments on waste	
LB Tower Hamlets		No	No comments on waste	
LB Waltham Forest		No	No consultation response	
National Grid		No	No comments on waste	
Natural		No	No comments on waste	

Stakeholder	Comment reference	Logged in TT consultation table	Comments	Response to comments
England				
RB Greenwich		No	No comments on waste	
RBKC		No	No comments on waste	

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Annex H: Sewage-derived litter

H.1.1 Table H.1 shows the reduction in the discharge of materials to the tidal Thames from the current baseline (2010) to post Thames Tideway Tunnel project completion (2021).

Table H.1 Estimated sewage-derived solid material that would be deposited on the foreshore of the tidal Thames per annum

	Discharge to river (m^3)	Baseline discharged to river (%)	Reduction of discharge to river (%)	Tonnes litter discharged (tonnes)
Current baseline	39,817,000	100	0	10,000
Post completion of the Lee Tunnel	17,871,000	45	55	4,500
Post completion of the Thames Tideway Tunnel project	2,335,000	6	94	600

H.1.2 The three scenarios displayed in Table H.1 are as follows:

a. the current baseline – takes into account the existing system and the existing STW (as of 2006)

b. post Lee Tunnel – takes into account the planned STW improvements and the completion of the Lee Tunnel. Date for this scenario is 2021 and takes into account the increase in population

c. post Thames Tideway Tunnel project – takes into account the planned STW improvements, the completion of the Lee Tunnel and the completion of the Thames Tideway Tunnel project (based on the preliminary phase two consultation scheme). The date set for this scenario is 2021 and takes into account the increase in population.

H.1.3 The five datasets summarised in the table are as follows:

a. discharge of all materials to the river – this is based on the capacity of the system described in the scenario. This also takes into account the predicted population increase

b. the scenario's discharge as a percentage of the baseline discharge to the river

c. the reduction of the baseline discharge achieved by the scenario

d. the tonnage of litter that is included in the discharged material. This is based on the assumption that the tonnage of litter per m^3 of discharged material would substantially change between the scenario's timeframes. Under this assumption, there are 260t of litter in 1million m^3 of discharge

e. number of spills from the system in a 'typical year' under each scenario. A typical (weather) year is taken as October 1979 to September 1980.

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.03**

Volume 3: Project-wide effects assessment appendices

Appendix A.4: Excavated materials options assessment (EMOA)

APFP Regulations 2009: Regulation **5(2)(a)**

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Creating a cleaner, healthier River Thames

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A.4 Excavated materials options assessment (EMOA)

A.4.1 The following report has its own table of contents

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Thames Tideway Tunnel

Environmental Statement

Volume 3 Appendices: Project-wide effects assessment

Appendix A.4: Excavated materials options assessment

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Executive summary

EX 1 Introduction

EX 1.1 The Thames Tideway Tunnel project would require the excavation of significant volumes of material at several sites across London. This excavated material would come primarily from the construction of the main tunnel but also from the construction of connections between the tunnel and existing combined sewer overflows (CSOs). To identify the potential preferred options for the management of the excavated material, a detailed Excavated material options assessment (EMOA) has been undertaken.

EX 1.2 The aims of the *EMOA* are to:

a. Identify suitable potential receptor sites for the treatment, handling or use of Thames Tideway Tunnel project excavated material taking into consideration:

   i the sustainability of potential receptor sites based on environmental, social and economic factors, as well as the viability in relation to handling the excavated material from the Thames Tideway Tunnel sites

   ii the application of the waste hierarchy

   iii the life-cycle of the excavated material at the receptor site in the assessment of impacts.

b. Determine the potential capacity for the treatment, handling and use of Thames Tideway Tunnel project excavated material.

c. Provide an evaluation process that would be used to support the application for development consent (the ‘application’), which would subsequently be used to evaluate tenders for the treatment, handling and use of the excavated material, to ensure that sustainability is taken into consideration during the procurement process.

d. Provide information to support the application process by demonstrating that there is sufficient capacity at suitable potential receptor sites for managing excavated materials.

e. Provide transparency for the application process through a clear and documented options assessment.

EX 1.3 The *EMOA* forms Appendix A.4 to Volume 3 Project-wide effects assessment of the *Environmental Statement*.

EX 1.4 The *EMOA* supports the *EM&W strategy* (Appendix A.3 to Vol 3 of the *Environmental Statement*) by demonstrating there is sufficient capacity at suitable potential receptor sites for managing excavated materials. The *EMOA* also provides a mechanism for assessing any additional suitable potential receptor sites for the treatment, handling or use of Thames Tideway Tunnel project excavated material.

EX 1.5 The *EM&W strategy* includes details of the anticipated volumes of excavated material and waste, both at the project wide level and also on a site by site basis. The volumes of excavated material to be removed from each of the sites and the volume of waste generated forms an important part of the assessment of likely significant effects described in the *Environmental Statement*[1].

EX 1.6 The EMOA represents the available receptor sites at a point in time. It is likely that other sites would become available before construction commnences. Thames Water would assess any new sites which are proposed, using the methodology presented in the EMOA and acceptable sites would be those which score no worse than those sites on the preferred receptor site list (at the time of submission of the application). It is anticipated that the Environment Agency approval would be needed before new receptor sites are identified for the excavated material.

EX 2 Method

EX 2.1 The assessment methodology for the *EMOA* applies a sustainability appraisal, developed in conjunction with the Environment Agency (EA) through a series of workshops. The *EMOA* assumes that the excavated material would be segregated at source (eg clay and sands would remain separated from the point of excavation until acceptance at a receptor site). While the objective would be to separate the materials (sands, clays, etc), the tunnel boring method would inevitably lead to a degree of mixing at a number of locations.

EX 2.2 The options assessment has been undertaken prior to obtaining consent for the project and before construction contractors have been appointed, in order to provide confidence that a sustainable solution can be delivered for all of the Thames Tideway Tunnel project excavated material. This means, that given the timescales involved, the assessment methodology needs to be flexible and to take into account the uncertainty associated with a number of factors, such as:

a. the exact volume and nature of material arisings are likely to change

b. specific receptor sites may cease to be viable by the time the project receives approval and/or over the construction period of the project

c. new receptor sites may become available throughout this period.

EX 2.3 The assessment has taken a phased approach and at each stage the least preferred receptor sites have been eliminated until the final most viable and sustainable receptor sites have been identified to form the planning stage preferred list. Inclusion of a receptor site on the planning stage preferred list does not guarantee that the site would ultimately form part of a contract for the use of Thames Tideway Tunnel project material.

[1] The process of excavating and removing of the material from the CSO and main tunnel sites is what has been assessed within the ES. For example the volume of excavated material sets the barge and lorry movements and the duration and type of plant used to excavate the material has informed the noise assessment.

The final solution would be procured through a formal tendering procedure. The receptor sites on the planning stage preferred list demonstrate the potential capacity to manage the excavated material in a sustainable manner which accords with the guidance in the *National Policy Statement (NPS)* (Defra, 2012)[1].

EX 2.4 The assessment is based on the consistent assessment of receptor sites against evaluation objectives agreed with the EA, whereby the same objectives are used at each stage in the assessment process. The *EMOA* evaluation objectives set the context for the *EMOA* and set out the key characteristics of the preferred receptor sites. The objectives have been developed to reflect TWULs aspirations for the management of excavated material in line with best practice, as well as reflecting the policy context within the NPS and other national and regional policies. The objectives for the *EMOA* are closely linked to those of the Thames Tideway Tunnel *Excavated material and waste (EM&W) strategy* (see Table EX 1).

Table EX 1 Excavated material options assessment evaluation objectives

Evaluation objectives
1. To ensure prudent use of land and other resources
2. To reduce climate change impacts
3. To protect local amenity
4. To conserve landscapes and townscapes
5. To protect to protect quality of and access to open space
6. To protect water quality
7. To protect biodiversity
8. To protect cultural heritage
9. To provide employment opportunities
10. To minimise the costs associated with the management of excavated material
11. To ensure operational suitability of the receptor site
12. To conform with the waste hierarchy
13. To conform with the proximity principle
14. To conform with sustainable transport policy
15. To conform with health and safety good practice

EX 2.5 The steps in the assessment process are:

a. Development of a long list of potential receptor sites for the treatment, reuse, recycling or disposal of excavated materials.

b. Viability filter involving the assessment of the long list against the operational evaluation objective associated with viability of the receptor sites.

c. Preliminary assessment to develop a short list of receptor sites which perform sufficiently well against all the evaluation objectives (environmental, social, operational, policy and health and safety).

d. Detailed assessment in which the receptor sites on the short list are further scrutinised to produce a planning stage preferred list of receptor sites which are considered to perform best against the full suite of evaluation objectives. For each short listed receptor site whose viability has been confirmed a detailed *Excavated materials option suitability (EMOS) report* has been produced. The *EMOS reports* provide a summary of the site operations and the overall performance of the receptor site against the evaluation objectives.

EX 3 Results

EX 3.1 The long list comprises 247 potential receptor sites across the seven business sectors which were identified as potentially having a use for the types of material excavated through the Thames Tideway Tunnel project (e.g. the use of chalk in the cement/concrete manufacturing sector). These receptor sites are primarily landfills and quarries in need of material for restoration (150 receptor sites) and recyclers (52 receptor sites).

EX 3.2 The receptor sites on the long list were assessed against a series of operational viability indicators related to:

a. the ability of the receptor site to accept the volumes and generation rates of the excavated material, and

b. whether the receptor site possesses the necessary planning consents and permits.

EX 3.3 This viability test determined that only 34 of the 247 long list receptor sites passed through the assessment and onto a viable list.

EX 3.4 The receptor sites on the viable list were subsequently assessed against all of the evaluation objectives and awarded a red (adverse), amber (neutral), or green (beneficial) grade against each objective. Only 28 receptor sites preformed sufficiently well based on the number of red grades and professional judgement as to whether any individual red grade (or combination of grades) made a particular receptor site unsuitable for inclusion on the short list.

EX 3.5 Based on information provided by the operators, all the receptor sites taken through to the short list were understood to be able to meet the criterion of accepting at least 200,000t of excavated material over the project's lifetime.

EX 3.6 The 28 sites which progressed to the short list were then re-interviewed and/or the appropriate planning consents and environmental permits were reviewed. Following this exercise 14 receptor sites were found to have issues which would make the sites unviable for use by the Thames Tideway Tunnel project based on current information.

EX 3.7 The remaining 14 sites underwent the detailed assessment. Following this assessment all 14 sites were taken through to the planning stage preferred list.

EX 3.8 Three receptor sites which have the potential to become viable in the future have been placed on the reserve list. These receptor sites could be reconsidered and taken forward through the process if their circumstances change.

EX 4 Conclusions

EX 4.1 It is considered unlikely that only one receptor site would be used to accept the Thames Tideway Tunnel project excavated material. Therefore a combination of receptor sites would form the final solution with respect to end/beneficial uses for the Thames Tideway Tunnel project excavated material. No single receptor site on the planning stage preferred list is currently permitted to accept all of the Thames Tideway Tunnel project material based on the anticipated timing and volume of material produced.

EX 4.2 The 14 receptor sites on the planning stage preferred list are shown in Table 5.1 and in summary:

a. All of the sites are located within 90km of the drive sites and all but two of the sites accessed by road are within 30km of the drive sites.

b. All but two of the receptor sites would accept all of the main excavated material from the Thames Tideway Tunnel sites (although some of the sites have expressed a preference for the chalk to be mixed with other materials).

c. Four of the receptor sites have planning consent up to 2019. However, three receptor sites are consented to complete restoration during 2021 and seven are currently consented to accept material beyond 2021.

EX 4.3 The Planning stage preferred list demonstrates that facilities can be identified which meet Thames Water's requirements with respect to delivery, sustainability considerations and environmental protection. However inclusion on the planning stage preferred list does not guarantee the use of a receptor site, as this could:

a. prejudice any future procurement activities; and

b. potentially rule out alternative receptor sites which perform as well as those on the *planning stage preferred list* and may become available prior to the Thames Tideway Tunnel construction work commencing.

EX 4.4 It is anticipated that TWUL or their agent would ensure through a process established in anagreement with the Environment Agency that the final location(s) and end use(s) for the material would be assessed against the *EMOA* and be equivalent to those receptor sites identified on the *Planning stage preferred list*.

EX 4.5

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1 Scope of the EMOA

1.1 Introduction

1.1.1 To support the application and the delivery of the Thames Tideway Tunnel project, an assessment of the suitable potential receptor sites for the treatment, handling and use of excavated material arising from the Thames Tideway Tunnel project during the construction phase has been undertaken. This report sets out the *Excavated material options assessment (EMOA)* method and results.

1.1.2 The construction of the Thames Tideway Tunnel project would require the excavation of a large volume of material at several sites throughout London. This excavated material would primarily arise from the construction of the main tunnel but also from the construction of the connections between the Tunnel and the existing CSOs.

1.1.3 Other construction phase wastes and operational wastes (post construction) (including hazardous waste) are not addressed in this document but are considered by the *Excavated material and waste (EM&W) strategy*. The *EM&W strategy* provides a framework for the management of materials and waste that would be produced throughout the construction and operational phases of the project.

1.1.4 The aims of the *EMOA* are to:

a. Identify suitable potential receptor sites for the treatment, handling or use of Thames Tideway Tunnel project excavated material taking into consideration:

   i the sustainability of potential receptor sites based on environmental, social and economic factors, as well as the viability in relation to handling the excavated material from the Thames Tideway Tunnel sites

   ii the application of the waste hierarchy

   iii the life-cycle of the excavated material at the receptor site in the assessment of impacts.

b. Determine the potential capacity for the treatment, handling and use of Thames Tideway Tunnel project excavated material.

c. Provide an evaluation process that would be used to support the application, which would subsequently be used to evaluate tenders for the treatment, handling and use of the excavated material, to ensure that sustainability is taken into consideration during the procurement process.

d. Provide information to support the application process by demonstrating that there is sufficient capacity at suitable potential receptor sites for managing excavated materials.

e. Provide transparency for the application process through a clear and documented options assessment.

1.1.5 The *EMOA* forms Appendix A.4 to Vol 3 Project-wide effects assessment of the *Environmental Statement*.

1.1.6 The *EMOA* supports the *EM&W strategy* (Appendix A.3 to Vol 3 Project-wide effects assessment of the *Environmental Statement*) by demonstrating there is sufficient capacity at suitable potential receptor sites for managing excavated materials. The *EMOA* also provides a mechanism for assessing any additional suitable potential receptor sites for the treatment, handling or use of Thames Tideway Tunnel project excavated material.

1.1.7 The *EM&W strategy* includes details of the anticipated volumes of excavated material and waste, both at the project wide level and also on a site by site basis. The volumes of excavated material to be removed from each of the sites and the volume of waste generated forms an important part of the assessment of likely significant effects described in the *Environmental Statement*[1].

1.1.8 The methodology provides a transparent mechanism to assess potentially suitable receptor sites for the excavated material from the Thames Tideway Tunnel project. The approach allows information relating to the most relevant criteria to be collated and the overall balance of adverse and beneficial attributes to be considered. The suitability of the receptor site is ultimately based on informed professional judgement.

1.1.9 Paragraph 2 of the Waste Framework Directive (waste FD) (European parliament, 2008)[2] relates to the application of the waste hierarchy and allows a life-cycle approach to be taken when considering the overall sustainability of a waste management option. The *EMOA* provides the mechanism through which the Thames Tideway Tunnel project would assess the 'best overall environmental outcome' with respect to the use of the Thames Tideway Tunnel project excavated material allowing a life-cycle approach to be taken with respect to the application of the waste hierarchy for the excavated material.

1.1.10 The Thames Tideway Tunnel project would produce a large volume of excavated material at a number of sites throughout London during the construction phase of the project (2016 to 2021). It is anticipated that receptor sites for the excavated material would primarily be located around Greater London and the South of England; although, some viable receptor sites may be further afield.

1.1.11 The *EMOA* has been undertaken during the preparation of the application. However, given the timescales involved, there are a number of uncertainties which could affect the assessment process. Therefore, the assessment needs to be robust whilst flexible as:

a. The exact volume and nature of excavated material may change.

b. The availability and suitability of the receptor sites identified through the assessment may change over both the time until project gains approval and the construction period of the project.

c. New receptor sites may become available throughout this period.

1.1.12 To accommodate this time dependent element, the assessment has been designed so that it can be rerun at any point until the receptor sites are procured and the excavated material is produced.

1.1.13 The assessment considers a number of factors including:

a. the quantity and characteristics of the excavated materials over time

b. the policy context (within London and the surrounding regions)

c. good practice guidance (on excavation material and waste management)

d. environmental factors relating to the transport, receipt, treatment and end use or disposal of excavated material at the receptor sites

e. socio-economic factors relating to the transport, receipt, treatment and end use or disposal of excavated material at the receptor sites

f. overall cost effectiveness.

1.1.14 It should be noted that the *EMOA* is designed to determine the potential suitability of receptor sites to accept Thames Tideway Tunnel project excavated material and it is not a detailed environmental impact assessment for the potential receptor sites. The environmental impact of each receptor site is the responsibility of the receptor site operator and would be considered as part of the application for planning consent for that site.

1.1.15 The Environment Agency (EA) is a key stakeholder for the *EMOA*. The methodology set out in this report takes into consideration comments received from the EA on April 2011 and at the waste technical working group meetings in May, July, October 2011 and February and April 2012.

1.1.16 The *EMOA represen*ts the available receptor sites at a point in time. As noted above, it is likely that other sites would become available before construction commences. Thames Water or its agents would assess any new sites which are proposed, using the methodology presented in the EMOA and acceptable sites would be those which score no worse than those sites on the preferred *receptor site list (at* the time of submission of the application). It is anticipated that the Environment Agency approval would be needed before new receptor sites are identified for the excavated material.

1.1.17

1.2 Excavated material volumes and types

1.2.1 The assessment methodology presented in this report is based on the estimated types and distribution of excavated materials.

1.2.2 Plate 1.1 shows the proposed Abbey Mills route and Plate 1.2 shows how the proposed length of the tunnel means that the in situ geology varies along the length of the tunnel. The excavated materials would vary as the tunnel construction progresses, from west to east, through clays to sands and gravels and then chalk.

1.2.3 Plate 1.3 shows the estimated materials arising at each of the Thames Tideway Tunnel project construction sites. Table 1.1 summarises the general characteristics of the anticipated excavated materials and the total estimated volumes and tonnages of each material. The assumed bulking factors and density of the excavated materials are provided in Annex A.1. Further detail relating to the characteristics of the anticipated excavated material is provided in Annex A.2.

1.2.4 The characteristics of the anticipated excavated material have been determined in order to ascertain its value and suitability for potential reuse, recovery and beneficial use through the options assessment.

1.2.5 There would be three main drive sites with different excavated material being generated at each site:

a. Carnwath Road Riverside, where the primary excavated material would be London Clay.

b. Kirtling Street, where the primary excavated materials would be London Clay and Thanet Sands/Lambeth Beds. Although it should be note that at Kirtling Street, there would be two tunnel boring machines (TBMs) which would extract two excavated material types. It is envisaged that when transporting this excavated material to the surface, the materials would be mixed, rather than having two independent conveyors. Therefore a material stream of mixed clay and Lambeth Beds gravels would be produced.

c. Chambers Wharf, where the primary excavated material would be chalk.

Plate 1.1 Route plan

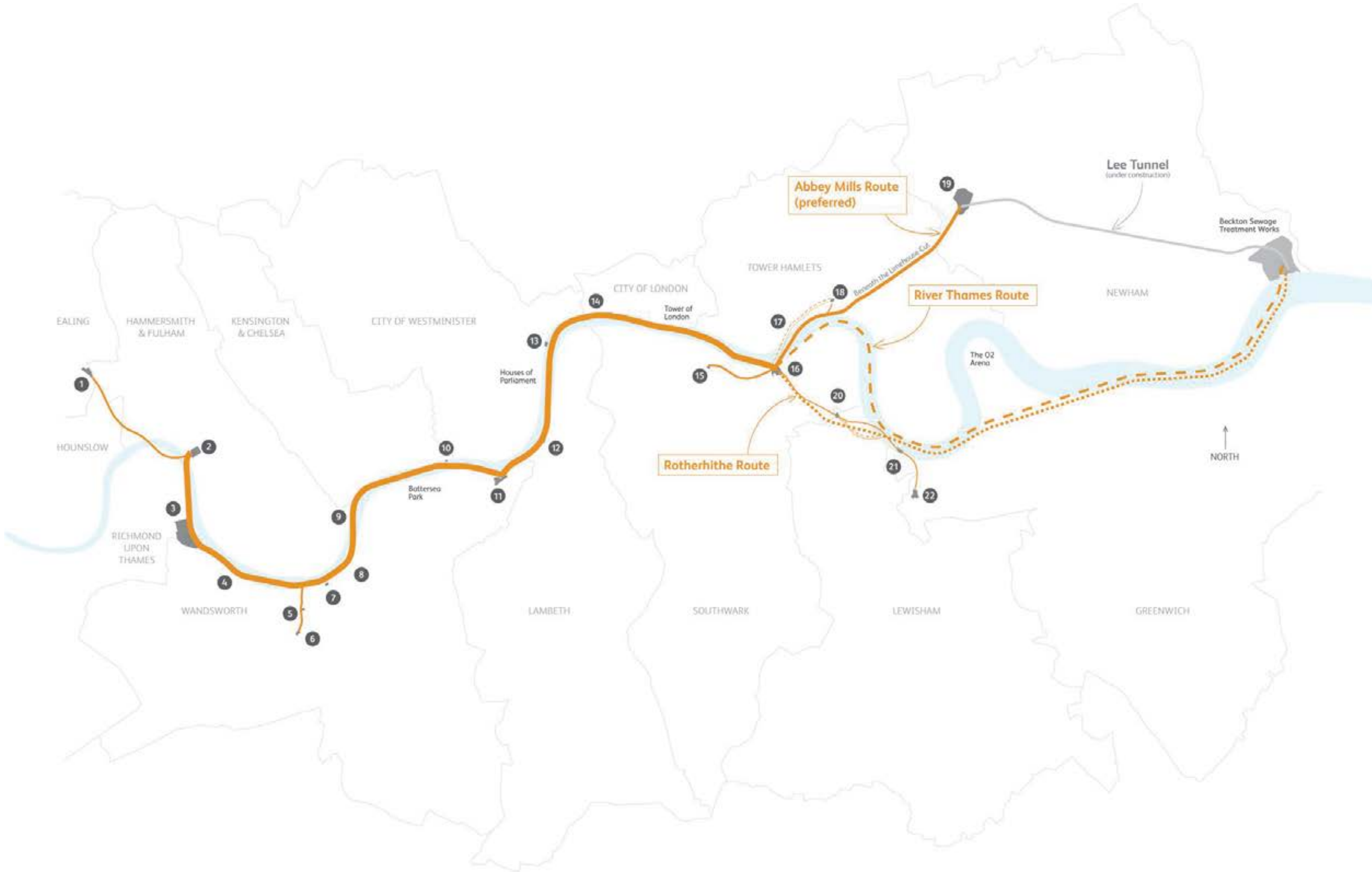

Plate 1.2 Cross section of tunnel

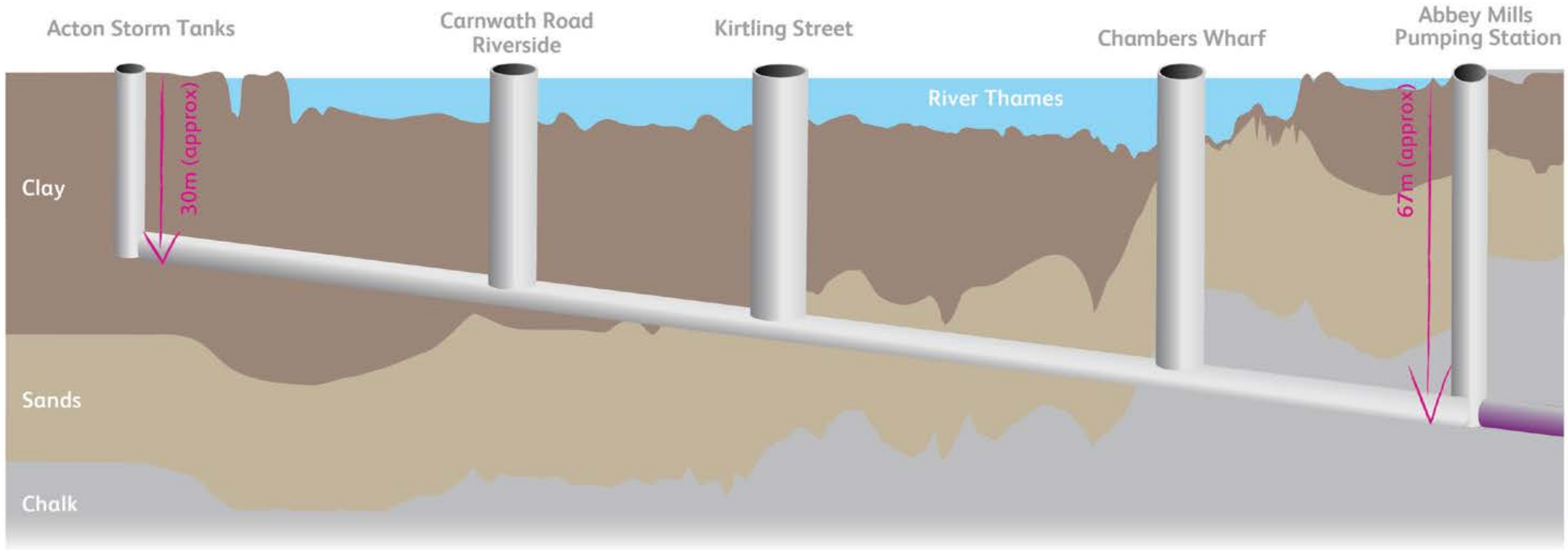

Plate 1.3 Estimated types and distribution of excavated materials (based on project at the time of *Environmental Statement*)

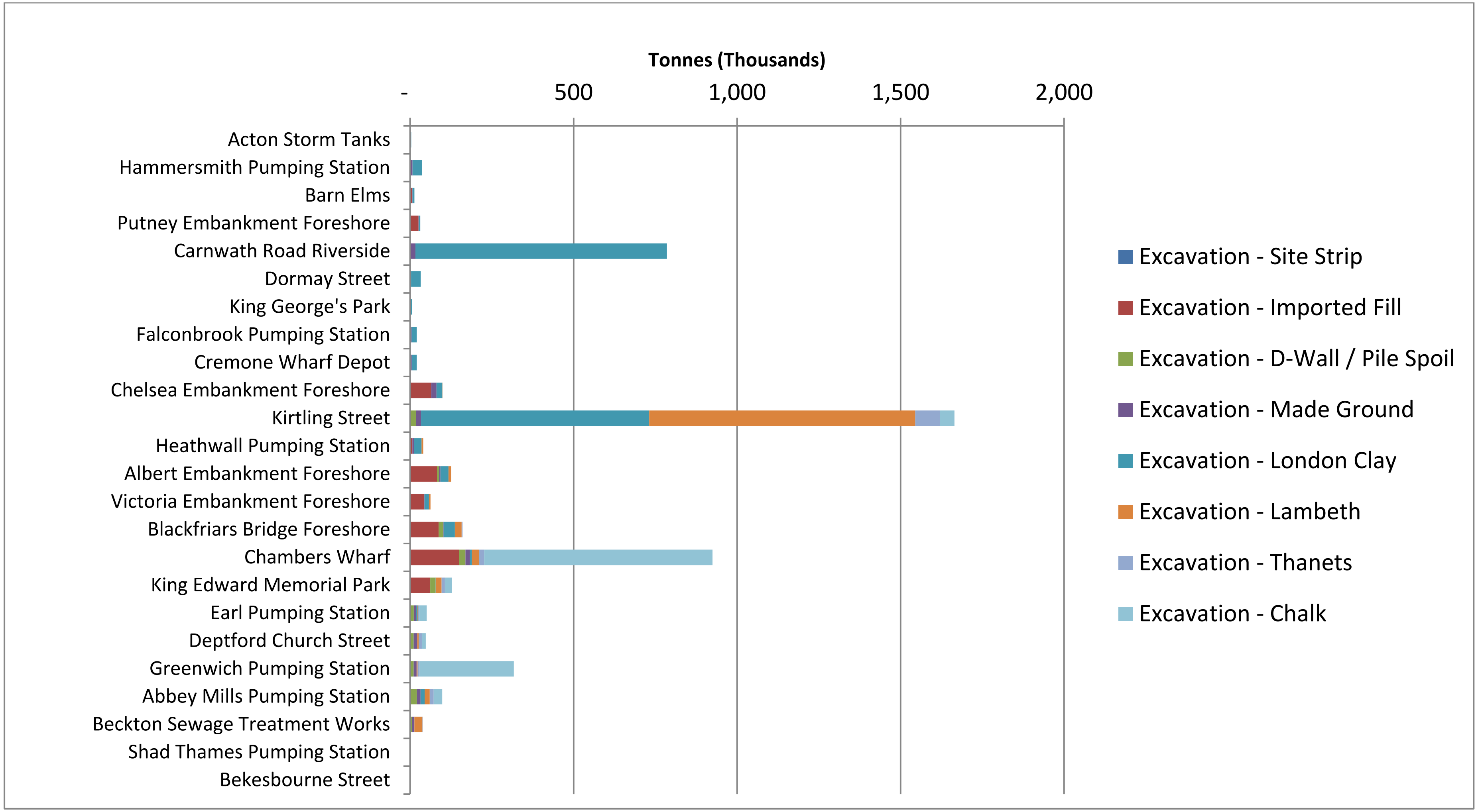

Table 1.1 Estimated total excavated materials arising from the Thames Tideway Tunnel project construction (based on *Environmental Statement* scheme)

Material	Description	Total volume in situ (‘000m^3)	Total volume excavated (‘000m^3)	Total weight (‘000t)
Site strip	This material is generally soft material, e.g. topsoil and vegetation, but can include materials such as concrete hard standings. It is removed from site so that the works are undertaken on a sound surface.	6	7	12
Imported fill	This material would generally be imported crushed angular fill. Could be inert demolition arisings or similar, which is later re excavated.	261	314	523
Diaphragm wall/pile spoil	This material would constitute the undisturbed materials, along with bentonite.	64	77	129
Made ground/ superficial deposits	There is no typical description for this material. Site investigation is required at each site to determine the nature of the material.	70	84	141
London Clay	Fine sandy silty clay to silty clay predominantly* excavated by tunnel boring machine.	854	1,452	1,708
Sands from the Thanet groups	Materials from the Thanet geological group predominantly* excavated by tunnel boring machine. Thanet Group comprises fine grained sands with higher clay / silt content in the lower sequence	68	96	137
Clays and sands from the Lambeth group	Materials from the Lambeth geological group predominantly* excavated by tunnel boring machine. Lambeth Group comprises highly variable sediments of clay, sands, pebble beds and shelly beds. Lambeth Group comprises highly variable sediments of clay, sands, pebble beds and shelly beds.	471	801	942
Chalk	Chalk predominantly* excavated by tunnel boring machine and mechanical excavation (likely to have high	556	890	1,112

Material	Description	Total volume in situ ('000m^3)	Total volume excavated ('000m^3)	Total weight ('000t)
	moisture content).			
Total excavated materials		**2,352**	**3,721**	**4,704**
** some material would be excavated during the shaft sinking process at the CSO interception shafts.*				

1.2.6 The Thames Tideway Tunnel project construction programme means that more excavated materials are generated during the years when the main tunnel drives are being excavated. Table 1.2 shows the tonnes of excavated material which would be produced in each year of the Thames Tideway Tunnel construction.

Table 1.2 Estimated excavated materials arising from the Thames Tideway Tunnel project construction ('000t) over time (based on *Environmental Statement* scheme)

	Year						Total
	2016	2017	2018	2019	2020	2021	
Total Thames Tideway Tunnel project production (tonnes)	63	549	1,938	1,852	147	155	4,704

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2 Assessment methodology

2.1 Options assessment approach

2.1.1 The methodology for assessment of the excavated material options is based on the *Sustainability Appraisal* (*SA*) methodology (ODPM, 2005)[3]. The method has been developed in consultation with the EA through a series of working group workshops. The methodology provides a mechanism for collating and assessing information relating to different aspects of each receptor site. This enables the overall suitability of different receptor sites, for inclusion in the planning stage preferred list, to be determined based on informed professional judgement.

2.1.2 As part of the Thames Tideway Tunnel project phase two consultation undertaken between 4 November 2011 and 10 February 2012 the *EM&W strategy* (including the *EMOA)* was consulted on.

2.1.3 The *EMOA* identifies a series of receptor sites, which achieve an appropriate level of sustainability performance and demonstrates that there is currently more than sufficient capacity to manage the excavated material in a sustainable manner.

2.1.4 The planning stage preferred list demonstrates that facilities can be identified which meet the Thames Tideway Tunnel project's requirements with respect to delivery, sustainability considerations and environmental protection. However inclusion on the planning stage preferred list does not guarantee the use of a receptor site, as this could:

a. prejudice any future procurement activities; and

b. potentially rule out alternative receptor sites which perform as well as those on the planning stage preferred list and may become available prior to the Thames Tideway Tunnel project construction work commencing.

2.1.5 The *EMOA represen*ts the available receptor sites at a point in time. It is likely that other sites would become available before construction commences. Thames Water or its agents would assess any new sites which are proposed, using the methodology presented in the EMOA and acceptable sites would be those which score no worse than those sites on the preferred *receptor site list (at* the time of submission of the application). It is anticipated that the Environment Agency approval would be needed before new receptor sites are identified for the excavated material.

2.1.6 Plate 2.1 illustrates the phased approach to the *EMOA*. It shows how as the assessment process progresses, the least preferred receptor sites are eliminated from the assessment until suitable potential receptor sites are identified for inclusion on the planning stage preferred list..

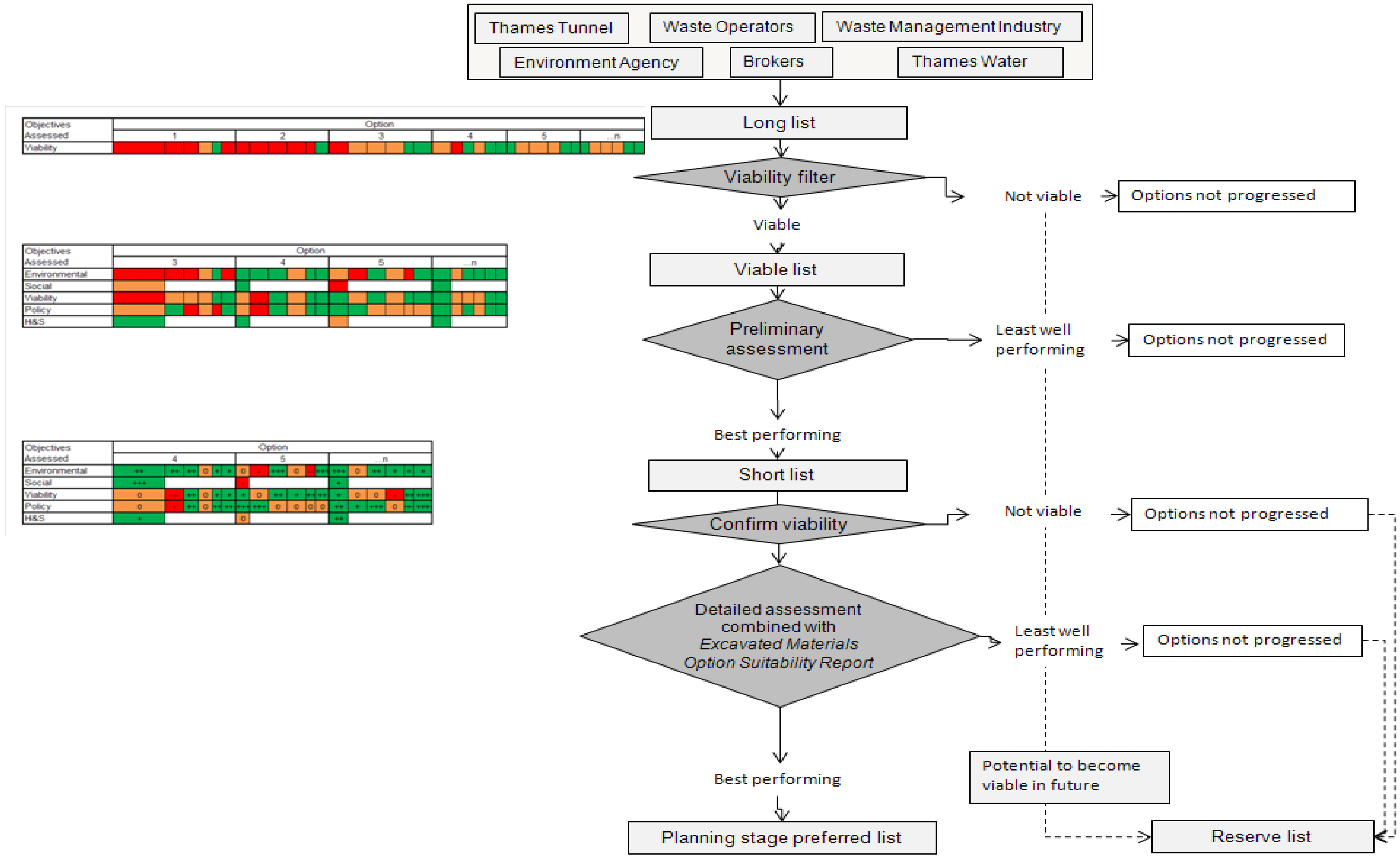
2.1.7 The receptor sites are assessed throughout the process against a set of evaluation objectives and evaluation indicators which have been developed in consultation with and agreed with the EA.

2.1.8 The EA have indicated that they consider that the *EMOA* provides a systematic approach for identifying potential suitability receptor sites for the excavated material from the Thames Tideway Tunnel project.

2.1.9 If new information is obtained which materially changes the performance of a receptor site, the receptor site can be reassessed at any stage in the *EMOA*.

2.1.10 The *stag*es of the *EMOA* are set out in with a detailed explanation of each stages set out in Section 2. Section 3 then sets out the assumptions and limitations of the *EMOA.*

Plate 2.1 Assessment process



2.2 Evaluation objectives

2.2.1 The evaluation objectives for the assessment of receptor sites set the context for the *EMOA.* The objectives reflect TWUL or their agents aspirations for the management of excavated material to be in line with best practice, as well as reflecting the regional and national policy context. The objectives for the *EMOA* are closely linked to those of the project *EM&W strategy*.

2.2.2 The evaluation objectives address:

a. environmental, social and economic issues

b. operational issues (including costs and reliability of delivery)

c. conformity with the *EM&W strategy*, waste management policy and health and safety good practice.

2.2.3 The evaluation objectives for the assessment are shown in Table 2.1.

2.2.4 The same evaluation objectives would be used at each stage in the assessment process.

Table 2.1 Excavated materials options assessment evaluation objectives

Evaluation objectives
1. To ensure prudent use of land and other resources
2. To reduce climate change impacts
3. To protect local amenity
4. To conserve landscapes and townscapes
5. To protect to protect quality of and access to open space
6. To protect water quality
7. To protect biodiversity
8. To protect cultural heritage
9. To provide employment opportunities
10. To minimise the costs associated with the management of excavated material
11. To ensure operational suitability of the receptor site
12. To conform with the waste hierarchy
13. To conform with the proximity principle
14. To conform with sustainable transport policy
15. To conform with health and safety good practice

2.2.5 The *EM&W strategy* sets out overarching objectives for the management of all excavated materials and wastes arising from the Thames Tideway Tunnel project, from construction design through to operation. The *EM&W strategy* objectives reflect a desire to manage materials and waste sustainably and appropriately and focus on delivery of the waste hierarchy. Article 4 of the waste FD sets out the waste hierarchy to ensure that waste is dealt with in the priority order of prevention, preparing for reuse, recycling, other recovery (e.g. energy recovery) and then disposal. The intention is to move all waste away from the disposal end of the waste hierarchy to the more preferable option of beneficial use, reuse, recycling or recovery, or ideally preventing waste in the first instance. The waste hierarchy and how it relates to the Thames Tideway Tunnel project is presented in detail in the *EM&W strategy*.

2.2.6 The evaluation objectives are informed by the following legislation and policy documents[I]:

a. Revised Waste Framework Directive (2008/98/EC)(European parliament, 2008)[4]

b. Planning Policy Statement 10 (PPS10)(DCLG, 2011)[5]

c. Waste Water National Policy Statement (Defra, 2012)[6]

d. National Waste Strategy 2007 (Defra, 2007)[7] and the Waste Strategy Review 2011 (Defra, 2011)[8]

e. *London Plan 2011* (GLA, 2011)[9]

f. *West London Sub Regional Plan* (GLA, 2006)[10]

g. Relevant LPA Documents[11]

h. Thames Water Environment Policy (Thames Water, 2010)[12]

i. Thames Tideway Vision[13].

2.2.7 The evaluation objectives also take into account the South East and Eastern England regional policy context, as it is possible that receptor sites could be located in these regions.

2.2.8 Environmental baseline data also provides context for the evaluation objectives. Due to the large potential area in which the excavated materials may be handled, the baseline context comprises London, South East of England and East of England. The EA's state of the environment reports provide this baseline information for each region with respect to issues of regional concern such as climate change, air quality, flood risk , water quality and waste management.

2.2.9 The methodology does not rule out receptor sites located further from London (e.g. receptor sites in the north of England and Europe are considered) and these are also considered to prevent potential viable receptor sites being missed off the assessment. However, the policy and environment context for other regions is not reviewed in detail.

2.2.10 Annex B.1relates the evaluation objectives to the relevant national and regional policies.

[I] The evaluation objectives were developed in March 2011 and the planning framework has since changed. In particular regional plans have been superseded and new national planning guidance has removed most of the Planning Policy Statements. It should be noted that PPS10 remains in force until such time as the National Waste Plan is published. The London Plan also remains in force. The other regional plans (South East England and East of England) continue to provide useful context and baseline data. The Waste Water National Policy Statement was formally published in March 2012 and provides guidance for the Thames Tideway Tunnel project as a Nationally Significant Infrastructure Project.

2.3 Evaluation indicators and evaluation criteria

2.3.1 To assess the performance of each receptor site, a set of evaluation indicators, shown in Table 2.2, have been developed for each of the *EMOA* evaluation objectives. The evaluation indicators are measurable attributes which reflect the performance of each receptor site against the overall objectives. The indicators reflect the regional environmental and socio-economic context as summarised in Annex B.1. They concentrate on the issues which have the most importance locally and on which the Thames Tideway Tunnel project is most likely to have an effect through the acceptance of its excavated materials.

2.3.2 The indicators remain the same throughout the *EMOA* and are assessed using the assessment method given in column three of Table 2.2.

Table 2.2 Excavated materials options assessment evaluation objectives and indicators

Evaluation objectives	Evaluation indicators	Assessment method
1. To ensure prudent use of land and other resources	a) Extent to which resources such as sand, gravel and chalk are conserved by processing or storage of Thames Tideway Tunnel project material at receptor sites.	Quantitative assessment of raw material substitution based on current or proposed activities at the receptor sites
	b) Extent to which Thames Tideway Tunnel project material would affect landtake at (footprint of) receptor sites.	Quantitative assessment of the proportion of the receptor site affected based on current or proposed activities at and footprint of the receptor site
2. To reduce climate change impacts	a) Greenhouse gases emitted through treatment, handling and use of excavated material at receptor sites (excludes transport).	Qualitative assessment based on professional judgement regarding the degree of handling and treatment required at the receptor site
	b) Extent to which flood risk is altered by Thames Tideway Tunnel project material at the receptor site (or in the local catchment).	Qualitative assessment based on professional judgement regarding the scale and nature of potential effects from handling, treatment, use or disposal of Thames Tideway Tunnel project material at the receptor site
	c) Greenhouse gases emitted through transport of Thames Tideway Tunnel project	Quantitative assessment based on published data for carbon dioxide (CO_2)

Evaluation objectives	Evaluation indicators	Assessment method
	material to the receptor sites.	emissions from standard haulage vehicles or barges.
3. To protect local amenity	a) Extent of potential effects on local amenity from treatment, handling and use of Thames Tideway Tunnel project material at receptor sites.	Qualitative assessment based on professional judgement regarding potential effects taking into consideration baseline air quality (proximity to an Air Quality Management Area (AQMA)), on site operations and proximity to sensitive receptors
4. To conserve landscapes and townscapes	a) Extent of short term visual & landscape impacts from treatment, handling and use of Thames Tideway Tunnel project material at receptor sites.	Qualitative assessment based on professional judgement regarding “visual context” of the receptor site including proximity to an Area of Outstanding Natural Beauty (AONBs).
	b) Extent of permanent visual & landscape impacts from treatment, handling and use of Thames Tideway Tunnel project material at receptor sites.	Qualitative assessment based on professional judgement regarding “visual context” of the receptor site including proximity to AONBs.
5. To protect quality of and access to open space	a) Would Thames Tideway Tunnel project material enhance quality of and access to open space in the short term?	Qualitative assessment based on professional judgement of short term effects on public rights of way and publically accessible open spaces.
	b) Would Thames Tideway Tunnel project material enhance quality of and access to open space in the long term?	Qualitative assessment based on professional judgement of long term effects on public rights of way and publically accessible open spaces.
6. To protect water quality	a) Extent of potential effects on fluvial water quality from treatment, handling and use of Thames Tideway Tunnel project material at receptor sites.	Qualitative assessment based on professional judgement regarding potential effects taking into consideration proximity to water courses and nature of activities at the receptor site.
	b) Extent of potential effects on groundwater quality from treatment, handling and use of	Qualitative assessment based on professional judgement regarding potential effects

Evaluation objectives	Evaluation indicators	Assessment method
	Thames Tideway Tunnel project material at receptor sites.	taking into consideration proximity to groundwater protection zones and nature of activities at the receptor site.
7. To protect biodiversity	a) Extent of potential effects on designated sites for nature conservation from treatment, handling and use of Thames Tideway Tunnel project material at receptor sites in the short term.	Qualitative assessment based on professional judgement of potential effects taking into consideration proximity to sites of international, national or local importance for nature conservation and nature of activities at the receptor site.
	b) Extent of potential effects on designated sites for nature conservation from treatment, handling and use of Thames Tideway Tunnel project material at receptor sites in the long term.	Qualitative assessment based on professional judgement of potential effects taking into consideration proximity to sites of international, national or local importance for nature conservation and nature of activities at the receptor site.
8. To protect cultural heritage	a) Extent of potential effects on designated or nominated cultural heritage sites from treatment, handling and use of Thames Tideway Tunnel project material at receptor sites.	Qualitative assessment based on professional judgement of potential effects taking into consideration proximity to sites of international, national or local importance and nature of activities at the receptor site.
9. To provide employment opportunities	a) Extent to which the acceptance of Thames Tideway Tunnel project material by the receptor site would affect the number of jobs available at the receptor sites in the short term.	Quantitative assessment of the potential for effects on job numbers in the short term based on available data and professional judgement.
	b) Extent to which the acceptance of Thames Tideway Tunnel project material by the receptor site would affect the number of jobs available at the receptor sites in the long term.	Quantitative assessment of the potential for effects on job numbers in the long term based on available data and professional judgement.
10. To minimise the costs associated	a) Costs of treatment,	Quantitative assessment of the potential cost of

Evaluation objectives	Evaluation indicators	Assessment method
with the management of excavated material	handling and use of material.	transporting, receiving, handling and disposing or using materials at the receptor sites based on available data relating to current prices.
11. To ensure operational suitability of the receptor site	a) Likelihood of implementation within the required timescale.	Quantitative assessment based on information from permits, planning conditions and site interviews
	b) Acceptability of material with Thames Tideway Tunnel project material characteristics by the receptor sites.	Qualitative assessment based on information from permits, planning consents and site interviews
	c) Capacity of the receptor site to accept the required volume of Thames Tideway Tunnel project material (based on likely tonnage accepted).	Quantitative assessment based on information from permits, planning conditions and site interviews
	d) Ability of the receptor sites to accept Thames Tideway Tunnel project material at the anticipated rate (speed of material generation versus acceptance rate).	Quantitative assessment of the receptor sites' ability to accept the number, frequency and size of transport vehicle required based on information from permits, planning conditions and site interviews
	e) Site operations have appropriate planning/permitting consents.	Qualitative assessment based on information from permits, planning conditions
	f) Can accept excavated material from multiple transport modes?	Qualitative assessment of the access to site from road network, marine transport and rail.
12. To conform with the waste hierarchy	a) Extent to which the receptor site complies with the *EM&W strategy*.	Quantitative assessment based on modelled performance. Information from the assessment has been based on site interviews and permitted capacity. Receptor sites have been

Evaluation objectives	Evaluation indicators	Assessment method
		assessed against the *EMOA* beneficial use test.[II]
13. To conform with the proximity principle[III]	a) Average distance from main tunnel drive sites.	Quantitative assessment based on distance from the main tunnel drive sites to receptor sites.
14. To conform with the sustainable transport policy	a) Conforms with the policy objective to move transport of materials from road to rail or marine transport.	Qualitative assessment of the potential for receptor sites to accept material from marine transport or rail.[IV]
15. To conform with health and safety good practice	a) Health and safety performance conforms with good practice.	Qualitative assessment based on assessment of health and safety track record for receptor sites, site operators and proposals for planned receptor sites.

2.3.3 Evaluation criteria are used to determine the performance of each receptor site against each of the evaluation indicators. The evaluation criteria are based on the assessment methods set out in Table 2.2.

2.3.4 The evaluation criteria set the basis for awarding a grade to each evaluation indicator (e.g. red, amber or green). The evaluation criteria become more detailed at each stage of the assessment to allow a greater degree of evaluation.

2.3.5 The evaluation criteria for each stage of the *EMOA* can be found in the following locations:

a. viability filter going from long list to viable list (see Annex B.4)

b. preliminary assessment going from the viable list to short list (see Annex B.5)

c. detailed assessment going from the short list to planning stage preferred list (see Annex B.8).

2.4 Development of the long list

2.4.1 The extensive list of potentially suitable receptor sites which could accept Thames Tideway Tunnel project excavated material for treatment, reuse,

[II] Beneficial use is the use the material for a positive purpose including recycling, use in industrial processes, use in development, land remediation, habitat creation and landfill restoration. The *EMOA* beneficial use test requires that the excavated material is required for the proposed purpose and that it would be managed in a manner that should not harm the environment or human health.

[III] The proximity principle is based on enabling waste to be managed at one of the nearest appropriate installations/sites.

[IV] It does not consider the transhipment sites and their direct effect on the Thames Tideway Tunnel project.

recycling, beneficial use or disposal is called the long list. The long list is compiled using the systematic approach detailed in this section.

2.4.2 Potential receptor sites for inclusion on the long list are identified with no pre-determined assumptions relating to costs, location, transport, quality or quantity. This is to ensure all reasonable endeavours are made not to intentionally discriminate any receptor site until investigated.

2.4.3 Potential receptor sites are identified by contacting organisations or industry bodies from the sectors listed below. The list reflects the opinions of professionals in the waste management and environmental industry sectors.

2.4.4 Sectors with a potential need for chalk:

a. users of lime for agricultural purposes
b. users of lime for industrial purposes
c. grout and adhesive manufacture
d. toothpaste manufacture
e. power industry for gas scrubbing
f. metal manufacturing
g. paint manufacturing
h. cement/concrete manufacturing
i. habitat creation
j. infrastructure creation or renewal
k. landfill restoration.

2.4.5 Sectors with a potential need for clay:

a. new developments – engineering material
b. flood defence
c. landfill engineering
d. brick manufacturing
e. oil field infilling
f. lagoon restoration
g. habitat creation
h. infrastructure creation or renewal
i. landfill restoration

2.4.6 Sectors with a potential need for sand and gravel:

a. new developments – engineering material
b. soil manufacturing/ amendment
c. aggregate suppliers
d. cement/concrete manufacturing

e. brick manufacturing

f. landscaping

g. habitat creation

h. infrastructure creation or renewal

i. inert material recyclers

j. landfill restoration.

2.4.7 For each sector, if the first organisation contacted categorically states that it has no use for the material and that it believes no other organisation in their sector is interested, then no further data is gathered from that sector. If a sector is found to have a use for the Thames Tideway Tunnel project material a more comprehensive survey is undertaken within that sector. All organisations contacted are recorded on the long list to ensure a record of all contacts is held.

2.4.8 Potential receptor sites within each sector are identified through:

a. Desk based internet searches on sectors, organisations or projects within these sectors.

b. HMRC website (Landfill operators and aggregate suppliers).

c. Discussions with Thames Water (TW), the EA, developers, manufacturers, aggregates companies, major land holders, waste brokers, waste management companies and other interested parties.

d. Literature review of Environmental Statements and Waste Strategies for similar projects within London such as:

   i the Lee Tunnel

   ii Crossrail

   iii Battersea Power Station redevelopment.

e. The EA's list of permitted inert, non-biodegradable landfills and physical treatment facilities.

f. The minerals and waste development plans for planning authorities in and around London.

g. The South East England Partnership Board (2009) *Aggregates Monitoring Report 2008*[14].

2.4.9 The long list includes receptor sites requiring all of the types of excavated material produced by the Thames Tideway Tunnel project and receptor sites requiring just one or two types of material. For example, only chalk slurry might be suitable for restoring chalk grassland.

2.4.10 Data gathering is focused on receptor sites within London, the East and South East England due to the evaluation objectives relating to the proximity principle, greenhouse gas emissions and cost. Where organisations identified have multiple locations within the UK (for example, waste management companies), those sites within or near the Greater London region are prioritised. Where the sector or type of receptor site does not have a London facility, sites further afield are considered, for example, using chalk as a catalysing agent in copper, iron and steel manufacture is not carried out within the London region.

2.4.11 Organisations with more than one potential site for accepting the Thames Tideway Tunnel project excavated material have each site recorded as a separate receptor site on the long list.

2.4.12 All potential receptor sites identified are recorded on the long list and those which are considered unviable (based on the assumptions set out in the viability filter method in Section 2.5) may be subsequently filtered out as part of the assessment process.

2.5 Viability filter (development of the viable list)

2.5.1 The next stage of the assessment is to consider the operational viability of the potential receptor sites. Therefore the viability filter stage assesses the long list of options to filter out the operational unviable receptor sites. Each receptor site is assessed against the operational evaluation objective 11 and associated evaluation indicators a – e, which are:

a. likelihood of implementation within the required timescale
b. acceptability of material with Thames Tideway Tunnel project material characteristics by the receptor sites
c. capacity of the receptor site to accept the required volume of Thames Tideway Tunnel project material (based on likely tonnage accepted)
d. ability of the receptor sites to accept Thames Tideway Tunnel project material at the anticipated rate (speed of material generation versus acceptance rate)
e. site operations have appropriate planning/permitting consents.

2.5.2 This operational objective and the associated indicators are set out in Annex B.4

2.5.3 Data relating to each evaluation indicator has been obtained from:

a. internet searches
b. telephone interviews using a standard set of questions (see Annex B.2)
c. information relating to permitted capacity provided by the EA. Whilst this data does not reflect the actual available capacity of the facility during the project lifetime, it does provide information reflecting the scale of operations at the facility.

2.5.4 Based on the information obtained, each operational indicator is given a preliminary red, amber, green performance grade. The evaluation criteria for awarding each gradation are set out in Annex B.4.

2.5.5 The grades are awarded based on the information obtained from the data gathering exercise and are primarily based on the information obtained from the operators interviewed.

2.5.6 Factors that could cause receptor sites not to be taken forward to the viable list include but are not limited to:

a. no capacity or limited at the receptor site

b. limited operational timescales of the receptor site compared to the Thames Tideway Tunnel project timescales

c. insufficient/limited information provided by the operator about the receptor site

d. the operator requesting that receptor sites are not taken forward

2.5.7 Professional judgement and information obtained from the operators is used to assess the viability against the criteria.

2.5.8 Those receptor sites which grade predominantly green and amber are given a green overall suitability grade and are taken forward to the viable list.

2.6 Preliminary assessment (development of the short list)

2.6.1 The third stage (preliminary assessment) of the *EMOA* develops a short list of the receptor sites from on the viable list. The purpose of the short list is to identify the receptor sites, on the viable list, which perform best against the full suite of evaluation objectives (environmental, social, operational, policy and health and safety), apart from cost, which is not considered at this stage in the assessment.

2.6.2 The receptor sites on the viable list are given a red, amber or green grade for each evaluation indicator and those that perform best progress through to the short list based on:

a. the number of red and green grades awarded for a site;

b. consideration of the reason for each red grade; and

c. professional judgement as to whether any individual red grade (or combination of grades) made a particular receptor site unsuitable.

2.6.3 Data is collated for all the sites on the viable list to enable performance against all of the evaluation indicators to be assessed for each receptor site. Operational objectives are reassessed at this stage to ensure any new or updated information is captured in the assessment.

2.6.4 All the receptor sites on the viable list are contacted again to not only obtain further information relating to their operational viability but also to obtain information relating to the other evaluation indicators. More detailed telephone discussions or face to face meetings are held. The discussions undertaken with the operators are based on the questions set out in the preliminary assessment prompt sheet. The prompt sheet is used to make sure all the relevant topics are covered and all the necessary information obtained during the conversation. This prompt sheet is presented in Annex B.7. The information obtained from these interviews is included in the results set out in Annex C.3.

2.6.5 Information relating to a receptor site's planning consents and permits is obtained from the operator at this stage in the assessment (a more detailed assessment of a receptor site's planning consent, obtained from Local Authority records and permit conditions from EA records, is conducted at the next stage of assessment, the detailed assessment, to confirm the operator's responses.)

2.6.6 A desk based study is undertaken to obtain the environmental baseline for each site on the viable list. This includes a review of data from:

a. The magic.defra.gov.uk website (www.magic.defra.gov.uk). Information held on the website includes nature conservation designations such as Ramsar sites and Sites of Special Scientific Interest (SSSIs), Scheduled Ancient Monuments, AONB, public rights of way, greenbelt and potential receptors such as water courses.

b. Defra's website on Air Quality Management Areas[15] provided information on Air Quality Management Areas.

c. The EA's web tool "Not in my backyard"[16]. This site holds information relating to flood zones, aquifers, permitted activities and landfills.

d. EA data relating to site permitting.

2.6.7 Straight line distances are measured from the excavated material extraction points (Carnwath Road Riverside for clays, Kirtling Street for Thanet and Lambeth groups, and Chambers Wharf for chalk) to each receptor site.

2.6.8 CO_2 equivalent (CO_2 eq) from transportation of the excavated material to each receptor sites is estimated using the Defra/DECC greenhouse gas conversion factors May 2012[17]. The purpose of the greenhouse gas (GhG) conversion factors is to help businesses convert existing data sources (e.g. utility bills, car mileage, refrigeration and fuel consumption) into CO_2 eq emissions by applying relevant conversion factors (e.g. calorific values, emission factors, oxidation factors). This tool provides conversion factors for freight transport by road, rail and shipping. The assumptions relating to emissions from different modes of transport are in line with the assumptions made in the Thames Tideway Tunnel project *Transport strategy* and *Energy statement* that support the application.

2.6.9 The information relating to each receptor site is collated and assessed to award each receptor site on the viable list a performance grade for each evaluation indicator; again using a traffic light approach. The justification for the grade is recorded in the results section of this report. The evaluation criteria which form the basis for this grading are presented in Annex B.5. The assumptions applied when grading the performance against each evaluation indicator are presented in Annex B.6.

2.6.10 Each receptor site is then assessed to determine whether it performed well enough to proceed to the short list. The justification for selection or de-selection of each receptor site is documented in Section 4 to provide full transparency in the assessment process. This assessment is based on both the number of red and green grades awarded for a site, a consideration of the reason for each red grade and professional judgement as to whether any individual red grade (or combination of grades) made a particular receptor site unsuitable. The information collated, grades awarded, overall suitability to be taken through to the short list and justifications are recorded in the preliminary assessment spreadsheet presented in Annex C.3.

2.7 Detailed assessment (development of planning stage preferred list)

2.7.1 The next step of the assessment develops a planning stage preferred list of receptor sites. The planning stage preferred list is a list of the receptor sites that have performed sufficiently well, against the full set of evaluation criteria in the *EMOA*, to demonstrate their suitability to accept excavated material.

2.7.2 The planning stage preferred list demonstrates that facilities can be identified which meet the Thames Tideway Tunnel project's requirements with respect to delivery, sustainability considerations and environmental protection. However inclusion on the planning stage preferred list does not guarantee the use of a receptor site, as this could:

a. prejudice any future procurement activities; and

b. potentially rule out alternative receptor sites which perform as well as those on the planning stage preferred list and may become available prior to the Thames Tideway Tunnel project construction work commencing.

2.7.3

2.7.4 The *EMOA represen*ts the available receptor sites at a point in time. It is likely that other sites would become available before construction commences. Thames Water or its agents would assess any new sites which are proposed, using the methodology presented in the EMOA and acceptable sites would be those which score no worse than those sites on the preferred *receptor site list (at* the time of submission of the application). .

2.7.5 In order to obtain a greater resolution at this stage of the assessment, the evaluation indicators are assessed against seven grades of impact (where possible). These seven grades of effect allow a more detailed assessment to be undertaken relating to the red, amber, green assessment of the previous stage. These performance grades are as set out in Table 2.3.

Table 2.3 Performance grades used in the detailed assessment to move from the short list to the planning stage preferred list

Effect	Primary scale	Secondary scale
Major adverse	Red	- - -
Moderate adverse	Red	- -
Minor adverse	Red	-

Effect	**Primary scale**	**Secondary scale**
Negligible	Amber	0
Minor beneficial	Green	+
Moderate beneficial	Green	++
Major beneficial	Green	+++

2.7.6 The planning stage preferred list forms part of the *EM&W strategy* and accompanies the application. It is designed to support the assessment of regional capacity and help to demonstrate that there is sufficient regional capacity to accommodate the Thames Tideway Tunnel project excavated material and wastes without having an adverse effect on overall regional capacity. It is anticipated that prior to construction, a greater number of receptor sides would

2.7.7 Receptor sites may move on or off this list if their performance alters, for example:

a. if a receptor site obtains planning consent it may move on to the list; or

b. if a receptor site finds alternative materials and no longer requires Thames Tideway Tunnel project excavated material it may move off the list).

2.7.8 All receptor sites added to the planning stage preffered list would be assessed against the full range of evaluation objectives using the detailed assessment.. This would ensure that any additional receptor sites meet or exceed the performance of the receptor sites on the planning stage preferred list. Approval of the final list of receptor sites would be sought from the Environment Agency.

2.7.9 The first step in the detailed assessment stage is to obtain further detail relating to the receptor sites' viability. This is to confirm that the receptor sites are still viable for the full detailed assessment. Information relating to viability is obtained from a detailed review of the receptor site's planning consents and environmental permits. A face to face interview is also held with the operator (see Annex B.7 for a copy of the prompt sheet used to guide these interviews).

2.7.10 The information obtained for each receptor site at this stage is assessed to determine whether there are any issues that would prevent the use of the receptor site. This detailed higher level reassessment is based on the operational evaluation objective 11 and associated evaluation indicators a – e to confirm viability. No other objectives are re-evaluated.

2.7.11 If further information gained from either speaking to the operators and/or reviewing the receptor site's consents highlights that the receptor site is not viable to continue onto the planning stage preferred list then this receptor site is not taken through to the full detailed assessment stage and remains on the short list.

2.7.12 Those receptor sites that pass the confirmation of viability assessment are further scrutinised, using more detailed criteria, to produce a planning stage preferred list of receptor sites, based on the receptor sites which perform best against the full suite of evaluation objectives.

2.7.13 The best performing receptor sites are identified through a detailed higher resolution reassessment of the receptor sites against the evaluation objectives and the development of an *Excavated materials options suitability (EMOS) report* for each receptor site. An *EMOS report* is only compiled for receptor sites which pass the confirmation of viability assessment.

2.7.14 At this stage in the assessment further data relating to the short listed receptor sites is obtained from:

a. interviews and site walkovers relating to the practicalities of using each receptor site

b. the Defra/DECC greenhouse gas conversion factors and the EA's WRATE tool[18] relating to greenhouse gas emissions

c. copies of planning consents and conditions (where available)

d. copies of environmental permits and permit conditions (where available)

e. site restoration plans and associated documents (where available)

f. other relevant documents, consents and plans (where available)

2.7.15 Indicative costs are assessed for each receptor site which pass the confirmation of viability assessment. The cost assessment includes estimated transport costs and gate fees (including landfill tax where appropriate) based on current prices. The cost assessment excludes any costs associated with transhipment as the transport routes are unknown at this stage. This cost estimate is used as a comparator between receptor sites and does not provide a forecast of actual excavated material management costs.

2.7.16 Once all the data relating to each of the short listed receptor sites which have passed the confirmation of viability assessment have been collated and assessed a grade is awarded against each evaluation indicator.

2.7.17 The timescales involved in the Thames Tideway Tunnel project and the relatively high level of this assessment inevitably means that there is a degree of uncertainty in the assessment. However, rather than using a "?" to indicate where there is uncertainty, professional judgement is used to estimate the most appropriate grade based on the current information and hence provide a more meaningful assessment at this time. This is to avoid the potential use of a large number of "?" which would limit the benefit of the *EMOA*. Where the likely outcome against a specific evaluation criteria cannot be ascertained satisfactorily an amber (0) grade is awarded and the uncertainty noted in the justification.

2.7.18 The evaluation criteria for awarding these grades against each evaluation indicator are set out in Annex B.8.

2.7.19 The assumptions applied when grading the performance against each evaluation indicator are presented in Annex B.9.

2.7.20 For each receptor site which passes the confirmation of viability assessment a detailed *EMOS report* is produced. The *EMOS report* is used to inform the workshop at which the receptor sites, recommended for inclusion the planning stage preferred list, are discussed. The *EMOS report* provides a summary of the site operations and the overall performance of the receptor site. The profile includes a detailed discussion on each of the evaluation indicators, a site map and location map and gives a conclusion on overall site suitability.

2.7.21 The planning stage preferred list of receptor sites is based on the outcome of the detailed assessment and experienced professional judgement as to whether any individual red grade (or combination of grades) made a particular receptor site unsuitable. The justification for selection or de-selection of each receptor site is documented in Section 4 to provide full transparency in the assessment process.

2.8 Reserve list

2.8.1 It is recognised that the performance of the receptor sites on the short list could change over time. Throughout the assessment there have been some receptor sites which have failed to proceed to the next stage of the assessment due to their current operational circumstances and do not meet the necessary grade to move to the planning stage preferred list. However these receptor sites have the potential to become viable in the future, and as such have been placed on a reserve list. These receptor sites include receptor sites which have yet to receive planning consent or whose ownership is in transition. These receptor sites may be reconsidered and taken forward through the process if their circumstances change.

2.9 Status of EMOA lists

2.9.1 The *EMOA* has been designed to take account of changing circumstances at the receptor sites. Receptor sites may move on or off the planning stage preferred list if their performance alters e.g.

a. if a receptor site obtains planning consent it may move on to the list, or

b. if a receptor site finds alternative materials and no longer requires Thames Tideway Tunnel project excavated material it may move off the list.

2.9.2 Receptor sites and other stakeholders, such as the EA and local authorities, have been contacted at intervals throughout the *EMOA* process and any new information received has been taken into account in the assessment.

2.9.3 If additional receptor sites are identified they would go through the same evaluation process as receptor sites identified at the beginning of the process and would be added to the long list.

2.9.4 Inclusion of a receptor site on the planning stage preferred list does not guarantee that the site would ultimately form part of a contract for the use of Thames Tideway Tunnel project material. The final solution would be procured through a formal tendering procedure.

2.9.5 Following submission of the application the *EMOA* would be held. Any new information received during the application process would be noted but the assessment would not be rerun. If development consent is obtained any information received following application approval would be assessed as part of the procurement phase of the assessment. Approval of the final list of receptor sites would be sought from the Environment Agency.

3 Assumptions and limitations

3.1 Introduction

3.1.1 The *EMOA* has been undertaken to support the application, and therefore, given the timescales involved, there are a number of uncertainties which could affect the assessment process. This means that the *EMOA* is based on a number of assumptions as well as some potential limitations.

3.1.2 This section highlights the key assumptions and limitations.

3.2 Overall assessment assumptions

3.2.1 The three main tunnel drive sites e.g. Carnwath Road Riverside, Kirtling Street and Chambers Wharf (plus Greenwich Pumping Station which is a CSO interception and connection tunnel drive site) would produce approximately 72% of the total anticipated excavated material for the project eg 3.4million tonnes. The remaining 18 sites would produce approximately 1.3million tonnes, 72,000t on average per site over the six years of construction. The *EMOA* focuses on identifying a series of sites which achieve an appropriate level of sustainability performance and demonstrates that there is currently more than sufficient capacity to manage the excavated material in a sustainable manner. In order to assess a manageable number of sites and to identify capacity for the full 4.7million tonnes, smaller receptor sites which might be appropriate for receiving relatively small volumes of material from the main tunnel sites have been filtered out of the assessment.

3.2.2 Smaller receptor sites are considered to be those which can accept less than 200,000t. However, this does not prevent these smaller receptor sites from forming part of the final solution for the Thames Tideway Tunnel project material if they meet the other assessment requirements at the procurement stage.

3.2.3 In the *EMOA* from the development of the long list up to the preliminary assessment it is assumed that the excavated material is segregated at source (eg clay and sands remain separated from excavation until final destination). However, the tunnel boring method would inevitably lead to a degree of mixing at a number of locations. The ability of the short listed receptor sites to accept this mixed material is investigated at the detailed assessment stage.

3.2.4 Aggregated 'combined options' comprising a combination of sites (owned by either one organisation or many) are not included in the assessment. This is because the number of permutations would be too great to enable meaningful comparisons.

3.2.5 A combined option comprising a network of receptor sites controlled by the same operator could offer more flexibility and practicality in delivering the solution. However, it is considered that for the purposes of this assessment, a combined option could discriminate against smaller operators without an extensive network of facilities. It is also considered that a combined option could reintroduce receptor sites which would be filtered out of the process if considered on their own. So organisations with more than one receptor site have each site recorded as a separate option on the long list.

3.2.6 The planning stage preferred list receptor sites make use of a range of transport modes (marine transport, road and rail). Receptor sites have not been excluded from the planning stage preferred list if they require material to be delivered using a mode which is not reflected in the Thames Tideway Tunnel project *Transport strategy*. At this stage it is assumed that if necessary excavated material would be taken from the main tunnel drive sites and CSO sites as set out in the *Transport strategy* and then taken to an intermodal transfer station (transhipment point) if necessary to deliver the material to the receptor site. It has been assumed that these transhipment poinst would have appropriate planning and environmental permits and that the environmental effects associated with the transhipment points would have been assessed and addressed by the relevant consents.

3.3 Ranking assumptions

3.3.1 Specific assumptions relating to the grading given for each evaluation indicator are recorded in the following locations:

a. viability filter assumptions can be found in Annex B.4

b. preliminary assessment assumptions can be found in Annex B.6

c. detailed assessment assumptions can be found in Annex B.9

3.3.2 Many of the receptor sites progressing to the detailed assessment stage of the EMOA have planning consent and if appropriate an environmental permit. Therefore for many of the environmental objectives these receptor sites have been awarded an amber grade (0) indicating that they have no or negligible effect on the environment as the site's impacts are controlled through the consenting and permitting process. This does not invalidate the assessment but demonstrates the acceptability of the receptor site with respect to these attributes.

3.4 Limitations

3.4.1 The *EMOA* methodology aims to ensure a comprehensive list of receptor sites is collated and assessed. However, it should be noted that the list is unlikely to be exhaustive. The type of receptor sites being assessed, especially receptor sites relating to restoration and use of materials in development, are not recorded in a single register. This means that it is inevitable that some potential receptor sites have not been identified by this assessment.

3.4.2 The assessment process relies to a large extent on responses to telephone surveys and internet searches. Whilst every endeavour is made to verify and ensure the information used is correct, the accuracy of all information cannot be guaranteed. The *EMOA* has been designed to allow for the reassessment of receptor sites if data with improved accuracy is obtained. Information obtained and assessed during the *EMOA* would not prevent any organisation from taking part in the procurement for a management solution for the Thames Tideway Tunnel project excavated material.

3.4.3 When contacted, several organisation/site representatives responded that they could not confirm the sites' ability to receive a specific throughput, capacity or meet the timescales of the Thames Tideway Tunnel project. This was largely due to the time horizons involved in the project (2016 and beyond). There is the potential for circumstances at the receptor site to alter to such a degree that information provided at this stage (2012) may no longer be accurate by 2016.

3.4.4 A number of the organisations contacted considered it likely that the circumstances at their sites would have changed in the future, which would affect their ability to receive Thames Tideway Tunnel project materials. The reasons given included that sites:

a. may obtain other significant contracts for material

b. expand

c. go out of business, or

d. use up their remaining void space by the time the Thames Tideway Tunnel project starts excavations.

3.4.5 Therefore, representatives were often unable to provide a guarantee that their sites would be able to receive Thames Tideway Tunnel project material and could only give assurances that they considered it likely or possible that their sites would be able to accept the material. In these instances, the ability of these sites to accept a useful amount of material was assessed.

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4 Assessment results

4.1 Development of long list

4.1.1 The long list was developed using the methodology set out in Section 2.4.

4.1.2 After identifying sectors and operators as detailed in the methodology, Table 4.1 shows the number of receptor sites assessed for each sector. The locations of the receptor sites on the long list are shown in Annex C.1.

Table 4.1 Number of receptor sites included in long list by sector

Sector	Number of receptor sites	Summary response
Agricultural lime	1*	This sector is unlikely to accept Thames Tideway Tunnel project produced chalk due to its anticipated high moisture content and the sector currently having sufficient supplies of better quality material.
Users of lime for industrial purposes (including metal manufacturing)	1*	This sector does not require chalk produced by Thames Tideway Tunnel project due to the anticipated variability in its quality and the current industrial suppliers having sufficient sources of chalk.
Grout and adhesive manufacture	1*	This sector would not require Thames Tideway Tunnel project supplied chalk due to the anticipated variability in its quality and the quantities required being low.
Toothpaste manufacture	1*	This sector would not require Thames Tideway Tunnel project supplied chalk as its characteristics are anticipated to be variable and the quantities required are low.
Paint manufacturing	1*	This sector would not require Thames Tideway Tunnel project material as its quality is anticipated to be variable and limited quantities are required.
Cement/concrete manufacturing	2*	This sector could be interested in receiving Thames Tideway Tunnel project material if its characteristics could be guaranteed. The sector currently has its own suppliers which can guarantee material characteristics.
Habitat restoration	6	This sector has the ability to receive Thames Tideway Tunnel project material and capacity is available.

Sector	Number of receptor sites	Summary response
Infrastructure creation or renewal - engineering material	25	There is some, but limited demand for Thames Tideway Tunnel project material for engineering and infill purposes.
Landfill and quarries (including lagoon restoration, general restoration and disposal)	150	This sector has the ability to receive Thames Tideway Tunnel project material and capacity is available for disposal and restoration requirements.
Flood defence	5	Thames Tideway Tunnel project material could be accepted; however capacity for schemes is currently unknown and unlikely to be able to use a sufficient quantity of material to make this sector a viable option.
Brick manufacture	1*	This sector would not receive Thames Tideway Tunnel project material due to its variable characteristics and having its own higher quality material suppliers.
Oil field infilling	1*	Thames Tideway Tunnel project material would not be feasible to be used in this sector.
Material recycling (including aggregates and soils)	52	A proportion of this sector would be able to receive and process inert Thames Tideway Tunnel project material. However a number of operators would not receive this material because they do not handle inert excavated materials of the type anticipated from the Thames Tideway Tunnel project.
Total number of receptor sites	247	

** For each sector, if the first organisation contacted categorically stated that it has no use for the material and that it believes no other organisation in their sector is interested, then no further data is gathered from that sector.*

4.1.3 The long list can be found in the excel spreadsheet provided as Annex C.1

4.1.4 A map showing the locations of the receptor sites on the long list can be found in Vol 3 Figure A4.C.1 (see separate volume of figures).

4.2 Viability filter (development of viable list)

4.2.1 Once the long list had been prepared, the viability filter, which assesses the long list against the deliverability objectives (evaluation indicators 11 a – e, as detailed in the Section 2.5), was applied.

4.2.2 The result of the viability filter is provided in Annex C.2 in the form of an excel spreadsheet detailing the data collected, grades given and assessment of viability for each receptor site.

4.2.3 Of the receptor sites that did not pass the viability filter one receptor site was noted as being potentially suitable in the future. This receptor site was Quidhampton Quarry and has been placed on the reserve list, see Section 5.2.

Limitations/uncertainty

4.2.4 The assessment during the viability filter stage has been primarily based on operator responses further investigations have been undertaken during the next phase of the *EMOA* to determine the capacities of potential receptor sites.

Viable list

4.2.5 The 34 receptor sites that passed the viability filter and progressed to the viable list are shown in Table 4.2. The table gives a short description of the receptor sites progressed, the reason for inclusion and the red, amber or green grades awarded for each evaluation indicator assessed as part of the viability filter, which were:

a. likelihood of implementation within the required timescale

b. acceptability of material with Thames Tideway Tunnel project material characteristics by the receptor sites

c. capacity of the receptor site to accept the required volume of Thames Tideway Tunnel project material

d. ability of the receptor sites to accept Thames Tideway Tunnel project material at the anticipated rate (speed of material generation versus acceptance rate)

e. site operations have required planning/permitting conditions.

4.2.6 The locations of the receptor sites on the viable list are shown in Vol 3 Figure A4.C.2 (see separate volume of figures).

4.2.7 The grades awarded to the receptor sites that did not progress are also detailed within Annex C.2.

Table 4.2 Viable list

OP ID	Name	Type of site	Overall suitability	Evaluation indicator 11				
				11a	11b	11c	11d	11e
BOU	Bournewood Inert Landfill Site	Inert landfill	The receptor site has the ability to accept some Thames Tideway Tunnel project material.					
BRE.2	Home Farm Landfill	Landfill and quarry merchants	The receptor site has the ability to accept some sands and gravels; however quantities have not been confirmed.					
BRE.5	Fairlop Quarry (area C) Brett-Lafarge Joint Venture	Landfill and quarry merchants	The receptor site has the ability to receive sands and gravels. Timescales for receiving material were not confirmed by the operator when contacted.					
BRE.6	Queen Mary Quarry	Material recycling (including aggregates and soils)	The receptor site would be able to accept some sands and gravels; however quantities have not been confirmed.					
CEM.1	Borough Green Quarry	Landfill and quarry restoration	The receptor site can potentially accept all Thames Tideway Tunnel project materials. It has the necessary planning consent and environmental permit in place.					
CEM.6	Kingsmead Quarry	Landfill and quarry restoration	The receptor site is an active quarry and the organisation representative indicated that material would be required for restoration from 2017.					
CEM.7	Barrington Quarry	Landfill and quarry	The receptor site has the ability to accept Thames Tideway Tunnel project material,					

OP ID	Name	Type of site	Overall suitability	Evaluation indicator 11				
				11a	11b	11c	11d	11e
		restoration	however there may be limitations.					
COR.1	Cory - Mucking Landfill	Landfill site due to stop accepting waste in 2011 but would require restoration material beyond this point	The receptor site is likely to have largely completed restoration by 2018 and therefore unlikely to require a large quantity of material.					
COR.2	Cory - Barling Marsh Landfill	A landfill which is due to stop receiving waste in 2014 but would require restoration material beyond this point	The receptor site could be available to accept some of the Thames Tideway Tunnel project material however there maybe limitation on throughput capabilities.					
FRO	Frontiers/ Storefield Aggregates	Infilling an old quarry for restoration.	The receptor site has the capacity to receive material from the Thames Tideway Tunnel project, however there may be some limitations on throughput capabilities.					
GAL.1	Hermitage Quarry Inert Landfill	Inert landfill and sands/gravels reprocessing facilities	The receptor site can accept the sands and gravels.					
HAN.1	Shipton-on-Cherwell Quarry	Quarry restoration	The receptor site has the ability to accept Thames Tideway Tunnel project material; however there may be some limitations.					

OP ID	Name	Type of site	Overall suitability	Evaluation indicator 11				
				11a	11b	11c	11d	11e
HEN.1	Harlington Pit	Aggregate suppliers	The receptor site has the ability to accept Thames Tideway Tunnel project material; however there may be some limitations.					
HEN.2	Sipson Lane	Aggregate suppliers	The receptor site has the ability to accept Thames Tideway Tunnel project material; however there may be some limitations.					
LAF.4	Lafarge – Tyttenhanger Quarry	Quarry and landfill	The receptor site can receive a useful amount of Thames Tideway Tunnel project material.					
LYO.2	Frank Lyons Group - Bunkers Hill	Quarry and landfill	The receptor site would be operational throughout the Thames Tideway Tunnel project. It is likely to be able to receive a useful amount of Thames Tideway Tunnel project material however there maybe limitations relating to the types of material accepted.					
MET	Metrotidal	Flood defence and tidal energy scheme	If this project were to be awarded planning consent and remain on schedule then this would be a potential viable option for Thames Tideway Tunnel project material.					
PEE.1	Peel Ports - Hoo Island	Currently the receptor site is a dredgings disposal site.	The receptor site currently accepts materials similar to those that would be produced by the Thames Tideway Tunnel project and would be operating throughout the Thames Tideway Tunnel project period. However permitting issue requires addressing before					

OP ID	Name	Type of site	Overall suitability	Evaluation indicator 11				
				11a	11b	11c	11d	11e
			material can be accepted.					
PRE	Premier Aggregates - Finmere Quarry	Aggregate quarry	The receptor site has the ability to receive a useful amount of Thames Tideway Tunnel project material for some Thames period.					
RAR	Little Belhus Landfill	Former landfill restoration	The receptor site would be able to receive material for some of the Thames Tideway Tunnel project period and would be able to accept a useful quantity.					
RIO	Riosoils - Dansand & Ardleigh Quarries	Quarry requiring restoration material as well as aggregate recycler and material broker.	The receptor site is likely to be able to receive a useful amount of Thames Tideway Tunnel project material.					
RSP	RSPB - Wallasea Island (Wallasea Wetland Creation Project)	Reclamation project to create a wetlands nature reserve for RSPB.	The receptor site would be able to receive a useful amount of Thames Tideway Tunnel project material.					
SIT.2	Runfold South Quarry	Inert landfill	The receptor site is currently operating as an inert landfill and has the ability to accept a useful amount of Thames Tideway Tunnel project material.					
SUM	Summerleaze - Denham Quarry	Gravel extraction quarry, where material is also	Thames Tideway Tunnel project material could be accepted at the receptor site.					

OP ID	Name	Type of site	Overall suitability	Evaluation indicator 11				
				11a	11b	11c	11d	11e
		required for restoration						
SUM.2	Summerleaze – East Burnham Quarry	Gravel extraction quarry, where material is also required for restoration	Thames Tideway Tunnel project material could be accepted at the receptor site.					
VEO.1	Veolia Essex - Rainham Landfill	Landfill due to be fully restored and suitable for public access by 2018.	The receptor site has the ability to accept Thames Tideway Tunnel project material; however there may be some limitations on the materials accepted					
VEO.3	Veolia Bucks - Wapseys Wood Landfill	Landfill due to close in 2012. This would then be restored.	This receptor site is likely to be available to receive Thames Tideway Tunnel project material, however it is likely that throughput and capacity would limit the receptor site's potential.					
VEO.5	Veolia Essex - Pitsea Landfill	Landfill due to close in 2015. This would then be restored to grass land and nature conservation.	This receptor site is likely to be available to receive Thames Tideway Tunnel project material, however it is likely that throughput and capacity would limit the receptor site's potential.					
VEO.6	Veolia Essex - Ockendon Landfill	Landfill, currently not being used	The receptor site is currently not operational and could be operational throughout the Thames Tideway Tunnel project, however it is likely that throughput and capacity would					

OP ID	Name	Type of site	Overall suitability	Evaluation indicator 11				
				11a	11b	11c	11d	11e
			limit the receptor site's potential.					
VIR	Elsenham Landfill	Landfill restoration	The receptor site has the ability to accept Thames Tideway Tunnel project material; however there may be some limitations.					
WES	Cliffe Pools	Habitat restoration	The receptor site is likely to be available to receive Thames Tideway Tunnel project material; however, there may be some limitations.					
WRG.3	Calvert Landfill	Landfill restoration	The receptor site has the ability to accept Thames Tideway Tunnel project material; however there may be some limitations.					
WRG.4	WRG - Stewartby/Brogborough Landfills	Stewarby landfill is due to close in the next five years and requires material. Brogborough would also require some material for restoration.	The receptor site has the ability to accept Thames Tideway Tunnel project material; however there may be some limitations.					
WRG.5	WRG - Sutton Courtney	Landfill restoration	The receptor site has the ability to accept some material over the next 20 years for restoration purposes.					

4.3 Preliminary assessment (development of short list)

4.3.1 The results of the preliminary assessment, which applied all 15 evaluation objectives and associated indicators to the viable list in order to develop the short list, are presented in Table 4.3 and as an excel spreadsheet in Annex C.3 containing operator responses and desk study information as well as justifications for each grade awarded.

4.3.2 Table 4.3 lists each receptor site on the viable list using its unique ID number and then presents the red, amber or green grade awarded to each evaluation indicator. The overall suitability of each receptor site for inclusion within the short list is also indicated.

4.3.3 Table 4.3 provides an illustration of the number of red and green grades awarded to each receptor site, which helps to inform the professional assessment of the receptor sites. As the amber grades represent no or negligible effect, they have been omitted from the graph because it provides a better illustration of the differences between the receptor sites.

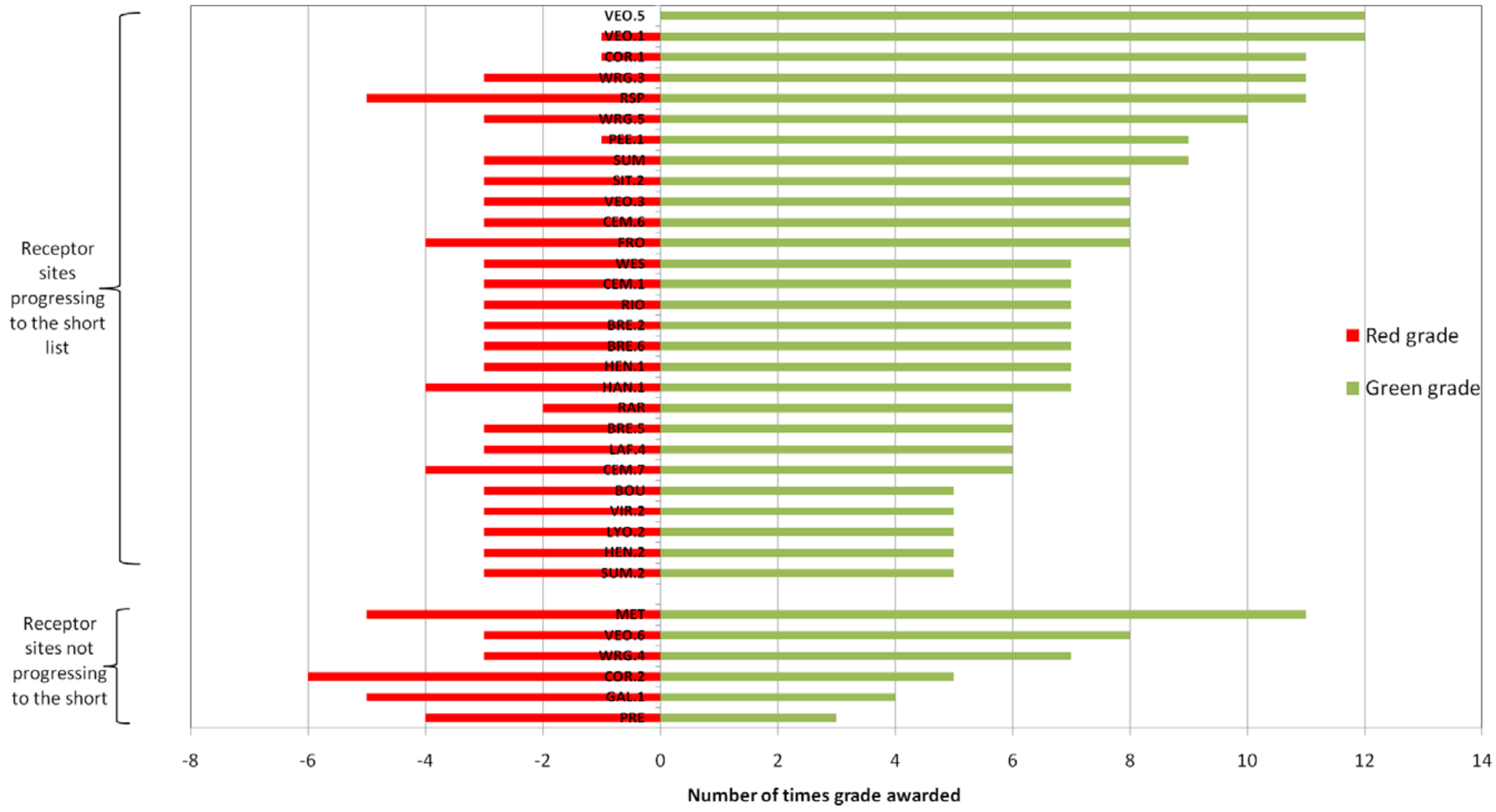
4.3.4 A map showing the locations of receptor sites on the short list can be found in Annex C.3.

Table 4.3 Preliminary assessment results*

Evaluation indicator	1. Land and other resources		2. Climate change			3. Air quality and odour	4. Landscapes and townscapes		5. Local amenity		6.Water quality		7.Biodiversity		8. Cultural heritage	9. Employment opportunities		11. Delivery						12. Waste hierarchy	13. Proximity principle	14. Sustainable transport policy	15. H&S good practice
Operator ID	a)	b)	a)	b)	c)	a)	a)	b)	a)	b)	a)	b)	a)	b)	a)	a)	b)	a)	b)	c)	d)	e)	f)	a)	a)	a)	a)
VEO.5																											
VEO.1																											
COR.1																											
PEE.1																											
RAR																											
SUM																											
BOU																											
WRG.3																											
WRG.5																											
SIT.2																											
VEO.3																											
CEM.1																											
CEM.6																											
WES																											
RIO																											
BRE.2																											
BRE.6																											
BRE.5																											
VIR.2																											
LYO.2																											
HEN.2																											
HEN.1																											
LAF.4																											
SUM.2																											
CEM.7																											n/a
HAN.1																											n/a
FRO																											
RSP																											n/a
WRG.4																											
VEO.6																											
PRE																											
GAL.1																											
MET																											n/a
COR.2																											

** Where a receptor site is not yet operational H&S track record could not be assessed and n/a is recorded.*

Plate 4.1 Number of red and green grades awarded to each receptor site in the preliminary assessment[V]



[V] As the amber grades represent no or negligible effect, they have been omitted from the graph because it provides a better illustration of the differences between the receptor sites

4.4 Short list

4.4.1 The grades for each receptor site were reviewed and an assessment of the overall performance of the receptor site was made based on both the absolute number of times a grade was awarded and professional judgement as to whether any individual red grade (or combination of grades) made a particular receptor site unsuitable. Six receptor sites were considered to perform less well based on the information assessed at this stage of the *EMOA*. These receptor sites have not been taken forward to the short list and are detailed in Table 4.4, which provides a summary of key site issues and a brief explanation of why the these sites are not included within the short list. Detailed information used to assess each receptor site can be found in Annex C.3.

4.4.2 A number of the receptor sites have not progressed to the short list because the operator/owner has not been able to confirm availability, with the necessary consents being in place, between 2016 and 2021 (e.g. the years when excavated material would be generated).

4.4.3 Those receptor sites which are considered most likely to be able to obtain the necessary consents or in some other way become available within the required time scales have been placed on the reserve list. The receptor sites on the reserve list are indicted in Table 4.4.

4.4.4 The 28 receptors which have progressed to the short list are presented in Table 4.5, which provides a summary of key site issues and a brief explanation for the site's inclusion on the short list. Detailed information used to assess each receptor site can be found in Annex C.3.

4.4.5 The locations of the receptor sites on the short list are presented in Annex C.3.

4.4.6 The short listed receptor sites were then subject to the detailed assessment to produce the planning stage preferred list (see Section 5.1).

Table 4.4 Receptor sites not progressing on to the short list

Site ID	Site name	Justification*	Status
COR.2	Barling Marsh Landfill	The receptor site is on average over 60km from the excavated material locations and can only receive material by road, which would be limited by permit restrictions affecting vehicle access. The total quantity of material the receptor site could receive is limited when compared to other receptor sites. There also might be short term effects on an internally designated site that is located within the receptor site boundary.	Not progressed to short list
GAL.1	Hermitage Quarry Inert Landfill	The receptor site would primarily dispose of the excavated material within the landfill void space. Therefore this receptor site would not meet the *EM&W strategy* objectives of limiting materials being disposed of rather than reused or recycled.	Not progressed to short list
MET	Metrotidal	The Metrotidal development is currently an outline proposal with defined timescale and therefore its availability to receive Thames Tideway Tunnel project material is unclear. As a result it is yet to obtain planning consent and an environmental permit, which when/if granted could restrict the nature or quantity of Thames Tideway Tunnel project material the receptor site could receive. This receptor site has been placed on the reserve list as it potentially could be available in the future, could accept all Thames Tideway Tunnel project material and would be accessible by marine transport.	Placed on reserve list
PRE	Finmere Quarry	This receptor site is on average over 85km from the excavated material locations and is only accessible by road. It can take a limited amount of clay and sands/gravels. It understood that some material may be disposed of in the landfill void space. Therefore this receptor site would not meet the *EM&W strategy* objectives of limiting materials being disposed of rather than reused or recycled.	Not progressed to short list
VEO.6	Ockendon Landfill	The receptor site is intended to be operational post 2040. However it is currently not operating whilst capacity in other landfills in the region is used. Once these landfills reach the end of their lifespan, the receptor site would reactivate its environmental permit and once again begin receiving restoration material. The operator anticipates that whilst this reactivation is likely to occur after the Thames Tideway Tunnel project is completed, it could begin receiving material for restoration prior to 2021. This receptor site has been placed on the reserve list as it potentially could be available in the future	Placed on reserve list

Site ID	Site name	Justification*	Status
		and could accept a useful quantity of Thames Tideway Tunnel project material.	
WRG.4	Stewartby/ Brogborough Landfills	This receptor sites are likely to be complete before the commencement of the Thames Tideway Tunnel project in 2016. This receptor site is over 70km from excavated material locations.	Not progressed to short list

** The information contained within this table is a summary of the information obtained during the preliminary assessment stage of the EMOA and reflects the information gained through interviews with receptor site representatives and desk based research.*

Table 4.5 Receptor sites progressing on to the short list

Site ID	Site name	Justification*
BOU	Bournewood Inert Landfill Site	The receptor site has the ability to receive Thames Tideway Tunnel project material up to January 2018. However the operator has suggested that if the quantity of restoration material required to complete restoration activities has not been sourced then this timeframe could be extended until sufficient quantity is received. This makes the receptor site available for two years of the project based on the Thames Tideway Tunnel project timescales. The receptor site is approximately 23km from the Thames Tideway Tunnel project excavated material locations. The restoration of Bournewood Inert Landfill back to agricultural land would result in a beneficial use for all material accepted by the site.
BRE.2	Home Farm Landfill	This receptor site could take all of the sands and gravels which it would reprocess into a product. Although it can only be accessed by road, it is approximately 25km from the Thames Tideway Tunnel project excavated material locations. The receptor site has planning consent and the necessary environmental permit.
BRE.5	Fairlop Quarry (area C)	This receptor site could take all of the sands and gravels, which it would reprocess into a product and some of the clay. Although it can only be accessed by road, it is close to the excavated material locations. The receptor site is approximately 21km from the Thames Tideway Tunnel project excavated material locations.

Site ID	Site name	Justification*
BRE.6	Queen Mary	This receptor site could take all of the sands and gravels which it would reprocess into a product. The receptor site can only be accessed by road and it is approximately 24km from the Thames Tideway Tunnel project excavated material locations.. The receptor site has planning consent and the necessary environmental permit.
CEM.1	Borough Green Quarry	The receptor site would be able to accept a large proportion of Thames Tideway Tunnel project material during and beyond the Thames Tideway Tunnel timescales. The receptor site is on average 37km from the main drive sites and can only accept material by road. Borough Green Quarry restoration to agricultural land would comprise beneficial use for all material accepted by the receptor site
CEM.6	Kingsmead Quarry	This receptor site is an operational sand and gravel quarry; however it is not yet receiving material for restoration and requires the necessary permit in order for this to occur. The receptor site would be restored to agricultural land and lakes. The receptor site has the ability to receive Thames Tideway Tunnel project material for the whole lifetime of the Thames Tideway Tunnel project. It is estimated by the operator that between 5 and 6 million tonnes of material is needed to restore the receptor site.
CEM.7	Barrington Landfill	Barrington Quarry has the potential to receive 1.2million m^3 of the Thames Tideway Tunnel project material in the short term (up to 2018), with potential to accept material beyond 2018 if further restoration is required and appropriate consents are obtained. The receptor site should be able to accept all types of excavated materials produced by the Thames Tideway Tunnel project. The receptor site can only accept material by rail.
COR.1	Cory - Mucking Landfill	This receptor site requires approximately 1.6million m^3 of material to complete restoration requirements. It is within 40km of the drive sites and can be accessed by road and marine transport. The receptor site would have largely completed restoration by 2018.
FRO	Frontiers/ Storefield Aggregates	This receptor site could take all of the sands and gravels. Although it can only be accessed by road, it is close to the excavated material locations. The receptor site has the necessary planning consent and permit in place to accept Thames Tideway Tunnel project material. The receptor site is required to have completed restoration activities by 2018 and is currently receiving material for restoration which would mean that by 2018 the capacity to receive Thames Tideway Tunnel project material is anticipated to be

Site ID	Site name	Justification*
		largely reduced.
HAN.1	Shipton on Cherwell Quarry	The receptor site would be able to receive all Thames Tideway Tunnel project material types and has capacity to receive 2.2million m^3 for restoration. The receptor site would also look to process some of the sands and gravels into a product. Restoration activities are consented until 2022 and the receptor site can only receive material by rail.
HEN.1	Harlington Pit	This receptor site could take sands and gravels of a suitable quality for processing into aggregate. The receptor site would be able to accept a useful volume of material by road.
HEN.2	Sipson Lane	This receptor site could take sands and gravels of a suitable quality for processing into aggregate. The receptor site would be able to accept a useful volume of material by road.
LAF.4	Tyttenhanger Quarry	The receptor site is an operational quarry and is currently receiving material for restoration. It is estimated that it would have capacity for approximately 11million tonnes of Thames Tideway Tunnel project material and is consented for operations until 2032. The receptor site is only accessible by road.
LYO.2	Bunkers Hill	This receptor site can take sands and gravels, for use in a restoration project. The operator estimates there would be a requirement for 1.75million m^3 of material for restoration. The receptor site would be able to accept material by road.
PEE.1	Hoo Island	The receptor site is an operational dredging deposit site and operates under an environmental permit which would not permit the acceptance of chalk material produced by the Thames Tideway Tunnel project. The receptor site does not have planning consent. However, there is a requirement to receive 4.3million m^3 of material for engineering purposes at the receptor site. The receptor site is accessible by marine transport and the operator also has transfer options for access by rail.
RAR	Little Belhus Landfill	The receptor site would be restored to a Country Park. Little Belhus has the potential to receive a useful amount of Thames Tideway Tunnel project material up to 2021. The receptor site is located approximately 29km from the drive site and is only accessible by road.

Site ID	Site name	Justification*
RIO	Dansand & Ardleigh Quarries	The receptor site has capacity to receive a useful amount of Thames Tideway Tunnel project material for use in restoration. The operator would act as a broker for additional Thames Tideway Tunnel project material to send to other third party receptor sites.
RSP	Wallasea Island (Wallasea Wetland Creation Project)	It is probable that the receptor site would be able to accept a large proportion of the Thames Tideway Tunnel project material at the rates required up until 2019. If the wetland creation project is not completed by the end of 2019, the receptor site would require an extension to the existing planning consent for restoration activities to continue. The receptor site would be able to accept all types of the excavated materials produced by the Thames Tideway Tunnel based on the planning consent. The receptor site is on average 69km from the excavated material locations and can only be accessed by ship. While the receptor site has some red gradings eg, potential adverse effects on a surrounding Ramsar site and only being accessible by one mode of transport, these are not considered sufficient to exclude the receptor site from further assessment.
SIT.2	Runfold South Quarry	The receptor site has capacity for 850,000m^3 of material for restoration to farmland. The receptor site has the necessary planning consent and permit in place.
SUM	Denham Quarry	The receptor site could accept 644,000m^3 Thames Tideway Tunnel project material by road. The receptor site is on average 24km from the excavated material locations and can only accept material by road. Denham Quarry has a recovery permit issued by the Environment Agency.
SUM.2	East Burnham Quarry	The receptor site has a requirement for 600,000m^3 of material to complete restoration by December 2021. The receptor site is only accessible by road however it is on average 34km from the excavated material locations.
VEO.1	Rainham Landfill	This receptor site has capacity to receive 1.66million m^3 of material for restoration. The receptor site has consent to complete restoration activities by 2018. The receptor site is located close to the excavated material locations and has good marine transport and road access. The Thames Tideway Tunnel project material would be used to restore the landfill to wildlife park.
VEO.3	Wapseys Wood Landfill	This receptor site could receive 100,000$m^3$of clay for restoration purposes. The receptor site is on average 31km from the excavated material locations and can only accept material by road.

Site ID	Site name	Justification*
VEO.5	Pitsea Landfill	This receptor site could receive 3million m^3 of material for restoration. The receptor site is located close to the drive sites and has road access. Limited marine transport access is also available at this site. The Thames Tideway Tunnel project material would be used to restore the landfill to wildlife park.
VIR.2	Elsenham Landfill	This receptor site has a requirement for a large volume of material for restoration and would be available throughout the Thames Tideway Tunnel time period. The receptor site is on average 57km from the excavated material locations and can only accept material by road.
WES	Cliffe Pools	The receptor site has capacity to receive 1.9million m^3 of material for restoration and habitat enhancement. It would also be operational throughout the timescales of the Thames Tideway Tunnel project. The receptor site is accessible by marine transport. The Thames Tideway Tunnel project material would be used to restore the receptor site to a nature reserve.
WRG.3	Calvert Landfill	The receptor site has sufficient capacity to accept all of the Thames Tideway Tunnel project material. It would also be operational throughout the timescales of the Thames Tideway Tunnel project. But it is only accessible via rail and is on average 75km from the main drive sites.
WRG.5	Sutton Courtenay	The receptor site can take a useful volume of material over the required time period. It is anticipated that between 1 and 2million m^3 of material is needed to restore the receptor site. The receptor site can only be accessed by rail. It would be restored to agricultural land.

** The information contained within this table is a summary of the information obtained during the preliminary assessment stage of the EMOA and reflects the information gained through interviews with receptor site representatives and desk based research.*

4.5 Detailed assessment (development of planning stage preferred list)

4.5.1 The short listed receptor sites were assessed further using the methodology described in Section 2.7.

Confirmation of viability assessment

4.5.2 To take account of the potential change in circumstance during the assessment, this reassessment of viability aimed to confirm the information provided by operators during earlier stages of the *EMOA*.

4.5.3 In order to confirm the information obtained from the receptor site operators in earlier stages of the *EMOA*, further information on the short listed receptor sites was collected and the receptor sites were reassessed based on the information provided by the receptor site's primary contact and/or the information contained in the receptor site's planning consent and environmental permit. The receptor sites were assessed for any issues which would prevent the site from being used for the Thames Tideway Tunnel project material (that had not been identified during the first viability filter). This prevents significant time being spent undertaking detailed assessments of non-viable receptor sites.

4.5.4 Following clarifications from operators and reviews of consents/permits, 14 receptor sites did not pass the confirmation of viability test and were not taken through the detailed assessment. Table 4.6 sets out the information obtained for each receptor site at the confirmation of viability stage. The information obtained for the remaining 14 receptor sites which were taken through to the detailed assessment is provided as part of the detailed assessment results in Section 4.5.

Table 4.6 Receptor sites not passing the conformation to viability assessment

Site ID	Name	Information obtained at confirmation of viability stage	Planning consent review	Permit conditions review
VEO .5	Veolia Essex - Pitsea Landfill	Operator indicated the restoration of the receptor site should be by 2017.	The receptor site has planning consent to be restored by 31 December 2017.	The receptor site has an environmental permit but this was not reviewed given that the receptor site only has planning consent until 2017.
VIR. 2	Elsenham Landfill	The receptor site has limited permitted capacity and can only take 30% of material from outside Essex from 2016. Permitted throughput for the receptor site is 165,000tpa thus it would only be able to accept 49,500tpa from the Thames Tideway Tunnel project. The receptor site is currently operating as a C&D landfill and would accept material from the Thames Tideway Tunnel for landfilling thus landfill tax would be charged. The receptor site can only accept material by road and is on average 57km from the main drive sites.	The planning consent for the receptor site was not been reviewed given the environmental permit restrictions on capacity.	The receptor site's environmental permit (EA permit number: BU7081) allows for 65,000tpa. There is a restriction stating that from 2016, up to 30% of input can be sourced outside of Essex, no more.
RIO	Riosoils - Dansand & Ardleigh Quarries	The operator stated that Dansand Quarry has planning consent until 2013. Riosoils have indicated that they are likely to broker Thames Tideway Tunnel project material to third parties. As these third parties locations cannot be identified they have not been assessed.	The planning consent for the receptor site was not reviewed given the operator response.	The environmental permit was not reviewed given that the receptor site only has planning consent until 2013.
LYO. 2	Bunkers Hill	The receptor site has planning consent until February 2017. Therefore the receptor site would not be available for a useful amount of Thames Tideway Tunnel project timeframe.	The receptor site has planning consent until February 2017.	The environmental permit (EA Permit number: BX 0512) states that the total quantity of waste

Site ID	Name	Information obtained at confirmation of viability stage	Planning consent review	Permit conditions review
				deposited in the landfill shall not exceed 1 million tonnes. The quantity that is deposited in the landfill in any year shall not exceed 50,000t.
BRE .2	Home Farm Landfill	The operator was contacted after the preliminary assessment and stated that the receptor site would not be available during the Thames Tideway Tunnel project timescales.	The planning consent for the receptor site has not been reviewed given the operator response.	The environmental permit for the receptor site has not been reviewed given the operator response.
BRE .5	Fairlop Quarry (area C)	This receptor site would be unable to accept the material from the Thames Tideway Tunnel project based on the characteristics required on site. The receptor site would only want to process clean material produced by the Thames Tideway Tunnel project into a saleable product. It is unlikely that the Thames Tideway Tunnel project would produce significant volumes of clean material for processing.	The planning consent for the receptor site has not been reviewed given the operator response.	The environmental permit for the receptor site has not been reviewed given the operator response.
BRE .6	Queen Mary	This receptor site would not be able to accept the material from the Thames Tideway Tunnel project based on the characteristics required on site. The receptor site only wants to process clean material produced by the Thames Tideway Tunnel project into a saleable product. It is unlikely that the Thames Tideway Tunnel project would produce significant volumes of clean material for processing.	The receptor site has planning consent for the importation of material until 31st December 2033.	The environmental permit for the receptor site has not been reviewed given the operator response.

Site ID	Name	Information obtained at confirmation of viability stage	Planning consent review	Permit conditions review
HEN .1	Harlington Pit	The receptor site would want to process the Thames Tideway Tunnel project material into a saleable product. Given that there would be no Thanet sands produced in 2017 this would not be viable as the receptor site only has planning consent until 2017.	The planning consent states that extraction of minerals shall cease by 31 October 2016 and restoration of the land to agriculture shall be completed by 31 October 2017. The planning consent states that no more than 56 HGV movements (28 in, 28 out) at the site are allowed in any one working day, involving a cumulative total not exceeding a maximum 150,000t of waste input each year.	The environmental permit for the receptor site has not been reviewed given the operator response.
HEN .2	Sipson Lane	This receptor site would not be able to accept the material from the Thames Tideway Tunnel project based on the characteristics required on site. The receptor site only wants to process clean material produced by the Thames Tideway Tunnel project into a saleable product. It is unlikely that the Thames	The planning consent for the receptor site has not been reviewed given the operator response.	The environmental permit for the receptor site has not been reviewed given the operator response.

Site ID	Name	Information obtained at confirmation of viability stage	Planning consent review	Permit conditions review
		Tideway Tunnel project would produce significant volumes of clean material for processing.		
FRO	Frontiers/ Storefield Aggregates	A total of 2million m^3 of restoration material is required for this project and the receptor site is currently receiving material at approximately 100 HGV's per day. If this rate of input were to continue, by the time Thames Tideway Tunnel project material would be produced in significant quantity (2018), the requirement of material for restoration at the receptor site would by largely met. Therefore it is considered that the receptor site would not have sufficient available capacity to receive a useful amount of Thames Tideway Tunnel project material.	The planning consent for the receptor site has not been reviewed given the operator response.	The environmental permit for the receptor site has not been reviewed given the operator response.
COR .1	Cory - Mucking Landfill	Original information obtained from the operator suggested that this receptor site would be operational until 2018. However the receptor site only has planning consent until 2016. This means that the receptor site would be closed prior to the start of the Thames Tideway Tunnel project.	The receptor site has planning consent until 2016.	The receptor site has an environmental permit (EA permit number: BV3782IM). The site is permitted to accept 100,000t of inert waste annually.
VEO .3	Veolia Bucks - Wapseys Wood Landfill	The operator confirmed that the receptor site should be closed by the end of 2016 and has restoration material already stockpiled on the site for restoration and would not require any additional material.	The planning consent for the receptor site has not been reviewed given the operator response.	The environmental permit for the receptor site has not been reviewed given the operator response.
SIT. 2	Runfold South Quarry	The operator confirmed that the receptor site would only be operational until 2015. This means that the	The planning consent for the receptor site	The environmental permit for the receptor site has

Site ID	Name	Information obtained at confirmation of viability stage	Planning consent review	Permit conditions review
		receptor site would be closed prior to the start of the Thames Tideway Tunnel project.	has not been reviewed given the operator response.	not been reviewed given the operator response.
PEE. 1	Peel Ports - Hoo Island	There is currently no planning consent in place at the receptor site. Currently the receptor is accepting dredging material and would only require a limited volume of Thames Tideway Tunnel project material.	The receptor site does not currently have planning consent	The receptor site has an environmental permit (EA permit number: EPR/DP3794LS). The site is permitted to accept 1.5million tonnes of non hazardous and inert material annually.

4.5.5 The receptor sites detailed in Table 4.6 are not taken through to the full detailed assessment stage and remain on the short list.

Detailed assessment

4.5.6 The 14 receptor sites that have passed the confirmation of viability assessment were further scrutinised, using more detailed criteria, to produce a planning stage preferred list of receptor sites. The grades awarded for each evaluation criteria for each receptor site that progressed through the confirmation of viability assessment are given in Table 4.7.

4.5.7 For each receptor site that passed the confirmation of viability assessment, an *EMOS report* has been produced, prior to a receptor site being confirmed on planning stage preferred list. The *EMOS* reports are provided in Annexes D.1 to D.14.

4.5.8 The *EMOS report* provides a summary of the site operations and the overall performance of the receptor site.

4.5.9 The 14 receptor sites which underwent the detailed assessment are all viable receptor sites which could accept a useful volume of the Thames Tideway Tunnel project material in at least one year of the Thames Tideway Tunnel project construction phase. All 14 receptor sites perform well against the overall suite of 15 evaluation objectives. Plate 4.2 shows that all the receptor sites have both beneficial and adverse effects. WES Cliffe Pools, RSP Wallasea Island and VEO.1 Rainham Landfill obtained the best overall rankings. SUM.2 East Burnham Quarry has received the largest number of red grades. This reflects the limitations on capacity, throughput and links to the strategic highway.

4.5.10 Table 4.8.provides detail of the overall suitability of each receptor site which passed the confirmation of viability for the planning stage preferred list.

Table 4.7 Detailed assessment results

Evaluation indicator	1. Land and other resources		2. Climate change			3. Air quality and odour	4. Landscapes and townscapes		5. Local amenity		6.Water quality		7.Biodiversity		8. Cultural heritage	9. Employment opportunities		10. Cost	11. To ensure operational suitability						12. Waste hierarchy	13. Proximity principle	14. Sustainable transport policy	15. Conform to Health and Safety
OP ID	a)	b)	a)	b)	c)	a)	a)	b)	a)	b)	a)	b)	a)	b)	a)	a)	b)	a)	a)	b)	c)	d)	e)	f)	a)	a)	a)	a)
WES					++			+	-	+++				+++	++	+	+	++	+++			+++	---	--	+++		+++	+
RSP			-	+++	+		-	+		+++	+			++		++	++			+++	++	+	+++	--	+++	-		n/a
VEO.1		-			++	+		++		+++								+++		+++	--	-	+++		+++	+	+++	+
WRG.3			+		-	+		+		++								+	+++	++	+	-	+++	--	+++	-		+
WRG.5			+		-	+		++		+								+	+++	++	-	-	+++	--	+++	-		+
HAN.1			-		-			++		++				++		+			+++	+++	--	-	+++	--	+++	--	++	
CEM.1			+					++		+								-	+++	+++	-	--	+++	--	+++	+	--	+
CEM.7			+					++		+				+		++		+	-	+++	--	-	+++	--	+++	-		n/a
CEM.6			+		-			++		++						+		--	+++	+++	-	n/a		--	+++	+	---	+
SUM								++		+++						+			++	++	--	--	+++	--	+++	+	---	
LAF.3			+					+		+								-	+++	+++		--	+++	--	+++	+	---	
RAR					+			++		+++						+		+	+	+++	--	--		--	+++	+	---	
BOU					+			+		+								++	--	+++	---	-	+++	--	+++	+	--	
SUM.2					-			+										--	++	-	--	--	+++	--	+++	+	---	n/a

Plate 4.2 Comparison of detailed assessment scoring

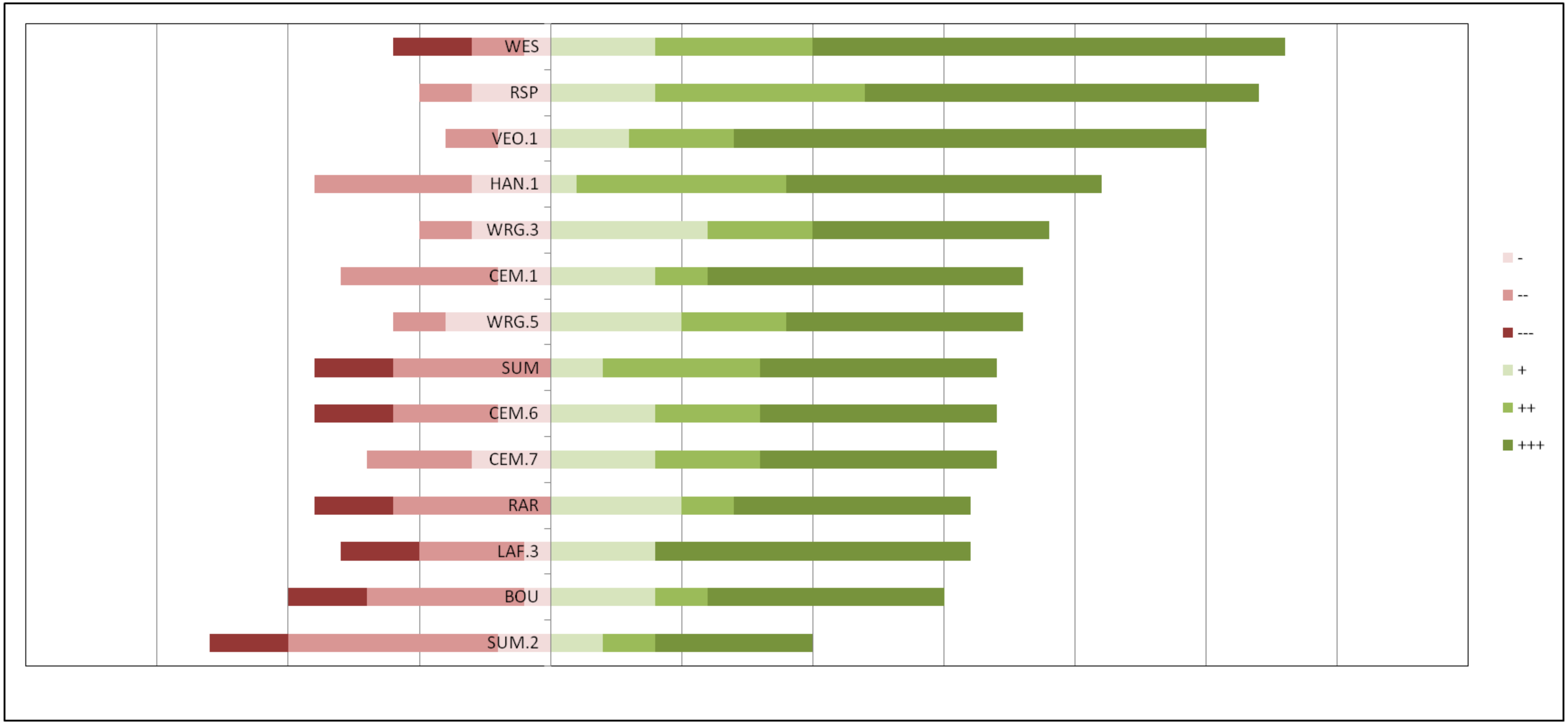


Table 4.8 Overall suitability of receptor sites following detailed assessment

Site ID	Name	Overall suitability
BOU	Bournewood Inert Landfill Site	The receptor site has the potential to provide a beneficial use for the excavated material received at the site. The receptor site has the ability to receive 6% of the Thames Tideway Tunnel project material up to January 2018. The receptor site has a beneficial or neutral grading for all evaluation indicators with the exception of some operational indicators and sustainable transport mode indicator. Bournewood Inert Landfill is included on the planning stage preferred list.
CEM.1	Borough Green Quarry	Borough Green Quarry would be able to accept a maximum of 450,000tpa of Thames Tideway Tunnel project material over the entire proposed Thames Tideway Tunnel project timeframe. The receptor site is on average 37km from the main drive sites and can only accept material by road. The receptor site would be restored to agricultural land which would provide a long term beneficial effect with respect to environmental and policy objectives. The receptor site has the ability to receive Thames Tideway Tunnel project material for the whole lifetime of the Thames Tideway Tunnel project. The receptor site has a beneficial or neutral grading for all evaluation indicators with the exception of some operational indicators, costs and sustainable transport mode indicator. Borough Green Quarry is included on the planning stage preferred list.
CEM.6	Kingsmead Quarry	Kingsmead Quarry would be restored to agricultural land and lakes which would provide a long term beneficial effect with respect to environmental and policy objectives. The receptor site has the potential to receive Thames Tideway Tunnel project material for the whole lifetime of the Thames Tideway Tunnel project. The receptor site does not yet have an environmental permit for restoration activities. It is estimated by the operator that between 5 and 6million tonnes of material is needed to restore the receptor site. The receptor site is over 60km by road from the transhipment point. Kingsmead Quarry included on the planning stage preferred list.
CEM.7	Barrington Landfill	Barrington Quarry has the ability to receive only 28% of the Thames Tideway Tunnel project material up to 2018. The receptor site is on schedule to be completed before the deadline set in the planning consent. The receptor site has the potential to accept material beyond 2018 if further restoration is required and appropriate consents are obtained. The receptor site has a beneficial or neutral

Site ID	Name	Overall suitability
		grading for all evaluation indicators with the exception of some operational indicators and the proximity principle indicator. Barrington Quarry is included on the planning stage preferred list.
HAN.1	Shipton on Cherwell Quarry	Shipton-on-Cherwell Quarry has the ability to receive 24% of the Thames Tideway Tunnel project material up to 2022. Although, the receptor site needs to develop its rail infrastructure which it is assumed would occur for the receptor site to receive Thames Tideway Tunnel project material. The receptor site has a beneficial or neutral grading for all other evaluation indicators with the exception of some of the operational indicators and the proximity principle indicator). Shipton-on-Cherwell Quarry is included on the planning stage preferred list.
LAF.4	Tyttenhanger Quarry	The receptor site has the potential to provide a beneficial use for the excavated material received at the site. The receptor site has the ability to receive 45% of the Thames Tideway Tunnel project material throughout the lifespan of the project. The receptor site has a positive or neutral grading for most evaluation indicators (with the exception of sustainable transport policy, transport mode, throughput and cost). Tyttenhanger Quarry is included on the planning stage preferred list.
RAR	Little Belhus Landfill	The receptor site would be restored to a Country Park which would have a long term beneficial effect with respect to environmental and policy objectives. Little Belhus has the potential to receive 15% of Thames Tideway Tunnel project material between 2016 and 2021. The receptor site is located approximately 29km from the drive site; however it is limited with regards to sustainable transport policies as it is only accessible by road. The receptor site has a beneficial or neutral grading for all other evaluation indicators except for some of the operational indicators. Little Belhus is included on the planning stage preferred list.
RSP	RSPB - Wallasea Island (Wallasea Wetland Creation Project)	This receptor site would provide a long term beneficial effect with respect to environmental, socio-economic and policy objectives. The receptor site has the potential to provide a beneficial use for the excavated material received at the site. However the receptor site is located over 69km from Thames Tideway Tunnel project drive sites. Wallasea Island is included on the planning stage preferred list.
SUM	Summerleaze - Denham Quarry	Denham Quarry has the ability to receive only 15% of the Thames Tideway Tunnel project material up to 2021. The receptor site is on schedule to be completed before the deadline set in the planning consent. The receptor site has commenced restoration operations and thus the need for

Site ID	Name	Overall suitability
		restoration material beyond 2016 is considerably reduced. However the receptor site could provide some capacity in the early years of the Thames Tideway Tunnel project. The receptor site has a beneficial or neutral grading for all other evaluation indicators with the exception of some of the operational indicators and the sustainable transport mode indicator). Denham Quarry is included on the planning stage preferred list.
SUM.2	East Burnham Quarry	East Burnham Quarry has the ability to receive only 16% of the Thames Tideway Tunnel project material up to 2021. The receptor site is not currently operational but would begin receiving material allocated for its restoration prior to 2016, and therefore its capacity to receive Thames Tideway Tunnel project excavated material could be considerably reduced. However the receptor site could provide some capacity in the early years of the Thames Tideway Tunnel project. The receptor site has a neutral grading for the majority of evaluation indicators (with the notable exceptions of sustainable transport mode, operational suitability, costs and GhG emissions). East Burnham Quarry is included on the planning stage preferred list.
VEO.1	Veolia Essex - Rainham Landfill	Rainham Landfill has the ability to receive 28% of the Thames Tideway Tunnel project material, and is available up to 2018. The quantity of material required for the restoration is approximately 2.8million tonnes, however due to the restrictions on the receptor site's throughput and availability it would only be able to receive 1.3million tonnes of Thames Tideway Tunnel project material. It has been assumed that all Thames Tideway Tunnel project material would be placed for restoration at the receptor site and not for disposal below the engineered landfill cap. Thames Tideway Tunnel project material can be delivered to the receptor site by marine transport and by road. The receptor site has a beneficial or neutral grading for all evaluation indicators with the exception of two of the operational indicators and the effect on landtake indicator. Rainham Landfill is included on the planning stage preferred list.
WES	Cliffe Pools	Cliffe Pools has the ability to receive 50% of the Thames Tideway Tunnel project material, and is available beyond 2022. This receptor site would provide a long term beneficial effect with respect to environmental, social and policy objectives as it is being restored to a nature reserve. The receptor site has the potential to provide a beneficial use for the excavated material received at the site. The receptor site is located 45km from Thames Tideway Tunnel project drive sites and is accessible by barge. However the receptor site is likely to require an amendment to its

Site ID	Name	Overall suitability
		planning consent and will also require a variation to its environmental permit to receive Thames Tideway Tunnel project material. Cliffe Pools is included on the planning stage preferred list.
WRG.3	Calvert Landfill	Calvert Landfill has the ability to receive Thames Tideway Tunnel project material for the whole lifetime of the Thames Tideway Tunnel project. It is anticipated that approximately 20million m^3 of material is needed to restore the receptor site. However the receptor site has a limited throughput based on its permitted capacity of 1million tpa. It is also located approximately 77km (in a straight line distance) from the Thames Tideway Tunnel drive sites but material would be delivered by rail. The receptor site has a beneficial or neutral grading for all other evaluation indicators (with the exception of GhG emissions). Calvert Landfill is included on the planning stage preferred list.
WRG.5	Sutton Courtenay	Sutton Courtenay Landfill has the ability to receive Thames Tideway Tunnel project material for the whole lifetime of the Thames Tideway Tunnel project. It is anticipated that between 1 and 2million m^3 of material is needed to restore the receptor site. However the receptor site has a permitted capacity of 600,000tpa of active and inert wastes, and has confirmed that 400,000tpa would be made available for Thames Tideway Tunnel project material thus limiting its capacity and throughput. It is also located approximately 77km (in a straight line distance) from the Thames Tideway Tunnel drive sites but material would be delivered by rail. The receptor site has a beneficial or neutral grading for all other evaluation indicators (with the exception of GhG emissions). Sutton Courtenay Landfill is included on the planning stage preferred list.

5 Conclusions

5.1 Planning stage preferred list

5.1.1 It is considered unlikely that only one receptor site would be used to accept all the Thames Tideway Tunnel project material. A combination of receptor sites would likely form the final solution with respect to end uses for the Thames Tideway Tunnel project excavated material.

5.1.2 All 14 of the receptor sites which have been through the detailed assessment have been taken through to the planning stage preferred list.

5.1.3 The 14 receptor sites on the planning stage preferred list are shown in Table 5.1 and in summary:

a. All of the sites are located within 90km of the drive sites and all but two of the sites accessed by road are within 30km of the drive sites.

b. All but two of the receptor sites would accept all of the main excavated material from the Thames Tideway Tunnel sites (although some of the sites have expressed a preference for the chalk to be mixed with other materials).

c. Four of the receptor sites have planning consent up to 2019. However, three receptor sites are consented to complete restoration during 2021 and seven are currently consented to accept material beyond 2021.

5.1.4 A map showing the locations of the receptor sites on the planning stage preferred list can be found in Annex C.4.

Table 5.1 Planning stage preferred list

Site ID	Name	Location (county)	Transport mode	End date	Total restoration material required by site ('000 tonnes)	Permitted capacity ('000 tpa)	Total excavated material that could be accepted[a] ('000 tonnes)	Summary of suitability
BOU	Bournewood Inert Landfill Site	Kent	Road	January 2018	2,091	200	263	The receptor site can take 6% of the Thames Tideway Tunnel project excavated material and is close to the main tunnel drive sites. It is only accessible by road.
CEM.7	Barrington Landfill	Cambridgeshire	Rail	2018	1,476	700	1,306	Barrington Quarry has the potential to receive 28% of the Thames Tideway Tunnel project excavated material in the short term (up to 2018), with potential to accept material beyond 2018 if further restoration is required and appropriate consents are obtained.
RSP	RSPB - Wallasea Island (Wallasea Wetland Creation Project)	Essex	Marine transport (Ship)	2019	9,300	3,000	4,402	Wallasea is a long distance from the main tunnel drive sites and can only be accessed by marine transport. However, it could take 94% of the Thames Tideway Tunnel project excavated material at the required throughput and would have a beneficial long term biodiversity impacts.
SUM	Summerleaz	Buckingh	Road	2021	792	Up to a	707	Denham Quarry could accept 15%

Site ID	Name	Location (county)	Transport mode	End date	Total restoration material required by site ('000 tonnes)	Permitted capacity ('000 tpa)	Total excavated material that could be accepted[a] ('000 tonnes)	Summary of suitability
	e - Denham Quarry	amshire				maximum of 715		of Thames Tideway Tunnel project excavated material by road.
VEO.1	Veolia Essex - Rainham Landfill	Essex	Road and marine transport (Barge)	2018	2,091	700	1,306	Rainham Landfill could take 28% of the Thames Tideway Tunnel project excavated material. The receptor site is located close to the main tunnel drive sites and has good marine transport and road access.
WRG.3	Calvert Landfill	Buckingh amshire	Rail	2047	24,600	1,000	2,919	Calvert Landfill has sufficient capacity to accept 62% of the Thames Tideway Tunnel project excavated material. It would also be operational throughout the timescales of the Thames Tideway Tunnel project. It is only accessible by rail and is only permitted to accept 1million tpa.
WRG.5	Sutton Courtenay	Oxfordsh ire	Rail	2031	2,460	600 but only 400 available for Thames Tideway Tunnel project	1,565	Sutton Courtenay landfill has sufficient capacity to accept a 33% of the Thames Tideway Tunnel project material. It would also be operational throughout the Thames Tideway Tunnel project. It is only accessible by rail and is permitted to accept 600,000tpa but the operator

Site ID	Name	Location (county)	Transport mode	End date	Total restoration material required by site ('000 tonnes)	Permitted capacity ('000 tpa)	Total excavated material that could be accepted[a] ('000 tonnes)	Summary of suitability
						material.		has indicated that only 400,000tpa would be made available for Thames Tideway Tunnel project material.
CEM.1	Borough Green Quarry	Kent	Road	2042	5,000	450	1,715	Borough Green Quarry can take 36% of the Thames Tideway Tunnel project excavated material and is close to the main tunnel drive sites. It is accessible by road.
CEM.6	Kingsmead Quarry	Berkshire	Road	2042	5,000	400	1,565	Kingsmead Quarry is not yet receiving material for restoration and requires the necessary permits. However, the receptor site would be able to accept 33% of the Thames Tideway Tunnel project excavated material by road.
RAR	Little Belhus Landfill	Essex	Road	2021	923	200	900	Little Belhus Landfill can accept 19% of the Thames Tideway Tunnel project excavated material. It is only accessible by road with limitations on movements. The receptor site is currently operating under exemptions however an environmental permit has been applied for.

Site ID	Name	Location (county)	Transport mode	End date	Total restoration material required by site ('000 tonnes)	Permitted capacity ('000 tpa)	Total excavated material that could be accepted[a] ('000 tonnes)	Summary of suitability
HAN.1	Shipton on Cherwell Quarry	Oxfordshire	Rail	2022	2,706	250	1,108	Shipton on Cherwell Quarry is not yet receiving material for restoration. However it has the ability to receive 24% of the Thames Tideway Tunnel excavated material. It is only accessible by rail but infrastructure is required to enable this.
SUM.2	East Burnham Quarry	Berkshire	Road	2021	750	150	750	East Burnham Quarry is only accessible by road; however it is on average 34km from Thames Tideway Tunnel main drive sites. It would not receive chalk material but would be able to receive all other material throughout the Thames Tideway Tunnel project lifespan, which equals to 16% of the Thames Tideway Tunnel project excavated material.
LAF.4	Tyttenhanger Quarry	Hertfordshire	Road	2032	11,000	600	2,107	Tyttenhanger Quarry can receive 45% of the Thames Tideway Tunnel project excavated materials. It is only accessible by road and is limited to receive 600,000tpa.

Site ID	Name	Location (county)	Transport mode	End date	Total restoration material required by site (‘000 tonnes)	Permitted capacity (‘000 tpa)	Total excavated material that could be accepted[a] (‘000 tonnes)	Summary of suitability
WES	Cliffe Pools	Kent	Marine transport (Barge)	2042	2,340	3,650[b]	2,340	Cliffe Pools can receive 50% of the Thames Tideway Tunnel project material but requires the necessary permits. It would not accept chalk material. The receptor site is accessible by marine transport (barge).

a. Based on the Thames Tideway Tunnel project excavated material production profile and the years the receptor site would be operational

b. Receptor site has planning consent which allows 10,000t per day, 365 days a year.

5.1.5 The planning stage preferred list demonstrates that there are sufficient sustainable end uses available for the excavated material, with:

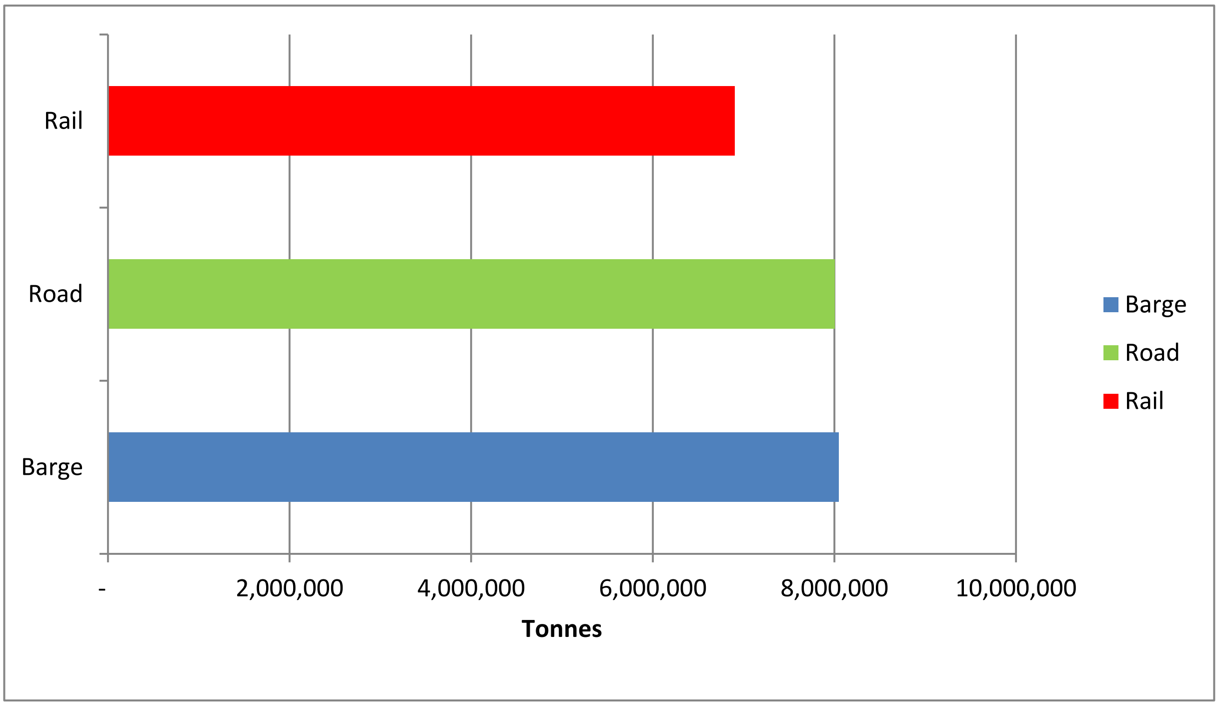
a. approximately 70million tonnes of material being required by the receptor sites on the planning stage preferred list; and

b. the receptor sites have the potential to receive a combined total of 22.96million tonnes based on the Thames Tideway Tunnel project excavated material production profile and the years the receptor site would be operational.

5.1.6 Plate 5.1.shows the combined tonnages that the receptor sites on the planning stage preferred list could receive by the delivery transport mode.

5.1.7 Furthermore, it is likely that additional receptor sites would come forward in the future as the business planning horizon for most waste and aggregates companies is around five years. It is anticipated that further acceptable receptor sites would become available as the project moves towards its proposed start date.

Plate 5.1 Capacity available within the planning stage preferred list receptor sites by transport mode based on permitted capacity



5.2 Reserve list

5.2.1 There are some receptor sites that have not progressed further in the assessment that may become viable in the future. These receptor sites could be reconsidered and taken forward through the process if their circumstances change as set out in Section 2.9. Table 5.2 provides details of the reserve list.

5.2.2 Further information on the reserve list can be found in Annex D.14

Table 5.2 Reserve list

OP ID	Name	Nature of proposal	Reason for non progression	Estimated capacity (m^3)	Current stage of assessment
VEO.6	Ockendon Landfill	Landfill restoration	Currently not operational	over 1million *	Viable list
MET	Metrotidal	Development	No planning consent	3million	Viable list
IME	Quidhampton Quarry	Quarry restoration	Ownership of site is not yet confirmed	2million	Long list

** The capacity for this receptor site is unknown or requires confirmation, however following discussions with the receptor site operators/owners approximate estimates for potential capacity available for Thames Tideway Tunnel project material would be in excess of 1million m^3.*

5.3 Next steps

5.3.1 If application approval is obtained the *EMOA* would move to the next phase and the evaluation objectives would form part of the tender evaluation for the procurement of the receptor sites. Appropriate evaluation indicators relating to each evaluation objective would be developed and assessed. The *EM&W strategy* sets out the Thames Tideway Tunnel project's objectives to ensure that the receptor sites procured would be assessed against the *EMOA* and be equivalent to those receptor sites identified on the *Planning stage preferred list*.

5.3.2 Any new information obtained relating to potential receptor sites during the application process would be noted. The receptor sites would not be reassessed during the application process.

5.3.3 Approval of the final list of receptor sites would be sought from the Environment Agency and secured via a side agreement.

Annexes

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Annex A Bulking factors and excavated material characteristics

A.1 Bulking factors and densities

A.1.1 The following densities and bulking factors have been used to estimate the tonnage and volume of excavated material produced by the Thames Tideway Tunnel project construction. These figures are based on a review of estimates and actual data from previous similar projects, such as Crossrail and the Channel Tunnel.

Table A.1 Density and bulking factors for excavated material

Stratum	Bulk density tonnes/m^3	Typical bulking factors		
		Shaft excavation	EPBM*	STBM**
Made Ground	1.7	1.2		
London Clay	2	1.4	1.7	
Lambeth Group	2.1	1.4	1.7	
Thanet Sands	1.8	1.1	1.4	1.4
Chalk (Seaford Member)	2	1.4	1.6	1.6

** Earth Pressure Balance Machine*
*** Smart Tunnel Boring Machine*

A.2 Excavated material characteristics

London Clay

A.2.1 A typical description is provided below based on data from British Geological Survey together with logs from boreholes excavated as part of investigations:

a. Grey fissured clay that weathers to a chocolate brown. Locally with crystals of selenite (gypsum).

Lambeth Group

A.2.2 The Lambeth Group (formerly known as the Woolwich and Reading Beds) is a complex sequence of gravels, sands and clays which exhibit considerable variation.

A.2.3 The tunnelling process is likely to add to the mixing of the materials.

A.2.4 A typical description based on data from British Geological Survey[19] together with logs from boreholes excavated as part of investigations includes:

a. The Lower and Upper Mottled Beds can be described as a mottled or multicoloured, stiff or very stiff fissured clay, compact silt, and dense or very dense sand.

b. The Upper Shelly Beds is mainly a grey shelly clay, and occasionally sand dominated unit and shelly limestone.

c. The Laminated Beds consists of thinly interbedded fine- to medium-grained sand, silt and clay, with locally more extensive sand bodies and thin shell and lignite beds.

d. The Lower Shelly Beds is a dark grey to black clay with abundant shells but may also be Shelly sand. Where shells predominate, thin limestone bands are formed.

e. The base of the Lambeth Group is marked by the Upnor Formation which comprises dense silty glauconitic sand.

Thanet Sands

A.2.5 A typical description is provided below based on data from British Geological Survey together with logs from boreholes excavated as part of investigations:

a. Generally dense glauconitic silty fine sand with occasional rounded flint gravel.

b. The base of the formation is marked by the Bullhead Beds, which comprise rounded gravel and cobbles of flint.

Chalk

A.2.6 The tunnel and shaft excavations would expose the Seaford Formation.

A.2.7 The Seaford and Lewes Chalk formations are comprised of a number of members, which are described in Table 1.1. The table also gives a summary of the results of index tests from ground investigations.

A.2.8 For tunnelling, to ensure effective transport and disposal, a maximum water content of processed material is likely to be specified. This would be 30% as a maximum and may be less if it appears feasible based on the progress of current tunnel projects in chalk.

A.2.9 Current experience suggests that the most effective method of dewatering chalk slurry involves the use of filter presses at the final stage of the treatment process.

A.2.10 The slurry treatment process is likely to comprise the following outline stages:

a. Coarse and fine screens would remove particles of more than 0.2mm size – most flint fragments would be removed here.

b. Hydrocyclones would be used to initiate the separation of water from the slurry.

c. The resultant material is passed to filter presses, which are claimed to produce a paste of chalk with a moisture content of less than 30% (tests undertaken for the Lee Tunnel indicate that 26% is achievable). The filter presses are understood to use less energy than the centrifuges used on CTRL C320, which produced a paste with 35% to 40% moisture content.

A.2.11 For shafts it is likely that additives would be required to dry out the spoil in order to assist transportation and disposal. It is not practical to allow long term natural drying out on site, because the site area required would be too large and it is weather dependent such that accurate programming would be impossible.

A.2.12 The addition of lime to the spoil may be required to ease the removal of the filter cake from the filter membranes. Tests for the Lee Tunnel suggest that the pH increases up to 12. Acid may be added to reduce the pH, but health and safety risks may prevent the use of lime and subsequently acid in the spoil treatment process.

A.2.13 Alternatives to lime, for example long-chain polymers such as DryAdd, may be considered.

A.2.14 In the case of the Thames Tideway Tunnel project[20], the chalk, with mean saturation moisture content (SMC) at about 26% and close to 100% saturated, would be completely pulverised to silt sized particles by the excavation process. Therefore it would not be suitable as backfill to structures and it would be very difficult to use as fill for embankments owing to the fines, which would give it a spongy nature likely to be unstable in slopes.

A.2.15 From experience of the Brighton and Hove Stormwater scheme, the chalk spoil re-cemented after several months of drying out in thin layers.

A.2.16 If the spoil is to be used in embankment construction or as a sub-grade to future foundations, it is likely that cement at a dosage of 3% would need to be added to control moisture levels; it is unlikely that the fill could be worked during the winter or periods of wet weather.

A.2.17 An end-product specification that is a maximum air voids limit of between 5% and 10% should be determined based on extensive compaction trials carried out on the chalk filter cake and monitored continuously throughout construction.

A.2.18 The most likely use of the chalk spoil is for landscaping or capping to landfills, where subsequent surface loading is minimal.

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Annex B Evaluation objectives and assumptions

B.1 Basis for selecting evaluation objectives and indicators

B.1.1 A review of national, regional and local plans has been undertaken to identify common policy areas which could be relevant for the Thames Tideway Tunnel project.

B.1.2 The occurrence of these common policies was then used to produce a list of evaluation objectives and indicators for the Thames Tideway Tunnel project, which aimed to encapsulate the common objectives of each policy theme. The list of evaluation objectives and which national, regional and local plans have informed the development of the evaluation objectives are presented in Table B.1.

B.1.3 The local authorities whose Local Plans have been reviewed are:

a. London Borough of Tower Hamlets;

b. London Borough of Lambeth;

c. Westminster City Council;

d. London Borough of Lewisham;

e. London Borough of Newham;

f. London Borough of Southwark;

g. City of London Corporation;

h. Royal Borough of Kensington and Chelsea;

i. London Borough of Ealing;

j. London Borough of Hounslow;

k. London Borough of Richmond upon Thames;

l. London Borough of Wandsworth;

m. Royal Borough of Greenwich; and

n. London Borough of Hammersmith and Fulham.

B.1.4 The policy documents reviewed are those versions which are currently published. It is noted that the *London Plan 2011*(GLA)[21] was updated in July 2011, the National Waste Strategy[22] for England and Wales was reviewed and published in June 2011 and the Waste Water National Policy Statement (Defra, 2012)[23] was issued in March 2012. These documents were developed after the evaluation objectives have been formulated. All renewed and reviewed documents have been assessed to ensure that policy themes are not significantly different to their previous versions. Where necessary the evaluation objectives have been reviewed to ensure they remain relevant at the time of the assessments.

Table B.1 Policies which inform the environmental objectives

	1. To ensure prudent use of land and other resources	2. To reduce climate change impacts	3. To protect local amenity	4. To conserve landscapes and townscapes	5. To protect quality of and access to open space	6. To protect water quality	7. To protect biodiversity	8. To protect cultural heritage	9. To provide employment opportunities	10. To minimise the costs associated with the management of excavated material	11. To ensure delivery	12. To conform with the waste hierarchy	To conform with the proximity principle	14. To conform with the sustainable transport policy	15. To conform with health and safety good practice
Waste Framework Directive (2008/98/EC)										✓	✓	✓			
Waste Water National Policy Statement 2012	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Planning Policy Statement 10			✓	✓	✓	✓	✓				✓				
National Waste Strategy for England and Wales 2007		✓			✓					✓	✓	✓			✓
London Plan 2011	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓
London Borough of Tower Hamlets	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	
London Borough of Lambeth				✓	✓		✓				✓	✓	✓		
Westminster City		✓	✓			✓		✓			✓	✓	✓		

Council	1. To ensure prudent use of land and other resources	2. To reduce climate change impacts	3. To protect local amenity	4. To conserve landscapes and townscapes	5. To protect quality of and access to open space	6. To protect water quality	7. To protect biodiversity	8. To protect cultural heritage	9. To provide employment opportunities	10. To minimise the costs associated with the management of excavated material	11. To ensure delivery	12. To conform with the waste hierarchy	To conform with the proximity principle	14. To conform with the sustainable transport policy	15. To conform with health and safety good practice
London Borough of Lewisham	✓	✓	✓	✓	✓	✓	✓				✓	✓		✓	
London Borough of Newham	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	
London Borough of Southwark		✓										✓	✓		
City of London Corporation	✓			✓	✓	✓	✓				✓	✓	✓	✓	
Royal Borough of Kensington and Chelsea			✓			✓		✓			✓	✓	✓	✓	
London Borough of Ealing	✓		✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	
London Borough of Hounslow	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	

	1. To ensure prudent use of land and other resources	2. To reduce climate change impacts	3. To protect local amenity	4. To conserve landscapes and townscapes	5. To protect quality of and access to open space	6. To protect water quality	7. To protect biodiversity	8. To protect cultural heritage	9. To provide employment opportunities	10. To minimise the costs associated with the management of excavated material	11. To ensure delivery	12. To conform with the waste hierarchy	To conform with the proximity principle	14. To conform with the sustainable transport policy	15. To conform with health and safety good practice
London Borough of Richmond upon Thames	✓	✓		✓	✓		✓	✓			✓	✓	✓		✓
London Borough of Wandsworth		✓	✓	✓	✓	✓	✓	✓				✓		✓	✓
Royal Borough of Greenwich	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	
London Borough of Hammersmith and Fulham	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓	

B.2 Viability filter telephone questionnaire

Table B.2 Viability filter telephone questionnaire

Potential outlet
Contact(s)
Telephone number
Date(s) contacted
Company background - (web search, publicity material, etc)
What materials would you accept/take/process?
How much capacity does your facility/project have for excavated material?
Do you need material for engineering projects/restoration/construction of roads (non disposal routes)?
How long would that capacity be available for?
Do you have a 10 year plan?
Where is your project/facility located? Postcode?
Do you have specification/acceptance criteria for the material? (What physical form would the material to be in?)
Do you have any vehicle/handling constraints?
Do you have any permitting/planning constraints?
Does your project need planning consent? Status?

B.3 Preliminary assessment operator interview prompt sheet

Table B.3 Interview prompt sheet used to support preliminary assessment of viable list receptor sites

Use of material
1) Materials produced by Thames include London clay, Lambeth beds, Thanet sands and chalk which could have high moisture content, as well as materials such as concrete from the tunnel production process. Would your site be able to accept all of these materials, and what limitations are there?
2) Could you accept between 200,000 and 4,600,000t of material?
3) Are you likely to be able to accept this material between 2016 and 2021?
4) What do you intend to use the material for? Restoration/Engineering/Remediation/Disposal etc
5) Would any of this material be used for disposal?
6) Where would you normally source material for restoration/reclamation/ engineering?
7) Are these sources of material ‘wastes’?
8) Do you use virgin material for any of these activities, and if so could this material be replaced with other stream?
9) What is the size of the site (in ha) you think the Thames material would be used on? If unsure give a % and the size of the whole site.
Final usage
10) Do you have any images or plans of what the final appearance of the site would be after restoration/reclamation?
11) Have any plans been produced which show the necessity for why restoration/reclamation needs to occur?
12) If the site were to accept Thames material for restoration/reclamation, would this directly create any jobs on the site?
13) Would the site have to cut staff if it did not receive Thames material?
Practicalities
14) What are your dates for requiring material?
15) How much material in total would you need? Has this been calculated?
16) Roughly as a % of Thames arisings would you accept of London clay, sands and gravels and wet (or dry) chalk? E.g. 80% clay, 20% sands, 0% chalk.
17) Potentially there could be up to 8,000t of material produced on average per day during construction. This rate could continue for several months. How would you manage this material?
18) What are the WACs for your site?

19)	Are there any other limits on what materials the site could accept for restoration/restoration?
20)	Are adequate permits and planning consents in place for you to accept materials? When would these be sought and would it be guaranteed that these would be obtained?
Flood impact	
21)	Is the site in a flood risk area?
22)	Has it been analysed if the use of the land as restoration/reclamation would have an impact on flood risk on other local areas? If not, is there anything in the sites permit or planning application which covers flood risk?
23)	What water abstraction points are on site (or near site)?
Transport	
24)	Does the site currently have a travel plan for the impact of deliveries of material on the surrounding road network? If so, what measures are in place to limit emissions on population and natural receptors?
25)	How do you currently accept the majority of your materials?
26)	Are there alternative transport connections locally that you are aware of which could be investigated?
27)	Are there transport constraints that you know of which could affect the delivery of material to the site?
Impact of site on local receptors	
28)	Have you ever had issues from nearby residents complaining about site operations or emissions etc?
29)	Have the impact of visual receptors for restoration/reclamation been examined in the sites planning application, or permit?
30)	Are management strategies in place for limiting water pollution and impact on wildlife habitats for activities on the site? Are these available and have they been agreed by the EA?
Financial	
31)	What are the finances for obtaining material for restoration/reclamation?
32)	If you purchase material for restoration/reclamation, roughly how much do you pay for a tonne (excluding transport costs)?*
33)	If you charge for contractors to deliver material which you use for restoration/reclamation, how much do you charge (excluding transport)?
34)	What indicative costs do you have for transport, if you offer this service i.e. £ per tonne, £ per mile, economies of scale etc.
35)	Are there any site specific planning/permitting issues which could affect the delivery of materials to the site?
36)	Could we get a copy of the Site’s H&S policy, or does the site operate a HSE management system to ISO18001 or equivalent?

* Information relating to cost was not assessed at this stage of the assessment

B.4 Viability assessment evaluation criteria

Table B.4 Evaluation criteria for development of viable list

Evaluation objectives	Evaluation indicators	Evaluation criteria		
		Red	Amber	Green
Operational objectives	Operational indicators	Limited viability	Potentially viable	Likely to be viable
11. To ensure operational suitability of the receptor site	a) Likelihood of implementation within the required timescale	The receptor site would not be available for use for Thames Tideway Tunnel project material for the required timescales.	The receptor site would potentially be available for use for Thames Tideway Tunnel project material for the required timescales or may be available for part of the project.	The receptor site would be available for use for Thames Tideway Tunnel project material for the required timescales.
	b) Acceptability of material with Thames Tideway Tunnel project material characteristics by the receptor sites	The receptor site could not accept for use any Thames Tideway Tunnel project material type based on their characteristics.	The receptor site could accept for use some Thames Tideway Tunnel project material types based on their characteristics.	The receptor site could accept for use all of the Thames Tideway Tunnel project material types based on their characteristics.
	c) Capacity of the receptor site to accept the required volume of Thames Tideway Tunnel project material (based on likely tonnage accepted)	The receptor site has limited capacity to accept Thames Tideway Tunnel project material.	The receptor site has capacity to accept a useful volume of Thames Tideway Tunnel project material.	The receptor site has sufficient capacity to accept Thames Tideway Tunnel project material.
	d) Ability of the receptor sites to accept Thames Tideway Tunnel	The receptor site is unlikely to be able to take the	The receptor site can accept some of the required	The receptor site can take the required throughput of

Evaluation objectives	Evaluation indicators	Evaluation criria		
		Red	Amber	Green
Operational objectives	Operational indicators	Limited viability	Potentially viable	Likely to be viable
	project material at the anticipated rate (speed of material generation versus acceptance rate)	required throughput of Thames Tideway Tunnel project material.	throughput of Thames Tideway Tunnel project material.	Thames Tideway Tunnel project material.
	e) Site operations have appropriate planning/permitting consents	The receptor site has no current planning consent or a relevant EA permit.	The receptor site has either planning consent or a relevant EA permit.	The receptor site currently accepts materials similar in nature to those that would be produced by Thames Tideway Tunnel project. The site has planning consent and an EA permit if necessary.

Viability filter assumptions

B.4.1 In addition to the evaluation criteria detailed in Table B.4, a number of assumptions are applied when grading the performance against each evaluation indicator.

Evaluation indicator 11 (a) – Timescale

B.4.2 It is assumed that the Thames Tideway Tunnel project would be producing excavated material between 2016 and 2021.

Evaluation indicator 11 (b) – Material characteristics

B.4.3 It is assumed that the excavated material arising from the project would comprise of chalk, Lambeth beds, Thanet sands, London clay, made ground/superficial deposits, site strip and construction related waste.

Evaluation indicators 11 (c) - Capacity

B.4.4 Under the evaluation indicator 11(c), 'capacity of the receptor site to accept the required volume of Thames Tideway Tunnel project material', it is assumed that excavated materials arising at the CSO sites would be aggregated with material from the main tunnel drive sites for the purpose of this assessment. As such, sites which could only accept the smaller volumes of material arising from the CSO sites have been excluded from this assessment at this stage. Smaller receptor sites have been ruled out of the assessment as it would be impractical to assess the large number of smaller receptor sites required to provide confidence that capacity would be available for all of the Thames Tideway Tunnel project material. This does not prevent small receptor sites from forming part of the solution at the procurement/delivery stage provided they meet the required standards.

B.4.5 Therefore, to ensure the assessment is manageable whilst fit for purpose the following assumptions have been made with respect to the definition of a "useful volume of excavated material". Any receptor site which can accept material above these thresholds is deemed to be able to accept a useful volume of material:

a. Any landfill sites/quarry restorations with a void capacity under 200,000t are given a red performance grade due to having limited capacity.

b. Any physical treatment sites with a capacity under 100,000tpa are given a red performance grade due to having limited capacity.

B.4.6 The void capacity of 200,000t equates to approximately 5% of aggregated excavated materials arisings over the Thames Tideway Tunnel project. So while limiting the assessment to a practical number of sites, this assumption ensures that receptor sites that could provide useful capacity are considered in the *EMOA*.

B.4.7 The following is also assumed for this evaluation indicator:

a. if a site can take 'all of at least one material' it is graded green

b. if a site can take 'a useful amount of at least one material' (as described in Table 1.1) it is graded amber

c. if a site 'cannot take a useful amount of the material' (as described in Table 1.1) it is graded red.

Evaluation indicators 11 (d) – Acceptance rate

B.4.8 Receptor sites have been graded based on the operator's responses with regards to the site's ability to accept Thames Tideway Tunnel project material at the anticipated rate.

Evaluation indicators 11 (e) - Planning/permitting consents

B.4.9 Under the evaluation indicator 11 e), 'site operations have appropriate planning/permitting consents', the assumption is that operational facilities have the permits required to operate at their current capacity.

B.5 Preliminary assessment evaluation criteria

Table B.5 Evaluation criteria for development of the short list

Evaluation objectives	Evaluation indicators	Short list		
		Red	Amber	Green
1. To ensure prudent use of land and other resources	a) Extent to which resources such as sand, gravel and chalk are conserved by processing or storage of Thames Tideway Tunnel project material at receptor sites	To enable the receptor site to accept Thames Tideway Tunnel project material virgin material would also be required.	Thames Tideway Tunnel project material is unlikely to affect virgin material use e.g. material replaces other reusable materials or no material substitution required.	Thames Tideway Tunnel project material would directly substitute virgin material.
	b) Extent to which Thames Tideway Tunnel project material would effect landtake at (footprint of) receptor sites in the long term	The acceptance of Thames Tideway Tunnel project material would contribute to the requirement for additional land extending the receptor site's boundary.	The acceptance of Thames Tideway Tunnel project material would not contribute to the requirement for additional land extending the receptor site's boundary.	The acceptance of Thames Tideway Tunnel project material would contribute to reducing the footprint of the receptor site.
2. To reduce climate change impacts	a) Greenhouse gases (GhG) emitted through material handling and treatment at receptor sites (excludes transport to site)	Thames Tideway Tunnel project material requires active treatment at receptor sites (e.g. turning, washing, grading); material would be double handled and/or no process to reduce transport by vehicle on site.	Thames Tideway Tunnel project material would not require treatment and minimal handling required e.g. passive drying used and material moved by conveyor where possible.	There is a *Carbon Management Plan* in place with systems in place to offset GhG emissions from the treatment, handling and use of Thames Tideway Tunnel project material.
	b) Extent to which flood	Operations at the receptor	Operations at the receptor	Operations at the

Evaluation objectives	Evaluation indicators	Short list		
		Red	**Amber**	**Green**
	risk is altered by Thames Tideway Tunnel project material at the receptor site (or in the local catchment)	site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would increase flood risk (from any source or a combination of sources) resulting in adverse effects to the site and surroundings.	site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would not change flood risk (from any source or a combination of sources) to the site and surroundings.	receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would reduce flood risk (from any source or a combination of sources) resulting in beneficial effects to the site and surroundings.
	c) Greenhouse gases (GhG) emitted through transport of Thames Tideway Tunnel project material to the receptor sites	Through the transport of Thames Tideway Tunnel project material high levels of CO_2 eq per tonne of excavated material accepted by the receptor site would be produced.	Through the transport of Thames Tideway Tunnel project material moderate levels of CO_2 eq per tonne of excavated material accepted by the receptor site would be produced.	Through the transport of Thames Tideway Tunnel project material low levels of CO_2 eq per tonne of excavated material accepted by the receptor site would be produced
3. To protect local amenity	a) Extent of potential effects on local amenity from treatment, handling and use of Thames Tideway Tunnel project material at receptor sites.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have adverse effects on the local amenity.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would not have an effect on the local amenity or any effect would be negligible.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have beneficial effects on the local amenity.

Evaluation objectives	Evaluation indicators	Short list		
		Red	**Amber**	**Green**
4. To conserve landscapes and townscapes at receiving locations	a) Extent of short term visual & landscape effects from receipt, treatment, handling and use of Thames Tideway Tunnel project material at receptor sites	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would change the landscape in the short term and would have adverse effects on sensitive receptors.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would not have a short term effect on the local visual amenity at the receptor site or any effect would be negligible.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would change the landscape in the short term and would have beneficial effects on sensitive receptors
	b) Extent of permanent visual & landscape effects from receipt, treatment, handling and use of Thames Tideway Tunnel project material at receptor sites	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a permanent adverse visual effect on the landscape, based on a 'do nothing' view of the site.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would not have a permanent effect or any effect would be negligible, based on a 'do nothing' view of the site.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a permanent beneficial effect on the landscape.
5. To protect quality of and access to open space	a) Would Thames Tideway Tunnel project material enhance quality of and access to open space in the short term?	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would

Evaluation objectives	Evaluation indicators	Short list		
		Red	**Amber**	**Green**
		remove or divert a PRoW or prevent access to open space	have no or a negligible effect on access to and quality of open space and PRoWs.	contribute, would create an enhancement to a PRoW and increase accessibility to public open space.
	b) Would Thames Tideway Tunnel project material enhance quality of and access to open space in the long term?	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would permanently remove or divert a PRoW or prevent access to open space	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would not affect the access to, and quality of, open space and PRoWs permanently.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would constitute an enhancement to the PRoW and increase accessibility to public open space.
6. To protect water quality	a) Extent of potential effects on fluvial water quality from receipt, treatment, handling and use of Thames Tideway Tunnel project material at receptor sites	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have an adverse effect on the local watercourses.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have no or negligible effect on the local watercourses.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a beneficial effect on local watercourses.

Evaluation objectives	Evaluation indicators	Short list		
		Red	**Amber**	**Green**
	b) Extent of potential effects on groundwater quality from receipt, treatment, handling and use of Thames Tideway Tunnel project material at receptor sites	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have an adverse effect on groundwater.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have no or negligible effect on groundwater.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a beneficial effect on groundwater quality.
7. To protect biodiversity	a) Extent of potential effects on designated sites from receipt, treatment, handling and use of Thames Tideway Tunnel project material at receptor sites in the short term	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have an adverse effect on a designated site.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have no or negligible effect on a designated site.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a beneficial effect on a designated site and/or creation/improvement of habitats

Evaluation objectives	Evaluation indicators	Short list		
		Red	**Amber**	**Green**
	b) Extent of potential effects on designated sites from receipt, treatment, handling and use of Thames Tideway Tunnel project material at receptor sites in the long term.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have an adverse effect on a designated site.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would no or negligible effect on a designated site.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a beneficial effect on a designated site and/or creation/improvement of habitats
8. To protect cultural heritage	a) Extent of potential effects on designated or nominated cultural heritage sites from receipt, treatment, handling and use of Thames Tideway Tunnel project material at receptor sites	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have an adverse effect on a designated site.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would no or negligible effect on a designated site.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a beneficial effect on a designated site.
9. To provide employment opportunities	a) Extent to which the acceptance of Thames Tideway Tunnel project material by the receptor site would affect the number jobs available at the receptor sites in the short term	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would lead job losses in the short term.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would not lead to job losses or gains in the short term.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would lead to job gains over the short

Evaluation objectives	Evaluation indicators	Short list		
		Red	Amber	Green
				term.
	b) Extent to which the acceptance of Thames Tideway Tunnel project material by the receptor site would affect the number jobs available at the receptor sites in the long term	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would lead to long term job losses.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would not lead to job losses or gains in the long term.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would lead to job gains over the long term.
11. To ensure operational suitability of the receptor site	a) Likelihood of implementation within the required timescale	The receptor site would not be available for use for Thames Tideway Tunnel project material for the required timescales.	The receptor site would potentially be available for use for Thames Tideway Tunnel project material for the required timescales or may be available for part of the project.	The receptor site would be available for use for Thames Tideway Tunnel project material for the required timescales.
	b) Acceptability of material with Thames Tideway Tunnel project material characteristics by the receptor sites	The receptor site could not accept for use any Thames Tideway Tunnel project material type based on their characteristics.	The receptor site could accept for use some Thames Tideway Tunnel project material types based on their characteristics.	The receptor site could accept for use all of the Thames Tideway Tunnel project material types based on their characteristics.
	c) Capacity of the	The receptor site has	The receptor site has	The receptor site has

Evaluation objectives	Evaluation indicators	Short list		
		Red	**Amber**	**Green**
	receptor site to accept the required volume of Thames Tideway Tunnel project material	limited capacity to accept Thames Tideway Tunnel project material.	capacity to accept a useful volume of Thames Tideway Tunnel project material.	sufficient capacity to accept Thames Tideway Tunnel project material.
	d) Ability of the receptor sites to accept Thames Tideway Tunnel project material at the anticipated rate (speed of material generation versus acceptance rate)	The receptor site is unlikely to be able to take the required throughput of Thames Tideway Tunnel project material.	The receptor site can accept some of the required throughput of Thames Tideway Tunnel project material.	The receptor site can take the required throughput of Thames Tideway Tunnel project material.
	e) Site operations have appropriate planning/permitting consents	The receptor site has no current planning consent or a relevant EA permit.	The receptor site has either planning consent or a relevant EA permit	The receptor site currently accepts materials similar in nature to those that would be produced by Thames Tideway Tunnel project. The site has planning consent and an EA permit if necessary.
	f) Can accept excavated material from multiple transport modes	The receptor site is only accessible by one transport mode	The receptor site is only accessible by two transport modes	The receptor site is on a strategic highway AND the site has good marine transport access and sufficient wharf capacity to receive Thames Tideway Tunnel project material AND the site

Evaluation objectives	Evaluation indicators	Short list		
		Red	Amber	Green
				has good rail access and sufficient rail capacity to receive Thames Tideway Tunnel project material
12. To conform with the waste hierarchy	a) Extent to which the receptor site meets the Thames Tideway Tunnel project *EM&W strategy*	Performance of receptor site is below target	Performance of receptor site meets target	Performance of receptor site exceeds target
13. To conform with the proximity principle	a) Average distance from main tunnel drive sites	The receptor site is greater than 60km from source of the Thames Tideway Tunnel project material	The receptor site is between 60km and 40km from source of the Thames Tideway Tunnel project material	The receptor site is less than 40km from source of the Thames Tideway Tunnel project material
14. To conform with sustainable transport policy	a) Conforms with the policy objective to move transport of materials from road to rail or marine transport	The receptor site can only be accessed by road and there is no direct access to a strategic highway	The receptor site has the potential to be accessed by rail or marine transport but may require some double handling or transhipment	The receptor site can be directly accessed from marine transport or rail and requires no double handling
15. To conform with Health and safety good practice	a) Health and Safety performance conforms with good practice	There is no H&S System at the receptor site more than five RIDDOR incidents in last two years recorded at the receptor site	The receptor sites H&S system is not accredited and there have been five or less RIDDOR incidents in last two years recorded at the receptor site	The receptor sites H&S system is accredited and there have been five or less RIDDOR incidents in last two year recorded at the receptor site

B.5.1 The red, amber and green grades are assessed against different scales of effect depending on the objective being assessed as set out in Table B.6.

Table B.6 Red, amber, green effect assessed for each evaluation objective

Evaluation objective	Red	Amber	Green
1, 2, 3, 4, 5, 6, 7, 8, 9	Adverse effect	No or Negligible effect	Beneficial effect
11	Limited viability	Potentially viable	Likely to be viable
12, 13, 14, 15	Below expectations	Meets expectations	Exceeds expectations

B.6 Preliminary assessment assumptions

Evaluation indicator 1 (a) – Conserving natural resources

B.6.1 Where receptor sites intend to process the excavated materials into product it is assumed that this product would substitute demand for virgin materials.

B.6.2 It is assumed that those receptor sites which would use the Thames Tideway Tunnel project materials for restoration would be able to source materials of a similar nature from other excavation or construction projects occurring in the region, rather than having to use virgin resources to meet their restoration requirements.

Evaluation indicator 1 (b) – Receptor sites landtake

B.6.3 Where receptor sites propose to reclaim land from the estuary, it is assumed that this would increase the receptor site's landtake (this should be awarded a red in accordance with the evaluation criteria). However, once reclaimed, this land would become available for other uses (this should be awarded a green in accordance with the evaluation criteria). In these instances, a grade of amber is awarded.

B.6.4 Receptor sites which have not yet determined the final end use but which are anticipated to result in a change of land use are awarded an amber grade where no further landtake is anticipated.

Evaluation indicator 2 (a) – Greenhouse gases emitted through processing Thames Tideway Tunnel project material

B.6.5 It is assumed that those receptor sites which intend to stockpile Thames Tideway Tunnel project material prior to distributing it where it is required would use mobile plant to distribute the material on the receptor site. This would therefore produce more greenhouse gas emissions than material distributed by a conveyor system or delivered directly to their final location and therefore these receptor sites are graded red.

Evaluation indicator 2 (b) – Flood risk

B.6.6 Where final restoration plans for the receptor site are unknown, then the impact of use of Thames Tideway Tunnel project material on flood risk cannot be adequately assessed and an amber grading is awarded pending further assessment at the detailed assessment stage.

B.6.7 Receptor sites which are not located in flood risk zones or which are located behind flood defences are awarded amber grades.

B.6.8 Receptor sites which provide improved flood defences are awarded a green grade.

Evaluation indicator 2 (c) – Greenhouse gases emitted through transport

B.6.9 This assessment provides a method for comparing approximate GhG emissions associated with transport to each receptor site in order to compare receptor sites and does not provide precise measure of anticipated transport emissions.

B.6.10 Using the Defra/DECC greenhouse gas conversion tool a number of modelling assumptions are made to produce the estimated indirect kg CO_2 equivalent (kg CO_2 eq) produced for transporting material to the receptor sites.

B.6.11 The following assumptions are made with respect to transport mode:

a. It is assumed that excavated material would be transported from three main tunnel drive sites, each excavating just one type of material. It is assumed that clay would be produced at Carnwath Road Riverside, sands and gravels at Kirtling Street and chalk at Chambers Wharf. This assumption is made to enable a comparison between the receptor sites and does not reflect the exact transportation logistics which would be assessed in detail elsewhere.

b. It is assumed that for all receptor sites located east of London excavated materials would be transported from the main tunnel drive sites on bulk cargo barges to a transhipment point at Barking (postcode IG11 0EG). It is assumed that the barges would be less than 5,000t (dead weight) and that they would be 60% loaded. At the transhipment point material would be unloaded from the barges and then loaded on to either road or another barge for delivery to the receptor site, depending on the receptor sites ability to receive material by barge.

c. For receptor sites located west, north and south of London, it is assumed that materials would be delivered directly to the receptor site from the drive site by road.

d. The road option selected from the tool as most likely to be used by Thames is 'articulated vehicles <3.5t-33t' which were 60% laden.

e. Emissions from rail transport are calculated from a railhead location at Bow East (postcode E15 1SA).

B.6.12 Assumptions relating to tonnage transported are:

a. The tonnage of each material type that would need transporting is based on the receptor site's capacity as provided by the site operators when interviewed.

b. Where capacity is provided by the operator in m^3 the following conversion factors are used to convert this to a tonnage equivalent[VI].

- o Chalk 1.27t/m^3
- o Sands and Gravels 1.24t/m^3
- o Clay 1.18t/m^3

c. Where receptor sites could receive three types of excavated material, but have a total capacity less than the total quantity of Thames Tideway Tunnel project material a percentage split of each material type is used to produce a tonnage per material type.

d. If only two materials can be received by the receptor site the percentage is split 50:50 between the two material types.

B.6.13 Assumptions relating to distance travelled are:

a. For receptor sites west, south and north of London distance is calculated directly from each drive site to the receptor site.

b. For receptor sites east of London the distance from the drive site to the transhipment point and then the distance from the transhipment point to the receptor site is calculated either by road, rail or by marine transport as appropriate.

B.6.14 Assumptions relating to the calculation of kg CO_2 eq per tonne are:

a. All kg CO_2 eq are calculated as "all scope" emissions, this includes the embedded production and operational CO_2 eq of these vehicle types[VII].

b. The Defra/ DECC tool for 2012 provides the following assumptions for kg CO_2 eq per tonne per km:

- o UK average artic (61% load) 0.107
- o ship, bulk cargo 0-4999dwt (60% load) 0.01664
- o rail freight 0.03634

c. In order to calculate the kg CO_2 eq per tonne per km, the tonnes transported by each mode of transport are multiplied by the distance travelled by that mode and by the kg CO_2 eq per tonne per km from the Defra/ DECC tool for marine transport, road or rail. Where more than one transport mode is used the kg CO_2 eq per tonne for each mode is calculated and then these are added together.

d. The road transport emissions within the Defra/DECC tool are calculated on the basis that a lorry would run empty for part of the time

[VI] These conversion factors are based on the densities and bulking factors set out in Annex A.1.

[VII] A sensitivity analysis based on using "Scope 3" figures (which exclude embedded production and operational CO2 eq) finds that, although overall emissions are lower in the "Scope 3" model, overall ranking between options does not alter.

in the overall transporting of the freight. Thus the user does not need to double the distance of their freight tonne km for parts of a trip done empty loaded, as this has already been considered in the calculations. However this is not the case for the marine transport or rail.

e. In order to provide a fairer comparison between receptor sites with very different capacities, a kg CO_2 eq per tonne is calculated by dividing the total estimated kg CO_2 eq by the capacity of the receptor site.

B.6.15 The receptor sites are assessed using the following thresholds:

a. 0.00 – 1.75kg CO_2 eq per tonne is graded green

b. 1.76 – 3.5kg CO_2 eq per tonne is graded amber

c. 3.5kg CO_2 eq per tonne and above is graded red.

B.6.16 This is a relative grading and a grade of red does not necessarily indicate an adverse effect.

Evaluation indicator 3 – Local amenity

B.6.17 For receptor sites which involve development of green field sites not in a commercial or industrial area, it is assumed that baseline air quality could be regarded as good. It is assumed that delivery of Thames Tideway Tunnel project material to these receptor sites would have an adverse impact on air quality, through deliveries and other works occurring at the location. The nature and proximity of sensitive receptors is taken into account when assessing the potential impact of Thames Tideway Tunnel project material against this indicator.

B.6.18 Deliveries to existing facilities are assumed to have a lower impact on baseline levels as operations already include material delivery and handling. This would be given an amber grade. If the facility is located within an AQMA and has an environmental permit the receptor site is still given an amber grade as any impacts would be taken into consideration in the permit conditions.

B.6.19 It is not considered that a green grade could be achieved for this indicator.

Evaluation indicator 4 (a) – Short term visual impacts

B.6.20 Currently undeveloped sites are given a grade of red as they would create works which are not currently present at that location.

B.6.21 It is assumed that those receptor sites which intend to stockpile material prior to distributing it would pile Thames Tideway Tunnel project material in to a temporary landform, which could have an adverse impact on local receptors with regard to visual impact. It is assumed that visual impacts would be mitigated and a grade of amber is given. An assessment of site management processes and mitigation measures for this impact are assessed at a later stage.

B.6.22 Additionally, it is assumed that those receptor sites which operate as active landfills would use Thames Tideway Tunnel project material as a visual screen to the active face of the landfill, which would have a beneficial impact on local visual receptors.

Environmental indicator 4 (b) – Long term visual impact

B.6.23 It is assumed that the long term visual impact of using Thames Tideway Tunnel project material at those receptor sites which would be restored to a land use similar to that which surrounds the receptor site would be beneficial, when compared to baseline levels.

B.6.24 Those receptor sites which are anticipated to be restored but for which no long term restoration plans are in place or a new development which comprises a land use other than the surrounding land use are awarded an amber grade. This assumes that visual amenity impacts can be mitigated.

B.6.25 Receptor sites for which long term plans are to develop buildings for commercial or residential use could have a long term adverse effect. If it is considered that these impacts could not be mitigated a receptor site is awarded a red grade.

Evaluation indicator 5 (a) – Short term quality of and access to open space

B.6.26 Those receptor sites which currently receive material, such as quarries or landfill are assumed to have no current public access. Therefore it is assumed that receipt of Thames Tideway Tunnel project material at these receptor sites would not impact public amenity, unless stated.

B.6.27 Those receptor sites which comprise new developments and impact on existing public rights of way are awarded a red grade.

Evaluation indicator 5 (b) – Long term quality of and access to open space

B.6.28 For those receptor sites which are to be restored to nature reserves or wildlife parks it is assumed that these would increase access to open space, as the receptor sites when receiving Thames Tideway Tunnel project material would be inaccessible by the public.

B.6.29 Those receptor sites where restoration plans are unknown or public access would be determined by a third party (e.g. farm land or commercial development) are awarded an amber grade.

B.6.30 If public rights of way would be permanently removed or disrupted a red grade is awarded.

Evaluation Indicator 6 (a) – Fluvial quality

B.6.31 For those receptor sites which are available to receive wet sands and gravels, there is the potential for the liquid effluent contained within this material to enter the rivers through migration. It is assumed that those receptor sites which have the ability to receive this material would undertake reasonable endeavours to limit this from occurring, therefore having no or negligible impact on the local rivers. Therefore it is assumed that the receipt of sand and gravel at a receptor site would have no or negligible impact on fluvial quality.

B.6.32 For those receptor sites which are available to receive chalk slurry, there is the potential for the liquid effluent contained within this material to enter local rivers through migration. It is assumed that those receptor sites which have the ability to receive this material would undertake reasonable endeavours to limit this from occurring, therefore having no or negligible impact on the local rivers.

B.6.33 For those receptor sites which involve reclaiming land from estuaries and rivers, it is assumed that the fluvial watercourses would be impacted by the receipt of Thames material, which by its nature cannot be mitigated. These receptor sites are awarded a red grade.

Evaluation indicator 6 (b) – Groundwater quality

B.6.34 For those receptor sites which are available to receive wet sands and gravels, there is the potential for the liquid effluent contained within this material to enter the groundwater through migration. It is assumed that those receptor sites which have the ability to receive this material would undertake reasonable endeavours to limit this from occurring, therefore having no or negligible impact on the local groundwater. Therefore it is assumed that the receipt of sand and gravel at a receptor site would have no or negligible impact on groundwater quality.

B.6.35 For those receptor sites which are available to receive chalk slurry, there is the potential for the liquid effluent contained within this material to enter the groundwater through migration. It is assumed that those receptor sites which have the ability to receive this material would undertake reasonable endeavours to limit this from occurring, therefore having no or negligible impact on the local groundwater. Therefore it is assumed that the receipt of chalk at a receptor site would have no or negligible impact on groundwater quality.

B.6.36 Those receptor sites which propose using clay for engineering purposes (e.g. landfill engineering) to reduce effluent are awarded a green grade as these receptor sites are using the impermeability of the clay to reduce the volume of leachate and prevent egress.

Evaluation indicator 7(a) – Biodiversity short term

B.6.37 A designated site is assumed to be a Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), Special Protection Area (SPA), Local Nature Reserve (LNR), National Nature Reserve (NNR), Ramsar site, Important Bird Area or woodland.

B.6.38 Where a receptor site is more than 1km from a designated site it has been assumed that the use of Thames Tideway Tunnel project material at the receptor site is likely to have a negligible or no impact on the designated site.

B.6.39 Where a permitted receptor site is in close proximity (within 1km from the receptor site boundary) to a designated site it has been assumed that the use of Thames Tideway Tunnel project material at the receptor site is likely to have a negligible or no impact on the designated site as any impacts should be mitigated under the site's environmental permit.

B.6.40 Where an operational but unpermitted receptor site or a development on a green field site is located in close proximity to designated sites it is assumed that the construction of the new receptor sites is likely to disrupt the designated site in the short term and a red grade is awarded.

Evaluation indicator 7(b) – Biodiversity long term

B.6.41 It is assumed that all receptor sites whose restoration plans are intended to create nature reserves, woodland or farmland would create new habitats which would encourage biodiversity. These are awarded a green grade.

B.6.42 Where final restoration plans have not yet been finalised the receptor site is awarded an amber grade.

B.6.43 Where receptor sites are likely to be restored to commercial or residential use an amber grade is awarded. At this stage in the assessment insufficient detail is available regarding these schemes to determine their impact on biodiversity. Any proposed restoration plans or planning documents are reviewed during the Detailed Assessment for receptor sites which proceed to the short list.

Evaluation indicator 8 – Cultural heritage

B.6.44 It is assumed that designated or nominated archaeological sites comprise Scheduled Ancient Monuments (SAMs), registered parks, gardens or battlefields.

B.6.45 It is assumed that all receptor sites which are located more than 1km from a SAM, registered park, garden or battlefield are likely to have a negligible impact on these SAMs. These receptor sites are awarded an amber grade.

B.6.46 For receptor sites located within 1km of a SAM, registered park, garden or battlefield professional judgement is used to award a grade based on the receptor site's operations, permit status and the nature of the archaeological site.

Evaluation indicator 9 (a) Short term employment potential

B.6.47 Operators provide estimates on employment in the short term. Those receptor sites where operators claim jobs would be created are graded green.

B.6.48 Those receptor sites which already have staff employed and which state that no new staff would be required are given an amber grade.

Evaluation indicator 9 (b) – Long term employment potential

B.6.49 It is assumed that at those receptor sites which use Thames Tideway Tunnel project material for habitat creation and restoration projects would lead to job losses in the long term when the habitat creation or restoration project has been completed. In some cases jobs would be created relating to the new land use (for example at a visitors centre). For the assessment it is assumed that there would be zero net job creation and losses in these instances.

Evaluation indicator 11 – To ensure operational suitability of the receptor site

B.6.50 Those assumptions made relating to evaluation indicator 11 a) to e) are the same as the assumptions made during the development of the viable list. These can be found in Annex B.4. Where additional information is obtained it is used to reassess these evaluation indicators.

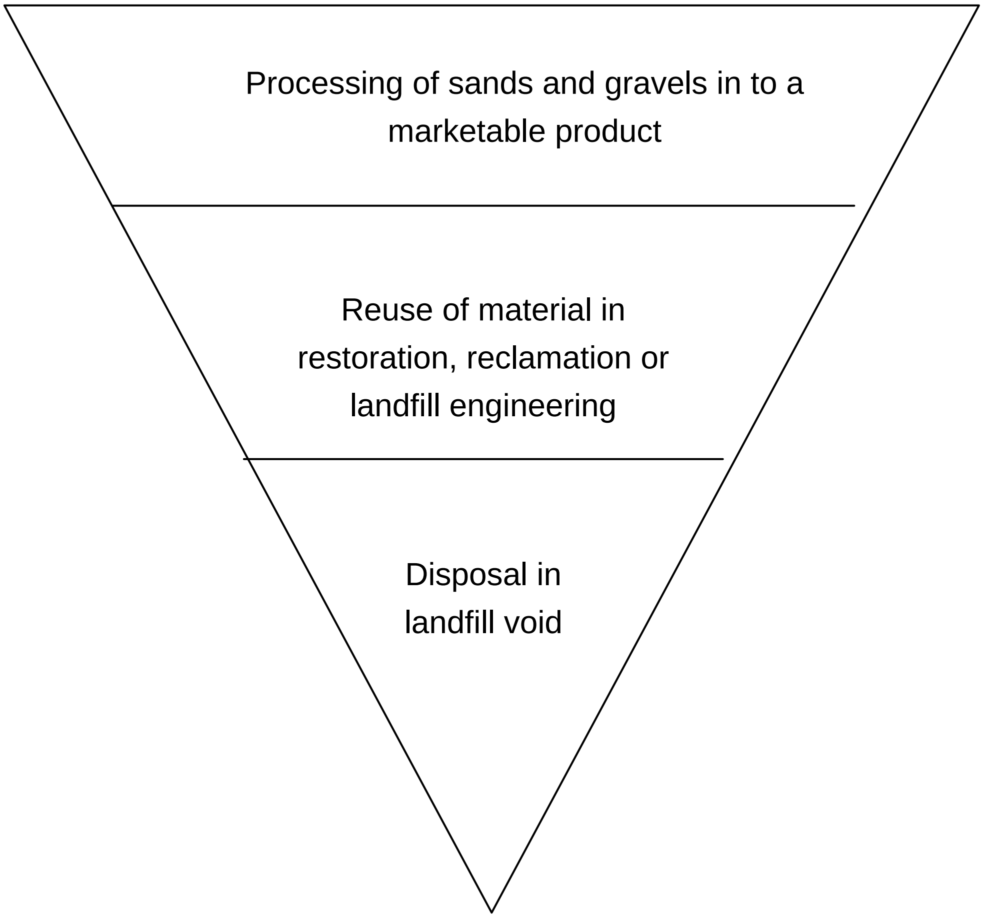
B.6.51 If new information is obtained which leads to a receptor site being awarded a lower grade than obtained in the initial Viability Assessment, this rescoring may lead to a lower performance, such that the receptor site is no longer deemed potentially viable. It remains on the viable list but would not progress to the short list.

Evaluation indicator 12 – Waste hierarchy

B.6.52 Those receptor sites which would recycle the sands and gravels in to a marketable product are assumed, through the process of recycling this material, to produce some material which is not marketable. It is therefore assumed that this material would be disposed of. However, if the receptor site is also using material for restoration purposes, it is assumed that that material not recycled would instead of being disposed would be included with that material the operator intends to use for restoration.

B.6.53 The position on the waste hierarchy of the final use of excavated materials by the receptor sites assessed has been interpreted in Plate B.1

Plate B.1 Hierarchy of excavated materials end use



Evaluation indicator 13 – Proximity principle

B.6.54 All receptor sites are assessed using a straight line distance from the main drive sites. Where receptor sites are able to receive excavated materials from more than one drive site, the average distance is calculated. The receptor site is then assessed according to this average figure.

$$\frac{\sum \text{Straight line distance from drive sites to receptor site}}{\text{number of drive sites delivering material to receptor site}}$$

= A average distance from drive sites to receptor site

Evaluation indicator 14 – Sustainable transport policy

B.6.55 It is assumed that those receptor sites which have marine transport and rail access would not require double handling and are directly accessible, therefore they are given a green grade.

B.6.56 However, if the receptor site can, and would expect to receive excavated material by road as well rail and/or marine transport, then it is graded amber.

Evaluation indicator 15 – Health and safety performance

B.6.57 It is assumed that if the receptor sites parent organisation has ISO18001 accreditation, then the receptor site would also operate under this accreditation. These receptor sites are given a green grade.

B.6.58 Receptor sites which stated that they had a health and safety system which is not ISO18001 accredited are given an amber grade.

B.6.59 Receptor sites which are not currently operational have not been graded against this evaluation indicator.

B.7 Detailed assessment operator interview prompt sheet

Table B.7 Prompt sheet used to support the detailed assessment interviews

General site observations
▪ Observations about the site ▪ Details about where the site is located ▪ General thoughts about the site
Environmental objective 1: To ensure prudent use of land and other resources
▪ What material types can you accept? ▪ What is the total amount of material which you can accept? ▪ What would you use each material type for? ▪ Assuming more material is needed in the future, where would you source it? ▪ If Thames Tideway Tunnel project material was not available where else would you be sourcing material? ▪ Are you expecting the site footprint to increase, stay the same or decrease from taking Thames Tideway Tunnel project material
Environmental objective 2: To reduce climate change impacts
▪ Please describe a walk through process for each material type you intend to use on site. From when it arrives at your gate in road /at your dock by marine transport. ▪ Does a Carbon Management Plan exist for the site? ▪ Are there any systems in place to offset GhG emissions? ▪ Please provide any details on flood risk the quarry has. Have there been any incidents of flooding? Have any flood reports been produced for the site? ▪ Can you provide details on any measures in place to prevent flooding? ▪ Has there been any assessment carried out on the potential impact on flood risk from the delivery of a large amount of material?
Environmental objective 3: To protect local amenity
▪ Please provide details any odour abatement measures that are in place at the site ▪ Please provide details of any air quality measures in place/monitoring/bowsers ▪ Please provide details of any local complaints about odour or noise ▪ Do you believe that receiving the Thames Tideway Tunnel project material at the site would have an adverse or beneficial effect on air quality and/or odour?
Environmental objective 4: To conserve landscapes and townscapes at receiving locations
▪ What visual screening is there currently in place at the site? ▪ What sensitive receptors are there around the site which can see the current operation? ▪ In the short term would the delivery/spreading of Thames material be better than current operations on the site? ▪ Restoration plans, what are they? ▪ What exactly would the Thames material be used for and how would this impact restoration of the site in the long term? ▪ Is the proposed restoration for the site different to surrounding landscape? ▪ How long have current operations been at the site – e.g. is it recent memory that the site was farmland or would restoration be an improvement to the area which

has not seen it for over 50 years
Environmental Objective 5: To protect quality of and access to open space
▪ Is the site currently accessible to the public? ▪ When fully restored, would the public be allowed access to the land covered by Thames Tideway Tunnel project material? ▪ What restrictions would they be? ▪ Do you think that public access might change in the future?
Environmental objective 6: To protect water quality
▪ Are there any water bodies (rivers, streams, lakes etc) within the site boundary? ▪ Are there any water bodies (rivers, streams, lakes etc) close to the site? ▪ What measures are there in place to prevent material/contamination entering water bodies? ▪ Have there been any issues with contamination from material entering groundwater?
Environmental Objective 7: To protect biodiversity
▪ Are there any designated habitat sites on the site (International, national and/or local sites)? ▪ What measures are there in place to prevent habitats/wildlife being adversely affected by current site operations? ▪ If the restoration of the site is not to a wildlife park, would there be any other habitats created?
Environmental objective 8: To protect cultural heritage
▪ Are there any scheduled ancient monuments or archaeological features on or near the site which were mitigated prior to the site becoming operational? ▪ Any historical issues which residents, local authority or English Nature may have raised concerns about? ▪ If there are some on site or close to the site do you think that the handling/treatment of Thames Tideway Tunnel project material would have an impact (either adverse or beneficial)?
Socio-economic objective 9: To provide employment opportunities
▪ Current staff levels likely to be able to cope with the delivery of Thames material? ▪ How would the staff roles change from operations/restoration and this process managed? ▪ Would Thames material being received at the site prolong the sites operations, and therefore keep staff employed for longer? ▪ Restoration plans, have potential staff numbers been estimated, and are these anticipated to be the same staff from current operations retrained or new staff?
Operational objective 10: To minimise the cost associated with the management of excavated material
• If Thames Tideway Tunnel project material were being produced today, how much would you charge Thames to deliver material to your site, per material type and per tonne? • Bulk discounts? • What other pricing mechanism are there available e.g. profit share?
Operational objective 11: To ensure operational suitability of the receptor site
• When can you start receiving each material type? • When does your permit say you must stop receiving material?

• Are there any extensions planned? • Any other timescale issues that could affect the use of Thames Tideway Tunnel project material? • Of the materials being produced, which can you receive? • What limits are there, seeing the characteristics of each? • Are there likely to be any other issues? • If you intend to deliver the material to other facilities within your network, we would need to carry out an additional site assessment to assess their viability. Where are these other sites locations? How much material can these receive, what limitations are there, what is the hierarchy of receiving this material at other sites (i.e. preferences?) Would Thames vehicles be required to be directed to deliver material to these other locations, or would it be transported internally? • The throughput of HGV's per month peak is X and the average daily issues would be. Is this achievable at the site. • What management procedures would be required to manage this? • How would this meet your permit requirements? • How would you manage other customers? • Are there any river issues/road issues which would impact throughput, e.g. tides or can the local road network cope with additional vehicles? • Copy of operating permit or exemption (issued by the EA) • Any permit constraints identified • Would the existing permit mean that you can accept Thames Tideway Tunnel project material on site? • If inadequate permits are in place, when do you intend to achieve these? What measures can you guarantee that these would be obtained? • Copy of planning consent (issued by local authority). Or the planning consent number. We want planning information on what they would be accepting the Thames Tideway Tunnel project material under. • Would the existing planning consents mean that you can accept Thames Tideway Tunnel project material on site? • Can you see any foreseeable problems with bringing Thames Tideway Tunnel project material to the site? • How is the majority of material delivered to site (road/rail/marine transport)? • What alternatives are there? • Are these currently 'drawing board'/ possibilities or are they actually in place? • Would additional investment in infrastructure would be required? • If additional infrastructure is required, how would this impact Thames costs etc. Would this require additional partnership organisations?
Waste management policy objective 12: To conform with the waste hierarchy
▪ Would the material be used in restoration or for recycling or disposal? ▪ Please can you provide %'s for material type against these hierarchy options.
Waste management policy objective 15: To conform with health and safety good practice
▪ What H&S accreditations do you have? ▪ What H&S management systems are in place?

- Can these be reviewed and what official monitoring/measurement/auditing procedures are currently in place to audit these?
- Can you provide number of RIDDORS for the site for the past three years, and details of corrective actions undertaken to prevent these occurring again?

B.8 Detailed assessment evaluation criteria B.8

Table B.8 Evaluation criteria for development of planning stage preferred list

Objectives	Evaluation indicators	Planning stage preferred list						
		---	--	-	0	+	++	+++
1. To ensure prudent use of land and other resources	a) Extent to which resources such as sand, gravel and chalk are conserved by processing or storage of Thames Tideway Tunnel project material at receptor sites	To enable the receptor site to accept Thames Tideway Tunnel project material virgin material would also be required (Thames Tideway Tunnel project material would comprise of less than 50% of the material requirements for this receptor site)	To enable the receptor site to accept Thames Tideway Tunnel project material virgin material would also be required (Thames Tideway Tunnel project material would comprise of greater than 50% and less than 75% of the material requirements for this receptor site)	To enable the receptor site to accept Thames Tideway Tunnel project material virgin material would also be required (Thames Tideway Tunnel project material would comprise greater than 75% of the material requirements for this receptor site)	Thames Tideway Tunnel project material is unlikely to affect virgin material use e.g. material replaces other reusable materials or no material substitution required	Thames Tideway Tunnel project material would directly substitute virgin material (less than 50% replacement of virgin material with Thames Tideway Tunnel project material)	Thames Tideway Tunnel project material would directly substitute virgin material (less than 50% and greater than 75% replacement of virgin material with Thames Tideway Tunnel project material)	Thames Tideway Tunnel project material would directly substitute virgin material (greater than or equal to 75% replacement of virgin material with Thames Tideway Tunnel project material)
	b) Extent to which Thames Tideway Tunnel project	The acceptance of Thames Tideway Tunnel project material would	The acceptance of Thames Tideway Tunnel project material would	The acceptance of Thames Tideway Tunnel project material would	The acceptance of Thames Tideway Tunnel project material would	The acceptance of Thames Tideway Tunnel project material would	The acceptance of Thames Tideway Tunnel project material would	The acceptance of Thames Tideway Tunnel project material would

Objectives	Evaluation indicators	Planning stage preferred list						
		---	--	-	0	+	++	+++
	material would effect landtake at (footprint of) receptor sites in the long term	contribute to the requirement for additional land extending the receptor site's boundary by greater than 2x.	contribute to the requirement for additional land extending the receptor site's boundary by up to 2x.	contribute to the requirement for additional land extending the receptor site's boundary by up to 0.5x.	not contribute to the requirement for additional land extending the receptor site's boundary	contribute to reducing the footprint of the receptor site by up to 0.25x	contribute to reducing the footprint of the receptor site by up to 0.5x	contribute to reducing the footprint of the receptor site by over 0.5x
2. To reduce climate change impacts	a) Greenhouse gases emitted through treatment, handling and use of Thames Tideway Tunnel project material at receptor sites (excludes transport)	NOT USED	NOT USED	Thames Tideway Tunnel project material requires active treatment at receptor sites (e.g. turning, washing, grading); material would be double handled and/or no process to reduce transport by vehicle on site	Thames Tideway Tunnel project material would not require treatment and minimal handling required e.g. passive drying used and material moved by conveyor where possible.	There is a *Carbon Management Plan* in place with systems in place to offset GhG emissions from the treatment, handling and use of Thames Tideway Tunnel project material.	NOT USED	NOT USED
	b) Extent to which flood risk is altered	Operations at the receptor site, to which	Operations at the receptor site, to which	Operations at the receptor site, to which	Operations at the receptor site, to which	Operations at the receptor site, to which	Operations at the receptor site, to which	Operations at the receptor site, to which

Objectives	Evaluation indicators	Planning stage preferred list						
		---	--	-	0	+	++	+++
	by Thames Tideway Tunnel project material at the receptor site (or in the local catchment)	the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would substantially increase flood risk (from any source or a combination of sources) resulting in adverse effects to the site and surroundings.	the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would moderately increase flood risk (from any source or a combination of sources) resulting in adverse effects to the site and surroundings.	the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would slightly increase flood risk (from any source or a combination of sources) resulting in adverse effects to the site and surroundings.	the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would not change flood risk (from any source or a combination of sources) to the site and surroundings.	the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would slightly reduce flood risk (from any source or a combination of sources) resulting in beneficial effects to the site and surroundings.	the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would moderately reduce flood risk (from any source or a combination of sources) resulting in beneficial effects to the site and surroundings.	the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would substantially reduce flood risk (from any source or a combination of sources) resulting in beneficial effects to the site and surroundings.
	c) Greenhouse gases emitted through transport of Thames Tideway Tunnel project material to the receptor	Through the transport of Thames Tideway Tunnel project material more than 10kg CO2 eq per tonne of excavated material accepted by	Through the transport of Thames Tideway Tunnel project material between 8 and less than or equal to 10kg CO2 eq per tonne of excavated	Through the transport of Thames Tideway Tunnel project material between 6 and less than or equal to 8kg CO2 eq per tonne of excavated	Through the transport of Thames Tideway Tunnel project material between 4 and less than or equal to 6kg CO2 eq per tonne of excavated	Through the transport of Thames Tideway Tunnel project material between 2 and less than or equal to 4kg CO2 eq per tonne of excavated	Through the transport of Thames Tideway Tunnel project material between 1 and less than or equal to 2kg CO2 eq per tonne of excavated	Through the transport of Thames Tideway Tunnel project material less than or equal to 1kg CO2 eq per tonne of excavated material accepted by

Objectives	Evaluation indicators	Planning stage preferred list						
		---	--	-	0	+	++	+++
	sites	the receptor site would be produced	material accepted by the receptor site would be produced	material accepted by the receptor site would be produced	material accepted by the receptor site would be produced	material accepted by the receptor site would be produced	material accepted by the receptor site would be produced	the receptor site would be produced
3. To protect local amenity	a) Extent of potential effects on local amenity from treatment, handling and use of Thames Tideway Tunnel project material at receptor sites	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a major adverse effect on the local amenity	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a moderate adverse effect on the local amenity	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a minor adverse effect on the local amenity	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would not have an effect on the local amenity or any effect would be negligible.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a minor beneficial effect on the local amenity	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a moderate beneficial effect on the local amenity	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a major beneficial effect on the local amenity
4. To conserve landscapes and townscapes at receiving locations	a) Extent of short term visual & landscape impacts from treatment, handling and use of Thames	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would

Objectives	Evaluation indicators	Planning stage preferred list						
		---	--	-	0	+	++	+++
	Tideway Tunnel project material at receptor sites	material would contribute, would change the landscape in the short term and would have a major adverse effect on sensitive receptors	material would contribute, would change the landscape in the short term and would have a moderate adverse effect on sensitive receptors	material would contribute, would change the landscape in the short term and would have a minor adverse effect on sensitive receptors	material would contribute, would not have a short term effect on the local visual amenity at the receptor site or any effect would be negligible	material would contribute, would change the landscape in the short term and would have a minor beneficial effect on sensitive receptors	material would contribute, would change the landscape in the short term and would have a moderate beneficial effect on sensitive receptors	contribute, would change the landscape in the short term and would have a major beneficial effect on sensitive receptors
	b) Extent of permanent visual & landscape impacts from treatment, handling and use of Thames Tideway Tunnel project material at receptor sites	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a permanent major adverse visual effect on the landscape, based on a 'do nothing' view of the site	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a permanent moderate adverse visual effect on the landscape, based on a 'do nothing' view	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a permanent slight adverse visual effect on the landscape, based on a 'do nothing' view	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would not have a permanent effect or any effect would be negligible, based on a 'do nothing' view	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a permanent minor beneficial visual effect on the landscape, based on a 'do nothing' view	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a permanent moderate beneficial visual effect on the landscape, based on a 'do nothing' view	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a permanent major beneficial effect on the landscape

Objectives	Evaluation indicators	Planning stage preferred list						
		---	--	-	0	+	++	+++
			of the site	of the site	of the site	of the site	of the site	
5. To protect quality of and access to open space	a) Would Thames Tideway Tunnel project material enhance quality of and access to open space in the short term?	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would remove a PRoW or open space	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would create a major diversion to a PRoW or limit access to a public open space	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would cause a minor rerouting of a PRoW	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have no or a negligible effect on access to and quality of open space and PRoWs	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would slightly enhance a PRoW or improve the quality of and access to public open space	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would moderately enhance a PRoW or improve the quality of and access to public open space	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would create a major enhancement to a PRoW and substantially increase accessibility to public open space
	b) Would Thames Tideway Tunnel project material enhance quality of and access to open	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute,	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute,

Objectives	Evaluation indicators	Planning stage preferred list						
		---	--	-	0	+	++	+++
	space in the long term?	contribute, would permanently remove PRoW or open space	contribute, would disrupt a PRoW or limit access to public open space	contribute, would permanently re route PRoW	contribute, would not affect the access to, and quality of, open space and PRoWs permanently	contribute, would slightly enhance a PRoW or improve the quality of and access to public open space	would moderately enhance a PRoW or improve the quality of and access to public open space	would constitute a major enhancement to the PRoW and substantially increase accessibility to public open space
6. To protect water quality	a) Extent of potential effects on fluvial water quality from treatment, handling and use of Thames Tideway Tunnel project material at receptor sites	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a major adverse effect on the local watercourses	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a moderate adverse effect on local watercourses	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a minor adverse effect on local watercourses	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have no or negligible effect on the local watercourses	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a minor beneficial effect on local watercourses.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a moderate beneficial effect on local watercourses.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a major beneficial effect on local watercourses.
	b) Extent of potential effects on groundwater	Operations at the receptor site, to which the treatment,	Operations at the receptor site, to which the treatment,	Operations at the receptor site, to which the treatment,	Operations at the receptor site, to which the treatment,	Operations at the receptor site, to which the treatment,	Operations at the receptor site, to which the treatment,	Operations at the receptor site, to which the treatment,

Objectives	Evaluation indicators	Planning stage preferred list						
		---	--	-	0	+	++	+++
	quality from treatment, handling and use of Thames Tideway Tunnel project material at receptor sites	handling and use of Thames Tideway Tunnel project material would contribute, would have a major adverse effect on groundwater.	handling and use of Thames Tideway Tunnel project material would contribute, would have a moderate adverse effect on groundwater.	handling and use of Thames Tideway Tunnel project material would contribute, would have a minor adverse effect on groundwater.	handling and use of Thames Tideway Tunnel project material would contribute, would have no or negligible effect on groundwater.	handling and use of Thames Tideway Tunnel project material would contribute, would have a minor beneficial effect on groundwater quality	handling and use of Thames Tideway Tunnel project material would contribute, would have a moderate beneficial effect on groundwater quality	handling and use of Thames Tideway Tunnel project material would contribute, would have a major beneficial effect on groundwater quality
7. To protect biodiversity	a) Extent of potential effects on designated sites from treatment, handling and use of Thames Tideway Tunnel project material at receptor sites in the short term	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a major adverse effect on a designated site	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a moderate adverse effect on a designated site	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a minor adverse effect on a designated site	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have no or negligible effect on a designated site	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a minor beneficial effect on a designated site and/or creation/impro vement of	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a moderate beneficial effect on a designated site and/or creation/impro vement of	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a major beneficial effect on a designated site and/or creation/improv ement of habitats

Objectives	Evaluation indicators	Planning stage preferred list						
		---	--	-	0	+	++	+++
						habitats	habitats	
	b) Extent of potential effects on designated sites from treatment, handling and use of Thames Tideway Tunnel project material at receptor sites in the long term.	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a major adverse effect on a designated site	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a moderate adverse effect on a designated site	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a minor adverse effect on a designated site	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would no or negligible effect on a designated site	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a minor beneficial effect on a designated site and/or creation/improvement of habitats	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a moderate beneficial effect on a designated site and/or creation/improvement of habitats	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would have a major beneficial effect on a designated site and/or creation/improvement of habitats
8. To protect cultural heritage	a) Extent of potential effects on designated or nominated archaeological sites from treatment, handling and use of	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute,

Objectives	Evaluation indicators	Planning stage preferred list						
		---	--	-	0	+	++	+++
	Thames Tideway Tunnel project material at receptor sites	contribute, would have a major adverse effect on a designated site	contribute, would have a moderate adverse effect on a designated site	contribute, would have a minor adverse effect on a designated site	contribute, would have no or negligible effect on a designated site	contribute, would have a minor beneficial effect on a designated site	contribute, would have a moderate beneficial effect on a designated site	would have a major beneficial effect on a designated site
9. To provide employment opportunities	a) Extent to which the acceptance of Thames Tideway Tunnel project material would affect the number jobs available at the receptor sites in the short term	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would lead to substantial short term job loss of more than 20 jobs	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would lead to moderate short term job loss of between 10 and less than or equal to 20 jobs	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would lead to minor short term job loss of less than 10 jobs	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would not lead to job losses or gains in the short term	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would lead to minor job gains over the short term of less than 10 jobs	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would lead to moderate job gains over the short term of between 10 and less than or equal to 20 jobs	Operations at the receptor site, to which the treatment, handling and use of Thames Tideway Tunnel project material would contribute, would lead to substantial job gains over the short term of more than 20 jobs
	b) Extent to which the acceptance of Thames Tideway	Operations at the receptor site, to which the treatment, handling and	Operations at the receptor site, to which the treatment, handling and	Operations at the receptor site, to which the treatment, handling and	Operations at the receptor site, to which the treatment, handling and	Operations at the receptor site, to which the treatment, handling and	Operations at the receptor site, to which the treatment, handling and	Operations at the receptor site, to which the treatment, handling and

Objectives	Evaluation indicators	Planning stage preferred list						
		---	--	-	0	+	++	+++
	Tunnel project material would affect the number jobs available at the receptor sites in the long term	use of Thames Tideway Tunnel project material would contribute, would lead to substantial long term job loss of more than 20 jobs	use of Thames Tideway Tunnel project material would contribute, would lead to moderate long term job loss of between 10 and less than or equal to 20 jobs	use of Thames Tideway Tunnel project material would contribute, would lead to minor long term job loss of less than 10 jobs	use of Thames Tideway Tunnel project material would contribute, would not lead to job losses or gains in the long term	use of Thames Tideway Tunnel project material would contribute, would lead to minor job gains over the long term of less than 10 jobs	use of Thames Tideway Tunnel project material would contribute, would lead to moderate job gains over the long term of between 10 and less than or equal to 20 jobs	use of Thames Tideway Tunnel project material would contribute, would lead to substantial job gains over the long term of more than 20 jobs
10. To minimise the costs associated with the management of excavated material	a) Costs of transporting, handling, treating, reusing, managing and disposal	The transportation, treatment, handling and use of Thames Tideway Tunnel project material would cost more than £25 per tonne	The transportation, treatment, handling and use of Thames Tideway Tunnel project material would cost between £22 and less than or equal to £25 per tonne	The transportation, treatment, handling and use of Thames Tideway Tunnel project material would cost between £19 and less than or equal to £22 per tonne	The transportation, treatment, handling and use of Thames Tideway Tunnel project material would cost between £16 and less than or equal to £19 per tonne	The transportation, treatment, handling and use of Thames Tideway Tunnel project material would cost between £13 and less than or equal to £16 per tonne	The transportation, treatment, handling and use of Thames Tideway Tunnel project material would cost between £10 and less than or equal to £13 per tonne	The transportation, treatment, handling and use of Thames Tideway Tunnel project material would cost less than £10 per tonne
11. To ensure operational	a) Likelihood of implementati	The receptor site would be available for	The receptor site would be available for	The receptor site would be available for	The receptor site would be available for	The receptor site would be available for	The receptor site would be available for	The receptor site would be available for

Objectives	Evaluation indicators	Planning stage preferred list						
		---	--	-	0	+	++	+++
suitability of the receptor site	on within the required timescale	use for Thames Tideway Tunnel project material for between 0% and 20% of the required timescale	use for Thames Tideway Tunnel project material for greater than or equal to 20% but less than 40% of the required timescale	use for Thames Tideway Tunnel project material for greater than or equal to 40% but less than 60% of the required timescale	use for Thames Tideway Tunnel project material for greater than or equal to 60% but less than 80% of the required timescale	use for Thames Tideway Tunnel project material for greater than or equal to 80% but less than 100% of the required timescale	use for Thames Tideway Tunnel project material for 100% of the required timescale	use for Thames Tideway Tunnel project material for more than 100% of the required timescale
	b) Acceptability of material with Thames Tideway Tunnel project material characteristics by the receptor sites	The receptor site could accept for use any one Thames Tideway Tunnel project material type based on their characteristics	The receptor site could accept for use two Thames Tideway Tunnel project material types based on their characteristics including at least one of the following: London Clay, Lambeth Group or chalk	The receptor site could accept for use two Thames Tideway Tunnel project material types based on their characteristics comprising: London Clay, Lambeth Group or chalk	The receptor site could accept for use three Thames Tideway Tunnel project material types based on their characteristics including at least two of the following: London Clay, Lambeth Group and chalk	The receptor site could accept for use the following three Thames Tideway Tunnel project material types based on their characteristics: London Clay, Lambeth Group and chalk	The receptor site could accept for use four Thames Tideway Tunnel project material types based on their characteristics including: London Clay, Lambeth Group and chalk	The receptor site could accept for use all of the Thames Tideway Tunnel project material types based on their characteristics
	c) Capacity of the receptor site to accept the	The receptor site has capacity to accept	The receptor site has capacity to accept	The receptor site has capacity to accept greater	The receptor site has capacity to accept greater	The receptor site has capacity to accept greater	The receptor site has capacity to accept greater	The receptor site has capacity to accept more

Objectives	Evaluation indicators	Planning stage preferred list						
		---	--	-	0	+	++	+++
	required volume of Thames Tideway Tunnel project material (based on likely tonnage accepted)	material greater than or equal to 0% but less than 15% of Thames Tideway Tunnel project material	material greater than or equal to 15% but less than 30% of Thames Tideway Tunnel project material	than or equal to 30% but less than 45% of Thames Tideway Tunnel project material	than or equal to 40% but less than 60% of Thames Tideway Tunnel project material	than or equal to 60% but less than 85% of Thames Tideway Tunnel project material	than or equal to 85% but less than 100% of Thames Tideway Tunnel project material	than 100% of Thames Tideway Tunnel project material
	d) Ability of the receptor sites to accept Thames Tideway Tunnel project material at the anticipated rate (speed of material generation vs. acceptance rate)	The receptor site could take less than 1,000t per day of Thames Tideway Tunnel project material	The receptor site could take greater than or equal to 1,000 but less than 2,800t per day of Thames Tideway Tunnel project material	The receptor site could take greater than or equal to 2,800 but less than 4,600t per day of Thames Tideway Tunnel project material	The receptor site could take greater than or equal to 4,600 but less than 6,400t per day of Thames Tideway Tunnel project material	The receptor site could take greater than or equal to 6,400 but less than 8,200t per day of Thames Tideway Tunnel project material	The receptor site could take greater than or equal to 8,200 but less than 10,000t per day of Thames Tideway Tunnel project material	The receptor site could take greater than or equal to 10,000t per day of Thames Tideway Tunnel project material
	e) Site operations have	The receptor site has no current	NOT USED	NOT USED	The receptor site has either planning	NOT USED	NOT USED	The receptor site has planning

Objectives	Evaluation indicators	Planning stage preferred list						
		---	--	-	0	+	++	+++
	appropriate planning/permitting consent	planning consent or a relevant EA permit. The receptor site has applied for planning consent			consent or a relevant EA permit			consent and a relevant EA permit
	f) Can accept excavated material from multiple transport modes	The receptor site is only accessible by one transport mode and transport infrastructure needs upgrading.	The receptor site is only accessible by one transport mode	The receptor site can be accessed by 2 transport modes but either there is no direct connection to the strategic highway OR transport infrastructure needs upgrading for marine transport or rail.	The receptor site is accessible by two transport modes with no infrastructure upgrades.	The receptor site can be accessed by 3 transport modes but there is no direct connection to a strategic highway AND transport infrastructure needs upgrading for marine transport or rail.	The receptor site can be accessed by 3 transport modes but there is either no direct road connection to a strategic highway OR transport infrastructure needs upgrading for marine transport or rail.	The receptor site is on a strategic highway AND the site has good marine transport access and sufficient wharf capacity to receive Thames Tideway Tunnel project material AND the site has good rail access and sufficient rail capacity to receive Thames Tideway Tunnel project

Objectives	Evaluation indicators	Planning stage preferred list						
		---	--	-	0	+	++	+++
								material
12. To conform to the waste hierarchy	a) Extent to which the option meets the *EM&W strategy*	Performance of receptor site is greatly below target	Performance of receptor site is moderately below target	Performance of receptor site is slightly below target	Performance of receptor site meets target	Performance of receptor site slightly exceeds target	Performance of receptor site moderately exceeds target	Performance of receptor site substantially exceeds target
13. To conform to proximity principle	a) Average distance from main tunnel drive sites	The receptor site is greater than 100km from source of the Thames Tideway Tunnel project material	The receptor site between 100km and 80km from source of the Thames Tideway Tunnel project material	The receptor site is between 80km and 60km from source of the Thames Tideway Tunnel project material	The receptor site is between 60km and 40km from source of the Thames Tideway Tunnel project material	The receptor site is between 40km and 20km from source of the Thames Tideway Tunnel project material	The receptor site is between 20km and 10km from source of the Thames Tideway Tunnel project material	The receptor site is less than 10km from source of the Thames Tideway Tunnel project material
14. To conform to sustainable transport policy	a) Conforms to policy objective to move transport of materials from road to rail or marine transport	The receptor site can only be accessed by road and there is no direct access to a strategic highway	The receptor site can only be accessed by road and there is direct access to a strategic highway	NOT USED	The receptor site has the potential to be accessed by rail or marine transport but may require some double handling or transhipment	NOT USED	The receptor site has the potential to be directly accessed by rail or marine transport but additional infrastructure is required	The receptor site can be directly accessed from marine transport or rail and requires no double handling
15. To conform to health and safety good practice	a) Health and Safety performance conforms to good	NOT USED	NOT USED	There is no H&S system at the receptor site or more than five	The receptor sites H&S system is not accredited and there have	The receptor sites H&S system is accredited and there have	NOT USED	NOT USED

Objectives	Evaluation indicators	Planning stage preferred list						
		---	--	-	0	+	++	+++
	practice			RIDDOR incidents recorded at the receptor site	been five or less RIDDOR incidents in three years recorded at the receptor site	been five or less RIDDOR incidents in three year recorded at the receptor site		

* *For these evaluation indicators grades are not used as the additional detail is not appropriate at this stage of the assessment.*

B.8.1 The red, amber and green grades are assessed against different scales of effect depending on the objective being assessed as set out in Table B.9.

Table B.9 Red, amber, green effect assessed for each evaluation objective

Evaluation objective	Red			Amber	Green		
	---	--	-	0	+	++	+++
1, 2, 3, 4, 5, 6, 7, 8, 9	Major adverse effect	Moderate adverse effect	Minor adverse effect	Negligible or no effect	Minor beneficial effect	Moderate beneficial effect	Major beneficial effect
11	Limited viability	Significant issues to be overcome	Potentially viable with moderate issues to be resolved	Potentially viable with minor issues to be resolved	Viable with moderate reservations	Viable with minor reservations	Completely viable
12, 13, 14, 15	Very poor performance	Poor performance	Slightly below exceptions	Meets expectations	Slightly beyond expectations	Exceeds expectations	Substantially exceeds expectations

B.9 Detailed assessment assumptions

B.9.1 At this stage in the assessment each evaluation indicator is graded against a seven grades of performance which are assessed against the evaluation criteria detailed in Annex B.8. This Annex (Annex B.9) provides additional information relating to the assumptions made at this stage in the assessment.

Evaluation indicator 1 (a) – Conserving natural resources

B.9.2 The assumptions for evaluation indicator 1 (a) use the same principles as the preliminary assessment assumptions for this evaluation indicator which are presented in Annex B.6.

Evaluation indicator 1 (b) – Receptor sites landtake

B.9.3 The assumptions for evaluation indicator 1 (b) use the same principles as the preliminary assessment assumptions for this evaluation indicator which are presented in Annex B.6.

Evaluation indicator 2 (a) – Greenhouse gases emitted through processing Thames material

B.9.4 Data from WRATE is used to estimate a kg CO_2 eq per tonne of material for the emissions associated with either reprocessing and recycling of ‘rubble’ as aggregate or associated with landfill.

B.9.5 Data is not available on the emissions associated with the reprocessing of the excavated material for use as aggregate but WRATE includes a model process for the processing and reuse of rubble. It includes the emissions associated with crushing and grading of material and the offset associated with the replacement of virgin aggregate. This process is used in the Thames Tideway Tunnel GhG model to represent the processing and reuse of the excavation material. The overall offset for processing excavated material into an aggregate product based on the WRATE data is -25.5kg CO_2 eq per tonne of excavated material.

B.9.6 For landfill the WRATE process is used. The excavated material is assumed to be inert soil and the emissions associated with material reception and spreading are used to represent its disposal. The overall GhG emissions for deposition of excavated material to land based on WRATE data for soil is 3.17kg CO_2 eq per tonne of excavated material.

B.9.7 Depending on the disposal/ treatment route of the material the factors above are applied to compare the impact of the materials end use.

B.9.8 The assumptions for evaluation indicator 2 (a) use the same principles as the preliminary assessment assumptions for this evaluation indicator which are presented in Annex B.6.

Evaluation indicator 2 (b) – Flood risk

B.9.9 The assumptions for evaluation indicator 2 (b) use the same principles as the preliminary assessment assumptions for this evaluation indicator which are presented in Annex B.6.

Evaluation indicator 2 (c) – Greenhouse gases emitted through transport

B.9.10 The full methodology for assessing GhG emissions relating to transport of excavated material and assumptions are presented in Annex B.10.

Evaluation indicator 3 – Local amenity

B.9.11 The impact on local amenity from the operations at the receptor site to which Thames Tideway Tunnel project material would contribute is assessed on a site by site basis

Evaluation indicator 4 (a) – Short term visual impacts

B.9.12 It is assumed that in the short term the following applies to the visual impact:

a) a change of activity from extraction to receiving material would have no impact and is given an amber grade

b) if the receptor site is currently inactive, any activity to receive material would have a minor adverse effect and is given a single minus red grade

c) if the receptor site is putting excavated material on an area that is currently grassed there would be a minor adverse effect and is given a red grade.

Environmental indicator 4 (b) – Long term visual impact

B.9.13 The long term visual impact is assessed on a site by site basis and assessed using the criteria set out in Annex B.8.

Evaluation indicator 5 (a) – Short term quality of and access to open space

B.9.14 The short term impacts on the quality of and access to open space are assessed on a site by site basis and assessed using the criteria set out in Annex B.8.

Evaluation indicator 5 (b) – Long term quality of and access to open space

B.9.15 The long term impacts on the quality of and access to open space are assessed on a site by site basis and assessed using the criteria set out in Annex B.8.

Evaluation indicator 6 (a) – Fluvial quality

B.9.16 The fluvial quality is assessed on a site by site basis and assessed using the criteria set out in Annex B.8.

Evaluation indicator 6 (b) – Groundwater quality

B.9.17 The groundwater quality is assessed on a site by site basis and assessed using the criteria set out in Annex B.8.

Evaluation indicator 7(a) – Biodiversity short term

B.9.18 The impact on biodiversity in the short term is assessed on a site by site basis and assessed using the criteria set out in Annex B.8.

B.9.19 A detailed ecological assessment of the sites is not carried out.

Evaluation indicator 7(b) – Biodiversity long term

B.9.20 The impact on biodiversity in the long term is assessed on a site by site basis and assessed using the criteria set out in Annex B.8.

B.9.21 A detailed ecological assessment of the receptor sites is not carried out.

Evaluation indicator 8 – Cultural heritage

B.9.22 The impact on cultural heritage is assessed on a site by site basis and assessed using the criteria set out in Annex B.8.

Evaluation indicator 9 (a) - Short term employment potential

B.9.23 The assumptions for evaluation indicator 9 (a) use the same principles as the preliminary assessment assumptions for this evaluation indicator which are presented in Annex B.6.

Evaluation indicator 9 (b) – Long term employment potential

B.9.24 The assumptions for evaluation indicator 9 (b) use the same principles as the preliminary assessment assumptions for this evaluation indicator which are presented in Annex B.6.

Evaluation indicator 10 – To minimise costs

B.9.25 The full details of the cost assumptions are presented in Annex B.10.

Evaluation indicator 11 (a) – Likelihood of implementation within the required timescale

B.9.26 It is assumed that the project would be producing excavated material between 2016 and 2021.

B.9.27 Receptor sites are assessed against the date stipulated in the planning consent by which operations at the receptor site are expected to cease.

Table B.10 Timescale grades used to assess evaluation objective 11 (a)

Timescales	Primary scale	Secondary scale
2016	Red	- - -
2017	Red	- -
2018	Red	-
2019	Amber	0
2020	Green	+
2021	Green	++

Timescales	Primary scale	Secondary scale
2021+	Green	+++

Evaluation indicator 11 (b) - Acceptability of material

B.9.28 It is assumed that the excavated material arising from the project would comprise of chalk, London clay, Lambeth Group, Thanet Sands, made ground/superficial deposits, site strip and construction related waste. The assessment is based in the number and type of materials a receptor site can accept and using the criteria set out in Annex B.8.

Evaluation indicator 11 (c) – Capacity

B.9.29 The capacity of the receptor site is based on the annual tonnage that it can accept and tonnages which are likely to be produced by the Thames Tideway Tunnel project during the number of years the receptor site is available.

Evaluation indicators 11 (d) – Throughput

B.9.30 The throughput of the receptor site is based on the number of vehicle movements (HGV, train or barge) stated in the planning consent compared to the assumed vehicle (HGV, train or barge) capacity and assessed is using the criteria set out in Annex B.8.

Evaluation indicators 11 (e) - Site operations have required planning/permitting

B.9.31 It is assumed that a receptor site that has no current planning consent or EA permit and the receptor site has applied for planning consent is graded red (---).

B.9.32 It is assumed that a receptor site that has either planning consent or an EA permit is graded amber (0).

B.9.33 It is assumed that a receptor site that has planning consent and an EA permit is graded green (+++).

Evaluation indicators 11 (f) - Multiple transport modes

B.9.34 It is assumed that a strategic highway is a motorway and/or major trunk road.

B.9.35 It is assumed that direct access is an access road to the receptor site that is connected directly to the network.

B.9.36 Direct access to the receptor site without double handling refers to the mode of transport connecting directly to the site (no transfer needed at the receptor site end).

Evaluation indicator 12 – Waste hierarchy

B.9.37 It is assumed that for an activity to be classified as beneficial use for the purposes of the *EMOA* (and hence for fulfilment of the Thames Tideway Tunnel project *EM&W strategy* objective to maximise reuse, recovery and beneficial use) it must meet the following tests:

a. The activity would lead to a beneficial reuse and bring land back into use or provide ecological benefit.

b. In the case of quarries or landfill sites, the activity has a planning requirement to be restored.

c. The activity does not attract landfill tax.

d. The material is suitable for its intended use and would not harm human health or the environment.

e. The minimum amount of material would be used to achieve the restoration required by any planning consent.

f. Alternative material (whether waste or not) would be required if Thames Tideway Tunnel project material was not to be used.

Evaluation indicator 13 – Proximity principle

B.9.38 The assumptions for evaluation indicator 13 use the same principles as the preliminary assessment assumptions for this evaluation indicator which is presented in Annex B.6.

Evaluation indicator 14 – Sustainable transport policy

B.9.39 The assumptions for evaluation indicator 14 use the same principles as the preliminary assessment assumptions for this evaluation indicator which is presented in Annex B.6.

Evaluation indicator 15 – Health and safety performance

B.9.40 It is assumed that a receptor site with no health and safety (H&S) system or more than five RIDDOR incidents in the last two years is graded red (-).

B.9.41 It is assumed that a receptor site with a H&S system that is not accredited with less than five RIDDOR incidents in the last two years is graded amber (0).

B.9.42 It is assumed that a receptor site with an accredited H&S system with less than five RIDDOR incidents in the last two years is graded green (+).

B.10 Detailed Assessment GhG and Cost assumptions

B.10.1 The *EMOA* does not attempt to assess the optimum logistics for transporting material from the tunnel sites to the receptor sites or to assess the overall impacts associated with the transport of excavated material. This has been undertaken by the *Transport strategy* and *Energy statement*. The objective of the *EMOA* is to determine a preferred list of potential receptor sites for the material. Therefore, the assumptions relating to transport of materials for the purpose of assessing evaluation objectives 2c) and 10a) are based on potential transport modes and materials in order to compare the receptor site options. This modelling does not attempt to determine the optimum transport mode or to accurately determine exactly which materials from each Thames Tideway Tunnel project site would go to each receptor site. The GhG emissions and costs calculated are for comparative purposes only and do not provide an exact representation of the transport emissions or costs associated with the Thames Tideway Tunnel project excavated material.

B.10.2 An Excel model is used to compare GhG emissions and costs relating to each short listed receptor sites in the *EMOA*. The same assumptions relating to tonnage transported, mode of transport and distances are used for the assessment of GhG emissions and transport costs.

Tonnage

B.10.3 The modelling is based on each material type from the four main tunnel drive sites and the smaller CSO sites.

B.10.4 The production profile by Thames Tideway Tunnel project site and material (in tonnes) modelled is set out in Table B.11.

Table B.11 Tonnes of excavated materials produced by Thames Tideway Tunnel project

Site	Material produced at site	Tonnes ('000s)						
		2016	2017	2018	2019	2020	2021	Total
Carnwath Road Riverside	98% London clay	33	94.9	477.9	179.6	0	0	785.4
Kirtling Street	42% London clay 49% Lambeth & Thanet	15.2	107.8	719.1	822.4	0	0	1,664
Chambers Wharf	75% chalk	2.7	102.2	235.7	436.8	0	147.9	925.3
Greenwich Pumping Station	91% chalk	4.6	35.2	174.4	100.9	1.9	0	317
Other sites	Mixture	7.6	208.8	330.7	312.1	145.1	6.7	1,011

Site	Material produced at site	Tonnes ('000s)						
		2016	2017	2018	2019	2020	2021	Total
Total arisings		**63**	**549**	**1,938**	**1,852**	**147**	**155**	**4,703**

B.10.5 Where a receptor site has capacity for less than the total Thames Tideway Tunnel project material the model assumes that:

a. material is taken from the closet Thames Tideway Tunnel project production sites first

b. the receptor site takes the maximum amount of material that it is allowed to take each year until the site is full

c. to avoid double handling of the material for sites that can accept HGVs the material from small production CSO sites is direct delivered in preference to material from the main drive sites that passes through the transhipment point.

B.10.6 Where a Thames Tideway Tunnel project site would produce predominantly chalk (e.g. Chambers Wharf and Greenwich Pumping Station), the model assumes that excavated material could not be sent to receptor sites that are not permitted to take chalk on its own.

B.10.7 The tonnage of each material type to be transported is based on the receptor site's capacity as provided by the site operators and set out in planning and permit conditions.

B.10.8 Each receptor site is assumed to accept all the material in line with the profile set out in Table B.11 unless limited by the maximum annual capacity of the site or the material types it can accept. Where receptor site limits do apply the maximum allowable tonnage of Thames Tideway Tunnel project material that can be accepted is assumed to be delivered to the site.

B.10.9 Where capacity is provided by the operator in m^3 the following conversion factors are used to convert this to a tonnage equivalent.

a. Chalk 1.27t/m^3

b. Lambeth beds & Thanet sands 1.24t/m^3

c. Clay 1.18t/m^3

Transport mode and distance

B.10.10 The transport mode and route assumed for each Thames Tideway Tunnel project site is based on the *Transport strategy*.

B.10.11 For shipment by marine transport, it is assumed that the transhipment point (postcode IG11 0EG) is used to transfer material directly from a smaller barge to a larger barge or sea going vessel for onward delivery. In general where material needs to be accepted at the receptor site by marine transport it is assumed that all material leaving Thames Tideway Tunnel project sites by road would be taken to the transhipment point for transfer onto marine transport.

B.10.12 For shipment by rail, it is assumed that material is transferred by road from the production sites or from the transhipment point to the railhead. It is assumed that Acton Main Line is used for transfer of material to receptor sites located west of London and Bow East is used for transfer of material to receptor sites located north of London.

B.10.13 As the model is designed to compare receptor sites and not provide an exact model of the transport logistics, it is assumed that all material (not just the inert fill) would be taken from the CSO interception foreshore sites by marine transport where the receptor site is accessible by marine transport.

B.10.14 The distances by road used are in line with those used by the *Transport Assessment* and avoid central London routes.

Transport emissions

B.10.15 The overall approach to the calculation of GhG emissions from transport is as follows:

B.10.16 $\sum \text{Total tonnes by mode} \times$ distance travelled by mode × CO_2 eq[VIII] conversion factor

=total kg CO_2 eq

B.10.17 Where more than one transport mode is used the kg CO_2 eq per tonne for each mode is calculated and then these are added together. This is then converted to a kg CO_2 eq per tonne accepted by the receptor site.

B.10.18 The model is developed using publicly available datasets to ensure transparency. The Defra/DECC[24] conversion factors for transport are used (which were developed by AEA and agreed with DfT). The conversion factors released by Defra/ DECC in May 2012 represent the current official set of government emissions factors that are used in a number of different policies. As this information is publicly available it is possible for organisations and individuals to calculate GhG emissions from a range of activities, including energy use, water consumption, waste disposal, recycling and transport activities. The conversion factors can also be used to calculate the amount of GhG emitted as a result of freight transport.

B.10.19 The Defra/DECC guidelines contain a large range of conversion factors for freight vehicles. Those presented in Table B.12 are considered to be the most appropriate for the Thames Tideway Tunnel project.

B.10.20 These conversion factors allow for either Scope 1 or Scope 3[IX] emissions to be calculated. Scope 1 emissions are direct emission from the combustion of the fuel while Scope 3 emissions include the indirect emissions. The model uses the kg CO_2 eq emissions from "All Scope", which includes Scope 1 and Scope 3 emissions.

[VIII] GHG results are presented as CO_2 equivalent (CO_2 eq) this takes into account the potency of different parameters so they can be expressed as a common unit. For example, methane is assessed to have a global warming potential 23 times that of carbon dioxide during a 100 year timeframe. Therefore 1 tonne of methane is equivalent to 23t of carbon dioxide and can be expressed as 23 CO_2 equivalents.

[IX] Scope 2 accounts for indirect energy emissions and is not applicable to transport movements.

Table B.12 Greenhouse Gas emissions for different transport modes (kg CO_2 eq per tonne per km) May 2012

kg CO_2 eq per tonne per km	UK Average articulated lorry (61% load)	Ship, bulk cargo 0-4,999 dead weight tonnes (60% load)	Rail freight
All Scopes	0.107	0.01664	0.03634

B.10.21 The road and marine transport emissions within the Defra/DECC tool are calculated on the basis of a 61% and 60% load respectively, this allows for the fact that they would run empty for part of the time in the overall transporting of the freight. This means that, in applying these figures, the user does not need to double the distance of their freight tonne km for parts of a trip when the vehicle is empty, as this has already been considered in the calculations. The Defra/DECC tool assumes that rail emissions are calculated for laden trips. This approach is taken in the Excel model.

B.10.22 The model assumes that road transport consists of a heavy goods vehicle with capacity for 16t of excavated material. This is most closely represented by 'UK Average Articulated Lorry (61% load)' in the Defra/DECC tool. The model uses the 'Ship, Bulk Cargo 0- 4,999 dead weight tonnes (60% load)' as this most closely represents the 350 – 1000t barges assumed in the *Transport Strategy*.

B.10.23 The model (developed in Excel) applies the conversation factors to the tonnage and distance transported for each of the receptor site considered, this is done for each year of the construction period to provide a profile of the GhG emissions over the construction period.

Intermodal transfer

B.10.24 For transfer WRATE includes an 'Intermodal transfer station water or rail' that is described as 'for up to 120k tpa comprising capital burdens for operational infrastructure, site vehicles and a transfer crane'. The burden associated with this is 0.6907kg CO_2 eq per tonne. This burden is applied to the tonnage of excavated material that is transferred every time it is assumed there is a change in the transport mode (e.g. from marine transport to road or from road to rail).

Overall GHG emissions

B.10.25 The results are summarised to show the impact for each shortlisted receptor site and are presented per tonne of material accepted by the receptor sites and in total.

Transport costs

B.10.26 The cost used in the *EMOA* is an estimated cost for comparison purposes and may differ from the actual cost which would be incurred if Thames Tideway Tunnel project material were taken to any specific receptor site.

B.10.27 The overall approach to the calculation of cost associated with transport is as follows:

$$\sum \text{Total tonnes by mode} \times \text{ distance travelled by mode} \times £/\text{tonne}/\text{km} = \text{total transport cost}$$

B.10.28 The road, river and rail transport costs are calculated from quotes gathered from operators based on today's prices. The costs assumed are set out in Table B.13.

Table B.13 Cost for different transport modes (£/tonne/km)

Transport mode	Cost £/tonne/km
Marine transport	£0.12
Road	£0.31
Rail	£0.05

Intermodal transfer cost

B.10.29 A cost of £0.75 per tonne is added to the overall transport cost every time the excavated material changes transport mode (e.g. from marine transport to road or from road to rail). This reflects the cost of transferring the material from one form of transport to another.

Overall cost

B.10.30 A gate fee of £4 per tonne is assumed for acceptance and placement of material at the receptor site based on current prices quoted by operational sites.

B.10.31 The overall cost comprises the cost of transport, intermodal transfer and gate fee. To enable comparison between receptor sites, this is expressed as a cost per tonne based on the tonnage accepted by the receptor site.

B.10.32 The overall cost excludes the costs associated with land purchase and infrastructure upgrades which may be required. This cost is an estimated cost for comparison purposes within the *EMOA* and may differ from the actual cost which would be agreed at the procurement stage if Thames Tideway Tunnel project material were taken to any particular receptor site

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Annex C Summary of Results

C.1 Long list results

C.1.1 The long list can be found in a separate document (Vol 3 Appendix A.4 Annex C.1).

C.1.2 The locations of the receptor sites on the long list are shown in Vol 3 Figure A4.C.1 (see separate volume of figures).

C.2 Viability filter results

C.2.1 The viability filter can be found in a separate document (Vol 3 Appendix A.4 Annex C.2).

C.2.2 The locations of the receptor sites on the viable list are shown in Vol 3 Figure A4.C.2 (see separate volume of figures).

C.3 Preliminary assessment results

C.3.1 The preliminary assessment can be found in a separate document (Vol 3 Appendix A.4 Annex C.3).

C.3.2 The locations of the receptor sites on the short list are shown in Vol 3 Figure A4.C.3 (see separate volume of figures).

C.4 Detailed assessment results

C.4.1 Full details of the planning stage preferred list can be found in Annex D.

C.4.2 The locations of the receptor sites on the planning stage preferred list are provided in Vol 3 Figure A4.C.4 (see separate volume of figures).

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Annex D EMOS reports

D.1 EMOS report – Barrington Quarry

D.1.1 Annex D.1 EMOS report - Barrignton Quarry can be found in a separate document (Vol 3 Appendix A.4 Annex D.1).

D.2 EMOS report – Rainham Landfill

D.2.1 Annex D.2 EMOS report - Rainham Landfill can be found in a separate document (Vol 3 Appendix A.4 Annex D.2).

D.3 EMOS report – Calvert Landfil

D.3.1 Annex D.3 EMOS report – Carvet Lanfill can be found in a separate document (Vol 3 Appendix A.4 Annex D.3).

D.4 EMOS report – Sutton Courtenay Landfill

D.4.1 Annex D.4 EMOS report – Sutton Courtenay Lanfill can be found in a separate document (Vol 3 Appendix A.4 Annex D.4).

D.5 EMOS report – Kingsmead Quarry

D.5.1 Annex D.5 EMOS report – Kingsmead Quarry can be found in a separate document (Vol 3 Appendix A.4 Annex D.5).

D.6 EMOS report – Borough Green Quarry

D.6.1 Annex D.6 EMOS report – Borough Green Quarry can be found in a separate document (Vol 3 Appendix A.4 Annex D.6).

D.7 EMOS report – Wallasea Island

D.7.1 Annex D.7 EMOS report – Wallasea Island can be found in a separate document (Vol 3 Appendix A.4 Annex D.7).

D.8 EMOS report – Bournewood Inert Landfill

D.8.1 Annex D.8 EMOS report – Bournewood Inert Landfill can be found in a separate document (Vol 3 Appendix A.4 Annex D.8).

D.9 EMOS report – Denham Quarry

D.9.1 Annex D.9 EMOS report Denham Quarry can be found in a separate document (Vol 3 Appendix A.4 Annex D.9).

D.10 EMOS report – Little Belhus

D.10.1 Annex D.10 EMOS report Little Belhus can be found in a separate document (Vol 3 Appendix A.4 Annex D.10).

D.11 EMOS report - Shipton on Cherwell Quarry

D.11.1 Annex D.11 EMOS report Cherwell Quarry can be found in a separate document (Vol 3 Appendix A.4 Annex D.11).

D.12 EMOS report - East Burnham Quarry

D.12.1 Annex D.12 EMOS report East Burnham Quarry can be found in a separate document (Vol 3 Appendix A.4 Annex D.12).

D.13 EMOS report - Tyttenhanger Quarry

D.13.1 Annex D.13 EMOS report Tyttenhanger Quarry can be found in a separate document (Vol 3 Appendix A.4 Annex D.13).

D.14 EMOS report - Cliffe Pools

D.14.1 Annex D.14 EMOS report Cliffe Pools can be found in a separate document (Vol 3 Appendix A.4 Annex D.14).

D.15 Reserve List Receptor Sites

D.15.1 Some receptor sites that have not progressed further in the assessment may become viable in the future. These receptor sites can be reconsidered and taken forward through the process if their circumstances change.

D.15.2 Information is provided below on those potential receptor sites that might be available to receive Thames Tideway Tunnel project material in the future.

VEO.6 Veolia – Ockendon Landfill (Essex)

D.15.3 The receptor site is intended to be operational post 2040. However it is currently not operational whilst capacity in other landfills in the region is used. Once these landfills reach the end of their lifespan, the receptor site would reactivate its environmental permit and once again begin receiving material.

D.15.4 Veolia stated that Thames Tideway Tunnel project material could be received at the receptor site if it were to become operational within the Thames Tideway Tunnel project lifespan and there was a demand for restoration material at the receptor site.

D.15.5 This receptor site is currently on the viable list.

MET: Metrotidal (Kent/Essex depending on the nature of the development)

D.15.6 The proposed scheme would use material to create tidal barriers and thereby make land available for other uses (predominantly habitat creation). In doing so electricity generation would be developed as well as a wetland habitat. The receptor site currently does not have planning consent or an environmental permit. The actual nature of the development is also required to be developed and is flexible to incorporate demand for transport, subject to local planning authority and regional requirements.

D.15.7 The receptor site is currently looking to develop the planning consent and the timescales of when material would be needed at the receptor site.

D.15.8 This receptor site is currently on the viable list.

IME: Quidhampton Quarry (Wiltshire)

D.15.9 The receptor site is owned by a holding company (Imerys) who are looking to sell the receptor site to an operator. The receptor site has potential for mineral extraction and is likely to require material for restoration. The receptor site currently does not have planning consent or an environmental permit to receive material which would be required before material could be received for restoration purposes. Once an operator has purchased the receptor site, plans for the requirement of material and the timescales of when this is likely to occur would be confirmed.

D.15.10 This receptor site is currently on the long list.

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