

**United Kingdom Holocaust Memorial
and Learning Centre**

Environmental Statement (Volume 2)
Main Text
December 2018

The Secretary of State for Housing Communities and Local Government

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EIA Quality Mark

This Environmental Statement and the Environmental Impact Assessment (EIA) carried out to identify the significant environmental effects of the proposed development have been undertaken in line with our commitments as members of the EIA Quality Mark.

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1 Introduction

1.1 Background

- 1.1.1. In 2014, the Prime Minister’s cross-party Holocaust Commission set out to establish what should be done to ensure that the memory of the Holocaust is preserved and that the lessons it teaches are never forgotten. The Holocaust had a significant impact on Britain’s history, our democracy and our values. Over seventy years on, it continues to shape our society as more evidence and testimony is uncovered.
- 1.1.2. In 2015, a report was subsequently produced by the Commission, outlining four key recommendations; including:
 - A striking and prominent new National Memorial;
 - A World-Class Learning Centre at the heart of a campus driving a network of national educational activity (to be co-located with the new National Memorial);
 - An endowment fund to secure the long-term future of Holocaust Education – including the new Learning Centre and projects across the country; and
 - An urgent programme to record and preserve the testimony of British Holocaust survivors and liberators.
- 1.1.3. Following the publication of the report, the UK Holocaust Memorial Foundation (UKHMF) was set up to take forward these recommendations. An international design competition was launched in September 2016, inviting designers, architects and artists from all over the world to enter their designs for the new National Memorial. The site recommended by UKHMF for the new Memorial and Learning Centre was Victoria Tower Gardens, adjacent to the Palace of Westminster in London.
- 1.1.4. In September 2017, the winning design team was announced as Adjaye Associates, Ron Arad Architects and Gustafson Porter + Bowman. The concept design submitted for the competition has since been further developed by the design team in consultation with key stakeholders.
- 1.1.5. The Minister for Housing, Communities and Local Government (MHCLG) is leading the development of the new Memorial and Learning Centre. The Department receives advice on the project from the UKHMF.
- 1.1.6. This Environmental Statement (ES) reports on the outcome of the Environmental Impact Assessment (EIA) and will accompany the planning application for the proposed UK Holocaust Memorial and Learning Centre (the Scheme).

1.2 Project aims, values and objectives

- 1.2.1. The Scheme will provide a single place for visitors to reflect on the impact of the Holocaust in the UK. The learning centre will challenge visitors to confront hatred and prejudice by addressing the British history of the Holocaust and subsequent genocides.
- 1.2.2. The Scheme will:
 - Convey the enormity of the Holocaust and its impact;
 - Become a landmark of national significance, highlighting the importance and relevance of the Holocaust to democracy and the United Kingdom’s history;
 - Establish a place where current and future generations can come to remember the victims of the Holocaust, Nazi persecution and subsequent genocides;
 - Affirm the United Kingdom’s commitment to stand up against prejudice and hatred, inspire reflection and encourage visitors to respect and embrace difference;
 - Provide visitors with a deeper understanding of the Holocaust and its victims, and those of subsequent genocides;
 - Enhance Victoria Tower Gardens – improving the visual and sensory experience of the green space, giving it focus and civic presence, both for visitors and existing users;
 - Be a logical and harmonious addition to the existing memorials in the gardens, and viewed as a physical representation of the United Kingdom’s conscience and values; and

- Address the sensitivities of the historic, political and national importance of the exceptional setting, adjacent to the Palace of Westminster, a UNESCO World Heritage Site, and the River Thames – and in one of the most visited, and recognisable parts of London.

1.3 Planning context

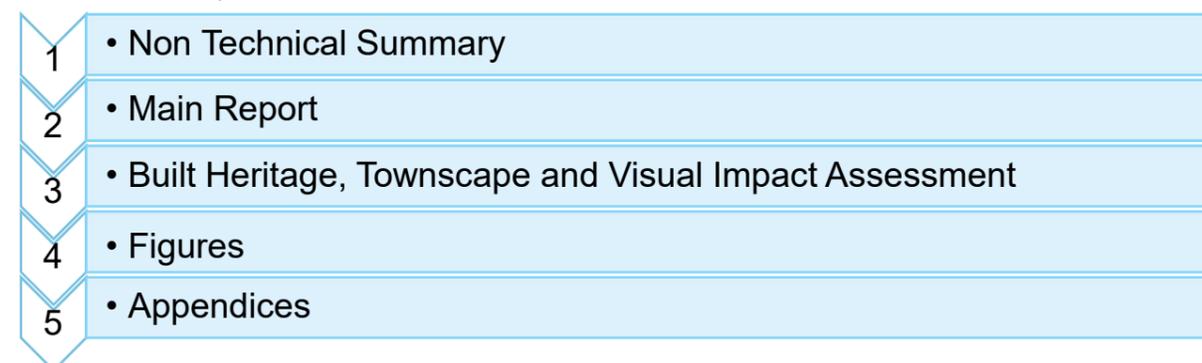
- 1.3.1. The basis for Environmental Impact Assessment (EIA) legislation in England and Wales is European Union (EU) Directive 85/337/EEC, superseded by EU Directive 97/11/EC, and amended by EU Directive 2014/52/EU, which came into effect in May 2014. For projects that fall under the town planning regime, this Directive is implemented in England by Statutory Instrument 2017 No. 571, The Town and Country Planning (EIA) Regulations 2017 (herein referred to as ‘the Regulations’).
- 1.3.2. The proposal to develop the Memorial falls within the classification of Schedule 2, Part 10(b) of the Regulations: ‘Infrastructure projects – urban development projects’. Projects listed within Schedule 2 of the Regulations may require EIA if they exceed certain thresholds stated within the legislation, and if ‘any part of that development is to be carried out in a sensitive area’.
- 1.3.3. One of the thresholds for this category of development is ‘The development includes more than 1 hectare of urban development which is not dwelling/house development’. The total area of the Victoria Tower Gardens is approximately 2.8 hectares (ha), with the final built area covering approximately 1.2 ha. The proposals therefore exceed the Schedule 2 threshold for non-dwelling/house urban development.
- 1.3.4. The Scheme location is a ‘sensitive area’, primarily due to the cultural heritage importance of the site and its surrounds within the City of Westminster. Regulation 6(2) of the EIA Regulations makes provision for developers to request that a planning authority adopts a formal opinion as to the need for EIA, known as a ‘screening opinion’. A formal screening opinion has not been requested from Westminster City Council, however, due to the sensitivity of the site this ES has been prepared in support of the planning application for the Scheme.
- 1.3.5. Regulation 15(1) makes provision for a developer to request that the planning authority gives a written opinion on the scope and level of detail of information to be included in an ES (a ‘scoping opinion’). A formal scoping opinion informs the scope of the supporting assessments that are carried out during the EIA process, and helps to ensure that the relevant significant environmental effects of the Scheme are identified at an early stage and addressed at an appropriate level of detail. A Scoping Report was submitted to Westminster City Council on 20th July 2018 and the scoping opinion was received on 23rd October 2018. The Scoping Opinion is included in Appendix A in Volume 5 and is considered further in Chapter 5 and the Topic Chapters.

1.4 Purpose of the Environmental Impact Assessment

- 1.4.1. Under the EIA Regulations Westminster City Council, when determining the outline planning application, is required to take into account the likely significant environmental effects that could arise as a result of the Scheme. The EIA Regulations require MHCLG to submit the necessary information for Westminster City Council to fulfil these requirements in the form of an ES. This report sets out the required information.

1.5 Structure of the Environmental Impact Assessment

- 1.5.1. The ES comprises four volumes as shown below. This document constitutes Volume 2 of the ES.



- 1.5.2. Volume 2, the Main Report, comprises 15 chapters as follows:
1. **Introduction** – Introduces the Scheme and provides the rationale and structure for the ES and how it relates to the other documents submitted as part of the planning application;
 2. **The Site and Surrounding Environment** – Describes the existing environmental conditions at the site and identifies sensitive receptors situated close to the site;
 3. **Project Description** – Describes the parameters of the Scheme;
 4. **Alternatives** – Describes the alternative proposals considered to deliver the Scheme;
 5. **Approach to the assessments** – Defines the scope and methodological approach to the environmental assessments including the assessment of the vulnerability of the Scheme to major accidents and disasters;
 6. **Air Quality** – Describes the existing local air quality, the potential effects of construction dust and traffic emissions and how they will be mitigated;
 7. **Built Heritage Townscape and Visual Impact Assessment** – Describes designated historic assets and landscape and townscape character, the potential effects on built heritage and how they will be mitigated. Due to the sensitive location of the Scheme and the subsequent nature of this assessment, this chapter is a standalone report located in Volume 3;
 8. **Archaeology** – Describes the existing and potential archaeological remains, the potential effects on archaeology and how they will be mitigated;
 9. **Population and Human Health** – Describes the characteristics of the local population, including health factors, and how the Scheme will contribute to local and regional growth and address health inequality. It identifies potential effects on population and health and how they will be mitigated;
 10. **Soils, Geology and Hydrogeology** – Describes the soils, geology and hydrogeology baseline, the potential effects during construction and operation, and how they will be mitigated;
 11. **Biodiversity** – Describes the biodiversity baseline, the potential effects on biodiversity features during construction and operation, and how they will be mitigated;
 12. **Water Quality and Flood Risk** - Describes the water baseline, the potential effects on water features and flood risk during construction and operation, and how they will be mitigated;
 13. **Traffic and Transport** – Describes the potential transportation and access impacts associated with the Scheme and how they will be mitigated;
 14. **Material Assets and Climate Change** – Describes material assets affected by the Scheme and considers both the potential impact of the Scheme on climate change and the vulnerability of the Scheme to climate change, how significant the effects will be and how they will be mitigated; and
 15. **Cumulative effects** – Assesses the interaction of the Scheme with other committed developments which may overlap in space or time. The chapter also considers the effects on individual receptors from multiple environmental impacts arising from the Scheme.

1.6 Appendices and supporting documents

1.6.1. Table 1-1 below details the supporting assessments and documents that are appended to the ES.

Table 1-1 - Details of the appendices and supporting documents in Volume 5

Appendix	Document
Appendix A	Scoping Opinion
Appendix B	Long list of major accidents and/or disasters
Appendix C	Construction Management Plan
Appendix D	Noise Surveys and Assessments: D.1 Environmental Noise Survey D.2 Assessment of noise and vibration impact from construction activities D.3 Assessment of noise impact from the proposed mechanical building services plant

Appendix	Document
Appendix E	Air Quality: E.1 Glossary of Air Quality Terms E.2 Policy and Guidance E.3 IAQM Construction Assessment Methodology E.4 City of Westminster: LAEI Total Emissions Spilt by Source Sector E.5 Wind Rose London City Airport (2016)
Appendix F	Archaeological Desk based assessment
Appendix G	Population and Human Health
Appendix H	Daylight, sunlight and overshadowing study
Appendix I	Site Investigation Report (March 2016)
Appendix J	Preliminary Geotechnical Site Investigation Desktop Study (July 2018)
Appendix K	Flood Risk Assessment
Appendix L	Drainage Strategy
Appendix M	Transport Assessment
Appendix N	Cumulative Effects

1.7 Legal Requirements

1.7.1. Schedule 4 of the EIA Regulations sets out the information that should be included in the ES. Table 1-2 sets out where in this ES the specific information requirements can be found.

Table 1-2 - Location of ES requirements under Schedule 4 of the EIA Regulations

Schedule 4 – Part 1 requirements Location within the ES	Location within the ES
Description of the development, including in particular: <ul style="list-style-type: none"> • A description of the location of the development; • A description of the physical characteristics of the whole development and the land use requirements during the construction and operational phases; • A description of the main characteristics of the operational phase of the development (in particular any production process), for instance, energy demand and energy used, nature and quantity of the materials and natural resources (including water, land, soil and biodiversity) used; • An estimate, by type and quantity, of expected residues and emissions (water, air and soil pollution, noise, vibration, light, heat, radiation, etc) resulting from the construction and operation of the scheme. 	Volume 2, Chapter 3
A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.	Volume 2, Chapter 4
A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge.	Volume 2, Chapters 6-15 inclusive
A description of the factors specified in regulation 4(2) likely to be significantly affected by the development: population, human health, biodiversity (for example fauna and flora), land (for example land take), soil (for example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air,	Volume 2, Chapters 6-15 inclusive

Schedule 4 – Part 1 requirements Location within the ES	Location within the ES
climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape.	
<p>A description of the likely significant effects of the development on the environment resulting from, inter alia:</p> <ul style="list-style-type: none"> The construction and existence of the development, including, where relevant, demolition works; The use of natural resources, in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources; The emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste; The risks to human health, cultural heritage or the environment (for example due to accidents or disasters); The cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources; The impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change; The technologies and the substances used. The description of the likely significant effects on the factors specified in regulation 4(2) should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development. This description should take into account the environmental protection objectives established at union or member state level which are relevant to the project, including in particular those established under council directive 92/43/eec(a) and directive 2009/147/ec(b). <p>The description of the likely significant effects on the factors specified in regulation 4(2) should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development. This description should take into account the environmental protection objectives established at Union or Member State level which are relevant to the project, including in particular those established under Council Directive 92/43/EEC(a) and Directive 2009/147/EC(b).</p>	Volume 2, Chapters 6-15 inclusive
A description of the forecasting methods or evidence, used to identify and assess the significant effects on the environment, including details of difficulties (for example technical deficiencies or lack of knowledge) encountered compiling the required information and the main uncertainties involved.	Volume 2, Chapters 6-15 inclusive
A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis). That description should explain the extent, to which significant adverse effects on the environment are avoided, prevented, reduced or offset, and should cover both the construction and operational phases.	Volume 2, Chapters 6-15 inclusive
A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned. Relevant information available and obtained through risk assessments pursuant to EU legislation such as Directive 2012/18/EU(c) of the European Parliament and of the Council or Council Directive 2009/71/Euratom(d) or UK environmental assessments may be used for this purpose provided that the requirements of this Directive are met. Where appropriate, this description should include measures envisaged to prevent or mitigate the significant	Volume 2 Chapter 5, Volume 5, Appendix B

Schedule 4 – Part 1 requirements Location within the ES	Location within the ES
adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies.	
A non-technical summary of the information listed above	Volume 1
A reference list detailing the sources used for the descriptions and assessments included in the environmental statement.	Volume 2

1.8 Competent Experts

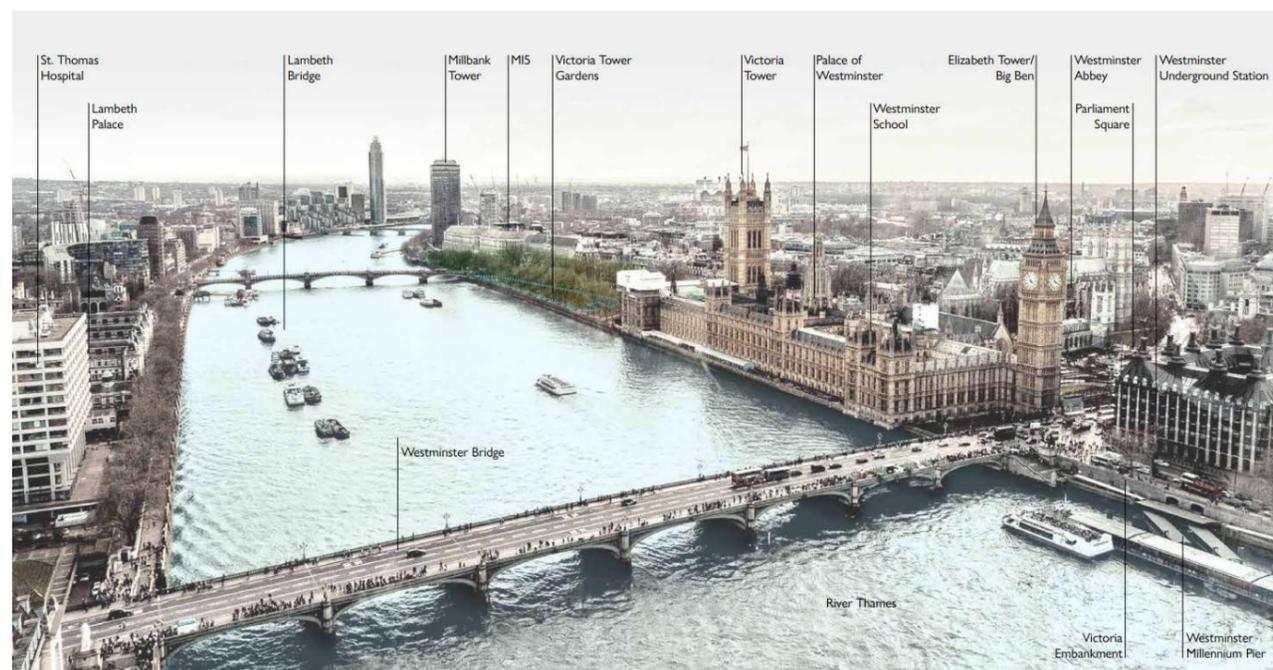
- 1.8.1. In accordance with the EIA Regulations, the coordination of the environmental assessment process and specialist assessments have been undertaken by a team of competent and qualified consultants registered with the relevant institutions and/or Chartered. Atkins is EIA Quality Mark registered through the Institute of Environmental Management and Assessment (IEMA). Accreditation is based around compliance with a series of EIA commitments, which IEMA regularly independently monitors through an annual review process. The EIA Quality Mark therefore provides registrants with a benchmark for their EIA activities and demonstrates a commitment to effective practice. Continued registration requires all of Atkins EIA coordinators and practitioners to be aware of the commitments and deliver EIA to a high standard. It also requires volunteers to write short articles, present at IEMA events or webinars and produce case studies as part of the commitment to improve EIA practice and share knowledge across the industry. These specialists work in close collaboration with designers and engineers, as part of an iterative design, consultation and assessment process. This process maximises the opportunity to avoid or reduce adverse environmental effects early in the design process and to identify mitigation measures to address those effects that cannot be avoided or reduced at source.

2 The Site and surrounding environment

2.1 Site location

- 2.1.1. Victoria Tower Gardens is located in the City of Westminster and has been an important public space for over a century. The Gardens are located on the north bank of the River Thames and adjoin the Palace of Westminster to the north. The east of the gardens is bordered by Millbank (A3212) and flanked by buildings, some of which are listed. The south end of the gardens is bounded by Horseferry Road and Lambeth Bridge.
- 2.1.2. The gardens are part of a wider urban and historic context, with physical and visual connectivity to important historic and modern monuments, open spaces and key buildings such as Westminster Abbey, Parliament Square, River Thames and the London Eye. Figure 2-1 below provides an aerial view of the gardens and surrounding areas.

Figure 2-1 - Aerial view of the Scheme



2.2 Description of the site and surrounding environment

- 2.2.1. The gardens are open daily from dawn to dusk and comprise amenity grassland crossed by several formal tarmac paths that link directly to the Thames riverside. There are no trees in the central part of the gardens, but mature trees almost completely line the perimeter of the site. There are public toilets, a play area and a seasonal kiosk that serves refreshments at the southern end of the gardens.
- 2.2.2. The Victoria Tower Gardens is already home to four different memorials, which all broadly commemorate themes of democracy and freedom. These are:
- The Buxton Memorial, a fountain in the centre of the site;
 - The Emmeline Pankhurst Memorial, a statue in the north west of the gardens;
 - The Burghers of Calais, a statue in the north of the gardens; and
 - The Spicer Memorial, a statue in the south of the gardens.
- 2.2.3.

- 2.2.4. Figure 2-2 and Figure 2-3 are photographs of the gardens facing north and south. Figure 2-4 shows the location of the existing memorials and facilities in the gardens. Figure 2.1 in Appendix 3 illustrates the environmental constraints of the Scheme.

Figure 2-2 - View of the existing Gardens looking north towards the Palace of Westminster



Figure 2-3 - View of the existing Gardens looking south towards Millbank Tower



Figure 2-4 - Dynamic View of the Gardens



2.2.5. The environment surrounding the garden is highly urbanised. The gardens are within the Westminster Abbey and Parliament Square Conservation Area which is dominated by many world-famous landmarks and a busy international tourist location. The gardens are adjacent to the Westminster World Heritage Site (Figure 2-5) which includes multiple Listed Buildings and Registered Parks (Figure 2-6).

Figure 2-5 - World Heritage and Conversation Areas

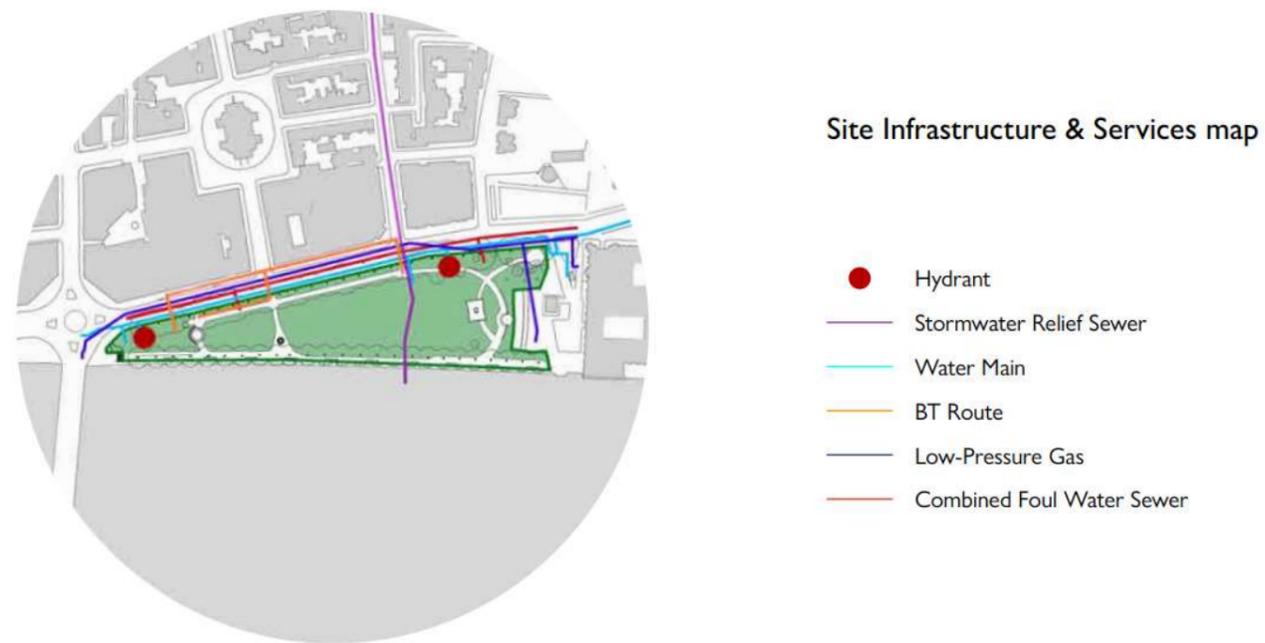


Figure 2-6 - Listed Buildings and Registered Parks



2.2.6. Infrastructure and services including a water main, stormwater relief sewer, two fire hydrants, a BT router, low pressure gas line and combined foul water sewer are also located within the gardens. Their locations are shown on Figure 2-7.

Figure 2-7 - Site infrastructure and services map



3 Project Description

3.1 Overview

- 3.1.1. The concept design of the new Memorial and Learning Centre locates the key elements of the Scheme in the southernmost portion of Victoria Tower Gardens. The Scheme includes a memorial, leaning centre, entrance pavilion, large courtyard area and café.
- 3.1.2. The Memorial will most commonly be approached from the north of the gardens by a new, curved path that sweeps diagonally across the parkland, passing by three of the existing memorials already present in the gardens. The Learning Centre will be located underground.

Figure 3-1 - Scheme Plan



- 3.1.3. Detailed Scheme drawings are provided in Volume 3 Figures. Further details about the Scheme design are provided below and the full Scheme design details are provided with the Design and Access Statement for the Scheme.

Need for a new Memorial and Learning Centre

- 3.1.4. The UK Holocaust Memorial and Learning Centre will allow visitors to reflect on the impact of the Holocaust in Britain. The Memorial will stand as a reminder of the importance of our democracy in standing for our shared values of mutual respect and tolerance for people of all faiths, ethnicities and background.
- 3.1.5. The Memorial and Learning Centre will draw on the history of the Holocaust in Britain and subsequent genocides, particularly the decisions made by the British Parliament, to stress the importance of tackling intolerance and hatred at all levels in our society.
- 3.1.6. The Memorial and Learning Centre will be an additional contribution to the Holocaust education in Britain complementing the Imperial War Museum's exhibition and working in partnership with a wide range of institutions.

Background of the Scheme design

- 3.1.7. The design proposal for the Scheme is to create a nationally significant landmark for current and future generations to remember, reflect and learn.

- 3.1.8. The design is drawn from extensive research into the site and subject matter and seeks to respect its context, honour the weight of its responsibility and inspire its visitors to strive to draw meaning and purpose out of tragedy.
- 3.1.9. The design has been influenced by careful understanding of the diverse use of the Victoria Tower Gardens, to ensure the Scheme not only allows the current activities to remain, but rather enhance the user experience. The new softly sloping landscape provides visitors with a new vantage point to the River Thames, a renewed perspective and relationship to the memorial and a distinctive entry point for an underground learning centre. The subtle shift in the landscape allows for all existing memorials within the gardens to remain visible. The overall Scheme seeks to complete the commemorative narrative of the existing, historic monuments to freedom and injustice. The Scheme will pay deference to – and form a visual link between – these monuments and the atrocities of the Holocaust against the backdrop of Britain's greatest symbol of democracy.
- 3.1.10. It is also intended to reimagine the existing playground in the new context of the Memorial, with additional soft landscaping to enhance the character of the playground and bring children closer in touch with nature.

3.2 Memorial and learning centre building

- 3.2.1. The Memorial itself will comprise twenty-three bronze-clad concrete 'fins', set vertically into the ground on a curving alignment. The highest point of the Memorial will be approximately 10m above the existing ground level. Within the area encompassed by the curvature of the fins, the flat parkland will be re-landscaped to form a grassed slope that subtly rises from north to south, so that only the tips of the fins are visible from the northern portion of the gardens. The spaces between the fins of the Memorial will form the entrance to the Learning Centre, which will be located entirely underground over two levels; a mezzanine level and a basement. This will require excavation of the site to a depth of 8m.
- 3.2.2. The internal floor area of the area Learning Centre will be 3,258m² over two floors.
- 3.2.3. To the south of the bronze-clad Memorial structure, a sunken (outdoor) courtyard will form the main entrance plaza. Visitors will buy and check their tickets at the entrance pavilion and proceed through security check before entering the courtyard.

3.3 Landscaping

- 3.3.1. The Scheme has been designed ensure it is integrated into the existing gardens creating a new landscape that allows visitors to come into contact and experience it. The design aims to retain and maintain open lawn space as well all activities that are currently undertaken in the gardens as far as possible and provide further enhancements.
- 3.3.2. Approximately 7% of existing green space within the gardens will be lost to the Scheme which includes the area for the bronze fins, courtyard, security hedge around the perimeter of the courtyard and the entrance pavilion.
- 3.3.3. The existing perimeter paths will be retained and a new diagonal route (made of small stones) through the gardens brings the visitors on a journey past other memorials in the gardens and leads them around to the entrance on the south side of the Memorial. While the Memorial is visible from all approaches, its integration into the gardens landscape aims to minimise the visual impact. Viewed from the south, the position and scale of the Memorial creates a powerful statement with the Houses of Parliament in the backdrop.
- 3.3.4. Reinforced grass paths will be provided through the gardens and new elevated benches and a timber boardwalk will be placed alongside the river embankment which will include a ramp at each end and multiple sets of steps along the boardwalk.
- 3.3.5. Natural building materials have been selected for the Scheme including basalt, concrete, natural stone and bronze in their unpolished form. These materials are robust and can assume different qualities over time as they age.
- 3.3.6. Planting of new shrubs, ground cover plants, hedges and reinforced grass is proposed to infill and enhance the gardens existing vegetation.
- 3.3.7. The retention of the playground in the south end of the site has been one of the main design considerations. The design of the playground will ensure a more efficient use of the space whilst simultaneously creating a more attractive play environment. The playground is being developed in consultation with local community groups.

3.4 Access and transport

- 3.4.1. The gardens are in a highly accessible location in central London, with close proximity to bus, underground, rail and river boat services. There are five visitor entrances to the gardens along Millbank from which visitors can make their way through the gardens.

3.5 Construction

- 3.5.1. Construction of the Scheme is currently planned to commence in Spring 2020 and is estimated to last up to 30 months.
- 3.5.2. Only general details regarding possible methods of construction of the new Memorial and Learning Centre are available at this stage. As the site is located within public gardens with no existing buildings, only limited demolition would be required to construct the Memorial and Learning Centre. The existing Buxton Memorial would be temporarily removed and safeguarded for the duration of the construction period and will be reinstated in the gardens on completion of the Scheme.
- 3.5.3. The gardens will remain open to the public throughout construction with the full use of the wider section nearest Westminster and along the river.

3.5.1 Construction method

- 3.5.4. Once the initial enabling works are complete, the construction site will be established, including site access, services diversions, setup of offices and welfare facilities, and installation of tree protection to safeguard retained trees in the gardens. Topsoil will be stripped from the working area and removed for storage off-site. This will be used in the post-construction reinstatement of the gardens.
- 3.5.5. The first stage of construction following site establishment will be the completion of piling works to form a deep supporting steel sheet piled wall in the ground around the perimeter of the footprint of the Learning Centre. Excavation of the space for the new Learning Centre will take place within this pile line.
- 3.5.6. The construction of the Learning Centre as a new subterranean space over two sub-levels will require substantial excavation works to construct the new building. Some of the excavated spoil may be re-used in any new landscaping works but considering the likely volume of material that will need to be excavated, it is unlikely that all the excavated material could be reused within the site and most will need to be removed to an appropriate disposal facility.
- 3.5.7. It is estimated that 30,000m³ of material will be required to be removed offsite over a three-month period. The method to be used to transport surplus excavated material from the site has not been fully confirmed at this stage however, it has been assumed that it will be removed to an appropriate disposal facility by road. For the removal of materials off site, it is anticipated that there will be approximately 38 heavy goods vehicles (HGV) movements per day and at peak there are expected to be up to 76 (HGVs) movements per day.
- 3.5.8. Alternative transport methods (including by river to reduce vehicle movements on the local road network) will be investigated during the next stages in the design process.
- 3.5.9. Once the excavations are complete, the underground space will be formed by pouring concrete to create a reinforced base slab and walls, with the internal construction completed once the foundation and walls are complete.
- 3.5.10. The Construction Management Plan in Appendix B in Volume 5 provides further details of the construction process for the Scheme.

3.5.2 Construction Logistics

- 3.5.11. Hoardings around the construction site will be provided to ensure public safety. They will be well maintained, provide relevant informative to the public and serve to minimise construction noise. The streets surrounding the site will be cleaned and maintained regularly by the contractor. Construction worker welfare facilities will be located within the hoarding line.
- 3.5.12. It is anticipated that roads closures will not be required during construction and all bus stops will be retained. Construction vehicles will access the gardens through three of the five gardens entrances and will be escorted through these entrances using temporary barriers. Vehicles will be on site for short durations to load and unload materials.

3.5.3 Protection of trees

- 3.5.13. Vertical tree barriers will be erected along the edge of the proposed groundworks and development footprint to create a construction exclusion zone to protect the London Plane trees within the gardens.
- 3.5.14. New footpaths will be established using a cellular confinement system to allow water filtration through the soil to the root systems of the trees that border the gardens and provide a permanent improvement to the Garden's landscaping. This system will also protect tree roots from vehicular movements during construction.

3.5.4 Community engagement

- 3.5.15. Engagement with local communities, surrounding neighbours and schools will continue throughout the detailed design phase to identify opportunities to enhance the Scheme and develop joint ventures.
- 3.5.16. A community liaison officer will be appointed to act as a single point of contact and respond to any issues raised by local communities and other stakeholders. A community liaison forum will be established with other local construction projects to co-ordinate activities and minimise impact in the surrounding area.

3.6 Operation

- 3.6.1. Details on how the new Memorial and Learning Centre will be operated are still in development. However, the intention is to form a Non-Departmental Government Body, overseen by MHCLG, who will be responsible for fundraising, construction staffing and operation of the Memorial and Learning Centre. It is assumed that access to the Memorial will be available whenever the Victoria Tower Gardens are open (currently dawn to dusk). Provision for out of hours access may also be required if special events or functions are held at the Learning Centre.
- 3.6.2. State of the art security measures will operate in and around the building, designed with sensitivity to the area and providing the highest level of protection for both employees and visitors, giving visitors a sense of confidence and assurance.

3.6.1 Ticketing

- 3.6.3. Access to the Learning Centre will require a ticket which will be checked before proceeding through a security check before entering the courtyard.
- 3.6.4. 100% of visitors will pre-book their tickets online. The average number of people visiting the Memorial and Learning Centre is estimated to be 3000 per day.
- 3.6.5. The entrance pavilion has been designed to ensure a seamless and quick entry to the Memorial and areas for queuing and gathering groups have been carefully included to ensure minimal disruption to other gardens users and visitors.

4 Alternatives

4.1 Site selection

- 4.1.1. The Prime Minister's Holocaust Commission Report (January 2015) identified three potential sites for the UK Holocaust Memorial and Learning Centre which include:
- Potters Field, next to the Mayor of London's office;
 - Millbank Tower; and
 - Imperial War Museum (IWM).
- 4.1.2. The sites were identified as an indication of the type of location that would have some importance and resonance for the project.
- 4.1.3. After many discussions, the UKHMF Board decided that none of these sites were suitable and all three sites were discounted. The reasoning for this is outlined below:
- Potters Field – this was part of a s106 agreement between the London Borough Southwark and the developer to deliver a cultural use next to the Greater London Authorities office as part of the residential development. The site was eventually sold to the new Bridge Theatre and therefore became no longer available;
 - Millbank Tower – this was also part of a major planning application to convert Millbank from an office tower to a residential tower. It was expected that the s106 agreement might make part of the podium block available for cultural use. To date, there is no evidence of redevelopment coming forward at this site and occupational office leases have now been extended to 2022; and
 - IWM – the proposition offered to UKHMF by the IWM was a memorial attached to a back wall with no prominence and a below-ground learning centre adjacent to it. The land was also owned by London Borough of Lambeth not the IWM. It was considered that the site lacked significance and that the activities would be subsidiary to the far larger remit of the IWM, whose aims in remembering Britain at war which are not consistent with the aims of the Holocaust Memorial and Learning Centre.
- 4.1.4. Since the site selection process, in early December 2018, the IWM and UKHMF have committed to work closely together as the exhibition within the Learning Centre is developed, to ensure that the curation and narrative does not replicate IWM's plans for its new galleries. Visitors to the Holocaust Memorial and Learning Centre will be encouraged to explore other resources, including the IWM's new Holocaust galleries which are due to open in 2021.
- 4.1.5. In Autumn 2015 the UKHMF Board agreed that a leading firm of property consultants should be appointed to carry out a search for a suitable site for the Holocaust Memorial and Learning Centre. CBRE was appointed from the firms approached to carry out a detailed thorough site search. The area of search was broadly consistent with the main Central London tourist / museum areas i.e. South Kensington (National History Museum, Science Museum, V&A) to the west; Tower of London to the east; Regent's Park to the north and Westminster and the river to the south. CBRE also wrote to and met with a number of parties to establish if there were any other sites available not on the market including:
- The estates officers of local authorities in the search area;
 - The Real Estate Investments Trusts with London portfolios;
 - The landed Estates;
 - Other investors and developers; and
 - Other agents.
- 4.1.6. In January 2016 twenty-four sites were identified by CBRE and considered by the UKHMF. However, a number of the sites identified in the site selection search were cost prohibitive; had poor visual importance; no emotional or political logic; and little or no outdoor space to provide a prominent memorial.
- 4.1.7. The three preferred sites identified by CBRE were:
- The Royal College of Gynecologists in Regent's Park (27 Sussex Place);
 - A part of the Knightsbridge Barracks; and

- A part of Middlesex Hospital.
- 4.1.8. It was determined that none of the above referenced shortlisted sites were suitable for the following reasons:
- The Royal College of Gynecologists in Regent's Park (27 Sussex Place) was cost prohibitive and has now been sold to its neighbour the London Business School;
 - Knightsbridge Barracks would have been dependent on the sale and redevelopment of the whole barracks which would not have been in UKHMF's control; and
 - Middlesex Hospital was not considered to be a sufficiently prominent location for the UKHMLC.
- 4.1.9. In January 2016 following discussions involving the Government Property Unit, Victoria Tower Gardens was identified as a possible site. After careful consideration, Victoria Tower Gardens were selected by the UKHMF Board as the outstanding candidate site for the following reasons:
- It provides an iconic location adjoining Parliament, sitting along the riverfront immediately next to the House of Lords;
 - Its relevance as a commemorative garden of Britain's national conscience, already containing significant memorial sculptures, marking momentous historic events, with significance for the struggle for human rights, that remain relevant today and will do so in the future;
 - It is visually prominent and adjacent to one of the most visited parts of London, within easy reach of a major tube station and many bus routes;
 - The resonance of being next to Parliament and on the timeless banks of the Thames is exceptional; and
 - Under the shadow of Victoria Tower, the Holocaust Memorial and Learning Centre would question the impacts of the Holocaust and subsequent genocides on our own Parliament.
- 4.1.10. The decision to select Victoria Tower Gardens as the location for the United Kingdom Holocaust Memorial and Learning Centre was announced by the Prime Minister, David Cameron, at Prime Minister's Questions on 27 January 2016. The Prime Minister said:
- 4.1.11. *"Last year, on the 70th anniversary of the liberation of Auschwitz, I said we would build a striking national memorial in London to show the importance Britain places on preserving the memory of the holocaust. Today, I can tell the House that this memorial will be built in Victoria Tower Gardens. It will stand beside Parliament as a permanent statement of our values as a nation, and it will be something for our children to visit for generations to come. I am grateful to all those who have made this possible, and who have given this work the cross-party status that it so profoundly deserves."*
- 4.1.12. Only two weeks ago, on 5 December 2018, during Prime Minister's Questions, Theresa May MP reaffirmed the Government's commitment to the Memorial and to the suitability of the preferred site:
- 4.1.13. *"... there is no better place for the Holocaust Memorial and Learning Centre to be than right next to our Parliament. What is important is that this is not just a memorial; it is a learning centre and it will be educating young people and others about the horrors of man's inhumanity to man."*

4.2 Design alternatives

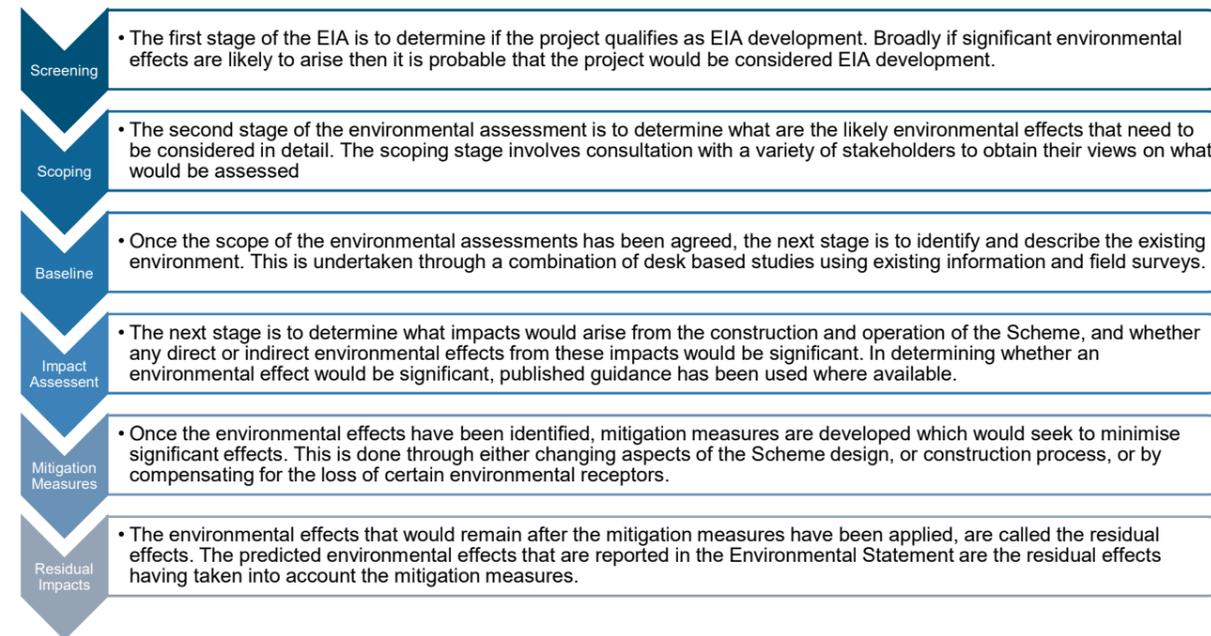
- 4.1.14. As described above in Chapter 1, a competition was held to design the Memorial and Learning Centre in September 2016 with 92 entries in total. Ten shortlisted design proposals were displayed to the public in February 2017. The winning design, by Adjaye Associates, was announced in October 2017. The winning design reflected extensive research into the site and the objectives of the UKHMF in developing the Holocaust Memorial and Learning Centre.
- 4.1.15. The design has been developed to ensure the Memorial and Learning Centre fits within the current surroundings within the gardens including:
- Not exceeding the height of the existing Buxton Memorial;
 - Not impacting on any existing trees;
 - Improving the landscape quality within the gardens while preserving the character of the existing use as public gardens to enhance the user experience; and
 - Improving views to the river.

- 4.1.16. Improvements to the initial design and further development of the design informed by the environmental assessments have included:
- Changes to the footprint and layout of the Memorial and Learning Centre to ensure the existing London Plane tree roots and their canopies are protected to ensure their long-term health;
 - New pathways within the gardens to ensure connections around the gardens are not fragmented as they currently are;
 - Enhancing existing gardens furniture that has become degraded over time and considering the options to improve the ponding in the gardens during winter; and
 - Enhancing the existing playground.

5 Approach to the Assessments

5.1 The EIA Process

5.1.1. EU Directive 2011/92/EU (the EIA Directive, amended by Council Directive 2014/52/EU) sets out the EIA process for all EU Member States and defines which projects need to undergo EIA. For the Scheme, The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) transposes the EIA Directive and underpins the EIA process. The process set out in the EIA Regulations is summarised below.



5.2 Screening and Scoping

5.2.1. A formal screening opinion has not been requested from Westminster City Council but, due to the sensitivity of the site, an ES has been produced in support of the planning application for the Scheme.

5.2.2. A high level environmental appraisal was undertaken to identify which aspects of the environment are likely to be significantly affected by the Scheme. This information was included in the Scoping Report submitted to Westminster City Council on 20th July 2018. A draft Scoping Opinion (Appendix A in Volume 5) was issued by Westminster City Council on 23rd October, which determined that assessment of the following environmental aspects should be included in the ES:

- Air quality;
- Built Heritage Townscape and Visual;
- Population and Human Health;
- Archaeology
- Soils Geology and Hydrogeology;
- Biodiversity;
- Traffic and Transport;

- Water Quality and Flood Risk;
- Material Assets and Climate Change; and
- Cumulative effects.

5.2.3. Westminster City Council agreed to scope out Noise and Vibration from the ES. Environmental noise surveys and further noise assessments are provided in Volume 5 Appendix D.

5.2.4. After receipt of the Scoping Opinion further discussions were held with the relevant stakeholders and the Westminster City Council to refine the scope. A summary of these responses is shown in each topic chapter.

5.2.6. Table 5-1 below presents the data sources used and surveys carried out to establish the baseline data for each environmental topic assessment scoped in to this report.

Table 5-1 - Topic baseline information sources

Environmental topic	Desktop Sources		Surveys	
Air Quality	✓	A review was undertaken of the air quality data for the local area as published by Westminster City Council ¹ , Defra ² , the Environment Agency ³ , London Air Quality Network ⁴ and the Greater London Authority and London Atmospheric Emissions Inventory (LAEI) ⁵ . A desk study to confirm the location of nearby existing receptors was undertaken as well as a review to identify new receptors from construction of the Scheme. Consultation with the Environmental Health Officer at Westminster City Council has been undertaken to agree the scope of the assessment and the methodology to be applied.	✗	No surveys undertaken.
Built Heritage, Townscape and visual	✓	Manual desk based review of OS maps including World Heritage Sites, listed buildings, conservation areas registered parks and gardens and locally listed buildings. Desk based archival research and secondary resources. Characterisation studies. Consultation with City of Westminster and Historic England to agree viewpoints.	✓	A number of site visits were undertaken in 2018 to understand the immediate setting of the site, the setting of the surrounding heritage receptors, the townscape character and appearance and key viewpoints.
Archaeology	✓	A desk based study was undertaken. Data on the historic environment was obtained from the primary repositories of such data, in this instance, the National Heritage List for England (NHLE), and the Greater London Historic Environment Record (GLHER). Consultation with the City of Westminster's Archaeological Advisor has been undertaken.	✗	No surveys undertaken.
Population and Human Health	✓	Data sources used to compile the baseline were Public Health England Local Health Profiles, Census 2011 data, Indices of Multiple Deprivation 2015, Westminster City Council, Greater London	✗	No surveys undertaken.

1 Westminster City Council (2018) Air Quality Annual Status Report for 2017

2 Defra Local Air Quality Management (LAQM) Support Pages. Available at: <http://laqm.defra.gov.uk/>. Accessed on 06/09/2018

3 Environment Agency. <http://maps.environment-agency.gov.uk>. Accessed on 06/09/2018

4 London Air Quality Network Website. Available at: <http://www.londonair.org.uk>. Accessed on 06/09/2018.

5 London Atmospheric Emissions Inventory (LAEI). Available at: <https://data.london.gov.uk/dataset/london-atmospheric-emissionsinventory-2013>. Accessed 06/09/2018

Environmental topic	Desktop Sources	Surveys
	Authority, Transport for London, NHS, Westminster Community Network, Westminster Local Involvement Network, Central London Clinical Commissioning Group, West London Clinical Commissioning Group, and other publicly-available socio-economic data sources.	
Soils Geology and Hydrogeology	✓ A review of the site investigation report (prepared in 2016) and the Geotechnical Site Investigation Desktop Study (July 2018). A desk based study of background information regarding the conditions for geology, hydrology and hydrogeology, identified potential geohazards and historical land use was undertaken.	✗ No surveys undertaken.
Biodiversity	✓ A desk study was undertaken in April 2017 and updated in October 2018 to obtain ecological data. In October 2018 Greenspace Information for Greater London (GiGL) was contacted to obtain ecological data including records of non-statutory designated sites, records of legally protected and notable species (fauna and flora). The Multi-Agency Geographic Information for the Countryside (MAGIC) was used to search for designated sites of nature conservation importance, notable habitats and the presence of waterbodies.	✓ Two site visits were undertaken in April 2017 and October 2018 by an ecologist to conduct a Phase 1 Habitat Survey.
Water Quality and Flood Risk	✓ Review of the Environment Agency Flood Map for Planning. Review of the Environment Agency's Catchment Data Explorer (2018). Consultation with the Environment Agency.	✗ No surveys undertaken.
Traffic and Transport	✓ A review of bus, National Rail and London Underground service frequencies. A review of pedestrian routes and crossing facilities from the site to local public transport nodes (bus stops and rail stations), together with a review of the local cycle network.	✓ A series of pedestrian and cycle counts (27th May 2017, 29th May 2017 and 13th September 2017). Kerbside activity surveys (30th September to 3rd October 2017). A Public Transport Accessibility Level (PTAL) assessment of the site.
Material Assets and Climate Change	✓ Review of nearby infrastructure and services. Review of current climate conditions from the Met Office regional data. Review of the future climate projections based on the United Kingdom Climate Projections 2009 (UKCP09). Review of UK and global greenhouse gas emissions.	✗ No surveys undertaken.
Cumulative Effects	✓ Review of local authority planning webpages for planning applications and consents and a review of allocated and proposed sites in local plans.	✗ No surveys undertaken.

- 5.2.7. The impact assessment identifies the impacts relevant to each of the environmental aspects, the affected receptors, and assesses the significance of the impacts.
- 5.2.8. The significance of the impacts depends on the sensitivity of the receptors and the severity of the impacts. The more sensitive a receptor is to an impact, the more significant the effect is likely to be. The more severe the impact, the more significant the effect is likely to be.
- 5.2.9. The sensitivity of a receptor depends on its importance and resilience. Table 5-2 below provides a definition of the receptor sensitivity based on an ordinal scale (Very High / High / Medium / Low) demarcated by qualitative definitions of importance and resilience. The highest nature of either the importance or resilience sensitivity determined for a receptor in accordance with the criteria below is considered the overall sensitivity for the receptor. Importance and resilience definitions are contextualised for each environmental topic.

Table 5-2 - Illustrative determination of sensitivity of receptors

Sensitivity of Receptor	Importance of receptors	Resilience of receptors
Very High	An attribute with a high quality and rarity on an international, regional or national scale with little or no potential for substitution.	Sensitive area or receptor with no resilience to imposed stresses.
High	An attribute with a high quality and rarity on a local scale with little or no potential for local substitution, or with a medium quality or rarity on a regional or national scale with limited potential for substitution.	Sensitive area or receptor with little resilience to imposed stresses.
Medium	An attribute with a medium quality and rarity on a local scale with limited potential for substitution, or an attribute of low quality and rarity on a regional or national scale.	The receiving environment or receptor has a moderate natural resilience to imposed stresses.
Low	An attribute of low quality and rarity on a local scale with potential for substitution locally.	The receiving environment or receptor has a high natural resilience to imposed stresses.

- 5.2.10. The severity, or magnitude, of the impact is described on a four-point scale: High / Medium / Low / Negligible. The higher the severity of the impact, the more likely the resulting effect would be significant.
- 5.2.11. Impact severity depends on several factors such as spatial scale, degree of changes, their duration, likelihood, frequency, and reversibility. The severity of the impacts is defined for each environmental topic depending on the specific characteristics of the impact factors and may be qualitative or referred to specific parameters and thresholds.
- 5.2.12. The definitions of the characteristics of the type and the nature of the impacts is reported in Table 5-3.

Table 5-3 - Definitions of type and nature of impacts

Term	Definition
Impact Nature	
Adverse	An impact that is considered to represent an adverse change from the baseline condition or introduces a new undesirable factor.
Beneficial	An impact that is considered to represent an improvement on the baseline condition or introduces a new desirable factor.
Impact Type	
Direct	Impacts that result from a direct interaction between a project activity (e.g. land take) and the receiving environment (e.g. loss of habitats).
Indirect	Impacts that result from other activities that do not form part of the project however are a consequence of the project (e.g. project implementation promotes service industries in the region).
Secondary or induced	Impacts that follow on from / arise as a consequence of the primary interactions between the project and its environment (e.g. loss of part of a habitat affects the viability of a species population over a wider area).
Cumulative	Impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted. This guidance has been applied during the assessment of cumulative impacts.

5.2.13. Table 5-4 determines the severity of the impact and the sensitivity of the receptors to assess the relevance of the impacts.

5.2.14. Significance can be adverse or beneficial and both types of effects have been considered within the assessments. The levels of the relevance of the impacts are categorised as follows:

- Major (adverse / beneficial);
- Moderate (adverse / beneficial);
- Minor (adverse / beneficial); and
- Negligible / no effect.

Table 5-4 - Impact significance matrix

Significance of the Impact		Magnitude or severity of impact			
		High	Medium	Low	Negligible
Receptor sensitivity or importance	Very High	Major	Major	Moderate	Minor
	High	Major	Moderate	Minor	Negligible
	Medium	Moderate	Moderate	Minor	Negligible
	Low	Minor	Minor	Negligible	Negligible

5.2.15. Major and moderate effects are generally regarded as being significant whereas minor and negligible effects are not significant.

5.2.16. Examples of how these definitions apply in practice are as follows:

- **Major beneficial or adverse effect** – where the Scheme would cause a significant improvement or deterioration to the existing environment;
- **Moderate beneficial or adverse effect** – where the Scheme would cause a noticeable improvement or deterioration to the existing environment;
- **Minor beneficial or adverse effect** – where the Scheme would cause a barely perceptible improvement or deterioration to the existing environment; and
- **Negligible** – no discernible improvement or deterioration to the existing environment.

5.3 Mitigation measures

5.3.1. For major and moderate adverse effects (significant effects) identified through the impact assessment process, mitigation measures have been proposed. Mitigation has been identified in accordance with a hierarchy of options in accordance with good practice.

- **Avoid** - making changes to the project's design or location to avoid adverse effects on an environmental feature;
- **Minimise** - reduction of adverse effects through sensitive environmental treatments/design;
- **Restore** - measures taken during or after construction to repair/reinstate and return a site to the situation prior to occurrence of impacts; and
- **Compensate/offset** - where avoidance or reduction measures are not available, it may be appropriate to provide compensatory/offsetting measures. It should be noted that compensatory measures do not eliminate the original adverse effect, they merely seek to offset it with a comparable positive one.

5.3.2. In addition to mitigation measures, where applicable, enhancement/improvement measures have been considered. This approach acknowledges the project preparation stage presents an opportunity to enhance these positive features through innovative design.

5.4 Consultation

5.4.1. In addition to the scoping consultations discussed above, the design and assessment team have undertaken consultation with the following stakeholders:

- GLAAS,
- Royal Parks;
- Westminster City Council,
- Historic England;
- Transport for London; and
- Environment Agency.

5.5 Uncertainties and assumptions

5.5.1. The environmental assessment process aims to assist good decision making based on the quality of the information provided including the potential environmental effects of the Scheme. Due to the nature of the assessment and the prediction of effects arising from events that have yet to take place, there is an inherent level of uncertainty within the assessments. Assessments use methods that are well-established and accepted to minimise this uncertainty.

5.5.2. As with any project, the design continues to evolve as further information is obtained and the design becomes more detailed. The level of detail presented about the site and the design within this ES is sufficient to identify and understand the main environmental issues and significant effects which could arise as a result of the Scheme. Where uncertainties exist, a worst-case scenario is assumed for the purposes of the EIA so that effective mitigation measures can be identified and deployed. Where a worst-case scenario has been used in the assessments, this is described in the relevant sections.

5.5.3. Specific limitations, uncertainties and assumptions relating to each of the environmental aspects are described in relevant assessment chapters.

5.6 Vulnerability to Major Accidents and Disasters

- 5.6.1. The EIA Regulations 2017 introduced a requirement to consider significant adverse effects of the Scheme on the environment deriving from the vulnerability of the Scheme to risks of major accidents and/or disasters relevant to the Scheme.
- 5.6.2. The general scope of the assessments covers:
- Vulnerability of the Scheme to risks of major accidents and/or disasters that are relevant to the Scheme (subsequently referred to as major events);
 - Identification of any consequential significant adverse environmental effects from those major events; and
 - Measures to prevent or mitigate the significant adverse environmental effects of those major events and details of the preparedness for and response to such major events.
- 5.6.3. The assessment of major events has:
- Applied professional judgement in consultation with MHCLG to develop Scheme specific definitions of major events;
 - Identified any major events that are relevant to and can affect the Scheme;
 - Where major events are identified, described the expected significant effects arising from the vulnerability of the Scheme to the events;
 - Reported the conclusions of this assessment within the individual environmental topic chapters; and
 - Clearly described any assumed mitigation measures and details of the preparedness for and proposed response to such emergencies, to provide an evidence base to support the conclusions and demonstrate that likely effects have been mitigated/managed to an acceptable level.
- 5.6.4. Key terms used in the assessment are listed below.

Table 5-5 - Assessment Terminology – Vulnerability to major accidents and disasters

Significance Category	Typical descriptors of effect
Major accident	The COMAH 2015 regulations define a 'major accident' as an occurrence such as a major emission, fire, or explosion resulting from uncontrolled developments in the course of the operation of any establishment and leading to serious danger to human health or the environment (whether immediate or delayed) inside or outside the establishment and involving one or more dangerous substances.
Natural disaster	A naturally occurring event such as extreme weather (storm, flooding) or a ground-related hazard event (subsidence, landslide, earthquake) with the potential to cause an event or situation that meets the definition of a major accident.
Risk	The likelihood of an impact occurring combined with the effect or consequence(s) of the impact on a receptor(s) if it does occur.
Risk event	An identified unplanned event which is considered relevant to the Scheme and has the potential to be a major accident or natural disaster subject to the identification of its potential to result in a significant adverse effect on an environmental receptor.
Serious damage	Serious damage includes the loss of life, permanent injury and temporary or permanent damage/destruction of an environmental receptor.
Vulnerability	In the context of environmental risk assessment, the term refers to the 'exposure and resilience' of the Scheme to the risk of a major accident or natural disaster.

- 5.6.5. By the above definitions, a significant adverse effect is considered to mean the loss of life or permanent injury, and/or permanent or long lasting damage to an environmental receptor. The significance of this effect takes into account the extent, severity and duration of harm and the importance and sensitivity of the receptor.
- 5.6.6. The potential effects resulting from major events and any consequences for receptors is reported in the individual environmental topic chapters and as such, vulnerability to major accidents and disasters is not a topic in itself.

- 5.6.7. Relevant major events are reported in this section, and any consequences for receptors are reported in each of the individual environmental topic chapters.

5.6.1 Methodology

- 5.6.8. The methodology adopted includes three main stages, as follows:
- Stage 1: a long list of all possible major events was developed. This list drew upon a variety of sources, including the UK Government's Risk Register of Civil Emergencies. Major events with little relevance in the UK were not included. Stage 1 also included an initial review of potential receptors to identify any groups that it was not considered necessary to include in the assessment;
 - Stage 2: a screening exercise was undertaken to review the long list of major events and to give consideration to their relevance to the Scheme, and therefore whether they should be included on the Scheme specific short list of major events requiring further consideration. The study area for relevant major events was identified to be within 2km of the Scheme; and
 - Stage 3: where further design mitigation is unable to remove the potential interaction between a major event and a particular topic, the relevant Environmental Statement chapter identifies the potential consequence for receptors covered by the topic and gives a qualitative evaluation of the potential for the significance of the reported effect to be increased as a result of a major event.

5.6.2 Assessment findings

Stage 1

- 5.6.9. The long list of major events is provided in Appendix B in Volume 5.

Stage 2

- 5.6.10. In general, major events, as they relate to the Scheme, fall into three categories:
- Events that could not realistically occur, due to the type of Scheme or its location;
 - Events that could realistically occur, but for which the Scheme and associated receptors, are no more vulnerable than any other development; and
 - Events that could occur, and to which the Scheme is particularly vulnerable, or which the Scheme has a particular capacity to exacerbate.
- 5.6.11. A screening stage was undertaken to try to identify this third group of major events, which then formed the shortlist of events to be taken forward for further consideration.

Stage 3

- 5.6.12. Stage 2 of the assessment resulted in a short list of major events that are considered to need further consideration at Stage 3, though this may only mean that the risk needs to remain on the design risk register until it is closed out through design. Specific major events that have been included on the short list and are considered in more detail are presented in Table 5-6.

Table 5-6 - Major events shortlisted for further consideration

Major Event	Reason for Consideration	Potential Receptors	Consequence	Mitigation
Geological disasters				
Ground instability	Works being undertaken underground may cause instability of the ground surrounding the Scheme.	Gardens users, infrastructure and property, surrounding environment and road users.	Causalities, damage to infrastructure and property, disruption to services.	Yes – within the Ground Investigation and Scheme design. The risk can be mitigated through design. There is a risk that the cost of construction may increase due to additional mitigation.
Hydrological Disasters				
Floods	Both the vulnerability of the Scheme to flooding, and its potential to exacerbate flooding, are covered in the Flood Risk Assessment and are also reported in EIA terms in the Water Quality and Flood Risk Chapter in the ES (Chapter 12). Both assessments address the risk to the Scheme and any increased risk due to the Scheme. A Flood Risk Assessment has concluded that although the site is in Flood Risk Zone 3 the site is heavily protected by flood defences that can cope with climate change and sea level rise and there is scope for the existing defence system to be improved to manage flood risk on the Thames. The timing of the defence raising will depend on the rate of sea level rise. Mitigation included in the Scheme design will ensure the risk is acceptable.	Gardens users, infrastructure and property, surrounding environment.	Causalities, damage to infrastructure and property, disruption to services.	The Environment Agency states that it is confident the TE2100 plan can cope with the changing climate and sea level rise and can improve the existing defence system to manage flood risk on the Thames. The timing of defence raising will depend on the rate of sea level rise. Sustainable drainage systems (SuDs) will be implemented to ensure surface water is drained in line with the surface water hierarchy and not increase the risk of flooding from surface water.
Tsunami/Storm Surge	The Scheme is located adjacent to the River Thames which is tidal. An increase in tidal level above the design level of the existing defences may result in flooding.	Gardens users, infrastructure and property, surrounding environment.	Causalities, damage to infrastructure and property, disruption to services.	The Environment Agency states that they are confident the TE2100 plan can cope with the changing climate and sea level rise and can improve the existing defence system to manage flood risk on the Thames. The timing of defence raising will depend on the rate of sea level rise.
Engineering Accidents/Failures				
Utilities failure (gas, electricity, water, sewage, oil, communications)	Numerous utility routes run adjacent to the Scheme that could fail and cause damage to the Scheme.	Gardens users, local residents, property, surrounding environment.	Potential for fire/explosion, pollution incident, injury.	All utilities companies have plans and arrangements in place to deal with supply disruptions and failures.
Flood defence/reservoirs	The Flood Risk Assessment considers the risk of flooding should a designated reservoir or flood defence fail. The Scheme is in close proximity to the River Thames flood and tidal defences. There is not considered to be any increased risk to the Scheme as a result of the defences and reservoirs.	Gardens users, infrastructure and property, surrounding environment.	Causalities, damage to infrastructure and property, disruption to services.	The Environment Agency states that they are confident the TE2100 plan can cope with the changing climate and sea level rise and can improve the existing defence system to manage flood risk on the Thames. The timing of defence raising will depend on the rate of sea level rise.
Terrorism/Crime/Civil Unrest				
Bomb/vehicle attack on infrastructure	The new Holocaust Memorial and Learning Centre may become a target for a terrorism or attack. A Security Statement has been prepared for the Scheme which details the security solutions which have taken account both criminal and terrorism concerns. The Scheme is unlikely to be any more of a target for this attack than currently exists and is therefore not considered further.	Gardens users, infrastructure and property, surrounding environment.	Causalities, damage to infrastructure and property, disruption to services	Within the Security Statement and design. A security area will be built to process all visitors through, limits on bag sizes, searching and screening regimes and other security regimes.

5.7 Assessment chapter structure

- 5.7.1. In the following chapters the environmental assessments for each of the environmental topics scoped in are presented.
- 5.7.2. Each assessment chapter follows, to the greatest extent, the same structure to maximise consistency and to ease the reading. Each assessment chapter has the following sub-headings:
- **Scope of the assessment** - Sets out what has been assessed. This is informed by the Scoping Opinion and the consultation responses undertaken at the scoping stage;
 - **Relevant planning and policy legislation** - Describes why the assessments have been undertaken by setting out the legislative basis for the assessment;
 - **Area of Influence** - Describe the criteria considered in determining the area of influence and the extent of the study area considered;
 - **Baseline Conditions** - Describe how the baseline was established and report the results of the analysis;
 - **Method of assessment** - Describes how the assessments have been undertaken, the criteria adopted to determine the sensitivity of the receptors and the impact severity;
 - **Impact assessment** - This chapter will include the analysis and assessment of the impacts;
 - **Cumulative Effects** - Provide qualitative considerations about potential cumulative effects. The cumulative impact is assessed exhaustively in a dedicated Chapter (Chapter 15);
 - **Mitigation measures** - Description of all the mitigation and control measures identified in the impact assessment section;
 - **Residual Effects** - Provides the relevance of impacts considering the effect of mitigations and control measures; and
 - **Summary Table** - A summary table reporting the essential information of each potential impact.

6 Air Quality

6.1 Scope of the assessment

- 6.1.1. The scope of the assessment has been determined in the following way:
- Consultation with the Environmental Health Officer (EHO) at Westminster City Council (WCC) to agree the scope of the assessment and the methodology to be applied;
 - Review of the air quality data for the local area as published by WCC⁶, Defra⁷, the Environment Agency (EA)⁸, London Air Quality Network⁹ and the Greater London Authority (GLA) London Atmospheric Emissions Inventory (LAEI)¹⁰; and
 - Desk study to confirm the location of nearby existing receptors that may be sensitive to changes in local air quality due to construction phase activities.
- 6.1.2. The scope of the assessment includes consideration of the potential impacts on local air quality resulting from:
- Dust and particulate matter generated by on-site activities during the construction phase;
 - Increases in pollutant concentrations due to exhaust emissions arising from construction traffic and plant; and
 - Increases in pollutant concentrations due to exhaust emissions arising from traffic generated by the Scheme once operational.
- 6.1.3. In addition, an air quality neutral assessment of building and transport emissions in the operational phase in accordance with GLA requirements has been undertaken.
- 6.1.4. A glossary of terms used in this Chapter is presented in Volume 5 Appendix E.1.

6.2 Response to Scoping Opinion

Table 6-1 - Summary of responses to stakeholder scoping opinions

Stakeholder	Comment	Response
Claire Parsons Westminster City Council (WCC), Senior Practitioner, Environmental Services, Regulatory Support Team 1	Ref. 18/06416/EIASCRC "An air quality neutral assessment must be provided for this development proposal. Overall, I am satisfied with the proposed approach. Please note comments are also provided to WSP on the proposed methodology for the air quality assessment".	An air quality neutral assessment has been included in Chapter 6. Comments on the proposed air quality methodology (email correspondence 5/10/2018) have been addressed in the Chapter. Including information about the trip generation and confirmation of the proposed onsite energy generation strategy in order to scope out a detailed modelling assessment for the operational phase of the Scheme.

⁶ Westminster City Council (2018) Air Quality Annual Status Report for 2017

⁷ Defra Local Air Quality Management (LAQM) Support Pages. Available at: <http://laqm.defra.gov.uk/>. Accessed on 06/09/2018

⁸ Environment Agency. <http://maps.environment-agency.gov.uk>. Accessed on 06/09/2018

⁹ London Air Quality Network Website. Available at: <http://www.londonair.org.uk>. Accessed on 06/09/2018.

¹⁰ London Atmospheric Emissions Inventory (LAEI). Available at: <https://data.london.gov.uk/dataset/london-atmospheric-emissionsinventory-2013>. Accessed 06/09/2018

¹¹ Department for Communities and Local Government (2018). National Planning Policy Framework.

¹² Mayor of London: Cleaning London's air, The Mayor's Air Quality Strategy (December 2010).

6.3 Relevant planning policy & legislation

Planning Policy

Table 6-2 - Policy Overview

Scale	Policy Document	Key Considerations for the Scheme
National	National Planning Policy Framework (NPPF) ¹¹	<i>Paragraph 180: "Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development."</i>
Regional	The Mayor's Air Quality Strategy for London ¹²	The Strategy requires that: "New developments in London shall as a minimum be 'air quality neutral' through the adoption of best practice in the management and mitigation of emissions".
	The London Plan: Spatial Development Strategy for Greater London – Policy 7.14 ¹³	The London Plan sets out to: "Promote sustainable design and construction in order to reduce emissions from the demolition and construction of buildings following the best practice guidance in the GLA and London Councils' 'The control of dust and emissions from construction and demolition'; "Be at least 'air quality neutral' and not lead to further deterioration of existing poor air quality".
Local	Westminster City Plan - Policy S31 ¹⁴	"Developments that include uses that are more vulnerable to air pollution (Air Quality Sensitive Receptors) will minimise the impact of poor air quality on occupants through the design of the building and appropriate technology".
	Westminster Code of Construction Practise (CoCP) ¹⁵	Section 7.3, which states submission of an "Air Quality (Dust) Risk Assessment (as set out in the Mayor's Planning Guidance) and a timetable of construction and demolition activities accompanied with proposed dust and emissions control measures. These measures will be based on those set out in the Mayor's Planning Guidance."

Legislation

Ambient Air Quality Directive

- 6.3.1. The European Union (EU) Ambient Air Quality Directive (2008/50/EC)¹⁶ sets legally binding limit values for concentrations in outdoor air of key air pollutants that impact public health including nitrogen dioxide (NO₂) and small particles known as PM₁₀ and PM_{2.5}.

Air Quality Standards Regulations

- 6.3.2. The Air Quality Standards Regulations 2010 (SI 2010, No.1001)¹⁷ (as amended)¹⁸ transpose the Ambient Air Quality Directive (2008/50/EC) into law in England. The Secretary of State is responsible for ensuring limit value compliance. The UK is divided into 43 zones for reporting compliance. London is included within

¹³ Mayor of London (March 2016) The London Plan: Spatial Development Strategy for Greater London Consolidated with alterations since 2011. Accessed 06/09/2018.

¹⁴ City of Westminster (2016). Westminster City Plan. Available at: <https://www.westminster.gov.uk/westminsters-city-plan-strategic-policies>. Accessed September 2018.

¹⁵ City of Westminster (2017). Westminster Code of Construction Practice. Available at: <https://www.westminster.gov.uk/code-construction-practice>. Accessed on 06/09/2018.

¹⁶ European Commission. Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe. Available from <http://ec.europa.eu/environment/air/quality/directive.htm>

¹⁷ UK Statute. The Air Quality Standards Regulations SI 2010 No.1001. Available from <http://www.legislation.gov.uk/uk/si/2010/1001/regulation/1/made>

¹⁸ UK Statute. The Air Quality Standards (Amendment) Regulations SI 2016 No.1184. Available from <https://www.legislation.gov.uk/uk/si/2016/1184/contents/made>

the Greater London Urban Area agglomeration zone (UK0001). The relevant limit values are included in Table 6-3.

Table 6-3 - Relevant Air Quality Assessment Levels (Limit Values and Objectives)

Pollutant	Averaging Period	Objective
Nitrogen Dioxide (NO ₂)	1-hour mean	200µg/m ³ not to be exceeded more than 18 times a year (99.79th percentile) – see Notes
	Annual mean	40µg/m ³
Particulate Matter (PM ₁₀)	Annual mean	40µg/m ³
	24-hour mean	50µg/m ³ not to be exceeded more than 35 times a year (90.41th percentile)
PM _{2.5} (particulate matter less than 2.5 micrometres in diameter)	Annual mean	25µg/m ³

Notes:
 1. Units of concentration micrograms per cubic metre (µg/m³)
 2. As a rule, the 1-hour mean NO₂ objective/limit value is unlikely to be breached if the annual mean is less than 60 µg/m³

Environment Act

6.3.3. Under Part IV of the Environment Act 1995 (c.25)¹⁹, local authorities have responsibility for Local Air Quality Management (LAQM) and must aim to meet national objectives for air quality. Where the objectives are not likely to be achieved, the local authority must declare an Air Quality Management Area (AQMA). The local authority is then required to produce an Air Quality Action Plan (AQAP) to improve air quality and work towards achieving the air quality objectives.

Air Quality Regulations

6.3.4. The Air Quality (England) Regulations 2000 (SI 2000, No.928)²⁰ (as amended)²¹ set out objectives for key air pollutants that affect human health and are relevant to LAQM. The objective thresholds are numerically the same as limit values (Table 6-3). The objectives apply only in the external environment and at locations with relevant exposure.

Environmental Protection Act 1990

6.3.5. Section 79 of the Environmental Protection Act 1990²² gives the following definitions of statutory nuisance relevant to dust and particles:

6.3.6. *“Any dust, steam, smell or other effluvia arising from industrial, trade or business premises or smoke, fumes or gases emitted from premises so as to be prejudicial to health or a nuisance”;* and *“Any accumulation or deposit which is prejudicial to health or a nuisance”.*

6.3.7. Following this, Section 80 says that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses.

6.3.8. There are no statutory limit values for dust deposition above which ‘nuisance’ is deemed to exist. Nuisance is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred.

6.4 Area of Influence

6.4.1. In accordance with the IAQM, an air quality assessment is undertaken where there are: ‘human receptors’ within 20m, 50m, 100m, 200m and 350m of the site boundary (Figure 6-1 in Volume 4), or within 50m of the

route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s); and/or ‘ecological receptors’ within 50m of the site boundary, or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s). It is within these distances that the impacts of dust soiling and increased particulate matter in the ambient air will have the greatest impact on local air quality at sensitive receptors.

6.4.2. Changes in concentrations of NO₂, PM₁₀ and PM_{2.5} at existing receptors along likely construction traffic routes within 500m of the site have been considered.

6.5 Baseline Conditions

Westminster City Councils (WCC) Review and Assessment of Air Quality

6.5.1. WCC has identified potential exceedances of the annual mean NO₂ (40µg/m³) and the daily (24-hour) mean PM₁₀ (50µg/m³ not to be exceeded more than 35 times a year) Air Quality Strategy (AQS) objectives. Therefore, they have declared a borough wide (AQMA). The main source of pollution within WCC is road emissions. The Scheme lies within the AQMA.

Local Emission Sources

6.5.2. The main source of key air pollutants around the Scheme are road traffic emissions using Millbank (A3212) with minor contributions from Horseferry Road and Lambeth Bridge (A3203). These contribute to the ambient concentrations of NO₂, NO_x, PM₁₀ and PM_{2.5}. The impacts of road traffic emissions on these pollutants tend to be most pronounced at roadside, with concentrations declining rapidly from the kerb towards background levels within 200m (but assuming there are no other notable sources within this distance).

6.5.3. There are no industrial pollution sources in the immediate vicinity of the Scheme that will influence the local air quality.

Local Authority Air Quality Monitoring Data

6.5.4. The nearest established monitoring station is located off Horseferry Road, before the junction with Regency Street, at approximately 490m to the west of the Scheme boundary. This monitoring station is maintained as part of Defra’s Automatic Urban and Rural Network (AURN) as well as the London Air Quality Network (LAQN) of which WCC is a participating local authority. Monitored concentrations of NO₂ and PM₁₀ for 2013 to 2017 inclusive are given in Table 6-4. The monitoring station is not at roadside and provides measurements that are representative of background conditions; it’s official classification is as an ‘urban background’ site.

Table 6-4 - Local Authority Monitoring Data 2013 to 2017

Monitoring Site	Pollutant	2013	2014	2015	2016	2017
Horseferry Road (Urban Background)	NO ₂	45	46	39	37	36
		0	0	0	0	0
	PM ₁₀	No data	19	17	17	17
		No data	8	3	6	6

Notes:
 1. Data taken from WCC 2017 Annual Status Report, https://www.westminster.gov.uk/sites/default/files/asr_london_2017_final_westminster_city_council_002.pdf (accessed 05/09/2018).
 2. Concentrations in bold italics indicates non-compliance with the relevant AQS objective.

19 UK Act. Environment Act 1995 c.25. Available from <http://www.legislation.gov.uk/ukpga/1995/25/contents>
 20 UK Statute. The Air Quality (England) Regulations SI 2000 No.928. Available from <http://www.legislation.gov.uk/uksi/2000/928/contents/made>

21 UK Statute. The Air Quality (England) (Amendment) Regulations SI 2002 No.3043. Available from <http://www.legislation.gov.uk/uksi/2002/3043/contents/made>
 22 UK Act. Environmental Protection Act 1990 c.43. Available from <https://www.legislation.gov.uk/ukpga/1990/43/contents>

6.5.5. Table 6-4 shows that whilst there is some inter-year variability and reduction in background annual mean NO₂, there is no consistent long-term trend.

6.5.6. Monitored background annual and daily mean PM₁₀ concentrations have been compliant with the AQS objectives for the for the last 5 years. Annual mean PM₁₀ concentrations have decreased by 2µg/m³ over the past 5 years. This has been accompanied by a small reduction in the number of exceedances of the daily mean threshold of 50µg/m³ from eight in 2013 to six in 2017.

Current and Future Baseline

LAEI Models for 2013

6.5.7. The 2013 LAEI projected emissions (Appendix E.4 in Volume 5) show that road traffic emissions currently the greatest source of NO_x in the Borough, domestic and commercial gas combustion are the second largest contributor to NO_x emissions. Decreases in pollutant emissions from other source sectors are also expected to occur in future years, most noticeably the predicted substantial decrease in Non-Road Mobile Machinery (NRMM) NO_x emissions from 2013 to 2020 due to the introduction of sector-specific emission controls across London by the GLA/Mayor of London in coming years.

6.5.8. Baseline annual mean NO₂ concentrations at the Scheme boundary exceed the AQS objective, ranging between 50 and 91 µg/m³ (Figure 6-2 in Volume 4). The highest concentrations occur next to the A3212 Millbank and at the junction with Horseferry Road and Lambeth Bridge. Annual mean concentrations are lower within the Scheme boundary but still around 46µg/m³. Consequently (with reference to Table 6-3), users of Victoria Tower Gardens are unlikely to experience 1-hour mean NO₂ concentrations exceeding 50µg/m³ more than 18 times a year although pedestrians on Millbank and Lambeth Bridge are likely to be exposed to 1-hour mean concentrations that breach the AQS objective.

6.5.9. The 2013 baseline annual mean PM₁₀ (Figure 6-3) and PM_{2.5} (Figure 6-4) concentrations within and around the Scheme comply with AQS objectives. PM₁₀ concentrations at the Scheme boundary are in the range 28 - 35µg/m³, and PM_{2.5} concentrations are in the range 17 - 20 µg/m³. As with NO₂, annual mean PM₁₀ and PM_{2.5} concentrations are lower away from the roadside.

LAEI Models for 2020

6.5.10. The LAEI predicts that annual mean NO₂, PM₁₀ and PM_{2.5} concentrations will be lower in 2020 than in 2013. Concentrations for these pollutants are illustrated Figure 6-5, Figure 6-6 and Figure 6-7. Annual mean NO₂ concentrations are expected to be close to the AQS objective (40µg/m³) at the Scheme boundary. Figure 6-5 shows that annual mean NO₂ concentrations within the Scheme boundary are expected to be around 35µg/m³, which is below the AQS objective.

6.5.11. Figure 6-6 and Figure 6-7 illustrate the 2020 baseline annual mean PM₁₀ and PM_{2.5} concentrations respectively within and around the Scheme. PM₁₀ and PM_{2.5} concentrations comply with AQS objectives.

Sensitive Receptors

6.5.12. The list of the key sensitive receptors with the potential to be affected during the construction phase of the Scheme is given in Table 6-5.

Table 6-5 - Sensitive Receptors

Distance from the Source (m)	Approximate Number of Receptors (Range)	Details
20	10-100	Office, retail, residential land use along Milbank Road, including 1 Milbank, 2 Milbank House, 4 Milbank, Westminster House, Cromwell House, Northwest House.
50	10-100	Office, retail, residential land use along Milbank Road, Great College Street, Great Peter Street, Dean Stanley Street, Hornsey Road, including 1 Milbank, 2 Milbank House, 4 Milbank, Westminster House, Cromwell House, Northwest House, Kings Building, Defra Building, and the Houses of Parliament.
100	>100	Office, retail, residential land use along Great College Street, Little College Street, Great Peter Street, Smith Square, Dean Stanley Street,

Distance from the Source (m)	Approximate Number of Receptors (Range)	Details
20	10-100	Office, retail, residential land use along Milbank Road, including 1 Milbank, 2 Milbank House, 4 Milbank, Westminster House, Cromwell House, Northwest House.
		Horseferry Road, Thorney Street, Lord North Street, including the Security Service (MI5), Ergon House, Local Government Association, Kings Building, Westminster House, Fielden House, the Houses of Parliament.
200	>100	Office, retail, residential land use along Great College Street, Little College Street, Great Peter Street, Smith Square, Horseferry Road, Dean Ryle Street, Thorney Street, Lord North Street, including, Local Government Association, Kings Building, Westminster House, Fielden House, the Houses of Parliament, The Home Office HM Prison Service Headquarters, Ergon House, the Security Service (MI5),
350	>100	Office, retail, residential, educational, museums, hospital land use along Great College Street, Smith Square, Great Peter Street, Lord North Street, Barton Street, Cowley Street, Gayfere Street, Milbank, Tufton Street, Marsham Street, Victoria Street, Storey Street, Page Street, Lambeth Bridge, Lambeth Palace Road, Westminster Bridge Road, Albert Embankment including the Houses of Parliament, Westminster Mansions, the Department of Education, The Home Office, the Security Service (MI5), St Thomas Hospital, The Audit Commission.

6.6 Method of assessment

Construction Phase Assessment

- 6.6.1. An assessment of the likely significant impacts on local air quality due to the generation and dispersion of dust and PM₁₀ during the construction phase has been undertaken with reference to: The Mayor of London's supplementary planning guidance (SPG) for the control of dust and emissions during construction and demolition; the available information for this phase of the Scheme provided by the Client and Project Team; and professional judgement.
- 6.6.2. The Mayor of London's SPG requires a Dust Risk Assessment to be undertaken following the methodology published by the IAQM, which assesses the risk of potential dust and PM₁₀ impacts from the following four sources: demolition; earthworks; general construction activities and track-out. It accounts for the nature and scale of the activities undertaken for each source and the sensitivity of the area to an increase in dust and PM₁₀ levels to assign a level of risk. Risks are described in terms of there being a low, medium or high risk of dust impacts. Once the level of risk has been ascertained, then site specific mitigation proportionate to the level of risk is identified, and the significance of residual effects determined. A summary of the IAQM assessment methodology is provided in Appendix E.3 in Volume 5.
- 6.6.3. In addition to impacts on local air quality due to on-site construction activities, exhaust emissions from construction vehicles and plant may have an impact on local air quality adjacent to the routes used by these vehicles to access the Scheme and in the vicinity of the Scheme itself. As detailed information on the number of vehicles and plant associated with the construction phase was not available at the time of writing, a qualitative assessment of their impact on local air quality has been undertaken using professional judgement and by considering the following:
- The number of type of construction traffic and plant likely to be generated by this phase of the Scheme;
 - The number and proximity of sensitive receptors to the Scheme and along the likely routes to be used by construction vehicles; and
 - The likely duration of the construction phase and the nature of the construction activities undertaken.

Operational Phase Assessment

Vehicle and Onsite Energy Generation Emissions

- 6.6.4. The Scheme is excluding car parking spaces and vehicle trips will only be associated with blue badge holders, coaches and exhibition changeovers. The expected vehicle movements are 27 light duty vehicles (LDV) and 14 heavy duty vehicles (HDV) per day. Based on the joint EPUK and IAQM 'planning for air quality' guidance²³, the number of vehicles do not exceed the 100 LDV or 25 HDV thresholds for indicating the need for an air quality assessment. Therefore, any impacts from vehicle emissions on air quality associated with the Scheme are unlikely to be significant and are scoped out of further assessment.
- 6.6.5. In relation to onsite energy generation, ground source heat pumps are proposed to provide heating and cooling for the Scheme. Joint EPUK and IAQM guidance advises combustion sources for onsite energy generation with less than 450kW capacity are unlikely to cause noticeable impacts. Therefore, based on the proposed onsite energy generation for the Scheme, emissions are not considered to be significant and are scoped out of further assessment.
- Mayor of London's Air Quality Neutral Policy**
- 6.6.6. An air quality neutral assessment has been undertaken following the methodology provided in the Mayor of London's SPG on Sustainable Design and Construction and further guidance from the 'Air Quality Neutral Planning Support' document.
- 6.6.7. The air quality neutral assessment takes into account figures pertaining to the Gross Floor Area (GFA) and anticipated development trip rates once operational for each planning use class proposed. In this case, the Gross Internal Area (GIA) has been used as a substitute for GFA. These figures are based on information provided by the Project Team and are presented in Table 6-6.

Table 6-6 - Sensitivity of Receptors for Air quality- Construction Phase

Parameter	Scheme Value
Gross Floor Area (m ²) ¹	Learning Centre 3,258 m ² Entrance Pavilion 95 m ² Cafe Kiosk 41 m ²
Annual Vehicle Trip Generation ²	9,746 cars (blue badge holders); 4,958 coaches; 40 HGVs for exhibition changeover

Note: 1. Information provided by Adjaye Associates, Lead Architect; 2. Indicative information provided by Transport Team.

- 6.6.8. For the calculation of the Transport Emissions Benchmark (TEB), the average distance travelled by vehicles was unavailable for the proposed learning centre use (assuming a land use class 'D1'). To calculate the TEB for D1 use, the approach provided in the SPG requires a comparison of the development trip generation against the 'Trip Rate Assessment Valid for London' (TRAVL) benchmark (trips/m²/annum) for D1 use. Therefore, the TRAVL benchmark trip rate for the land use class D1 in Central London, 0.07 trips/m²/annum, was used for comparison with the estimated trip generation for the Scheme.

Sensitivity of the Receptors

Construction Phase

- 6.6.9. Sensitive locations are places where the public or sensitive ecological habitats may be exposed to pollutants resulting from activities associated with the Scheme. These include locations sensitive to an increase in dust deposition and PM₁₀ exposure due to on-site construction activities, and locations sensitive to exposure to gaseous pollutants emitted from the exhausts of construction traffic associated with the Scheme. Sensitive receptors for the construction phase are presented in Table 6-7

Table 6-7 - Sensitivity of Receptors for Air quality

Sensitivity of Receptor	Importance / resilience of receptors	
	Dust Soiling Effects	Health Effects of PM ₁₀
High	Users can reasonably expect enjoyment of a high level of amenity; or The appearance, aesthetics or value of their property would be diminished by soiling; and The people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Indicative examples include dwellings, museums and other culturally important collections and long-term car parks and showrooms.	Locations where members of the public are exposed over a period relevant to the air quality objective for PM ₁₀ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). Indicative examples include residential properties, hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.
Medium	Users would expect to enjoy a reasonable level of amenity, but would reasonably expect to enjoy the same level of amenity as their home; or The appearance, aesthetics or value of their property could be diminished by soiling; or The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land Indicative examples include parks and places of work	Locations where the people exposed are workers, and exposure is over a period relevant to the air quality objective for PM ₁₀ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). Indicative examples include office and shop workers, but will generally not include workers occupationally exposed to PM ₁₀ , as protection is covered by Health and Safety at Work legislation.
Low	The enjoyment of amenity would not reasonably be expected; or Property would no reasonably be expected to be diminished in appearance aesthetics or value by soiling; or There is transient exposure, where people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Indicative examples include playing fields, farmland, footpaths short term car parks and roads.	Locations where human exposure is transient Indicative examples include public footpaths, playing fields, parks and shopping streets.

Impact severity

- 6.6.10. The assessment of potential effects has taken into account the construction stage. The significance level attributed to each effect has been assessed based on the magnitude of change due to the Scheme and the sensitivity of the affected receptor are summarised in Appendix E.3 in Volume 5.

Construction Phase

- 6.6.11. For the construction stage, IAQM guidance regarding determination of the significance of effect has been followed, where:
- 6.6.12. "IAQM recommends that significance is only assigned to the effect after considering the construction activity with mitigation. It is, therefore, important that the mitigation measures are defined in a form suitable for implementation by way of a planning condition or legal obligation within a section 106 agreement, and are

²³ Environmental Protection UK and Institute of Air Quality Management (Version 1.2 Updated January 2017). Land Use Planning & Development Control: Planning for Air Quality.

included in a DMP or a more general Code of Construction Practice or Construction Environmental Management Plan.”

- 6.6.13. “For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be ‘not significant’.”

6.7 Potential Impacts

Construction Phase

6.7.1. Construction activities that have the potential to generate and/or re-suspend dust and PM₁₀. include:

- Site clearance and preparation;
- Preparation of temporary access/egress to the Scheme and haulage routes;
- Earthworks;
- Materials handling, storage, stockpiling, spillage and disposal;
- Movement of vehicles and construction traffic within the Scheme (including excavators and dumper trucks);
- Use of crushing and screening equipment/plant;
- Exhaust emissions from site plant, especially when used at the extremes of their capacity and during mechanical breakdown;
- Construction of buildings, roads and areas of hardstanding alongside fabrication processes;
- Internal and external finishing and refurbishment; and
- Site landscaping after completion.

6.7.2. Most releases are likely to occur during the 'working week'. However, for some potential release sources (e.g. exposed soil produced from significant earthwork activities) in the absence of dust control mitigation measures, dust generation has the potential to occur 24 hours per day over the period during which such activities are to take place.

Assessment of Potential Dust Emission Magnitude

6.7.3. The IAQM assessment methodology has been used to determine the potential dust emission magnitude for the following four different dust and PM₁₀ sources: demolition; earthworks; construction; and, trackout. The findings of the assessment are presented below.

Demolition

6.7.4. No demolition activities will occur at the Scheme as part of the construction phase. Therefore, consideration of the impact of this source on dust soiling and ambient PM₁₀ is not required.

Earthworks

6.7.5. The total area of the Scheme is more than 10,000m², the soil type is clay and therefore potentially dusty, and the total material that will be moved is estimated to be between 20,000 and 100,000 tonnes. It is also estimated that less than five heavy earth moving vehicles will be active at any one time. Therefore, the potential dust emission magnitude is 'medium' for earthwork activities.

Construction Activities

6.7.6. The total volume of buildings to be constructed on the Scheme will be approximately 25,000m³ (which lies in the IAQM range of 25,000m³ and 100,000m³) with potentially dusty construction materials being used. Therefore, the potential dust emission magnitude is 'medium' for construction activities

Trackout

6.7.7. Detailed information on the number of heavy duty vehicles (HDVs) associated with this phase of the Scheme is not available and therefore professional judgement has been used. It has been assumed that given the size of the development area there are likely to be 10 - 50 HDV outward movements in any one day. The potential dust emission magnitude is 'medium' for trackout.

6.7.8. Table 6-8 summarises the potential dust emission magnitude determined for each relevant construction activity.

Table 6-8 - Potential Dust Emission Magnitude

Activity	Dust Emission Magnitude
Earthworks	Medium
Construction Activities	Medium
Trackout	Medium

Assessment of the Sensitivity of the Study Area

6.7.9. There are no sensitive ecological receptors within 50m of the boundary of the Scheme. Therefore, the need to assess the impact of construction dust on ecological receptors has been screened out.

6.7.10. A wind rose generated using the 2016 meteorological data used from the nearest meteorological observing station, at London City Airport, is presented in Appendix E.5 in Volume 5. This shows that the prevailing wind direction is from the southwest with a small component from the east. Therefore, receptors located to northeast and west of the Scheme are more likely to be affected by dust and particulate matter emitted and re-suspended during the construction phase.

6.7.11. Under low wind speed conditions, it is likely that most dust would be deposited in the area immediately surrounding the source. Much of the area surrounding the Scheme and along the construction routes is comprised of a mixture of residential and commercial/office premises.

6.7.12. The annual mean PM₁₀ with reference to LAEI data for 2013 is at worst 34µg/m³ along the A3212 Millbank, Horseferry Road, Millbank and Lambeth Bridge (A3203) form the main ingress and egress routes construction vehicles are expected to use, so receptors along these links are likely to be affected by dust trackout.

6.7.13. Taking the above into account and following the IAQM assessment methodology, the sensitivity of the area to changes in dust and PM₁₀ has been derived for each of the construction activities considered. The results are shown in Table 6-9..

Table 6-9 - Sensitivity of the Study Area

Potential Impact	Sensitivity of the Surrounding Area		
	Earthworks	Construction Activities	Trackout
Dust Soiling	High	High	High
Human Health	High	High	High

Risk of Impacts

6.7.14. The predicted dust emission magnitude has been combined with the defined sensitivity of the area to determine the risk of impacts during the construction phase, prior to mitigation (please see Appendix E.3 in Volume 5).

6.7.15.

6.7.16.

6.7.17. Table 6-10 below provides a summary of the risk of dust impacts for the Scheme. The risk category identified for each construction activity has been used to determine the level of mitigation required.

Table 6-10 - Summary Dust Risk Table to Define Site Specific Mitigation

Potential Impact	Risk		
	Earthworks	Construction Activities	Trackout
Dust Soiling	Medium	Medium	Medium
Human Health	Medium	Medium	Medium

6.7.18. Based on the criteria detailed in the Mayor of London’s SPG for the control of dust and emissions during construction, the risk of dust impacts associated with the Scheme would be the same as that shown in Table 6-10.

Construction Vehicles and NRMM

6.7.19. The greatest impact on air quality due to emissions from vehicles and NRMM associated with the construction stage will be in the areas immediately adjacent to the site access. It is anticipated that construction traffic will access the site via Millbank (A3212), Horseferry Road and Lambeth Bridge (A3203). Due to the size of the site, it is likely that the construction traffic increment will be relatively small in comparison to the existing traffic flows on these roads.

6.7.20. The exact NRMM to be used will be determined by the appointed contractor. The number of NRMM and their location within the Scheme are likely to be variable over the construction period.

6.7.21. Based on the current local air quality conditions in the area, the proximity of sensitive receptors (high sensitivity) to the roads likely to be used by construction vehicles, the likely numbers of construction vehicles (low severity), and NRMM that will be used (low severity), the impacts are therefore considered to be minor and not significant without mitigation measures in place.

Operation Phase

Air Quality Neutral Assessment

6.7.22. The findings of the air quality neutral assessment based for transport emissions associated are given in Table 6-11.

Table 6-11 - Summary of Air Quality Neutral Assessment

Land Use Class	GIA (m2)	Annual Two-Way Trip	Trip Rate (trips/m2/annum)	Benchmark Trip Rate (trips/m2/annum)
D1	3,384	14,744	4.4	0.07

6.8 For the Scheme, the average number of trips is 4.4 trips/m²/annum. This is above the benchmark trip rate of 0.07 trips/m²/annum given in the air quality neutral assessment guidance for D1 use in Central London area. Therefore, the proposed use is not air quality neutral.

Cumulative Effects

6.8.1. Relevant committed developments in the area which could interact with the Scheme are described within Chapter 15 Cumulative Effects. The potential for cumulative effects in relation to air quality during the construction and operational phases of the Scheme are discussed below.

Construction

6.8.2. According to the IAQM guidance, dust and PM₁₀ impacts associated with a construction site will be limited to zones within 350m of the site boundary and within 50m of construction vehicle routes up to 500m from the site access point(s). Cumulative impacts could therefore arise if there are other construction projects

ongoing at the same time with overlapping dust impact zones. The developments with potential cumulative impacts include: 52 Horseferry Road (15/07690/FULL), 20 Great Smith Street (17/09875/FULL), 32-34 Great Peter Street and 12 Dacre Street (17/01327/FULL); 32-34 Great Peter Street (15/07778/FULL), 55 Broadway (14/10496/FULL) and 36-46 Albert Embankment (16/00795/FULL) as illustrated in Figure 15.2 in Volume 4.

6.8.3. Mitigation measures proposed in Section 6.8 will minimise the impact of dust and PM₁₀ emissions associated with the Scheme. It is expected that similar measures will be in place in any nearby construction works that are ongoing at the same time. Consequently, any cumulative impacts would be minimised and unlikely to be significant.

Operational

6.8.4. The Scheme will have negligible contribution to cumulative air quality impacts. Therefore, no specific mitigation is required to address cumulative air quality impacts during the operational phase. Mitigation measures

6.9 Mitigation Measures

Construction Phase

6.9.1. Based on the dust assessment result, mitigation will be required. Mitigation measures for a “Medium Risk” site for earthwork activities, construction and trackout, will be in place following the recommendation from the IAQM Guidance. Some of the key mitigation measures include the following:

- A Dust Management Plan (DMP) to be implemented and approved by WCC;
- A stakeholder communications plan that includes community engagement before work commences on site should be developed and implemented;
- All dust and air quality complaints to be recorded and causes identified. Complaints log will be made available to WCC request;
- Any exceptional incidents that cause dust and/or air emissions, either on- or offsite will be recorded, and an action will be taken to resolve the situation recorded in a log book; and
- Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone and the London NRMM standards.

Operation Phase

6.9.2. The air quality neutral assessment shows that the Scheme is above the benchmark for transport emissions based on the TRAVL benchmark. To reduce vehicle emissions, the Scheme is proposing a green travel plan to encourage cycling, promote the use of public transport, the use of electric vehicle and low emissions vehicles.

6.10 Residual Effects

Construction

6.10.1. The impacts of dust and PM₁₀ generated by construction activities following the application of the mitigation measures described above and good site practice are negligible.

6.10.2. The impacts of emissions to air from construction vehicles and plant on local air quality are negligible.

Operation

6.10.3. The residual effect of the Scheme during the operational stage on local air quality are negligible.

6.11 Summary Table

Table 6-12 - Construction dust risk assessment

Activity	Baseline	Impact assessment			Mitigation	
Impact	Receptor	Receptor Sensitivity	Dust emission magnitude	Risk before Mitigation	Mitigation Measures	Residual Effect
Earthworks, on dust and PM ₁₀ concentrations	Residential, commercial, offices, River Thames.	High	Medium	Medium	Mitigation measures as described in section 6.9.1.	Negligible
Construction, on dust and PM ₁₀ concentrations	Residential, commercial, offices, River Thames.	High	Medium	Medium		Negligible
Trackout, on dust and PM ₁₀ concentrations	Residential, commercial, offices, River Thames.	High	Medium	Medium		Negligible

Table 6-13 - Construction phase air quality assessment

Activity	Baseline	Impact assessment			Mitigation	
Impact	Receptor	Receptor Sensitivity	Impact Severity	Effect before Mitigation	Mitigation Measures	Residual Effect
Construction vehicles and plant on NO ₂ and PM ₁₀ & PM _{2.5} concentrations	Residential, commercial, offices.	High	Medium	Minor	Mitigation measures as described in section 6.9.1.	Negligible

7 Built Heritage, Townscape and Visual Impact Assessment

For the full Built Heritage, Townscape and Visual Impact Assessment please see Volume 3 of the Environmental Statement.

8 Archaeology

8.1 Scope of the assessment

8.1.1. This chapter of the Environmental Statement was prepared by an Atkins Heritage Consultant. It covers the potential impacts of the Scheme upon buried archaeological assets (buried heritage assets) only and does not cover the historic built environment, including non-direct impacts, such as setting. These are covered in Chapter 7 Built Heritage Townscape and Visual. It is supported by a detailed desk-based assessment, which forms a technical appendix to this chapter (Volume 5 Appendix F).

8.2 Responses to scoping opinion

8.1.2. There were no responses to the scoping opinion request specific to Archaeology.

8.3 Relevant planning policy & legislation

Table 8-1 - Policy overview

Scale	Policy Document	Key Considerations for the Scheme
National	National Planning Policy Framework 2018	The significance of any heritage assets affected by an application are to be assessed to a level proportionate to their importance in a manner sufficient to understand the potential impact on their significance. At a minimum this requires consultation with the respective Historic Environment Record. Footnote 63 states that non-designated assets of archaeological interest which are demonstrably as significant as scheduled monuments should be considered to the same policies for designated assets.
Regional	The London Plan 2018	New developments should make provision for the protection of archaeological resources, landscapes and significant memorials. Where preservation <i>in situ</i> cannot occur, provision for investigation and recording should be made, with the results archived and disseminated.
Local	Westminster City Plan	Policy S25 of the Westminster City Plan does not outline any further considerations for the Scheme.

8.4 Area of Influence

8.4.1. A study area of 250m was considered using professional judgement to be sufficient to place the site into its historical and archaeological background, including for the identification of archaeological potential.

8.5 Baseline Conditions

8.5.1. Baseline conditions for this assessment were established through the production of a Desk-Based Assessment, which forms a technical appendix to this chapter (Appendix F in Volume 5). The assessment was carried out in accordance with of national planning policy (NPPF)²⁴, regional²⁵, and local planning policies²⁶, and in accordance with MHCLG planning practice guidance²⁷, Historic England guidance²⁸ and standards specified by the Chartered Institute for Archaeologists (CIfA)^{29 30}. Data on the historic environment was obtained from the primary repositories of such data, in this instance, the National Heritage

List for England (NHLE), and the Greater London Historic Environment Record (GLHER). Data for the GLHER was obtained on 17/08/2018.

Topography and geology

- 8.5.2. The topographic and geological conditions of the site can be useful in predicting early human settlement. The ground levels on the site are entirely artificial and are recorded at 4.5m – 4.8m above Ordnance Datum (OD).
- 8.5.3. The Site would have historically been within the confluence of the River Thames and River Tyburn. Historic British Geological Survey (BGS) boreholes indicate that Thames gravels are present 9.1m – 10.7m below present ground level, allowing for variations in the underlying topography caused by riverine action (scour). Natural gravels are overlain by alluvial deposits, which are likely heavily waterlogged providing anaerobic conditions suitable for the preservation of organic material, which extend from 6.3m below present ground level. A layer of peat was noted at 8.3m below present ground level, suggesting a period of drying out in the river floodplain.
- 8.5.4. These deposits are overlain by made ground related to land reclamation.

Designated assets

- 8.5.5. The Site lies within the Grade II Registered Victoria Tower Gardens. The gardens also contain four Listed structures, which comprise:
 - The statues of the Burghers of Calais, Grade I Listed;
 - Buxton Memorial Fountain, Grade II* Listed;
 - The statue of Miss Emmeline Pankhurst, Grade II Listed; and
 - River embankment from the Houses of Parliament to Lambeth Bridge, Grade II Listed.
- 8.5.6. Immediately north of the site is the World Heritage Site of the Palace of Westminster and Abbey, which contains the Jewel Tower and Chapter House, both Scheduled Monuments.

Chronological Background

Prehistoric Period (800,000 BC – AD43)

- 8.5.7. For much of the prehistoric period, the site would have been within the confluence of the River Thames and River Tyburn, an ancient tributary of the Thames. The site would have been under water, and unsuitable for early human habitation for much of this period, particularly during the Palaeolithic to Neolithic periods, although it may have been used for wetland exploitation. It is likely that during the Bronze Age, the area around the site dried, as the river waters receded; peat deposits noted in historic boreholes are indicative of drying wetlands, creating landscapes favourable for activity. Past excavations 200m to the north of the site, in St Stephen’s Chapel recorded a timber revetment dating to this period, suggesting activity on the gravel island to the north-west of the site (later, Thorney Island) and an attempt to prevent tidal inundation. A number of bronze artefacts have been recovered from the River Thames including swords and axes, 175m south-east of the site. Whilst these were recovered as chance finds, they may be representative of a wider practice of ritual deposition which occurred during the Bronze and Iron Ages. By the Iron Age, the floodplains had become inundated and the area unsuited to habitation once again.

Roman Period (AD43 – AD410)

- 8.5.8. As in the preceding period, the site would have been within the confluence of the River Thames and River Tyburn at this time. The Roman period is poorly represented in the vicinity of the site, as the area was likely unsuited to intensive settlement. An antiquarian find comprising a concrete floor with tiles, roof tiles and “rubbish” including bone and pottery was noted during excavations for foundations of the new canon’s house in the 19th century, 110m north-west of the site. Further remains of Roman walls and a hypocaust were found beneath the nave of Westminster Abbey 260m north-west of the site. This is likely indicative of a

24 DCLG (Department of Communities and Local Government), July 2018, National Planning Policy Framework

25 GLA [Greater London Authority], 2016, The London Plan

26 City of Westminster, 2016, Westminster’s City Plan

27 DCLG (Department of Communities and Local Government), 2014, Conserving and Enhancing the Historic Environment: Planning Practice Guide

28 EH (English Heritage), 2008 Conservation principles, policies and guidance (Swindon: Historic England)

29 CIfA (Chartered Institute for Archaeologists), 2017, Standard and guidance for historic environment desk-based assessment, Reading

30 EH [English Heritage], 2017, The setting of heritage assets. Historic Environment Good Practice Advice in Planning Note 3.

small riverside settlement, or villa existing at the time, and it is possible that the site contains riverine features such as jetties or boats associated with this.

Early Medieval Period (AD410 – 1066)

8.5.9. The Site would have been located on the edge of Thorney Island, in the confluence of the River Thames and River Tyburn during this period. The earliest reference to a settlement on the island is a charter by King Offa dated to 785, suggesting a foundation date for an ecclesiastical settlement here. However, the origins of the area as a royal centre date to the mid-11th century, when Edward the Confessor moved his palace to Thorney Island to oversee construction of the church dedicated to St Peter. This period would have seen a degree of land reclamation to the north of the site, in the area of the Palace of Westminster. The chance find of an 8th century sword was recovered from Black Rod’s Garden, immediately north of the site, at a depth of 35 feet, suggesting it was within the river at this time. Although the site would have been unsuitable for habitation, it may have been used for wetland and riverine exploitation, including early wharves and jetties.

Later Medieval Period (1066-1520)

8.5.10. During the later medieval period, development continued on Thorney Island, around the ecclesiastical and royal precincts, and increased land reclamation took place to the north extending towards Charing Cross. Around the 12th century, the riverside walls were constructed around these precincts, roughly following the line of Great College Street, extending north to the Jewel Tower before turning eastwards, along the southern edge of the palace precinct. This would have likely demarked the edge of reclaimed dry land and the River Thames and River Tyburn. Excavations as part of the Jubilee Line extension recorded a timber dock to the north of the palace, measuring 51m in length. The Site would have still been within the rivers at this time, and although would not have been intensively occupied, it was likely used for riverine transportation and communication purposes, and it is probable that similar docks would have extended along the river front.

Post-medieval and modern Periods (1520 – Present)

8.5.11. By the early 16th century, the western half of the site had been reclaimed from the River Thames. Early historic mapping shows the line of the foreshore ran roughly through the centre of the site, with the River Tyburn flowing into the northern part. Around this time, the Abbott’s mill existed on the bank of the River Tyburn, along with “The Q. Slaughterhouse”, likely the Queen’s slaughterhouse. By the late-17th century, the mill and slaughterhouse had been cleared away, and a series of wharves and docks established along the river front. Although the individual forms of the wharf buildings appear to have changed over the following two centuries, the character of the riverfront appears to have remained much the same, with successive phases of wharves and docks. It is likely that some of these were used in the construction of London’s fashionable western suburbs, for the storage of timber, stone, and bricks, brought in by river.

8.5.12. The Site retained this character until the end of the 19th century, when the northern part of Victoria Tower Gardens was laid out, involving land reclamation to create the present riverward extent. By 1916, the full extent of the gardens had been laid out. Except for changes to the formal layout of the gardens, the site has remained the same.

Geophysical Survey

8.5.13. A geophysical survey was carried out in 2017 by SUMO Ltd, comprising ground penetrating radar (GPR) across the entire Site. The survey identified the original layout of the formal gardens, along with deeper anomalies indicating areas of made ground or building footings. These are likely to be the foundations of the former wharves that occupied the site until the end of the 19th century. A linear trend was identified crossing the site from south to north; this was interpreted as a possible river wall but may just represent the foreshore area of the former Thames river front. The absence of anomalies to the east of this line indicates the area of reclaimed land for the full extent of the registered gardens.

Archaeological Survival

8.5.14. Archaeological survival is expected to be High.

8.5.15. The Site was converted into public Gardens in the early 20th century and has remained so since. In the west of the site earlier remains will have likely been truncated by the footings of later wharf buildings, but these are considered to be heritage assets in their own right.

8.5.16. The east of the site was within the River Thames until the creation of the full, current extent of the gardens in the early 20th century. The thick made ground deposits will have protected palaeoenvironmental remains within alluvial deposits.

Archaeological Potential and Sensitivity

8.5.17. Table 8-2 below summarises the archaeological potential and sensitivity of the site.

Table 8-2 - Summary of archaeological potential and sensitivity

Period	Potential	Features	Sensitivity
Palaeoenvironmental (all periods)	High	Environmental evidence and artefacts contained within alluvium	Medium (evidential)
Prehistoric	Moderate	Evidence of wetland exploitation (trackways, docks, votive items, boats etc)	High (Evidential)
		Residual artefacts	Low (evidential)
Roman	Moderate	Evidence of wetland exploitation (trackways, docks, boats etc)	High (Evidential)
		Residual artefacts	Low (evidential)
Early Medieval	Moderate	Evidence of wetland exploitation (trackways, docks, boats etc)	High (Evidential)
		Residual artefacts	Low (evidential)
Later Medieval	Moderate	Evidence of wetland exploitation (trackways, docks, boats etc)	High (Evidential)
		Residual artefacts	Low (evidential)
Post-medieval	High (in the west of the site)	Footings of 16th century Abbott’s Mill	High (associated)
		Footings of 16th century slaughterhouse	Medium (evidential)
		River management features from the 16th century (timber revetments, walls etc)	Medium (Evidential/Historic)
		Footings of wharf buildings and wharf features from the 17th century	Medium (Evidential/Historic)

8.6 Method of assessment

Sensitivity of the Receptors

8.6.1. For the purpose of this assessment the sensitivity of a receptor is synonymous with the heritage asset’s significance. The significance of a heritage asset lies in its value to the current and future generations due to its heritage interest, be it archaeological, architectural, artistic, or historic. For this assessment the determination of the significance of an asset, whether it is designated or non-designated, is based on one or

more of its values as outlined by Historic England, using professional judgement³¹. The four principal values are:

- **Evidential value:** the potential of the physical remains to yield evidence of past human activity. This might take into account date; rarity; state of preservation; diversity/complexity; contribution to published priorities; supporting documentation; collective value and comparative potential;
- **Aesthetic value:** this derives from the ways in which people draw sensory and intellectual stimulation from the heritage asset, taking into account what other people have said or written;
- **Historical value:** the ways in which past people, events and aspects of life can be connected through heritage asset to the present, such a connection often being illustrative or associative; and
- **Communal value:** this derives from the meanings of a heritage asset for the people who know about it, or for whom it figures in their collective experience or memory; communal values are closely bound up with historical, particularly associative, and aesthetic values, along with and educational, social or economic values.

8.6.2. Where known heritage assets are identified, their heritage significance is partly determined by reference to existing designations where available, and partly through professional judgement. For previously unidentified sites where no designation has been assigned, an estimate has been made of the likely historic, artistic or archaeological importance of that resource based on professional knowledge and judgement.

8.6.3. There is no single defining criterion which dictates overall significance. Each asset is assessed in a case by case basis against the range of criteria listed above. Unless the nature and extent of a buried heritage asset has been determined exactly through prior archaeological investigation, significance can be classified as 'uncertain'. Table 8-3 below gives examples of the typical sensitivity of designated and non-designated archaeological receptors.

Table 8-3 - Sensitivity of Receptors for Archaeology

Sensitivity of Receptor	Importance / resilience of receptors	Example
Very High	Internationally important or significant heritage assets.	World Heritage Sites, or buildings recognised as being of international importance.
High	Nationally important heritage assets generally recognised through designation as being of exceptional interest and value.	Grade I and II* Listed Buildings, Grade I and II* Registered Parks and Gardens, Scheduled Monuments, Protected Wreck Sites, Registered Historic Battlefields, Conservation Areas with notable concentrations of heritage assets and undesignated assets of national or international importance.
Medium	Nationally or regionally important heritage assets recognised as being of special interest, generally designated.	Grade II Listed Buildings, Grade II Registered Parks and Gardens, Conservation Areas and undesignated assets of regional or national importance, including archaeological remains, which relate to regional research objectives or can provide important information relating to particular historic events or trends that are of importance to the region.
Low	Assets that are of interest at a local level primarily for the contribution to the local historic environment.	Undesignated heritage assets such as locally listed buildings, undesignated archaeological sites, undesignated historic parks and gardens etc. Can also include degraded designated assets that no longer warrant designation.
Negligible	Elements of the historic environment which are of insufficient significance to merit consideration in planning decisions and hence be classed as heritage assets.	Undesignated features with very limited or no historic interest. Can also include highly degraded designated assets that no longer warrant designation.
Unknown	The importance of an asset has not been ascertained.	

31 EH [English Heritage], 2008 Conservation principles, policies and guidance (Swindon: Historic England)

Impact severity

8.6.4. The impact severity on known or potential archaeological assets is based on the change in asset significance caused by the Scheme through physical effects. In most cases this would constitute any works below ground (e.g. basement excavation) that would physically alter or remove the potential archaeological asset. Table 8-4 describes the criteria used to determine the impact severity upon archaeological assets.

Table 8-4 - Impact Severity for Archaeology

Impact Severity	Description of Impact
High	Complete removal of asset. Change to asset significance resulting in a fundamental change in our ability to understand and appreciate the resource and its historical context, character and setting. The transformation of an asset's setting in a way that fundamentally compromises its ability to be understood or appreciated. The scale of change would be such that it could result in a designated asset being undesignated or having its level of designation lowered
Medium	Change to asset significance resulting in an appreciable change in our ability to understand and appreciate the asset and its historical context, character and setting. Notable alterations to the setting of an asset that affect our appreciation of it and its significance, or the unrecorded loss of archaeological interest.
Low	Change to asset significance resulting in a small change in our ability to understand and appreciate the asset and its historical context, character and setting
Negligible	Minimal or no material change to asset significance. No change in our ability to understand and appreciate the asset and its historical context, character and/or setting.
Uncertain	Level of survival/condition of archaeological resource is unknown. Therefore, the impact severity is unknown.

Significance and likely environmental effects

8.6.5. The likely environmental effect is determined by assessing the sensitivity of the baseline receptors with the impact severity upon those receptors. Effects upon baseline receptors are either adverse (negative) or beneficial (positive) and are defined without mitigation. Where information is insufficient to be able to quantify either the resource sensitivity or impact severity with any degree of certainty, the effect is given as Uncertain. Table 8-5 below outlines how the significance of environmental effects upon archaeological remains is determined.

Table 8-5 - Determining Significance of Likely Environmental Effect Prior to Mitigation

Sensitivity	Impact Severity				
	High	Medium	Low	Negligible	Uncertain
Very high	Effect of Major Significance	Effect of Major Significance	Effect of Moderate Significance	Effect of Minor Significance	Uncertain
High	Effect of Major Significance	Effect of Major or Moderate Significance	Effect of Moderate or Minor Significance	Effect of Minor Significance	Uncertain
Medium	Effect of Major or Moderate Significance	Effect of Moderate Significance	Effect of Minor Significance	Effect of Minor or Negligible Significance	Uncertain

Sensitivity	Impact Severity				
	High	Medium	Low	Negligible	Uncertain
Low	Effect of Moderate or Minor Significance	Effect of Minor Significance	Effect of Minor or Negligible Significance	Effect of Minor or Negligible Significance	Uncertain
Negligible	Effect of Minor Significance	Effect of Minor or Negligible Significance	Effect of Minor or Negligible Significance	Effect of Negligible Significance	Uncertain
Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain

8.6.6. The significance of the likely effects upon archaeological remains is outlined in Table 8-6 below.

Table 8-6 - Significance of Effect upon Archaeological Remains

Significance of Effect	Description
Major Adverse (Significant)	Substantial harm to, or loss of an asset's significance as a result of changes to its physical form or setting. For example, this would include demolition, removal of physical attributes critical to an asset, loss of all archaeological interest or the transformation of an asset's setting in a way that fundamentally compromises its ability to be understood or appreciated. The scale of change would be such that it could result in a designated asset being undesignated or having its level of designation lowered.
Moderate Adverse (Significant)	Less than substantial harm to an asset's significance as a result of changes to its physical form or setting. For example, this could include: physical alterations that remove or alter some elements of significance, but do not substantially alter the overall significance of the asset; notable alterations to the setting of an asset that affect our appreciation of it and its significance; or the unrecorded loss of archaeological interest.
Minor Adverse (Not significant)	Limited harm to an asset's significance as a result of changes to its physical form or setting. For example, this could include: physical changes that alter some elements of significance but do not noticeably alter the overall significance of the asset; and small-scale alterations to the setting of an asset that hardly affect its significance.
Negligible (Not significant)	Very minor changes to setting or form of the asset.
No Change/ Neutral (Not significant)	No appreciable change to an asset's significance.
Minor Beneficial (Not significant)	Limited improvement of an asset's significance as a result of changes to its physical form or setting. For example, this could include: physical changes that reveal or conserve some elements of significance but do not noticeably alter the overall significance of the asset; or small-scale alterations to the setting of an asset that improve our ability to appreciate it.
Moderate Beneficial (Significant)	Notable enhancement of an asset's significance as a result of changes to its physical form or setting. For example, this could include: physical alterations that conserve or restore elements of significance; notable alterations to the setting of an asset that improve our appreciation of it and its significance; or changes in use that help safeguard an asset.
Major Beneficial (Significant)	Substantial enhancement of an asset's significance as a result of changes to its physical form or setting.

Significance of Effect	Description
	For example, this could include: major changes that conserve or restore elements of high significance; alterations to the setting of an asset that very substantially improve our appreciation of it and its significance; or changes in use that safeguard an asset, e.g. by taking it off Historic England's At Risk Register.

Residual effects and mitigation

- 8.6.7. The implementation of an appropriate mitigation strategy would aim to offset or reduce likely significant adverse effects to archaeological remains. Mitigation would be either implemented through preservation *in situ*, through design changes, or preservation by record, comprising archaeological investigation and recording before and/or during development.
- 8.6.8. Archaeological remains are a finite, irreplaceable resource and it is considered standard practice to implement a programme of mitigation to offset any level of adverse effect on a buried heritage asset. The level of mitigation proposed is to be proportionate, in each case, to the significance of the asset being affected.
- 8.6.9. Whilst preservation *in situ* is considered to be the most preferable mitigation, it is not always the most practicable. A programme of preservation by record would ultimately lead to the physical removal of an archaeological asset, however, as the asset will have been recorded and archived to an appropriate standard as outlined by best practice guidelines, it would offset the overall significant effect to the asset.

8.7 Potential Impacts

Construction

- 8.7.1. All potential impacts to buried archaeological remains would arise during the construction phase of the Scheme. All potential impacts would be permanent in nature.
- 8.7.2. Table 8-7 outlines the impacts and likely significant effects of the Scheme on archaeological remains. All significant effects are presented as they would be prior to mitigation.
- 8.7.3. As outlined in Chapter 3, the Scheme entails the excavation of a new basement extending to 8.0m to 10.0m below ground level (-4.5m to 6.5m OD) for the construction of a new education centre beneath the monument. This would totally remove any archaeological remains that may be present within the footprint of the education centre and could extend well into underlying natural gravels. This would result in a high magnitude of change on any remains present, resulting in a Major Adverse impact which is significant.
- 8.7.4. New piles would be inserted prior to basement excavation. This would entail the creation of a secant pile wall around the perimeter of the basement, and the insertion of seven piles in the centre of the education centre. It is assumed for the purposes of this assessment that the proposed seven piles are medium diameter and well-spaced. The insertion of new piles would entirely remove any archaeological remains within the footprint of each pile as it is driven downwards. Depending upon the piling technique employed, additional impacts to surrounding remains may arise as the pile is driven downwards. The insertion of new piles would be considered a low magnitude impact severity, and given the significance of the potential archaeology that would likely be affected, would result in an initial Minor Adverse Effect which is not considered to be significant.
- 8.7.5. It is anticipated that dewatering will occur as part of the basement excavation. This would change the hydrology of the surrounding alluvium, and likely change the conditions from anaerobic to aerobic. Such a change would affect the preservation of surrounding palaeoenvironmental remains within these deposits, such a change may result in a high magnitude of change to these deposits, resulting in a Major or Moderate Adverse effect which is considered significant.

Table 8-7 - Likely Significant Effects upon Archaeological Remains

Receptor	Sensitivity	Impact Severity	Significant Effect
Palaeoenvironmental remains	Medium (evidential)	High Excavation of a new basement level 10.0m below ground level would entirely remove any remains and likely extend into underlying terrace gravels. Dewatering would change the conditions of preservation in the alluvial deposits surrounding the area of Scheme.	Major or Moderate Adverse
Footings of 16 th century Abbott's Mill	High (Associated)		Major Adverse
Footings of 16 th century slaughter house	Medium to High (evidential)		Major Adverse
Evidence of river management features from 16 th century	Medium (evidential/historic)		Major or Moderate Adverse
Footings of wharves and associated docks from 17 th century onwards	Medium (evidential/historic)		Major or Moderate Adverse
Early 20 th century garden features	Medium (associated)		Major or Moderate Adverse
Wetland and riverine exploitation from the prehistoric period onwards	High (evidential)		Major Adverse

Operation

8.7.6. The dewatering of surrounding alluvial deposits would likely affect the survival of palaeoenvironmental remains contained within them. Such effects as assessed above would continue into the operational phase of the Scheme, these would be considered to be a high magnitude of change resulting in a Major or Moderate adverse effect, that would be permanent in nature and is considered to be significant.

8.8 Cumulative Effects

Construction

8.8.1. No other currently consented development will affect the archaeological assets that would be likely to be impacted by the construction of the Scheme during the construction phase. There would therefore be no cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments.

Operation

8.8.2. As stated above there will be no cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments during operation.

8.9 Mitigation measures

Construction

- 8.9.1. The Site does not contain any statutorily designated archaeological remains such as Scheduled Monuments. The Site is unlikely to contain archaeological remains of such sensitivity that warrant preservation *in situ*. It is considered that a programme of preservation by record would adequately offset any significant effects upon archaeological remains.
- 8.9.2. Consultation with the City of Westminster's Archaeological Advisor has been undertaken at the time of writing, and an initial phased programme of works is being devised. This will entail the creation of a sub-surface deposit model from data derived geoarchaeological boreholes, and targeted evaluation trenches within the area of the Scheme to greater understand the nature of archaeological remains.
- 8.9.3. The results of this initial phase of field work will be then used to devise an appropriate mitigation strategy to ensure that archaeological remains are not removed without prior recording. This will likely entail a full archaeological excavation in the area of below ground works. Such an excavation could provide opportunities for public engagement events and outreach programmes.
- 8.9.4. Any such works will be undertaken under a Written Scheme of Investigation (WSI), agreed with the City of Westminster's Archaeological Advisor.

Operation

8.9.5. Operational effects would arise from permanent, indirect impacts to the surrounding alluvial deposits, and are expected to affect palaeoenvironmental remains only. Such remains are not considered of such sensitivity to warrant preservation *in situ*. Mitigation measures for impacts arising from the construction phase of the Scheme entail the creation of a sub-surface deposit model using geoarchaeological borehole data. The creation of such a deposit model, including environmental archaeological analysis of any micro and macro plant remains contained within, would be sufficient to record the nature and character of the palaeoenvironmental record contained within the alluvial deposits.

8.10 Residual Effects

Construction

- 8.10.1. Following the successful implementation of an approved mitigation strategy, the residual significant effects to archaeological remains arising from the construction phase of the Scheme would be reduced to Negligible – not significant.
- 8.10.2. Although archaeological remains will be removed through controlled excavation, their form, nature and extent will be preserved in the archaeological record and deposited into the relevant archive receiving body, to allow future generations to understand the resource, its context and character.

Operation

8.10.3. Following the successful implementation of an approved mitigation strategy, the residual significant effects to palaeoenvironmental remains arising from indirect impacts would be reduced to Minor Adverse – not significant, as the context of the asset would be permanently changed.

8.11 Summary Table

Table 8-8 - Construction phase effects on Archaeology

Activity	Baseline		Impact assessment		Mitigation	
	Receptor	Receptor Sensitivity	Impact Severity	Effect before Mitigation	Mitigation Measures	Residual Effect
Excavation of new basement level up to 10.0m below present ground level.	Palaeoenvironmental remains	Medium	High – total asset removal	Major or Moderate Adverse	Preservation by record. Phased programme of works agreed with City of Westminster’s Advisor. Includes creation of a geoarchaeological deposit model and targeted evaluation to inform further mitigation. Further work likely entails full excavation.	Negligible
	Footings of 16 th century Abbott’s Mill	High		Major Adverse		
	Footings of 16 th century slaughter house	Medium to High		Major Adverse		
	Evidence of river management features from 16 th century	Medium		Major of Moderate Adverse		
	Footings of wharves and associated docks from 17 th century onwards	Medium		Major of Moderate Adverse		
	Early 20 th century garden features	High		Major Adverse		
	Wetland and riverine exploitation from the prehistoric period onwards	High		Major Adverse		

Table 8-9 - Operational phase effects on Archaeology

Activity	Baseline		Impact assessment		Mitigation	
	Receptor	Receptor Sensitivity	Impact Severity	Effect before Mitigation	Mitigation Measures	Residual Effect
Dewatering during construction	Palaeoenvironmental remains	Medium	High – Change to survival conditions resulting in fundamental change in our ability to understand the asset	Major or Moderate Adverse	Preservation by record. Geoarchaeological deposit model would record the nature of sub-surface deposits.	Minor Adverse

9 Population and Human Health

9.1 Scope of the assessment

- 9.1.1. This chapter presents the assessment of potential effects of the Scheme, on population and human health comprising physical, mental and social wellbeing.
- 9.1.2. The key elements of the Scheme will be located in the southernmost portion of Victoria Tower Gardens. Victoria Tower Gardens is in the highly urbanised City of Westminster. Victoria Tower Gardens form part of a wider urban network and historic core, with physical and visual connectivity to important historic and modern attractions, open spaces and key buildings. The Gardens also provide important green space, amenity open space, and recreational and leisure-time facilities for local communities, workers and visitors.
- 9.1.3. With no consolidated significance criteria, professional judgement will be applied to the baseline information outlined in Section 9.5 to establish likely effects on population and human health, particularly for vulnerable groups who are more susceptible to changes (e.g. children and adolescents, older people, people who are disabled and/or with other health problems, and low income groups), including where effects result from other ES topic areas (e.g. air quality affecting a vulnerable population). The impact assessment seeks to identify:
- Potential positive and negative population and human health effects on the local community and wider groups arising from the construction and operation of the Scheme, with a particular focus on vulnerable groups and the distribution of health effects;
 - Opportunities for improving health and reducing health inequalities; and
 - Mitigation opportunities.
- 9.1.4. Where relevant, the ES topic chapters have considered a realistic worst-case scenario to capture the full scope of potential impacts. As this chapter considers the results of other ES chapters relevant to human health (e.g. Air Quality, Landscape, Transport, and Materials and Waste), the realistic worst-case impacts arising from other topic chapter assessments are automatically included within the population and human health assessment.

9.2 Responses to scoping opinion

Table 9-1 - Summary of responses to stakeholder scoping opinions

Stakeholder	Comment	Response
The Gardens Trust	<p>'Chapter 9 - Population and Human Health gives scant indication of the importance of the open space to local residents and children's play but does mention that it is within an area lacking in informal play space from the City of Westminster Open Space Strategy 2007. No mention as to the potential effect on play/recreation/public health, surprising given it is adjacent to an area deficient in public open space. Some indication of the impacts that the reduction in open space and change in the nature of that space, is provided in 9.3.2, but is scant. It's sum total is the sentence 'the new Memorial and Learning Centre will attract a higher number of visitors than at present, and change the way that visitors use the gardens'.</p> <p>It does not set out the amount of potential loss of usable open space and impact on how it operates and functions as a green space and important play space, and the subsequent potential effects on the local population and human health. There is no mention of any mitigation of these effects. Possibly as there cannot be mitigation for such a loss'.</p>	Refer to sections 9.7 to 9.11 of this chapter, with particular reference to the assessment of green space and land blight, and access to open space, recreational and leisure-time facilities.

Stakeholder	Comment	Response
Environmental Health	Noise - 'Clarity is required on whether noise will be a significant effect. The executive summary suggests noise will be a significant effect (in terms of population and human health) but goes onto say that noise will not be a significant effect. The noise chapter has identified key assessment areas for both construction and operational noise (in connection with mechanical plant). Overall, I am satisfied with the approach taken'.	<p>There is potential for noise and ground borne vibration effects from construction activities, however these effects will be temporary. A noise survey that looks at noise and vibration impact from construction activities has been carried out. Noise and vibration from construction will be managed through a CMP.</p> <p>During operation, no effects are anticipated as the site is already an established public open space.</p>
Environmental Health	'I am satisfied with the proposed approach to assessing in combination effects from noise and air quality and have no specific comments'	The population and human health chapter is by nature an in-combination assessment of the population and human health impacts of all environmental effects of the Scheme. Environmental health matters will therefore be addressed as part of the assessment.

9.3 Relevant planning policy & legislation

Table 9-2 - Policy overview

Scale	Policy Document	Key Considerations for Human Health
National	National Planning Policy Framework (NPPF)	<p>The government's National Planning Policy Framework (NPPF) 2012 created a structure which assists local councils in creating their own local plans. It is part of the government's reforms to make the planning system less complex and more accessible. A revised NPPF was published on 24 July 2018.</p> <p>The NPPF outlines the important role that the planning policies and decisions should play in creating 'healthy, inclusive and safe places' by promoting social interaction, safety, accessibility and healthy lifestyles (Paragraph 91). The influence of planning is not limited to the proactive promotion of health; the likely effects of pollution caused by new development on health and living conditions should be considered and mitigated (Paragraph 180).</p>
	Planning Practice Guidance (PPG)	<p>PPG on Health and wellbeing states that, as the built and natural environments are major determinants of health and wellbeing, local planning authorities should consider these issues in planning decision making.</p> <p>Healthy communities are defined as those which support healthy behaviours, reduce health inequalities, and enhance physical and mental health. Where appropriate, healthy communities should also encourage active lifestyles – which can be facilitated through development (including transport and services) – and support social interaction through the creation of healthy living environments for people of all ages.</p>
	The London Plan	Strategic planning in London is the shared responsibility of the Mayor of London, 32 London boroughs and the Corporation of the City of London. Under the

Scale	Policy Document	Key Considerations for Human Health
		<p>legislation establishing the Greater London Authority (GLA), the Mayor must produce a spatial development strategy (SDS) – which has become known as ‘the London Plan’ – and to keep it under review. Boroughs’ local development documents must be ‘in general conformity’ with the London Plan, which is also legally part of the development plan that has to be taken into account when planning decisions are taken in any part of London unless there are planning reasons why it should not.</p> <p>The document brings together the geographical and locational (though not site specific) aspects of the Mayor’s other strategies, including reducing health inequalities.</p>
	Fair Society, Healthy Lives (the Marmot Review) 2010 [3]	The Marmot Review found that individual health is influenced by wider ‘social’ determinants such as income, education, local environmental quality and employment. The review established six policy objectives for reducing health inequalities including ‘to create and develop healthy and sustainable places and communities’.
	Health and Social Care Act 2012 [4]	City of Westminster Council (CoWC) has responsibility for public health, following the Health and Social Care Act which bestowed new duties and responsibilities for health improvement and health protection on local authorities. The Act requires every local authority to use all the levers at its disposal to improve health and wellbeing, with the promotion and protection of health and wellbeing embedded throughout all directorates and functions, including spatial planning and development management.
	Public Health Outcomes Framework 2016-19 [5]	<p>The Public Health Outcomes Framework seeks to improve and protect the nation’s health and wellbeing and improve the health of the poorest fastest, measured through healthy life expectancy and its discrepancy with life expectancy. The Framework summarises the public health responsibilities of boroughs and establishes indicators to measure progress towards the objectives of improving the wider determinants of health and of helping people to live healthy lifestyles. These include several which may be affected by planning decisions, as follows:</p> <ul style="list-style-type: none"> • Killed and seriously injured casualties on England’s roads; • The percentage of the population affected by noise; • Utilisation of outdoor space for exercise/health reasons; • Social isolation; • Excess weight in adults and children; • Proportion of physically active and inactive adults; and • Self-reported well-being.
Local	Westminster City Plan Consolidated with all changes since November 2013 (Nov 2016)	Westminster’s City Plan is the local plan for Westminster. It sets out the vision for the City of Westminster up to and beyond 2027 and puts in place a policy framework to deliver that vision. Policy S29 ‘Health, safety and Wellbeing’ specifically relates to health and wellbeing, a key objective for many of Westminster’s partners: ‘Development should ensure that the need to secure a healthy and safe environment is addressed, including minimising opportunities for crime, including the risk of terrorism, and addressing any specific risks to health or safety from the local environment or conditions. Developments should also maximise opportunities to contribute to health and well-being, including supporting opportunities for improved life chances and healthier lifestyle choices’
	Westminster’s Unitary Development Plan (UDP)	Westminster’s Unitary Development Plan (UDP) was approved by full council on 24 January 2007, and parts of it were ‘saved’ by the Secretary of State on the 24 January 2010 and weren’t replaced by the City Plan. The ‘saved policies’ should not be considered out-of-date and due weight should continue to be given to relevant policies, particularly to their degree of consistency with the NPPF - the

Scale	Policy Document	Key Considerations for Human Health
		closer the policies in the UDP to those in the NPPF, the greater the weight that should be given. These policies will be replaced by the revisions to the City Plan once they are adopted.
	Health and Wellbeing Strategy for Westminster 2017-2022	The strategy sets out how the Westminster Health and Wellbeing Board and partners will deliver services to help people in Westminster live a healthy life. Key priorities include improving outcomes for children and young people, reducing the risk factors for long term conditions, and improving mental health outcomes
	Joint Strategic Needs Assessment (JSNA)	JSNAs are detailed documents that have been reviewed and agreed by the local Health and Wellbeing Boards. Several JSNAs have been produced by Westminster in partnership with Kensington and Chelsea, and Hammersmith and Fulham, relating to health issues such as childhood obesity, physical activity, substance misuse, mental health, health and wellbeing.

9.4 Area of Influence

- 9.4.1. The study area for the purposes of the population and human health assessment is based on the extent of the likely significant effects on physical, mental and social wellbeing during the construction and operational phases of the Scheme. The below study areas have been defined to capture the key characteristics and population and human health issues for the area and determine the effects of any changes in health determinants because of the Scheme. The study area includes:
- A wider study area used to define the characteristics, population and human health issues for the clinical health area of Westminster;
 - A core study area used to define the characteristics, population and human health issues for the St James’ ward, within which the Scheme itself is located.
- 9.4.2. As some health impacts are derived from changes in health determinants also considered in other technical assessments, the study area also encompasses that used for each topic, as follows:
- Air Quality: 350m from the boundary of the site and construction vehicle routes up to 500m from the site entrance, up to 50m from the edge of roads;
 - Materials and Waste: within the boundary of the site, plus the atmosphere for climate
 - Transport: within the gardens, entailing the 5 accesses and the walking paths, plus a wider study area established on the likely areas of influence of the various travel modes and where these have the potential to create a significant effect
- 9.4.3. The study area for health determinants which are not covered by the other topic assessments - such as social cohesion and lifetime neighbourhoods, and exposure to crime, violence and social disorder - is based on the identified likely impacts of the Scheme to these determinants.

9.5 Baseline Conditions

- 9.5.1. A full and comprehensive baseline which captures the characteristics and population and human health issues for the area is presented in Appendix G in Volume 5. This includes socio-economic and demographic characteristics and trends, health and wellbeing characteristics including physical health, mental health and social wellbeing, and details of the natural and built environment, accessibility, and surrounding context for the Scheme. The key characteristics are summarised below.

Socio-economic and demographic characteristics

Population

- 9.5.2. The Scheme itself is within the St James Ward of the City of Westminster, in London. The St James’s Ward Profile 2018 shows that in June 2016 St James’s reached a population of 11,495, which accounts for 5% of Westminster. Since 2014, there has been an increase in population of 5%.

9.5.3. In June 2017, the resident population of Westminster reached 252,450. The Westminster population increases to approximately 900,000 during the daytime which is the highest daytime population of any London borough, including residents, employees and visitors.

Demographic profile

- 9.5.4. St James's Ward and Westminster have a highly diverse local community. The gender split in St James's and Westminster is unusual, with more men than women. 58% of St James's population is male, 42% is female.
- 9.5.5. 14% of the population in St James's is 65 or older, greater than Westminster's average. 74% are between 18 and 64, greater than the borough average. 12% are under 18, less than the borough average.
- 9.5.6. According to the 2011 Census, 16% of families in St James's were composed of lone parents with dependent children. 26% of children in the ward were receiving free school meals in 2017, an indicator of family financial stress.
- 9.5.7. Westminster has the highest level of international migration of any place in England. Just under half of the resident population was born outside of the UK, which is equal to the average for St James' Ward.
- 9.5.8. English was being spoken in 69% of St James's households, which is equal to the Westminster average. Since 2010, more residents have been leaving the City of Westminster to settle elsewhere in the UK than have been moving to the borough from within the country.

Socio-economic

- 9.5.9. Socio-economic determinants are an important component of physical and mental health, and social wellbeing. St James's local economy hosts 219,035 jobs and 11,560 businesses.
- 9.5.10. Westminster's local areas are amongst the most and least deprived in London. Westminster is one of the 20% most deprived districts/unitary authorities in England. St James's is within the 30-40% most deprived in the UK for the average deprivation rank.
- 9.5.11. In 2011, 70% of St James's population were economically active, greater than Westminster. 6% were unemployed, less than Westminster. 37% of St James's was classified as workless, greater than Westminster.
- 9.5.12. At secondary schools, 35% of St James's pupils achieved GCSE grades of 9-5 (A*-C), greater than Westminster.
- 9.5.13. Around 27% (6,900) of children in Westminster live in low income families, which is significantly higher than the national average. Income equality in Westminster is the 2nd highest of all London boroughs.
- 9.5.14. Westminster is England's top homeless hot spot, accounting for 35% of all rough sleepers in London.

Demographic, Economic and Social Trends

- 9.5.15. Looking at likely demographic, economic and social trends over the next 15 years in Westminster, it is estimated there will be an increase in people aged over 85 years, a smaller proportion of children and young people, an increase in long term health conditions for young people, and more commuters which will put increased pressure on transport and public spaces.

Health and wellbeing characteristics

Physical Health

- 9.5.16. 190,000 people are registered with GPs in Westminster, excluding the Queens Park and Paddington area of Westminster which falls outside the clinical commissioning group area.
- 9.5.17. In 2011, 85% of St James's residents reported their health condition was 'very good' or 'good', greater than the Westminster average. 5% of St James's perceived their health to be 'bad' or 'very bad'. Generally, St James's residents experience greater wellbeing than elsewhere in London.
- 9.5.18. According to the 2011 Census, 12.9% of St James's population were affected by long-term illness or disability, less than Westminster.
- 9.5.19. There are various and complex pressures in Westminster, including a small but increasing proportion of the population that is elderly and a growing number of people with long term conditions.

9.5.20. There are significant differences in life expectancy and mortality between and within the electoral wards in Westminster. For example, men living in the least deprived areas live nearly 12.5 years longer than men living in the most deprived areas. For women this gap is nearly 7.5 years. Additionally, the most deprived 20% of the population are likely to begin experiencing long-term disability 10 years earlier than the least deprived.

9.5.21. The principle cause of premature (<75) death in Westminster is cancer, followed by cardiovascular disease and chronic obstructive pulmonary disease (COPD). Diagnosis of long term conditions associated with ageing, such as dementia and Alzheimer's are expected to increase.

9.5.22. Children in St James's are on average more likely to be overweight, have poor dental health, and experience poor mental health than their peers in the rest of London and the country. This will have health, social and economic implications later in life.

9.5.23. Westminster falls within the worst 20% of areas nationally for road traffic accidents, and parts of the City are among the worst performers in air quality tests in Europe.

Mental Health

9.5.24. Central London CCG, within which the Scheme is situated, has a high level of severe and enduring mental illness known to GPs in the country in 2012/13.

9.5.25. Nearly half of all ill health for under-65s is related to mental illnesses. Poor mental health can affect quality of life, life expectancy and the ability to participate in society.

9.5.26. Unemployment and worklessness is a known cause for poor mental health in Westminster. Poor mental health and stress can be a barrier to employment and meaningful occupations.

9.5.27. In the Westminster Noise Attitudes Survey (2008), a high proportion of residents said they have been disturbed by noise when sleeping, resting or concentrating. Noise can lead to sleep disturbance which can have detrimental effects on physical health. There is also growing evidence linking environmental noise to cardiovascular disease and psychological problems.

Social wellbeing

9.5.28. The 2017 City Survey found 1% of St James's residents reported they were struggling financially, less than Westminster. 98% of residents felt safe, however 19% felt that crime in the neighbourhood impacted their quality of life.

9.5.29. Crime rates in Westminster's wards are influenced by the influx of visitors to the borough. Between July 2016 and July 2017, 14,226 crimes were reported in St James's, equating to a crime rate of 138 per 100 residents. This is much greater than Westminster.

9.5.30. According to the 2017 City Survey, 19% of residents in St James's perceived anti-social behaviour to be a problem in the area. 75% say that people from different backgrounds get on well.

Natural and built environment

Built environment

9.5.31. Comprehensive details of the built environment in the study area is defined in Appendix G in Volume 5.

9.5.32. There is limited residential property in the immediate vicinity of Victoria Tower Gardens, with the River Thames and Palace of Westminster to the immediate east and north, and Lambeth Bridge to the south. The buildings adjacent to Victoria Tower Gardens on Millbank and extending back towards Smith Square are predominantly Government, commercial and office space, although this includes some residential elements. Guy's and St Thomas's Hospital is located on the opposite bank of the river.

9.5.33. There are five pedestrian access points to Victoria Tower Gardens off the road to the west and, at the southern end, near the roundabout west of Lambeth Bridge. The Gardens are a popular leisure venue, used equally by people taking advantage of the open green space, benches, play area, toilets and refreshment kiosk, and by walkers and runners passing through while following a riverside route. Most activity is concentrated along the riverside on the eastern edge of the site. A Parliamentary Education Centre, opened in 2015, attracts visitors, including school groups, to the northern end of the gardens.

9.5.34. Westminster's built up central location means that its parks and open spaces play an essential role in the quality of life for residents. Although this part of the borough is not deficient in publicly accessible open space, it is close to an area of open space deficiency and within an area lacking in informal play space (City

of Westminster Open Space Strategy 2007) which makes the existing play area within Victoria Tower Gardens an important local resource.

- 9.5.35. Large business and visitor populations are significant parts of the local and London economy. However, these groups also put pressure on services and the environment. The combination of high density development, land use and volumes of vehicle/pedestrian movement in the area combine to create a complex, yet finely balanced urban environment.
- 9.5.36. Westminster is world renowned for its theatres and entertainment, as well as national landmarks and districts. Westminster's local economy hosts 708,380 jobs and 55,398 businesses, contributing over £55bn to the country's economic output.
- 9.5.37. The economic, cultural and social attractiveness of Westminster, and restrictions on space, mean that the demand for housing is high, and median house prices are very high. St James's contains 8,352 residential properties in 2017, which accounts for 7% of Westminster's housing stock. St James's also has a high proportion of second homes
- 9.5.38. Of St James's households in the Census 2011, the majority had 1 person in a household, 34% were families, of which 29% had dependent children, and 16% were lone parents.

Natural environment

- 9.5.39. According to a 2013 study, 86% of homes in St James's had good access to local parks, greater than Westminster. Respondents of the 2017 City Survey (for London) suggest 69% of people used open spaces and public parks in the last three months. 49% were satisfied with them.
- 9.5.40. Air pollution is a problem in the area. Through Westminster's Greener City Action Plan, the Council aim to tackle poor air quality and develop a sustainable transport system that delivers health and wellbeing benefits and reduces pollution while keeping the city moving.
- 9.5.41. The Westminster Noise Strategy 2010-2015 finds the sound environment in Westminster is varied. Westminster is relatively noisy at night.

Accessibility

- 9.5.42. Westminster has a number of rail terminals, Underground stations and bus services which pass through Westminster's streets. Car ownership in Westminster has been rising for several years.
- 9.5.43. Millbank/Abingdon Street runs south-north from Parliament Street, west of the Scheme site, connecting to Lambeth Bridge and Horseferry Road to the south, and to the wider street and minor road network.
- 9.5.44. St James's integration into the public transport network is very good.

Surrounding context

- 9.5.45. The Scheme is bounded by:
 - To the north: The Houses of Parliament/Palace of Westminster;
 - To the south: Lambeth Bridge and Lambeth Bridge/Millbank/Horseferry Road roundabout, beyond which is 6-storey commercial properties and Millbank Medical Centre;
 - To the west: footpath and Millbank/Abingden Street, medium density commercial buildings, Abingden Street Gardens, Jewel Tower (Medieval Palace of Westminster), Monastery, Westminster Abbey, Westminster School, retail premises and residential properties;
- 9.5.46. To the east: riverside footpath, River Thames, Lambeth Palace, St Thomas' Hospital London, Evelina London Children's Hospital, and Kings College buildings, beyond which is Archbishops Park, then the residential areas of Lambeth North and Lambeth.
- 9.5.47. A high-level review of the area confirms there are several potential health receptors within 500m of the Scheme. This includes visitor attractions, greenspace, open space and play areas, commercial and retail premises, medical facilities, educational establishments, places of worship, care/nursing homes, recreation and leisure networks, public transport, and parking.

Identification of health receptors in the study area

- 9.5.48. Table 9-3 sets out the relevant health receptors in the study area, identified through the community health profile and baseline review, which will be considered in the assessment.

Table 9-3 - Health receptors in the study area

Population group	Receptor description
Wider groups	The key challenges to the physical health, mental and social wellbeing of the local resident population arise from inactivity and unhealthy lifestyle choices and are also linked to the local road network. Residents of properties particularly to the west and south of the Scheme, employees and customers at the large number of businesses and government institutions interspersed throughout the area, walkers, runners and cyclists using recreation routes and the local footpath, cycleway and road network, large numbers of visitors to nearby visitor attractions, and public transport users are likely to be most exposed to health impacts.
Vulnerable groups	
Children and adolescents	Children attending local primary and secondary schools, using outdoor spaces in the area (notably Victoria Tower Gardens and Horsferry play area), and visiting the tourist attractions are most exposed to potential physical and mental health impacts. Adolescents in the area suffer disproportionately from poor mental health.
Older people	The older population within the study area suffer disproportionately from poor mental and physical health. They are likely to be present in the residential properties, retirement homes, medical centres and hospitals within the study area.
People who are disabled and/or with other health problems	People who are disabled and/or with other health problems are likely to be vulnerable to changes to health determinants. They are likely to be present in the residential properties, hospitals, clinics, commercial buildings, offices, visitor attractions, recreational and leisure assets, and blue badge car parking bays. According to the 2011 Census, 12.9% of St James's population and 14% of Westminster's population were affected by long-term illness or disability.
Low-income groups	Low-income residents are particularly concentrated in parts of Westminster. Although the highest concentrations are likely to be slightly removed from the site of the Scheme, they suffer multiple deprivation including housing deficiencies and lower air quality which makes them more vulnerable to physical and mental health impacts. These groups may benefit from employment opportunities created by the Scheme.

9.6 Method of assessment

Identifying the Sensitive Receptors

Introduction

9.6.1. Despite the requirement to consider 'population and human health' amongst the other environmental topics for assessment, the May 2017 EIA Directive does not establish the way in which this topic is to be addressed and there is no prescribed EIA definition for 'population and human health'. This assessment is based upon Institute of Environmental Management and Assessment (IEMA) guidance contained in 'Health in Environmental Impact Assessment: A Primer for a Proportionate Approach' [8] and the World Health Organisation (WHO) definition of health used by the public health profession in the UK, in which health is defined as 'a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity'.

Health receptors

9.6.2. Although IEMA advises that the coverage of health in the EIA need not equate to Health Impact Assessment (HIA), EIA practice in relation to health can nevertheless be informed by good practice guidance for HIA. Therefore, a further consideration in the assessment is equity, or the distribution of effects (i.e. demographic, socio-economic, or geographic). This follows the procedure for HIA which judges the 'effects of a policy, programme or project on both the health of a population and the distribution of those effects within the population'. The IEMA guidance also recommends that specific attention should be paid to impacts on vulnerable receptor groups. These groups are likely to be more susceptible to the changes to health determinants than other social groups and are defined by their age, health status and income (Table 9-4).

Table 9-4 - Vulnerable receptor groups

Group	Relevant medium	Explanation
Children and adolescents	Schools and nurseries, day care centres, residential houses, visitor attractions, greenspace, public open space and/or play areas, recreational assets, coach drop off/pick up points	Children and adolescents constitute a vulnerable population group because they are more sensitive than young and middle-aged adults to air pollution, noise, odour and other environmental factors and their bodies and minds are less able to deal with them. Particularly susceptible children are those from low-income and/or black and minority ethnic (BME) backgrounds and/or living in deprived areas.
Older people	Retirement homes, residential houses, hospitals, clinics, visitor attractions	Older people constitute a vulnerable group because they are more sensitive than young and middle-aged adults. Older people also have physical mobility problems as well as sensory deficits e.g. visual and hearing loss/changes which can make disruption to local footpaths and changes to the neighbourhood setting, for example, particularly anxiety-provoking and worrying leading to withdrawal and isolation or an increase in accidents.
People who are disabled and/or with other health problems	Hospitals, clinics, residential houses, commercial buildings, offices, visitor attractions, recreational assets, blue badge car parking bays	People with existing physical and mental illnesses, including sleep disturbance, anxiety and depression, are likely to be more sensitive to changes to their local environment.
Low-income groups	Residential houses, commercial buildings, visitor attractions, public open space and/or play areas, recreational and leisure-time facilities	People on low incomes (living in deprived areas is a proxy measure for low income) are generally more likely to already be affected by environmental pollution and can have reduced access to health and social care as well as other services and amenities.

9.6.3. Wider receptor groups include residents and workers living/working in the proximity of the Scheme, construction workers, walkers, runners and cyclists, passers-by, and public transport users who are likely to be exposed to changes to health determinants.

Health determinants

9.6.4. Following IEMA guidance on the UK public health profession's 'wider determinants of health' model, this assessment considers physical, mental and social health and wellbeing to be underpinned by determinants spanning environmental, social and economic aspects as follows: the global ecosystem; natural and built environment; activities; local economy; community; lifestyle; and individual factors. Of those listed, determinants which are potentially influenced by the Scheme and therefore scoped in for assessment concern the natural and built environment, activities, local economy, and community (see Table 9-5).

Table 9-5 - Health determinants scoped in for assessment

Aspect	Health Determinants
Natural environment	<ul style="list-style-type: none"> Air pollution Green space and land blight
Activities	<ul style="list-style-type: none"> Access to healthcare services & other social infrastructure Risk of injuries and death Access to open space, recreational and leisure-time activities Access to transport options and community facilities Active travel
Local economy	<ul style="list-style-type: none"> Access to work and training
Community	<ul style="list-style-type: none"> Social cohesion and lifetime neighbourhoods Social norms and attitudes (e.g. discrimination, racism and distrust of government) Exposure to crime, social disorder and homelessness

Health baseline and community health profile

9.6.5. The baseline and community health profile (see section 9.5) has been established from analysis of local socio-economic, demographic and health data in comparison with sub-regional and national data, and a review of sub-regional and local health studies and strategies. It provides an understanding of the health determinants and receptors in the study area (see section 9.4), particularly the presence of any vulnerable groups which may be more susceptible to potential impacts. It covers the following aspects:

- Demographic and socio-economic: demographic change, age, employment, economy, and education;
- Health: health and wellbeing status, health and social care provision;
- Quality of life: deprivation, social capital and community cohesion, crime and safety; and
- Natural and built environment: buildings, transport and connectivity, local amenities and facilities.

9.6.6. Data sources used to compile the baseline were Public Health England Local Health Profiles, Census 2011 data, Indices of Multiple Deprivation 2015, Westminster City Council, Greater London Authority, Transport for London, NHS, Westminster Community Network, Westminster Local Involvement Network, Central London Clinical Commissioning Group, West London Clinical Commissioning Group, and other publicly-available socio-economic data sources.

Sensitivity of the receptors

9.6.7. The potential effects of the Scheme on the physical and mental health, and social wellbeing of local population groups depend on the receptors' sensitivity to changes to the health determinants identified above. The assessment has involved a review of evidence on pathways for the transmission of changes in health determinants to the health of population groups, grounded in the local health baseline context, to

assign each receptor a sensitivity value with respect to each determinant according to the criteria in Table 9-6.

Table 9-6 - Sensitivity of receptors for Human Health

Sensitivity of receptor	Importance / resilience of receptor
Very High	Health receptor is expected to be directly affected. Receptor is very well placed to take advantage of beneficial impacts, and/or is very poorly placed to deal with any adverse impacts.
High	Health receptor is likely to be directly affected. Receptor is well placed to take advantage of beneficial impacts, and/or is not well placed to deal with any adverse impacts.
Medium	Health receptor is likely to be indirectly affected. Average ability to maximise beneficial impacts or cope with adverse impacts.
Low	Health receptor is unlikely to be affected. Receptor is not well placed to take advantage of beneficial impacts, and/or is well placed to deal with any adverse impacts.

- 9.6.8. Sensitivity of health receptors depends on whether the receptor is likely to be directly affected by changes to health determinants caused by the Scheme and whether the receptor is well placed to deal with impacts (criteria set out in Table 9-6). The understanding of the health receptors in the study area obtained through the baseline assessment (Table 9-3) combined with a review of evidence of pathways of impact to human health (Table 9-7) inform the assessment of the sensitivity of each receptor to each health determinant (Table 9-8).
- 9.6.9. The health determinants relevant to the Scheme are included in Table 9-7 below. The health receptor sensitivity to these health determinants is included in Table 9-8.

Table 9-7 - Pathways of impact to Human Health

Health determinant	Impact to health, including to vulnerable groups
Air pollution	Poor environmental quality and exposure to waste is linked to increased risk for physical health, including respiratory and gastrointestinal problems, and lower mental health outcomes. Those with existing health issues are likely to be more vulnerable. Asthma, allergies and some types of cancer are of particular concern to children.
Green space and land blight Access to open space, recreational and leisure-time activities	Greenspace, open space, and recreational and leisure-time facilities reduce air pollution and have been linked to higher levels of physical activity ³² , reduced levels of obesity in children and reductions in the number of long-term conditions such as heart disease, diabetes, cancer and musculoskeletal conditions ³³ . The proportion of green and open space is linked to reported levels of health and mental health ³⁴ for all ages and socio-economic groups, through improving companionship, sense of identity, belonging and happiness.
Access to healthcare services and other social infrastructure	Availability and use of healthcare services that prevent and treat disease and other social infrastructure is important for promoting and maintaining health, preventing and treating disease, reducing unnecessary disability and premature death, and achieving health equality for the population. Groups more vulnerable to illness, such as the elderly and children, benefit disproportionately.
Risk of injuries and death	An individual's risk of injury may be impacted by many social, personal, economic and environmental factors. The physical environment such as transport systems and infrastructure, land use and urban development can affect the rate of incidents, injuries and death. Road traffic injuries are a major public health issue, particularly in the study area. Injuries resulting from motor vehicle accidents are the leading cause of death for young people.

³² Coombes et al 2010; Lee and Maheswaran 2010

³³ Department of Health 2012

Health determinant	Impact to health, including to vulnerable groups
Access to transport options and community facilities	Transport is vital as it allows access to family and friends, education, healthcare, community facilities, food and jobs. Sustainable transport systems support safe and community friendly streets and spaces, minimise harmful impacts on the environment and increase walking, cycling and public transport use. Efficient transport systems reduce socio-economic inequalities by allowing people access to jobs and health appointments, for example.
Active Travel	Active travel promotes mental and physical wellbeing by encouraging walking and cycling which improve health. Such communities are generally more physically active, experience increased social contact, lower levels of traffic injuries and are less exposed to air pollution. Regular physical activity has many benefits to health. It reduces the risk of chronic conditions such as cardiovascular disease, diabetes, cancer, obesity, musculoskeletal conditions, and mental health problems and improves mood. Footpaths and cycle lanes contribute to physical activity. Research shows that keeping physically active can reduce the risk of heart and circulatory disease and risk of early death. Physical activity is also shown to reduce the chances of asthma, diabetes and cancer.
Access to work and training	Income and work are two of the most important determinants of health and wellbeing. Employment and skills influence mental and physical health, with low education levels and unemployment linked with increased stress, lower self-confidence, increased rates of illness and premature death. Those on lower incomes due to low skills or unemployment are also less likely to be able to engage in healthy behaviours which impact physical and mental health.
Social cohesion and lifetime neighbourhoods	Social cohesion and lifetime neighbourhoods are important in reducing health and social inequalities. Relationships and support networks are important for physical health, social and mental wellbeing, particularly for elderly populations at risk of social isolation, those on low incomes, young people and children. Social cohesion increases connections and solidarity amongst groups. The potential impact of social capital on social cohesion will vary depending on the ways in which the effects are enhanced or diminished by the wider social, political, economic and cultural environment. Lack of social cohesion can have adverse effects on behaviours, leading to crime, disorder and violence.
Social norms and attitudes (e.g. discrimination, racism)	Social norms and attitudes, such as discrimination and racism, reflect the social, physical and environmental conditions in which people are born, live, learn, play, work and age. This can have adverse impacts on health such as self-esteem and emotional wellbeing, cognitive functioning, increased risk of stress and serious chronic health conditions.
Exposure to crime, social disorder and homelessness	Exposure to crime, social disorder and homelessness can be linked to health and social factors, and lack of cooperation in a community. This can have powerful negative or positive influences on physical and mental health. Exposure reduces self-esteem, activates stress mechanisms, affects eating and sleeping, and increases the risk of health conditions such as heart disease, depression and post-traumatic stress disorder. The affects can be particularly damaging for children and older people.

³⁴ Barton and Pretty 2010

Table 9-8 - Health receptor sensitivity to health determinants

Health receptor	Determinant and sensitivity
Wider groups	<ul style="list-style-type: none"> Air pollution - Medium Green space and land blight - Medium Access to healthcare services & other social infrastructure - Medium Risk of injuries and death - Medium Access to open space, recreational and leisure-time activities - Medium Access to transport options and community facilities - Medium Active travel - Medium Access to work and training - Low Social cohesion and lifetime neighbourhoods - Low Social norms and attitudes (e.g. discrimination, racism and distrust of government) - Low Exposure to crime, social disorder and homelessness - Low
Children and adolescents	<ul style="list-style-type: none"> Air pollution - High Green space and land blight - High Access to healthcare services & other social infrastructure - High Risk of injuries and death - Very High Access to open space, recreational and leisure-time activities - High Access to transport options and community facilities - Medium Active travel - Medium Access to work and training - Low Social cohesion and lifetime neighbourhoods - Medium Social norms and attitudes (e.g. discrimination, racism and distrust of government) - Low Exposure to crime, social disorder and homelessness - Medium
Older people	<ul style="list-style-type: none"> Air pollution - High Green space and land blight - Low Access to healthcare services & other social infrastructure - High Risk of injuries and death - High Access to open space, recreational and leisure-time activities - Medium Access to transport options and community facilities - High Active travel - Medium Access to work and training - Low Social cohesion and lifetime neighbourhoods - Medium Social norms and attitudes (e.g. discrimination, racism and distrust of government) - Medium Exposure to crime, social disorder and homelessness - Medium
People who are disabled and/or with other health problems	<ul style="list-style-type: none"> Air pollution - High Green space and land blight - Low Access to healthcare services & other social infrastructure - High Risk of injuries and death - High Access to open space, recreational and leisure-time activities - Medium Access to transport options and community facilities - High Active travel - Medium

Health receptor	Determinant and sensitivity
	<ul style="list-style-type: none"> Access to work and training - Low Social cohesion and lifetime neighbourhoods - Medium Social norms and attitudes (e.g. discrimination, racism and distrust of government) - High Exposure to crime, social disorder and homelessness - Medium
Low-income groups	<ul style="list-style-type: none"> Air pollution - Medium Green space and land blight - Medium Access to healthcare services & other social infrastructure - High Risk of injuries and death - High Access to open space, recreational and leisure-time activities - High Access to transport options and community facilities - High Active travel - Medium Access to work and training - Medium Social cohesion and lifetime neighbourhoods - Medium Social norms and attitudes (e.g. discrimination, racism and distrust of government) - High Exposure to crime, social disorder and homelessness - Medium

Impact severity

Impact magnitude

- 9.6.10. Identification and assessment of the health determinants affected by the Scheme has drawn upon the health baseline for the study area and residual effects identified in other relevant EIA topic assessments and the Daylight and Sunlight Report (Appendix H in Volume 5) for the Scheme. The reported changes to wider health determinants are therefore inclusive of cumulative effects and any mitigation measures identified in the topic assessments.
- 9.6.11. However, the determinants of access to open space, recreational and leisure facilities, social cohesion and lifetime neighbourhoods, social norms and attitudes, exposure to crime, social disorder and homelessness are not covered by other topic assessments. Professional judgement, informed by the description and scope of the Scheme, has therefore been used to assess the change to these determinants.
- 9.6.12. The likely severity of impact of the changes to the health determinants on human health via each health determinant is assessed according to the criteria in Table 9-9 below. Assessment of impact severity also considers the direction of change (positive/negative), scheme stage (construction/operation) and impact on vulnerable groups. For consistency, the criteria closely match those used in assessment of the other environmental effects of the Scheme.

Table 9-9 - Impact Magnitude for Human Health

Impact Severity	Description of Impact
High	<ul style="list-style-type: none"> Permanent impact to the health determinant Impact affecting large number of people Impact affects vulnerable population groups
Medium	<ul style="list-style-type: none"> Long-term impact (over a year) to the health determinant Impact affecting moderate number of people Impact affects some vulnerable population groups
Low	<ul style="list-style-type: none"> Short-term, temporary impact (several months) to the health determinant Impact affecting low-moderate number of people

Impact Severity	Description of Impact
	<ul style="list-style-type: none"> Impact affects few vulnerable population groups
Negligible	<ul style="list-style-type: none"> No or non-perceptible impact to the health determinant or to vulnerable groups

Significance of effects

9.6.13. The assessment brings together receptors' sensitivity and the likely magnitude of impact to health determinants to identify significant health effects using the criteria set out in the Impact Relevance Matrix, Table 5-4. Major and moderate effects are categorised as 'significant'. Minor and negligible effects as 'not significant'.

Limitations

9.6.14. Whilst it is possible to identify effects to population and human health induced by the Scheme via health determinants, health is dependent on multiple factors, some of which rest with individuals and/or is outside the influence of planning decisions. Identifying health effects of the Scheme is therefore a qualitative exercise, based on the health baseline, professional judgement and reasoned argument. The anticipated impacts of the Scheme to health determinants during the construction and operational phases are outlined in Table 9-10 and 9-11 below.

Construction

9.6.15. The construction phase of the Scheme is anticipated to generate impacts to health determinants as outlined in Table 9-10.

Table 9-10 - Construction phase health determinant impacts

Health determinant	Impact description	Impact magnitude
Air pollution	There could be long-term (up to 24 months) negative impacts, affecting a large number of people, including some vulnerable groups. Local communities, residents, workers, visitors and passers-by at locations within 350m from the boundary of the site and construction vehicle routes up to 500m from the site entrance and up to 50m from the edge of roads would be most at risk due to dust from site works and construction vehicles along with exhaust emissions from construction and other traffic due to road disruption and diversions.	Medium
Green space and land blight	The Scheme will lead to some loss of green space however it is anticipated that the majority of the gardens should still be accessible during the construction phase. This may result in some adverse effects on physical activity and stress and have a negative aesthetic impact on the use and perception of the green space.	Medium
Access to healthcare services & other social infrastructure	It is unlikely that the construction phase would increase delays and congestion for those accessing healthcare services and other social infrastructure nearby by car or on-foot, resulting in changes in physical fitness, physical health and mental wellbeing. Vulnerable groups who are more reliant on these services are unlikely to be significantly affected.	Low
Risk of injuries and death	Increased construction traffic in the area would increase the risk of injury because of increased traffic levels, particularly for vulnerable road users. However, this increased risk would be temporary and capable of mitigation. It is unlikely there would be alteration to existing traffic routes and patterns.	Medium
Access to open space,	Victoria Tower Gardens and Horseferry playground provide important open space to residents and children's play in a wider area that is lacking in	Medium

Health determinant	Impact description	Impact magnitude
recreational and leisure-time activities	informal play space. The Scheme will lead to some loss of green space however it is anticipated that the majority of the gardens should still be accessible during the construction phase. This could have adverse effects particularly for children and adolescents who are regular users, reducing levels of physical activity, however this effect is temporary (only lasting for a portion of the construction works) and reversible: once construction is complete, all gates of the park will return to public use. The Scheme could also have a negative aesthetic impact on the use of these facilities.	
Access to transport options and community facilities	Access to transport options and community facilities would be largely unaffected. Good access to services, opportunities for physical activity, wellbeing, participation, community interaction and social cohesion would be largely maintained, minimising any impacts on physical fitness, physical health and mental wellbeing.	Low
Active travel	The impact of the construction of the Scheme will be largely confined to within the site boundary, thus it is not anticipated to significantly impact pedestrian or cyclist movement, capacity or severance. There may be a slight temporary reduction in amenity for users of the network of footpaths within Victoria Tower Gardens and for pedestrians and cyclists along local roads due to increased traffic. There may also be slight severance, notably for users of the footpath that runs east-west past the Buxton Memorial Fountain, towards Millbank, However, it is unlikely that these changes would result in any significant disruption, altered traffic movements or perception that walking and cycling routes have become unsafe which would reduce active travel.	Low
Access to work and training	Construction of the Scheme would generate new employment opportunities, which could provide financial security and contribute to self-esteem, particularly for low-income groups in the area. Whilst the construction period would be temporary, access to skills and training schemes for new workers, would have long-term benefits. There could also be temporary adverse impacts for people accessing employment in the area resulting from road and/or footpath closures/diversions and disruption to traffic and road flows, though this would not be significant.	Low
Social cohesion and lifetime neighbourhoods	During construction there could be a temporary minor decrease in access to services and amenities resulting from road and/or footpath closures/diversions and disruption to traffic and road flows. Due to the self-contained nature of the Scheme, it is unlikely there would be any reduced social interaction or increased community severance which would adversely affect wellbeing and mental health or lead to reduced active travel or reduced physical fitness.	Low
Social norms and attitudes (e.g. discrimination, racism and distrust of government)	It is unlikely there would be any significant impacts on social norms and attitudes during the construction phase of the Scheme.	Low
Exposure to crime, social disorder and homelessness	A temporary increase in the risk of crime is typically associated with construction sites. Due to high levels of homelessness within the Westminster area, there is potential that any homeless users of Victoria Tower Gardens would be displaced to other locations within the borough.	Low

Health determinant	Impact description	Impact magnitude
	On balance, the likely effects would be negligible.	

Operation

9.6.16. The operational phase of the Scheme is anticipated to generate impacts to health determinants as outlined in Table 9-11.

Table 9-11 - Operational phase health determinant impacts

Health determinant	Impact description	Impact magnitude
Air pollution	Most visitors to the site would arrive via public transport. Therefore, it is unlikely that the Scheme would significantly increase car or motor vehicle usage leading to an increase in air pollution. However, the Scheme would introduce additional sensitive receptors (up to 3,000 visitors are expected to visit the Memorial each day, and staff) into a poor air quality area, making the Scheme above the benchmark for transport emissions based on the 'Trip Rate Assessment Valid for London' (TRAVL) benchmark for such usage.	Low
Green space and land blight	In general, green space has been linked to better mental health and wellbeing whilst showing reduced levels of obesity, disease and respiratory problems for vulnerable groups. Once the Scheme is operational there will be a limited reduction in green space however there will be a greater number of people using the gardens which could affect social wellbeing.	Medium
Access to healthcare services & other social infrastructure	The Scheme is unlikely to significantly affect access to healthcare services and other social infrastructure. Whilst there will be an increase in visitor and employee numbers, the pressure that this will place on local health facilities and social infrastructure is expected to be negligible.	Negligible
Risk of injuries and death	The Scheme has been designed to improve the physical environment by reflecting the current diverse use of the Victoria Tower Gardens, allowing current activities to remain and enhancing the overall user experience. However, employees and up to 3,000 visitors are expected to visit the Memorial and Learning Centre each day, which could increase travelling, put increased pressure on transport systems and infrastructure, and lead to queuing/ gathering of groups which could potentially increase the risk of minor incidents and injuries. As most people will arrive at the Scheme by public transport and walking, road traffic injuries resulting from increased motor vehicle usage in the vicinity, particularly for vulnerable groups, is expected to be negligible.	Low
Access to open space, recreational and leisure-time activities	As discussed, there is expected to be a reduction of around 7% in green space, however the Scheme will retain all activities that are currently undertaken in the Garden and provide further enhancements across the site. For example, the design of the playground to the south of the Scheme is being developed in consultation with local community groups, and comprehensive landscaping is being proposed. Increased numbers of employees and visitors would provide a sense of confidence and security; however, this could also lead to increased demand for the recreational activities, resulting in minor adverse impacts on physical health and social wellbeing.	Low

Health determinant	Impact description	Impact magnitude
Access to transport options and community facilities	Access to transport options and community facilities would be largely unaffected. The Scheme itself will generate negligible volumes of vehicular traffic. Despite the introduction of employees for the Scheme and increased visitor numbers, good access to services, opportunities for physical activity, wellbeing, participation, community interaction and social cohesion would be largely maintained, minimising any impacts on physical fitness, physical health and mental wellbeing.	Low
Active travel	The Scheme is not anticipated to significantly impact pedestrian or cyclist movement, capacity or severance. Improved links to the surrounding area and provision of cycle parking, along with increased security and safety measures are likely to have minor beneficial impacts for pedestrians and cyclists.	Low
Access to work and training	The Scheme is likely to support a number of jobs which would contribute to the local, regional and national economy, and potentially provide benefits to unemployed and low-income groups in the area. There would also be indirect benefits for nearby retail and community facilities, and other visitor attractions, through linked visitor trips.	Medium
Social cohesion and lifetime neighbourhoods	The Scheme will cater for a range of ages and users and create an inclusive community. Inclusive design and access for disabled and older people will enhance the character, legibility, permeability and safety of the area. The Scheme also has potential to increase social cohesion by providing a social, political and cultural environment that seeks to fight exclusion and marginalism, adding to the success of London's cultural and creative sectors which are central to the city's economic and social success.	Medium
Social norms and attitudes (e.g. discrimination, racism and distrust of government)	The Scheme will represent democracy and the importance of mutual respect and tolerance for people at all levels of society, including all faiths, backgrounds and ethnicities. The overall scheme links to the existing memorials within the gardens and seeks to provide a narrative of freedom contrasted with injustice. It is likely that overall the Scheme will help the fight against discrimination and racism, which could have positive indirect health benefits for the local and wider population.	Medium
Exposure to crime, social disorder and homelessness	The Scheme will increase the level of footfall and activity in the area throughout the day and evening, which along with on-site security measures, is likely to result in a greater sense of safety and lower risk of crime. By providing built development and formalising the area around the Scheme, it is likely there would be a negligible effect on levels of homelessness.	Low

9.7 Potential Impacts

Construction

- 9.7.1. Effects on Population and Human Health are assessed by bringing together the assessment of receptors' sensitivity with the magnitude of impacts to health determinants, outlined in Table 9-12 below.
- 9.7.2. During the construction phase, and without mitigation, moderate adverse effects would relate to air pollution (exposure to construction dust), risk of injuries, access to open space, recreational and leisure-time facilities and disruption of access to normal uses. This could result in short-term, temporary adverse effects on physical activity and stress and wellbeing and have a negative aesthetic impact on the use and perception of the green space.

- 9.7.3. Minor beneficial effects are anticipated via 'low income groups' access to work and training, with employment opportunities that could provide financial security and contribute to self-esteem. Access to skills and training could provide long-term benefits.
- 9.7.4. All other population and human health effects during construction are likely to be minor adverse or negligible.
- 9.7.5. The significant effects identified (i.e. major or moderate adverse effects) would be temporary in nature and capable of being mitigated by the measures outlined in sections 9.9 and 9.10.

Table 9-12 - Construction phase effects on Human Health

Health Determinants	Receptors				
	Wider groups	Children and adolescents	Older people	People who are disabled and/or with other health problems	Low-income groups
Air pollution	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse
Green space and land blight	Moderate Adverse	Moderate Adverse	Minor Adverse	Minor Adverse	Moderate Adverse
Access to healthcare services & other social infrastructure	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse
Risk of injuries and death	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse
Access to open space, recreational and leisure-time activities	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse	Moderate Adverse
Access to transport options and community facilities	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse
Active travel	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse
Access to work and training	Negligible	Negligible	Negligible	Negligible	Minor beneficial
Social cohesion and lifetime neighbourhoods	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse

Health Determinants	Receptors				
	Wider groups	Children and adolescents	Older people	People who are disabled and/or with other health problems	Low-income groups
Social norms and attitudes (e.g. discrimination, racism and distrust of government)	Negligible	Negligible	Minor Adverse	Minor Adverse	Minor Adverse
Exposure to crime, social disorder and homelessness	Negligible	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse

Operation

- 9.7.6. Operational phase effects on Population and Human Health bring together the assessment of the receptors' sensitivity with the magnitude of impacts to health determinants, as outlined in 9-13 below.
- 9.7.7. During operation, there is likely to be a moderate (significant) effect on use of the green space as a result of the projected increase in footfall. Apart from the small loss of gardens to the courtyard and pavilion, the park area will remain freely accessible to the public, however it will accommodate a much higher number of visitors than at present. This could affect the wellbeing of regular users of the gardens.
- 9.7.8. Moderate beneficial effects are anticipated in relation to access to work and training. This could potentially influence mental and physical health, reduce stress, improve self-confidence, and reduce rates of illness and premature death. Moderate beneficial impacts are also anticipated via 'children and adolescents', 'older people', 'people who are disabled and/or with other health problems', and 'low-income groups' social cohesion and lifetime neighbourhoods, and via 'older people', 'people who are disabled and/or with other health problems', and 'low-income groups' social norms and attitudes. This could help to reduce health and social inequalities, improve relationships and social networks, have positive effects on behaviours that lead to crime, disorder and violence, and create physical and environmental conditions that could help against discrimination and racism.
- 9.7.9. All other population and human health effects are likely to be minor beneficial/adverse or negligible during operation of the Scheme.

Table 9-13 - Operational phase effects on Human Health

Health Determinants	Receptors				
	Wider groups	Children and adolescents	Older people	People who are disabled and/or with other health problems	Low-income groups
Air pollution	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse
Green space and land blight	Moderate Adverse	Moderate Adverse	Minor Adverse	Minor Adverse	Moderate Adverse

Health Determinants	Receptors				
	Wider groups	Children and adolescents	Older people	People who are disabled and/or with other health problems	Low-income groups
Access to healthcare services & other social infrastructure	Negligible	Negligible	Negligible	Negligible	Negligible
Risk of injuries and death	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse
Access to open space, recreational and leisure-time activities	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse
Access to transport options and community facilities	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse
Active travel	Minor beneficial	Minor beneficial	Minor beneficial	Minor beneficial	Minor beneficial
Access to work and training	Minor beneficial	Minor beneficial	Minor beneficial	Minor beneficial	Moderate beneficial
Social cohesion and lifetime neighbourhoods	Minor beneficial	Moderate beneficial	Moderate beneficial	Moderate beneficial	Moderate beneficial
Social norms and attitudes (e.g. discrimination, racism and distrust of government)	Minor beneficial	Minor beneficial	Moderate beneficial	Moderate beneficial	Moderate beneficial
Exposure to crime, social disorder and homelessness	Negligible	Minor beneficial	Minor beneficial	Negligible	Minor beneficial

9.8 Cumulative Effects

- 9.8.1. This population and human health chapter is by nature an in-combination assessment of the population and human health impacts of all environmental effects of the Scheme. The full scope of expected impacts on the health determinants and ultimately on human health has been covered in the assessment.
- 9.8.2. It is possible to identify further combined effects to human health receptors arising from effects to individual health determinants. For example, the benefits identified to health during the operational phase of the Scheme are likely to operate in a mutually reinforcing way: improved social cohesion and lifetime neighbourhoods, improved social norms and attitudes, and access to work and training, whilst directly improving the population's physical health and mental wellbeing, could in turn improve physical health

through greater propensity for active travel or use of outdoor spaces, and reduced exposure to crime, social disorder and homelessness.

- 9.8.3. If further synergisms of other environmental aspects are found to influence environmental effects, this could increase the magnitude of the impacts already identified on human health receptors. Any significant in-combination effects relating to the other environmental topics will be discussed in Chapter 15, Cumulative Effects.
- 9.8.4. Cumulative effects of the Scheme and other developments have been incorporated into the findings of the technical chapters on which this assessment is based and are hence included in the assessment.

Construction

- 9.8.5. There are several consented schemes within the area which, when combined with the Scheme, could cumulatively reduce amenity for identified sensitive receptors during construction. The consented schemes within the study area, or in proximity to the study area boundary, include:

- 13/09737/FULL (16/06616/FULL) - 9 Ergon House, Millbank SW1P 3HZ
- 15/07819/FULL - 29 Great Peter Street SW1P 3LW
- 15/07778/FULL - 32-34 Great Peter Street SW1P 2DB
- 16/01796/FULL - 29-35 Old Queen Street SW1H 9JA
- 15/01059/FULL - 14 Great Peter Street SW1P 3NQ
- 17/01327/FULL - 19 Dacre Street SW1H 0DH
- 13/12539/FULL (16/05060/FULL) - 1-3 Queen Anne's Gate SW1H 9BT
- 15/07690/FULL - 52 Horsferry Road SW1P 2AF
- 17/09875/FULL - 20 Great Smith Street SW1P 3BT
- 14/04757/FUL (16/01103/VOC) - 22-29 Albert Embankment SE1 7TJ
- 18/03776/LBC and 18/03775/FULL - Westminster Bridge
- 18/03778/LBC and 18/03777/FULL – Lambeth Bridge

- 9.8.6. The findings from the other technical chapters confirm that during construction there will be an increase in construction traffic in the area, and dust and pollution generated by the consented schemes which could have adverse impacts on population and human health, however mitigation and best practice should reduce adverse effects for each of the relevant developments to an acceptable level that would result in no significant adverse residual effects. These effects will be of limited duration and intensity. Therefore, the likely cumulative effects on population and human health during construction will be negligible. As the UKHM scheme itself reduces residual affects affecting health determinants to a negligible/minor adverse level, there is little scope for cumulative effects.

Operation

- 9.8.7. The local economy would likely see a positive cumulative effect from the consented schemes which include a mix of residential, retail, and office developments, including access, cycle parking provision and landscaping, and improvement works to Westminster and Lambeth Bridges. This will have minor beneficial effects for the health and wellbeing of local communities via the provision of much needed housing, access to open space, access to work and training, social cohesion and lifetime neighbourhoods. The Scheme itself provides positive benefits for diversifying cultural offering and improving social attitudes, which would be mutually reinforced by an increased resident and visitor population, and other social opportunities.

9.9 Mitigation measures

Construction

- 9.9.1. The population and human health assessment, being based upon residual effects identified by other technical assessments, thus incorporates the appropriate mitigation measures identified in those chapters. To minimise the effects on physical health from air pollution and injury during construction, proposed mitigation measures include a Construction Management Plan, general communication, general dust

management, site monitoring, preparing and maintaining the site, operating vehicles/machinery effectively, sustainable travel, construction management and best practice construction practices.

9.9.2. All mitigation measures are identified in Table 9-14.

Operation

9.9.3. Additional specific impact mitigation for human health has been identified to address the other minor adverse effects resulting from the Scheme. For example, new footpaths will be introduced as part of the new design for what will become almost completely new gardens, along with flower and shrub planting, newly laid grass with drainage, new seating and lighting. This would help to mitigate the loss of a small area of green space/open space which is required to implement the Scheme, whilst improving the general landscaping of the area, the sense of safety and wellbeing, and reducing perceptions of crime.

9.9.4. It is proposed to implement a Travel Plan for the Scheme, this will involve the implementation of various measures to encourage the use of sustainable travel modes and reduce traffic-related air pollution when travelling to the Scheme, including the management of coach operations.

9.9.5. All mitigation measures are identified in Table 9-15.

9.10 Residual Effects

Construction

9.10.1. During the construction phase, there remains a moderate (significant) population and human health effect on for existing users of Victoria Tower Gardens due to a reduction in the useable area of the park. This effect is temporary (only lasting for a portion of the construction works) and reversible: once construction is complete, all gates of the park will return to public use. This temporary residual effect on pedestrian amenity is also reported in the Transport Chapter.

Operation

9.10.2. Apart from the small loss of open space to the development, the gardens will remain freely accessible to the public, however this open space will accommodate a much higher number of visitors than at present. There will be a moderate (significant) effect on health and wellbeing experienced by existing park users because of the projected increase in footfall. This permanent residual effect on pedestrian amenity is also reported in the Transport Chapter.

9.11 Summary Table

9.11.1. The Scheme is anticipated to have significant beneficial effects on Population and Human Health during operation via improved social cohesion and lifetime neighbourhoods, social norms and attitudes, and access to work and training. Improved footpaths and cycle lane environment, provision of a high-quality Memorial and Learning Centre for wider and vulnerable groups to enjoy, new and improved landscaping and lighting, potential improvements to current facilities, and options to design the playground to the south of the Scheme, would improve the current physical and environmental conditions and contribute positively to physical health, mental and social wellbeing.

9.11.2. With appropriate mitigation in place, including landscaping, planting and enhancement measures to mitigate the loss of an area of open/green space, the assessment concludes there would be a moderate (significant) adverse residual effect on Population and Human Health during construction from the reduction in useable area of the park and a moderate (significant) adverse residual effect during operation from the increased number of visitors using the gardens.

9.11.3. Tables 9-14 and 9-15 summarise the identified Population and Human Health effects of the Scheme.

9.12 Summary Table

Table 9-14 - Construction phase effects on Population and Human Health

Activity	Baseline	Impact assessment			Mitigation	
Impact	Receptor	Receptor sensitivity	Impact Severity	Impact Relevance	Mitigation Measures	Residual Effect
Air pollution	Wider Groups *	Medium	Medium	Moderate Adverse	<ul style="list-style-type: none"> General communication General dust management Site monitoring Preparing and maintaining the site Operating vehicles/machinery effectively and sustainable travel Construction management and best practice construction practices 	Negligible
	Children and adolescents	High	Medium	Moderate Adverse		Negligible
	Older people	High	Medium	Moderate Adverse		Negligible
	People who are disabled and/or with other health problems	High	Medium	Moderate Adverse		Negligible
	Low-income groups	Medium	Medium	Moderate Adverse		Negligible
Green space and land blight	Wider Groups *	Medium	Medium	Moderate Adverse	<ul style="list-style-type: none"> Minimise disruption of normal uses and access to green space Keep the gardens open to the public where possible Retain the wider section nearest Westminster and along the river, away from the works 	Moderate Adverse
	Children and adolescents	High	Medium	Moderate Adverse		Moderate Adverse
	Older people	Low	Medium	Minor Adverse		Minor Adverse
	People who are disabled and/or with other health problems	Low	Medium	Minor Adverse		Minor Adverse
	Low-income groups	Medium	Medium	Moderate Adverse		Moderate Adverse
Access to healthcare services & other social infrastructure	Wider Groups *	Medium	Low	Minor Adverse	<ul style="list-style-type: none"> Retain and minimise disruption to footways, access, bus lane operation, and disabled parking nearby Operating vehicles/machinery effectively and sustainable travel Construction management Best practice 	Negligible
	Children and adolescents	High	Low	Minor Adverse		Negligible
	Older people	High	Low	Minor Adverse		Negligible
	People who are disabled and/or with other health problems	High	Low	Minor Adverse		Negligible
	Low-income groups	High	Low	Minor Adverse		Negligible
Risk of injuries and death	Wider Groups *	Medium	Medium	Moderate Adverse	<ul style="list-style-type: none"> Construction management and best practice Measures to mitigate transport impacts Traffic marshalling Retention of existing pedestrian accesses where possible No construction along the footway Encourage construction staff to travel to and from the site by public transport Consider options for alternative means of removing excavated materials from the site, other than road 	Negligible
	Children and adolescents	Very High	Medium	Moderate Adverse		Minor Adverse
	Older people	High	Medium	Moderate Adverse		Negligible
	People who are disabled and/or with other health problems	High	Medium	Moderate Adverse		Negligible
	Low-income groups	High	Medium	Moderate Adverse		Negligible
Access to open space, recreational and leisure-time activities	Wider Groups *	Medium	Medium	Moderate Adverse	<ul style="list-style-type: none"> Minimise disruption of normal uses and access to open space Retain all activities currently undertaken in the gardens as far as possible Keep the gardens open to the public where possible Retain the section of open space nearest Westminster and along the river, away from the works 	Negligible
	Children and adolescents	High	Medium	Moderate Adverse		Minor Adverse
	Older people	Medium	Medium	Moderate Adverse		Negligible
	People who are disabled and/or with other health problems	Medium	Medium	Moderate Adverse		Negligible
	Low-income groups	High	Medium	Moderate Adverse		Minor Adverse
	Wider Groups *	Medium	Low	Minor Adverse		Negligible

Activity	Baseline	Impact assessment			Mitigation	
Impact	Receptor	Receptor sensitivity	Impact Severity	Impact Relevance	Mitigation Measures	Residual Effect
Access to transport options and community facilities	Children and adolescents	Medium	Low	Minor Adverse	<ul style="list-style-type: none"> Retain safe and unhindered access to transport systems, community facilities and services Retain existing bus stop capacity Retain peak-hour bus lane operation 	Negligible
	Older people	High	Low	Minor Adverse		Negligible
	People who are disabled and/or with other health problems	High	Low	Minor Adverse		Negligible
	Low-income groups	High	Low	Minor Adverse		Negligible
Active travel	Wider Groups *	Medium	Low	Minor Adverse	<ul style="list-style-type: none"> Maintain a safe and accessible pedestrian and cycle environment Retain pedestrian and cycle access to the gardens and along the riverside path Traffic marshalling No construction along the footway 	Negligible
	Children and adolescents	Medium	Low	Minor Adverse		Negligible
	Older people	Medium	Low	Minor Adverse		Negligible
	People who are disabled and/or with other health problems	Medium	Low	Minor Adverse		Negligible
	Low-income groups	Medium	Low	Minor Adverse		Negligible
Access to work and training	Wider Groups *	Low	Low	Negligible	<ul style="list-style-type: none"> Retain access to employment and training in the area Retain peak-hour bus lane operation Traffic marshalling No construction along the footway 	Negligible
	Children and adolescents	Low	Low	Negligible		Negligible
	Older people	Low	Low	Negligible		Negligible
	People who are disabled and/or with other health problems	Low	Low	Negligible		Negligible
	Low-income groups	Medium	Low	Minor Beneficial		Minor Beneficial
Social cohesion and lifetime neighbourhoods	Wider Groups *	Low	Low	Negligible	<ul style="list-style-type: none"> Prevent community severance Maintain connections, access to services and amenities, providing ongoing opportunities for social interaction 	Negligible
	Children and adolescents	Medium	Low	Minor Adverse		Negligible
	Older people	Medium	Low	Minor Adverse		Negligible
	People who are disabled and/or with other health problems	Medium	Low	Minor Adverse		Negligible
	Low-income groups	Medium	Low	Minor Adverse		Negligible
Social norms and attitudes (e.g. discrimination, racism and distrust of government)	Wider Groups *	Low	Low	Negligible	<ul style="list-style-type: none"> General communication Create a physical, social and working environment that genders tolerance, equality and inclusivity 	Negligible
	Children and adolescents	Low	Low	Negligible		Negligible
	Older people	Medium	Low	Minor Adverse		Negligible
	People who are disabled and/or with other health problems	High	Low	Minor Adverse		Negligible
	Low-income groups	High	Low	Minor Adverse		Negligible
Exposure to crime, social disorder and homelessness	Wider Groups *	Low	Low	Negligible	<ul style="list-style-type: none"> Effective construction management procedures such as hoardings and making sure the site is well lit and secure overnight. 	Negligible
	Children and adolescents	Medium	Low	Minor Adverse		Negligible
	Older people	Medium	Low	Minor Adverse		Negligible
	People who are disabled and/or with other health problems	Medium	Low	Minor Adverse		Negligible
	Low-income groups	Medium	Low	Minor Adverse		Negligible

Table 9-15 - Operational phase effects on Population and Human Health

Activity	Baseline	Impact assessment			Mitigation	
Impact	Receptor	Receptor sensitivity	Impact Severity	Impact Relevance	Mitigation Measures	Residual Effect
Air pollution	Wider Groups *	Medium	Low	Minor Adverse	<ul style="list-style-type: none"> Measures to reduce vehicle emissions Measures to encourage cycling and promote the use of public transport, and the use of electric vehicles and low emission vehicles 	Negligible
	Children and adolescents	High	Low	Minor Adverse		Negligible
	Older people	High	Low	Minor Adverse		Negligible
	People who are disabled and/or with other health problems	High	Low	Minor Adverse		Negligible
	Low-income groups	Medium	Low	Minor Adverse		Negligible
Green space and land blight	Wider Groups *	Medium	Medium	Moderate Adverse	<ul style="list-style-type: none"> Only 7% loss of open space Investigate potential to provide additional green infrastructure enhancements as part of the Scheme 	Moderate Adverse
	Children and adolescents	High	Medium	Moderate Adverse		Moderate Adverse
	Older people	Low	Medium	Minor Adverse		Minor Adverse
	People who are disabled and/or with other health problems	Low	Medium	Minor Adverse		Minor Adverse
	Low-income groups	Medium	Medium	Moderate Adverse		Minor Adverse
Access to healthcare services & other social infrastructure	Wider Groups *	Medium	Negligible	Negligible	<ul style="list-style-type: none"> Investigate potential to increase footway capacity north of gate 1 	Negligible
	Children and adolescents	High	Negligible	Negligible		Negligible
	Older people	High	Negligible	Negligible		Negligible
	People who are disabled and/or with other health problems	High	Negligible	Negligible		Negligible
	Low-income groups	High	Negligible	Negligible		Negligible
Risk of injuries and death	Wider Groups *	Medium	Low	Minor Adverse	<ul style="list-style-type: none"> Provision of kerbside loading facilities for mobility impaired visitors Memorial visitors to access the gardens via Gate 1 to minimise footfall along Millbank Advanced booking systems, on-site safety and security measures, and queue management facilities 	Negligible
	Children and adolescents	Very High	Low	Moderate Adverse		Minor Adverse
	Older people	High	Low	Minor Adverse		Negligible
	People who are disabled and/or with other health problems	High	Low	Minor Adverse		Negligible
	Low-income groups	High	Low	Minor Adverse		Negligible
Access to open space, recreational and leisure-time activities	Wider Groups *	Medium	Low	Minor Adverse	<ul style="list-style-type: none"> Improvements to current facilities Enhancements to open space, such as planting, landscaping and increased lighting Enhancements to the playground to the south of the Scheme, in consultation with the local community 	Minor Adverse
	Children and adolescents	High	Low	Minor Adverse		Minor Adverse
	Older people	Medium	Low	Minor Adverse		Minor Adverse
	People who are disabled and/or with other health problems	Medium	Low	Minor Adverse		Minor Adverse
	Low-income groups	High	Low	Minor Adverse		Minor Adverse
Access to transport options and community facilities	Wider Groups *	Medium	Low	Minor Adverse	<ul style="list-style-type: none"> Retain existing bus stop capacity Encourage high use of public transport services Investigate potential for additional cycle parking provision Retain peak-hour bus lane operation 	Negligible
	Children and adolescents	Medium	Low	Minor Adverse		Negligible
	Older people	High	Low	Minor Adverse		Negligible
	People who are disabled and/or with other health problems	High	Low	Minor Adverse		Negligible
	Low-income groups	High	Low	Minor Adverse		Negligible

Active travel	Wider Groups *	Medium	Low	Minor Beneficial	No mitigation required Scheme enhancements include: <ul style="list-style-type: none"> Improving the environment for pedestrians and cyclists 	Minor Beneficial
	Children and adolescents	Medium	Low	Minor Beneficial		Minor Beneficial
	Older people	Medium	Low	Minor Beneficial		Minor Beneficial
	People who are disabled and/or with other health problems	Medium	Low	Minor Beneficial		Minor Beneficial
	Low-income groups	Medium	Low	Minor Beneficial		Minor Beneficial
Access to work and training	Wider Groups *	Low	Medium	Minor Beneficial	No mitigation required Scheme enhancements include: <ul style="list-style-type: none"> Providing work and training opportunities for local communities, the unemployed and low-income groups 	Minor Beneficial
	Children and adolescents	Low	Medium	Minor Beneficial		Minor Beneficial
	Older people	Low	Medium	Minor Beneficial		Minor Beneficial
	People who are disabled and/or with other health problems	Low	Medium	Minor Beneficial		Minor Beneficial
	Low-income groups	Medium	Medium	Moderate Beneficial		Moderate Beneficial
Social cohesion and lifetime neighbourhoods	Wider Groups *	Low	Medium	Minor Beneficial	No mitigation required Scheme enhancements include: <ul style="list-style-type: none"> Inclusive design and access Investigate potential to increase social cohesion 	Minor Beneficial
	Children and adolescents	Medium	Medium	Moderate Beneficial		Moderate Beneficial
	Older people	Medium	Medium	Moderate Beneficial		Moderate Beneficial
	People who are disabled and/or with other health problems	Medium	Medium	Moderate Beneficial		Moderate Beneficial
	Low-income groups	Medium	Medium	Moderate Beneficial		Moderate Beneficial
Social norms and attitudes (e.g. discrimination, racism and distrust of government)	Wider Groups *	Low	Medium	Minor Beneficial	No mitigation required Scheme enhancements include: <ul style="list-style-type: none"> Investigate diversity training for Memorial staff Creating an inclusive environment General communication of what the Memorial represents 	Minor Beneficial
	Children and adolescents	Low	Medium	Minor Beneficial		Minor Beneficial
	Older people	Medium	Medium	Moderate Beneficial		Moderate Beneficial
	People who are disabled and/or with other health problems	High	Medium	Moderate Beneficial		Moderate Beneficial
	Low-income groups	High	Medium	Moderate Beneficial		Moderate Beneficial
Exposure to crime, social disorder and homelessness	Wider Groups *	Low	Low	Negligible	No mitigation required Scheme enhancements include: <ul style="list-style-type: none"> On-site safety and security measures Good design and lighting 	Negligible
	Children and adolescents	Medium	Low	Minor Beneficial		Minor Beneficial
	Older people	Medium	Low	Minor Beneficial		Minor Beneficial
	People who are disabled and/or with other health problems	Medium	Low	Minor Beneficial		Minor Beneficial
	Low-income groups	Medium	Low	Minor Beneficial		Minor Beneficial

* Wider groups are defined as residents, workers, visitors, by-passers, cyclists, walkers, runners, users of public transport

10 Soils, Geology and Hydrogeology

10.1 Scope of the assessment

- 10.1.1. This chapter considers potential impacts related to soils, geology and hydrogeology. Soils, geology and groundwater comprise a fundamental component of the natural environment whose properties also directly and indirectly affect the built environment. In addition, impacts to groundwater often lead to impacts on surface water bodies, which have also been considered as receptors within this assessment. There is typically an overlap between the geo-environmental issues within this chapter and issues assessed under other technical disciplines, including potential damage to built heritage, ecology or archaeological receptors.
- 10.1.2. Waste is considered in this chapter as earthworks are anticipated as part of the Scheme and will generate significant volumes of surplus soils considered to be waste soils. The most common fate for such material is disposal to land (either by removal to an off-site location for re-use or by removal to an off-site waste disposal facility) wherein there can be potential geo-environmental impacts.
- 10.1.3. Unexploded ordnance (UXO) is not usually considered a contaminant (except in cases where explosive chemicals may be present in the soil outside of munitions, such as at weapons manufacturing facilities). However, UXO does constitute a risk associated with soils and is therefore considered as part of this chapter.
- 10.1.4. A site investigation report (dated March 2016) (Appendix I in Volume 5) and a preliminary geotechnical site investigation desktop study (July 2018) (Appendix J in Volume 5) have been undertaken for the Scheme. However, these are both desk-based study and no intrusive ground investigation data has been collected or reviewed to date. The Scoping Report established the background information regarding the conditions for geology, hydrology and hydrogeology and identified potential geohazards. Information on historical land use at the site was reviewed to help identify potential sources of contamination. Potential human health and controlled waters receptors were identified.

10.2 Responses to scoping opinion

Table 10-1 - Summary of responses to stakeholder scoping opinions

Stakeholder	Comment	Response
Environment Agency	We require development to be set back 16m from the defences to allow for maintenance, inspections and improvements ... If the minimum of 16m setback is not possible we would expect the applicant to submit evidence to demonstrate that any flood walls/defences are in good enough condition to protect the proposed development for its lifetime.	The potential impact on the river wall from heavy loading or collapse of soils has been considered in Section 10.7.1. Selection of the correct plant and temporary loading have been raised as mitigation measures. In addition, the requirement for a flood defence condition survey to be undertaken if works are within the 16 m setback distance has been highlighted in Section 10.9.1.
	It is important that the applicant is aware of the invisible (below ground) sections which make up a tidal flood defence when designing a construction method. This includes any tie rods, anchors and any other supporting structures below the surface.	The need to locate piles or intrusive ground investigation locations outside of the 16 m set-back area has been raised in Section 10.9.1. Where this is unavoidable, it has been suggested that care should be taken to identify any tie rods, anchors or other supporting structures below the surface.
	Any use of waste on the site would require authorisation from us either as an exempt or permitted operation.	Current design proposals will require excavation and removal from site rather raising of ground levels.
	Any waste material removed from site must also correctly follow duty of care	Generation of a large volume of waste has been identified as a potential impact in Section 10.7.1. It has been recommended that ground investigation is

Stakeholder	Comment	Response
	procedures, with all loads documented by waste transfer notes.	undertaken to characterise the likely nature of waste material. In addition, the requirement for following duty of care procedures has been set out in Section 10.9.1.
Natural England	Site is not located in a SSSI, RAMSAR or similar setting.	-
The Royal Parks	...notably school children visiting the existing education centre in Victoria Tower Gardens	Given school children will be visiting the education centre, the receptor sensitivity for the potential impact on off-site receptors exposed to wind-blown dust has been increased to Very High.
	In addition, the impact of that construction traffic upon mature tree roots and the longevity of those trees should be considered.	Potential impacts from construction traffic and heavy loading near mature trees along the western boundary of the site has been raised in Section 10.7.1. It has been recommended that where heavy loads cannot be avoided or kept away from mature trees that temporary surfacing is used to spread loads.

10.3 Relevant planning policy & legislation

Table 10-2 - Policy overview

Scale	Policy Document	Key Considerations for the Scheme
National	National Planning Policy Framework 2018	<p>Planning policies and decisions should ensure that:</p> <ul style="list-style-type: none"> • The site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation; • After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and • Adequate site investigation information, prepared by a competent person, is presented.
Local	The London Plan March 2018	<p>Appropriate measures should be taken to ensure that development on previously contaminated land does not activate or spread contamination. Waste should be removed from construction sites, and materials brought to the site, by water or rail transport wherever that is practicable. The River Thames is a strategically important and iconic feature of London. This role should be protected and promoted.</p>
	Westminster City Plan: Planning and Pollution Control	<p>Planning applications for the development of land which is contaminated will be encouraged. Where land for development is, or has been, used for purposes such as ..., riverside wharves, ... developers must carry out a detailed survey. Where contamination is identified, a strategy and measures for the remediation of the site must be provided to the council.</p>
Legislation	Environmental Protection Act 1990	<p>Establishes a legal framework for dealing with land contamination in England. It provides a means of dealing with unacceptable risks posed by land contamination to human health and the environment.</p>

Scale	Policy Document	Key Considerations for the Scheme
	Water Framework Directive Directions 2015	Provides environmental quality standards for surface water bodies and groundwater bodies.
Guidance	Defra Contaminated Land Statutory Guidance 2012	Government objectives with respect to land contamination policy are set out as: <ul style="list-style-type: none"> To identify and remove unacceptable risks to human health and the environment; To seek to ensure that contaminated land is made suitable for its current use; and To ensure that the burdens faced by individuals, companies and society as a whole are proportionate, manageable and compatible with the principles of sustainable development.
	Groundwater Protection Guidance 2017 (formerly GP3)	Identifies types of groundwater receptors as well as providing guidance for how to assess risks to groundwater.

10.4 Area of Influence

- 10.4.1. The works are to take place in Victoria Tower Gardens in the City of Westminster. The final excavation area will encompass an internal floor area of approximately 3258m², with excavation of the site to a depth of approximately 8m below current ground level. Spaces between fins of the Memorial will form the entrance to the Learning Centre, which will be located entirely underground over two levels; a mezzanine level and a basement.
- 10.4.2. The majority of the area of influence associated with soils and geology assessment is restricted to the site itself and any temporary areas required for construction. The exceptions to this are considerations of wind-blown dust and vibration on human health and structural receptors within the proximity of the proposed development. Impacts relating to hydrogeology may have a larger area of influence, depending on the groundwater flow regime. The area of influence for this soils, geology and hydrogeology assessment will therefore be 250m from the site boundary as shown in Figure 15.2 in Volume 4.

10.5 Baseline Conditions

- 10.5.1. Baseline conditions have been established through the Scoping Report and supporting desk-based assessment.

Geology

- 10.5.2. Based on published data from the British Geological Survey, the site is underlain by Made Ground and superficial drift deposits of Alluvium and River Terrace Deposits. The major bedrock unit under the site is the London Clay Formation, which is underlain by the Lambeth Group, Thanet Formation and White Chalk Sub-Group at depth.

Hydrogeology

- 10.5.3. Hydrogeological classification of the superficial and bedrock geology is based on the Environment Agency aquifer designations. The River Terrace Deposits, are classed as a 'Secondary A' aquifer while the London Clay Formation is classified as 'Unproductive Strata'. Although the Lambeth Group and Thanet Formation are classified as 'Secondary A' aquifers and the White Chalk Sub-group as a 'Principal' aquifer impacts on these units are unlikely given the thickness of London Clay Formation, which will act as an aquitard between groundwater in the River Terrace Deposits and these aquifers at depth. The River Terrace deposits are considered in continuity with the River Thames, located adjacent to the eastern boundary of the site.

Contamination

- 10.5.4. Potential sources of contamination in the context of soils, geology and hydrogeology can be divided into residual sources resulting from historical land uses, and new sources related to contemporary land use. In addition, the Scheme may introduce potential sources of contamination during the construction phase.

Historical land use

- 10.5.5. During the late 19th century, the shoreline of the River Thames in the vicinity of the site included: two coal wharves, a cement works, and an oil factory (detailed unknown), a brewery, distillery, cooperage, graveyard, and an electricity works (to the west of Lambeth Bridge between 1916 and 1940).

Contemporary Land Use

- 10.5.6. Two active consents for storm water overflow discharge are located 30m and 90m south of the site, and a third (associated with the Palace of Westminster) located 140m north of the site for sewage discharge.
- 10.5.7. A dry cleaner is located at 54 Horseferry Road, 160m southwest of the site, and another at 27 Page Street located 240m southwest of the site.

Geotechnical

- 10.5.8. Made Ground is expected to vary substantially in composition, geotechnical properties and thickness over the site. In addition, the Alluvium deposits may not be considered as being a suitable foundation stratum. Buried remains of former post medieval buildings may present obstructions to piling and excavation works for the construction of the new proposed basement. Mature trees are present along the edges of the site. Sensitive structures and utilities are present in the surrounding area to the site and along its boundaries. An assessment of the impact of construction on ground movement and sensitive structures will be required, Liaison with London Underground Limited, Metropolitan Police and the Government has been progressed to confirm the presence of any underground assets.

Waste Soils

- 10.5.9. Based on the current proposed designs the volume of the underground structure will be 25,000m³. Given site constraints, material is unlikely to be re-used on site, and therefore is likely to require removal to an off-site waste disposal facility or for off-site re-use. The characterisation of the soil will determine the its end fate and associated costs.

10.6 Method of assessment

- 10.6.1. Qualitative assessment of the environmental impacts to soils, geology and hydrogeology is dependent on data from an intrusive ground investigation. At this stage, no intrusive ground investigation has been undertaken. Therefore, a qualitative (desk-based) assessment has been undertaken, with impacts assessed based on published records including geological and historical mapping, and professional judgement. Where significant uncertainty remains with regards to ground conditions it has been necessary to take a conservative approach.
- 10.6.2. Impacts relating to land contamination, have been assessed in accordance with the Environment Agency guidance in model procedures for the management of land contamination (CLR11). Land contamination risks are therefore considered within a conceptual framework based on potential pollutant linkages. Potential pollutant linkages require a source of contamination to be linked to a receptor by a viable pathway. In assessing the environmental impacts of the Scheme, consideration is given to whether it might add, remove or modify sources, pathways or receptors.

10.6.1 Sensitivity of the Receptors

Table 10-3 - Sensitivity of Receptors for Soils, Geology and Hydrogeology

Sensitivity of Receptor	Importance / resilience of receptors
Very High	<ul style="list-style-type: none"> Principal aquifer designation AND in an inner source protection zone for the abstraction of potable water. Water framework directive (WFD) high status surface water body. Sensitive human health receptors (e.g. young children). Buildings / structures of national importance (e.g. listed buildings or strategic pipelines). International statutory ecological designations (e.g. Special Areas of Conservation or Ramsar site).
High	<ul style="list-style-type: none"> Principal aquifer designation OR in an inner source protection zone for the abstraction of potable water. WFD good status surface water body. Typical human health receptors (e.g. adult members of the public). Residential buildings or national infrastructure (e.g. bridges or railways). National statutory ecological designations (e.g. Sites of Special Scientific Interest).
Medium	<ul style="list-style-type: none"> Secondary aquifer designation and/or in an outer source protection zone for the abstraction of potable water. WFD moderate status surface water body. Low-sensitivity human health receptors (e.g. construction workers wearing personal protective equipment). High-density commercial buildings (e.g. office blocks). Non-statutory ecological designations (e.g. Local Wildlife Sites)
Low	<ul style="list-style-type: none"> Secondary aquifer designation but with water quality or quantity issues. WFD poor status surface water body. Low-density commercial buildings (e.g. warehouses). Non-designated ecology (e.g. trees, landscaping, meadows).

Impact severity

10.6.3. The impact severity has been determined based on factors including the scale, duration, frequency and reversibility of such an impact. Table 10-4 provides examples of impact severity that could be assigned to various impacts. Additionally, the likelihood of an impact will be factored into the final impact severity designation. For example, destruction of a building/structure would be considered a very high impact severity, however if this is highly unlikely it the impact severity may be reduced to high or medium.

Table 10-4 - Impact Severity for Soils, Geology and Hydrogeology

Impact Severity	Description of Impact
High	<ul style="list-style-type: none"> Permanent abandonment of water abstraction. Reduction in WFD status of a surface water body. Permanent loss of a statutory ecological designation. Destruction of building/structure. Loss of life or serious illness.
Medium	<ul style="list-style-type: none"> Temporary shut-down of water abstraction.

Impact Severity	Description of Impact
	<ul style="list-style-type: none"> Duration of impacts on water quality insufficient to affect WFD status. Obvious harm to ecological system (e.g. mass fish-kill). Significant damage to building/structure. Injury or illness that requires treatment.
Low	<ul style="list-style-type: none"> Additional treatment required for water abstraction. Magnitude of impacts on water quality insufficient to affect WFD status. Easily repaired damage to building/structure. Harm to ecological system that will recover within a year. Increased risk of health complications.
Negligible	<ul style="list-style-type: none"> Quality impacted but not likely to require additional treatment. Impacts on quality of surface water within baseline variation. Damage to building/structure that does not require repair. Changes to ecological system within baseline variation Risk to health not statistically different from baseline.

10.7 Potential Impacts

10.7.1. The effect of the impact and consequently the significance has been determined based on impact severity and the sensitivity of the receptor concerned in accordance with the matrix in Table 5-4 impacts relating to construction and operational phases have been considered separately in the following sections and are summarised in Table 10-5 and Table 10-6 respectively. Justifications for sensitivity of receptors and severity of impacts are provided in the following sections. Where multiple impacts have been identified for the same receptor, to avoid duplication, justification for its sensitivity is provided in the first instance only.

Construction

Pollution incidents

10.7.2. During construction there is potential for pollution incidents, including but not limited to: spillage of fuel from tanks or during refuelling, oil leaks from plant and spillage of chemicals. Infiltration of contaminants into the ground may pose a risk to the superficial aquifer and, following lateral migration, the neighbouring River Thames. Although the River Terrace Deposits are classed as a 'Secondary A Aquifer', the sensitivity of the superficial aquifer is considered low, rather than medium. This is because groundwater in the superficial deposits is of low resource potential given its water quality given the urban environment and proximity to the estuarine River Thames. Based on the large quantity and poor quality of water in this section of the River Thames it has been considered a low sensitivity receptor. Pollution incidents are classified by the Environment Agency based on their impact to the environment, from category 1 (serious) to category 4 (little or no impact). It is anticipated that as the severity of a pollution incident increases the likelihood of it happening decreases. Therefore, an unmitigated impact severity of high has been assumed based on the ecological harm that would likely occur in the River Thames should a fuel tank or chemical container fail.

Mobilisation of existing contamination: increased infiltration

10.7.3. The superficial aquifer and River Thames are considered low sensitivity receptors. Given the unknown quality of material used to reclaim the current site from the River Thames, there is potential for soil to be a source of leachate contamination to the controlled waters receptors. However, even worst case the increase in infiltration rate is unlikely to be more than two to three times the baseline infiltration and therefore the impact severity of mobilisation of existing soil contamination by an increase in infiltration is considered low.

Mobilisation of existing contamination: creation of preferential pathways

10.7.4. The current proposed design involves excavation of at least 8m, final depths depending on foundation design. Given the potential for contaminated soil or perched water in the shallow Made Ground, it is

possible that preferential pathways maybe created because of excavation or piling works. Creation of preferential pathways is therefore considered to pose a medium impact severity.

Mobilisation of existing contamination: direct exposure during excavation

- 10.7.5. During excavation works and stockpiling and processing of excavated material construction workers without mitigation could be exposed to soil or groundwater contamination through dermal, ingestion and inhalation pathways. Given the proximity to excavations and excavated material the likelihood of contact is high and given the unknown ground conditions it has been conservatively assumed that gross contamination is present. Therefore, the impact severity is considered high. Construction workers, wearing generic personal protective equipment have been considered as a medium sensitivity receptor.

Mobilisation of existing contamination: wind-blown dust

- 10.7.6. Wind-blown dust may impact on human health. Given the uncertainty around soil quality, the impact severity has been considered medium. Although the general members of the public are of high sensitivity school-children visiting the existing education centre in the north of Victoria Tower Gardens have been considered as being of very high sensitivity.

Disposal of excavated soil

- 10.7.7. Based on the proposed floor area and excavation depth, a large volume (25,000m³) of material will require excavation. Without ground investigation, there is considerable uncertainty in the characterisation of this waste material. The assignment of impact severity and receptor sensitivity are less relevant to this impact consideration. However, the overall impact relevance is considered moderate adverse.

Compression or collapse of soils

- 10.7.8. Several mature trees are present along the western boundary of the site. Although these are not of rarity or ecological status, they have been considered of medium receptor sensitivity due to the difficulty and time taken for replacement. The potential harm to the trees resulting from compression of soils around the root systems is likely to impact the growth or lifespan of the trees rather than recover and so has been considered high.
- 10.7.9. Within Victoria Tower Gardens there are several structures of exceptionally high importance, including listed memorials and the river wall which is important part of the flood defence for the surrounding area which includes listed buildings such as the Palace of Westminster, which all form part of the Westminster World Heritage Site. Therefore, the sensitivity of the surrounding structures is of the highest level and have been considered very high.

Vibration due to piling

- 10.7.10. Surrounding buildings and structures are of very high sensitivity. Although, the likelihood of significant damage is relatively low (depending on ground conditions), the impact severity has been considered as medium. In addition, vibration, even at low levels where damage to buildings/structures is unlikely, may be felt by members of the public which can lead to concern and a bad public perception of the works, near sensitive buildings and structures.

Encountering unexploded ordnance during excavation

- 10.7.11. Based on the location of the site in central London there is a generalised potential risk of UXO such as war-time bombs being present beneath the site. During construction there is a risk of detonating these if they are struck or disturbed as part of excavation or piling works. The likelihood of encountering UXO is currently highly uncertain, but the magnitude of the impact could result in catastrophic damage to surrounding buildings/structures or fatalities to human health receptors in the vicinity. Therefore, the impact severity is considered high.

Operation

Accumulation of ground gas in new enclosed space

- 10.7.12. Although visitors to the holocaust memorial will include young children, the receptor sensitivity has been considered as high rather than very high. This is because, unlike ingested dose pathways, young children are not more susceptible to the risks from explosion and asphyxiation due to accumulation of ground gas than other human health receptors. The consequences of asphyxiation or explosion are fatalities and

therefore of the highest severity, however given the current understanding of ground conditions the ground gas generation potential is relatively low. Therefore, the impact severity has been considered medium based on the low likelihood of such an event.

Flooding due to obstruction of groundwater flow

- 10.7.13. Although the surrounding buildings are of very high sensitivity, the basements of these buildings have been considered as high sensitivity. The new proposed underground structure has the potential to obstruct groundwater flow. Depending on groundwater flow conditions, this may result in mounding of groundwater behind the below ground structures. If this raises groundwater in the vicinity of surrounding basements this may increase the risk of flooding or groundwater ingress. The impact severity however is considered low, because of the distance to neighbouring buildings and high hydraulic conductivity anticipated in the River Terrace Deposits.

10.8 Cumulative Effects

Construction

- 10.8.1. Three potentially concurrent impacts have been identified for the River Thames and superficial aquifer during construction. There is some potential for cumulative effects whereby the impact of a pollution incident (e.g. spillage of fuel or plant leaking oil) is made worse as a result of creation of preferential pathways by excavations, boreholes, or piles.
- 10.8.2. Similarly, two potential impacts to neighbouring structures have been identified and the cumulative effects of vibration and heavy loading may result in a higher likelihood of collapse or damage to neighbouring structures.
- 10.8.3. A review of committed developments in the nearby vicinity has identified the excavation of basements, piling works, and general construction at 9 Millbank and Ergon House (application reference: 16/06616/FULL). Based on the soils and groundwater suspected to be present below the site there may be adverse cumulative effects from the mobilisation of contaminants at this neighbouring site, as well as movement of surplus material off-site during the construction works.
- 10.8.4. In addition, construction as part of the Thames Tideway Tunnel development consent order will run 100 m to the east of the site. However, the depth of the tunnel in this location means that cumulative effects are unlikely.
- 10.8.5. No other cumulative effects are anticipated in relation to soil and geology.

Operation

- 10.8.6. The two impacts identified for the operational phase do not impact the same receptor and therefore no cumulative effects are anticipated.

10.9 Mitigation measures

Construction

- 10.9.1. An intrusive ground investigation of the site will be undertaken prior to construction. Information from the ground investigation will reduce uncertainty in ground conditions, inform better design and enable a preliminary waste characterisation. The intrusive ground investigation will include geotechnical and geo-environmental analysis of soils (including asbestos screening) and groundwater, in-situ geotechnical testing, and monitoring of groundwater and ground gas.
- 10.9.2. Based on the Scheme plan, piling and excavation works are to be outside of 16 m setback distance from river wall flood defence. However, if development is proposed within 16 m of the river wall a flood defence condition survey must be undertaken.
- 10.9.3. As with any piling or excavation works, intrusive ground investigation locations will be located outside of the 16 m set-back from the river wall. Where this is unavoidable, care must be taken to identify any tie rods, anchors and any other supporting structures below the surface. Failure to do so may result in damage to the integrity of the river wall.

- 10.9.4. Water quality in the superficial aquifer and River Thames are anticipated to already be impacted due to the urban environment and brackish nature of the river. It is therefore, important to establish baseline water quality in the superficial aquifer and River Thames during the ground investigation.
- 10.9.5. During construction it is possible that unexpected gross contamination that had not been identified during intrusive ground investigation is encountered. Therefore, a strategy must be developed for discovery of gross contamination.
- 10.9.6. Appropriate dust suppression techniques (e.g. wetting of soil) will be adopted during construction. The level of dust suppression required would be informed by the findings of an intrusive ground investigation. Care to ensure no mobilisation of existing contamination would be considered prior to damping down.
- 10.9.7. Given the sensitivity of neighbouring buildings and structures the correct selection of plant, equipment and construction methods is an important mitigation method. Works will also be phased such that the risk of collapse of soils due to excavation and heavy loading is minimised. Where heavy loads are unavoidable, the use of temporary surfacing to spread the loads will be considered.
- 10.9.8. To reduce the likelihood of a pollution incident occurring, containment measures will be used for refuelling on site. Appropriate pollution emergency response planning, availability of spill kits, and use of biodegradable oils and lubricants in construction plant will be used to mitigate the impact severity should a pollution incident occur.
- 10.9.9. Good waste management practices will be adopted, including the treatment and processing of excavated material to increase the proportion sent for beneficial re-use where possible. Any waste material removed from the site must also correctly follow duty of care procedures, with all loads documented by appropriate transfer notes.
- 10.9.10. Given the potential risk of UXO at the site, a detailed UXO risk assessment survey should be undertaken for the site. Depending on the findings of this survey it may be necessary to have a watching brief, or geophysical survey for UXO on-site during excavation or piling.

Operation

- 10.9.11. An intrusive ground investigation will also provide mitigation of potential impacts during the operational phase. After any ground investigation an appropriate number of groundwater and ground gas monitoring rounds should be undertaken. Ground gas monitoring data obtained during the ground investigation should be used to inform a ground gas risk assessment to determine if ground gas protection measures are required.

10.10 Residual Effects

Construction

Pollution incidents

- 10.10.1. Appropriate pollution emergency planning, combined with spill kits and containment measures will reduce the severity of a pollution incident should a spill occur. The residual amount reaching the superficial aquifer should then have a negligible effect.

Mobilisation of existing contamination: increased infiltration

- 10.10.2. No mitigation measures have been suggested as this is already a negligible effect.

Mobilisation of existing contamination: creation of preferential pathways

- 10.10.3. Reduced uncertainty about ground conditions following an intrusive ground investigation and a suitable discovery strategy for unexpected gross contamination will allow for construction methods to be adopted so that the residual effect of this impact is negligible.

Mobilisation of existing contamination: direct exposure during excavation

- 10.10.4. The use of appropriate personal protective equipment (informed by the findings of an intrusive ground investigation) and adoption of good hygiene practices, should be effective at cutting the pathway for direct contact of construction workers with contaminated soil and groundwater. Therefore, the residual effect is considered negligible.

Mobilisation of existing contamination: wind-blown dust

- 10.10.5. If the required dust suppression methods, as determined from the soil analysis results (including asbestos screening), are adopted the amount of wind-blown dust leaving the site should be minimal. Therefore, the residual effect to off-site receptors is considered to be minor adverse.

Disposal of excavated soil

- 10.10.6. Better characterisation of soils will reduce the impact of their disposal to landfill as a larger proportion of material will be possible to put into beneficial re-use.

Compression or collapse of soils

- 10.10.7. Appropriate phasing of works and exclusion distances will reduce the risk of collapse from unstable excavations. Where the use of heavy plant, or loading cannot be kept away from sensitive structures or trees spreading of the loads and use appropriate plant to reduce loads where possible should keep the residual effects negligible.

Vibration due to piling

- 10.10.8. Although correct selection of plant and construction methods (particularly with regards to any piling) will act to reduce the severity of any vibration, this cannot be fully eliminated, and the residual effect remains minor adverse.

Encountering unexploded ordnance during excavation

- 10.10.9. A detailed UXO survey and risk assessment will recommend the requirements for watching brief and geophysical surveying for UXO during excavation. Although this does not reduce the chance of encountering any UXO it does increase the chance of it being identified and remediated in advance. Therefore, the risk is considered minor adverse.

Operation

Accumulation of ground gas in new enclosed space

- 10.10.10. As the building will be designed with the required gas protection measures as suggested by a ground gas risk assessment, the residual risk from accumulation of ground gas is considered negligible.

Flooding due to obstruction of groundwater flow

- 10.10.11. The impact relevance before mitigation is considered minor adverse. While monitoring of groundwater water levels will help reduce uncertainty, the residual effect is still considered minor adverse.

10.11 Summary Table

Table 10-5 - Construction phase effects on Soils, Geology and Hydrogeology

Activity Impact	Baseline Receptor	Impact assessment			Mitigation Mitigation Measures	Residual Effect
		Receptor sensitivity	Impact Severity	Effect before Mitigation		
Pollution incident (e.g. fuel spillage or plant leaking oil).	River Thames and superficial aquifer	Low	High	Minor adverse	<ul style="list-style-type: none"> Appropriate pollution emergency response planning. Use of suitable spill kits and containment measures for refuelling on site. Use of biodegradable oils and lubricants in construction plant. 	Negligible
Mobilisation of existing contamination by:						
Increased infiltration due to removal of topsoil or changes to drainage.	River Thames and superficial aquifer	Low	Low	Negligible	<ul style="list-style-type: none"> NA 	Negligible
Ccreation of preferential pathways by excavations, boreholes, or piles.	River Thames and superficial aquifer	Low	Medium	Minor adverse	<ul style="list-style-type: none"> Intrusive site investigation to reduce uncertainty around ground conditions. Preparation of a discovery strategy for unexpected contamination. Best practice construction methods (e.g. clean drilling techniques). 	Negligible
Cconstruction workers directly exposed during excavation work.	Construction workers	Medium	High	Moderate adverse	<ul style="list-style-type: none"> Intrusive site investigation to reduce uncertainty around ground conditions. Best construction practices (e.g. good site hygiene and appropriate personal protective equipment). 	Negligible
Off-site receptors exposed to wind-blown dust.	Off-site pedestrians and school children visiting the education centre	Very High	Medium	Major adverse	<ul style="list-style-type: none"> Intrusive site investigation to reduce uncertainty around ground conditions, including asbestos screening. Appropriate dust suppression techniques (e.g. wetting of soils). 	Minor adverse
Excavation of soil which requires disposal:						
Off-site re-use	Regional requirements	Medium	Medium	Moderate adverse	<ul style="list-style-type: none"> Intrusive site investigation to reduce uncertainty around ground conditions. Good waste management practices. Document all waste loads removed from site with material transfer notes. Consideration of removal of waste by water if practicable. 	Minor adverse
Disposal to landfill	Regional landfill availability	Medium	Medium	Moderate adverse	<ul style="list-style-type: none"> Intrusive site investigation to reduce uncertainty around ground conditions. Good waste management practices (e.g. treatment and processing) to increase the amount of excavated material sent for beneficial re-use. Document all waste loads removed from site with waste transfer notes. Consideration of removal of waste by water if practicable. 	Minor adverse
Geohazards (e.g. compression or collapse of soils due to heavy loading).	Neighbouring trees	Medium	High	Moderate adverse	<ul style="list-style-type: none"> Correct selection of plant, equipment and construction methods. Use of temporary surfacing to spread vehicle loads. Appropriate phasing of the works. Undertake a flood defence condition survey if development within 16 m. 	Negligible
	Neighbouring structures and buildings (e.g. listed buildings, memorials and river wall)	Very High	Medium	Major adverse		Negligible
Vibration due to piling, earthworks and plant movement.	Neighbouring structures and buildings (e.g. listed buildings, memorials and river wall)	Very High	Medium	Major adverse	<ul style="list-style-type: none"> Intrusive site investigation to reduce uncertainty around ground conditions. Correct selection of plant, equipment and construction methods. Undertake a flood defence condition survey if development within 16 m. 	Minor adverse
Detonation of unexploded ordnance	Neighbouring buildings or structures, construction workers and off-site pedestrians.	Very High	High	Major adverse	<ul style="list-style-type: none"> Detailed UXO risk assessment survey to be undertaken for the site. Which may recommend a watching brief or geophysical survey for UXO, during excavation works. 	Minor adverse

Table 10-6 - Operational phase effects on Soils, Geology and Hydrogeology

Activity Impact	Baseline Receptor	Impact assessment			Mitigation Mitigation Measures	Residual Effect
		Receptor sensitivity	Impact Severity	Impact Relevance		
Accumulation of ground gas in new enclosed underground spaces.	Future site visitors and staff	High	Medium	Moderate adverse	<ul style="list-style-type: none"> Intrusive site investigation to reduce uncertainty around ground gas. Ground gas risk assessment to determine required gas protection measures. 	Negligible
Groundwater flooding due to obstruction by new underground structures.	Neighbouring basements	High	Low	Minor adverse	<ul style="list-style-type: none"> Intrusive site investigation to reduce uncertainty around ground conditions, including monitoring of groundwater levels. 	Minor adverse

11 Biodiversity

11.1 Scope of assessment

11.1.1. This assessment has been undertaken with reference to current good practice³⁵ and describes the ecological baseline and evaluates the nature conservation value of ecological features present with the Area of Influence (Ecological Zone of Influence) for the Scheme. It characterises the impacts and the effects (both positive and negative) of the Scheme on important ecological features, sets out avoidance, mitigation, compensation and enhancement measures, and assesses the significance of the residual effects (both positive and negative) of the Scheme on the important ecological features.

11.2 Responses to scoping opinion

Table 11-1 - Summary of responses to stakeholder scoping opinions

Stakeholder	Comment	Response
Royal Parks	From some of the preliminary designs that The Royal Parks has seen, there is a school of thought that assumes high levels of ornamental lighting and night-time public use. We would object strongly to any such proposals on the grounds that Victoria Tower Gardens is one of the few remaining relatively dark spaces adjacent to the River Thames and an important flight path for bats and night flying invertebrates. Consequently, we do not accept at this stage that there is a case for scoping ecological effects out of the EIA.	Biodiversity has been scoped back into the ES. An assessment of the impacts of the lighting to be installed is found in this chapter.
Westminster City Council	The City Council shares the view of The Royal Parks outlined above. Given the nature of Victoria Tower Gardens as public gardens and garden and its location adjacent to the river, the scoping out of 'Biodiversity, flora and fauna' is not supported. This chapter should be provided in the ES.	Biodiversity has been scoped back into the ES. An assessment of the impacts of the lighting to be installed is found in this chapter.
The Gardens Trust	We note that most importantly for this site, the 50 mature plane trees framing the view to the Grade I listed Victoria Tower and Houses of Parliament and the potential effects on them due to the 8 m underground construction are given scant mention. The construction methodology refers to the installation of tree protection to safeguard retained trees in the Garden during construction but does not mention mitigation measures for potential long-term effects on them because of construction.	Mitigation measures for the mature London plane trees during operation of the Scheme have been listed in this chapter.
Natural England	The scoping request is for a proposal that does not appear, from the information provided, to affect any nationally designated geological or ecological sites (Ramsar, SPA, SAC, SSSI,	All impacts on nationally designated ecological sites has been scoped out of the assessment.

35 CIEEM (September 2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester.

Stakeholder	Comment	Response
	NNR) or landscapes (National Parks, AONBs, Heritage Coasts, National Trails). At present therefore, it is not a priority for Natural England to advise on the detail of this EIA.	

11.3 Relevant planning policy & legislation

11.3.1. A summary of planning policy and legislation relevant to the Scheme is listed below:

Table 11-2 - Planning policy overview

Scale	Policy Document	Key Considerations for the Scheme
National	Natural Environment and Rural Communities (NERC) Act 2006	Section 41 (41) of the NERC Act 2006 requires the Secretary of State to publish a list of habitats and species which are of principle importance for the conservation of biodiversity in England. These are referred to as 'Priority Habitats or Species'. This list is used by public bodies, including local and regional authorities, to help guide their decisions and ensure they are carrying out their duties under Section 40 of the NERC Act, which requires them to have regard to the conservation of biodiversity in England when carrying out their normal functions. There are priority habitats adjacent to the site. Further details are provided in the Baseline Conditions Section (Section 11.5).
National	National Planning Policy Framework (NPPF), 2018	The NPPF sets out the Government's planning policies for England and how these are expected to be applied. Chapter 15 of the NPPF 'Conserving and enhancing the natural environment' sets out the requirements to consider biodiversity in planning decisions. The paragraphs within Chapter 15 relevant to the Scheme are summarised below: Chapter 15 of the NPPF 'Conserving and enhancing the natural environment' sets out the requirements to consider biodiversity in planning decisions. The paragraphs within Chapter 15 relevant to the Scheme are summarised below: <i>170 Planning policies and decisions should contribute to and enhance the natural and local environment by:</i> <ul style="list-style-type: none"> protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan); recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland; and minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures. <i>171 Plans should: distinguish between the hierarchy of international, national and locally designated sites; allocate land with the least environmental or amenity value, where consistent with other policies in this Framework³⁶; take a strategic approach to maintaining and enhancing networks of habitats and green</i>

36 Where significant development of agricultural land is demonstrated to be necessary, areas of poorer quality land should be preferred to those of a higher quality.

Scale	Policy Document	Key Considerations for the Scheme
		<p><i>infrastructure; and plan for the enhancement of natural capital at a catchment or landscape scale across local authority boundaries.</i></p> <p><i>174 To protect and enhance biodiversity and geodiversity, plans should:</i></p> <ul style="list-style-type: none"> Identify, map and safeguard components of local wildlife-rich habitats and wider ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity³⁷; wildlife corridors and stepping stones that connect them; and areas identified by national and local partnerships for habitat management, enhancement, restoration or creation³⁸; and Promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity. <p><i>175 When determining planning applications, local planning authorities should apply the following principles:</i></p> <ul style="list-style-type: none"> a) if significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused; b) development on land within or outside a Site of Special Scientific Interest, and which is likely to have an adverse effect on it (either individually or in combination with other developments), should not normally be permitted. The only exception is where the benefits of the development in the location proposed clearly outweigh both its likely impact on the features of the site that make it of special scientific interest, and any broader impacts on the national network of Sites of Special Scientific Interest; c) development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) should be refused, unless there are wholly exceptional reasons³⁹ and a suitable compensation strategy exists; and d) development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to incorporate biodiversity improvements in and around developments should be encouraged, especially where this can secure measurable net gains for biodiversity. <p><i>176 The following should be given the same protection as habitats sites:</i></p> <ul style="list-style-type: none"> Potential Special Protection Areas and possible Special Areas of Conservation; Listed or proposed Ramsar sites⁴⁰; and Sites identified, or required, as compensatory measures for adverse effects on habitats sites, potential Special Protection Areas, possible Special Areas of Conservation, and listed or proposed Ramsar sites. <p><i>177 The presumption in favour of sustainable development does not apply where development requiring appropriate assessment because of its potential impact on a habitats site is being planned or determined.</i></p>

³⁷Circular 06/2005 provides further guidance in respect of statutory obligations for biodiversity and geological conservation and their impact within the planning system.
³⁸Where areas that are part of the Nature Recovery Network are identified in plans, it may be appropriate to specify the types of development that may be suitable within them.
³⁹For example, infrastructure projects (including nationally significant infrastructure projects, orders under the Transport and Works Act and hybrid bills), where the public benefit would clearly outweigh the loss or deterioration of habitat.

Scale	Policy Document	Key Considerations for the Scheme
Regional	The London Plan, 2018	<p>Policy G6 of the London Plan 2018 relates to 'Biodiversity and access to nature'. The plan outlines the following targets for development proposals:</p> <p>a) Sites of Importance for Nature Conservation (SINCs) should be protected;</p> <p>b) in developing Development Plan policies, boroughs should:</p> <ol style="list-style-type: none"> 1) identify SINCs and green corridors; 2) identify areas of deficiency in access to nature and seek opportunities to address them; 3) seek opportunities to create habitats that are of particular relevance and benefit in an urban context; 4) include policies and proposals for the protection and conservation of priority species and habitats and opportunities for increasing species populations 5) ensure sites of European or national nature conservation importance are clearly identified and appropriately assessed <p>c) Where harm to a SINC (other than a European (International) designated site is unavoidable, the following approach should be applied to minimise development impacts:</p> <ol style="list-style-type: none"> 1) avoid adverse impact to the special biodiversity interest of the site 2) minimise the spatial impact and mitigate it by improving the quality or management of the rest of the site 3) seek appropriate off-site compensation only in exceptional cases where the benefits of the development proposal clearly outweigh the biodiversity impacts. <p>d) Biodiversity enhancement should be considered from the start of the development process. e) Proposals which create new or improved habitats that result in positive gains for biodiversity should be considered positively, as should measures to reduce deficiencies in access to wildlife sites</p>
Local	Westminster City Plan, 2016	<p>Westminster's City Plan is the key policy document for determining planning applications in Westminster. The relevant policies for biodiversity are:</p> <p>Policy 36 – Sites of Importance for Nature Conservation</p> <p>Sites of Importance for Nature Conservation (SINCs) will be protected and enhanced. Proposals, both temporary and permanent, will need to demonstrate that they do not have a detrimental impact on the habitats or populations supported in these sites; and</p> <p>SINCs will be protected and managed for their ecological value as the priority.</p> <p>Policy 38 – Biodiversity and Green Infrastructure</p> <p>Biodiversity and green infrastructure will be protected and enhanced throughout Westminster and opportunities to extend and create new wildlife habitat as part of development will be maximised. Proposals within Areas of Wildlife Deficiency should include features to enhance biodiversity, particularly for priority species and habitat; and</p> <p>Where developments would impact on species or habitat, especially where identified in the relevant Biodiversity Action Plan at national, regional or local level, the potential harm should firstly be avoided, secondly be mitigated, or finally appropriate compensation will be sought. Where harm cannot be prevented, sufficiently mitigated against or adequately compensated for, permission will be refused.</p>

⁴⁰ Potential Special Protection Areas, possible Special Areas of Conservation and proposed Ramsar sites are sites on which Government has initiated public consultation on the scientific case for designation as a Special Protection Area, candidate Special Area of Conservation or Ramsar site.

Scale	Policy Document	Key Considerations for the Scheme
	Westminster Biodiversity Action Plan, 2008	The Westminster Biodiversity Action Plan (2008) has been developed by the City of Westminster to prevent the decline of and improve conditions for species and habitats that are a conservation priority. Individual habitat plans, and species plans have been developed, which include the following which are relevant to the site: Bat Species Action Plan; Parks and Green Spaces Habitats Action Plan; and Tidal Thames Habitat Action Plan.

Table 11-3 - Legislation overview

Species	Legislation	Offences	Licensing procedures and guidance
Bats European protected species	Conservation of Habitats and Species Regulations 2017 Reg 43	Deliberately ⁴¹ capture, injure or kill a bat; deliberate disturbance ⁴² of bats; or damage or destroy a breeding site or resting place used by a bat. [The protection of bat roosts is considered to apply regardless of whether bats are present.]	A Natural England (NE) licence in respect of development is required. Guidance documents: <i>NE Standing Advice for protected species 2013</i> <i>European Protected Species: Mitigation Licensing- How to get a licence (NE 2013)</i> <i>Bat Mitigation Guidelines (English Nature 2004)</i> <i>Bat Workers Manual (JNCC 2004)</i>
	Wildlife and Countryside Act 1981 (as amended) S.9	Intentionally or recklessly obstruct access to any structure or place used for shelter or protection or disturb ⁴³ a bat in such a place.	Licence from NE is required for surveys (scientific purposes) that would involve disturbance of bats or entering a known or suspected roost site.
Birds	Wildlife and Countryside Act 1981 (as amended) S.1	Intentionally kill, injure or take any wild bird; intentionally take, damage or destroy the nest of any wild bird while that nest is in use or being built; intentionally take or destroy the nest or eggs of any wild bird. Intentionally or recklessly disturb a Schedule 1 species while it is building a nest or is in, on or near a nest containing eggs or young; intentionally or recklessly disturb dependent young of such a species [e.g. most birds of prey, kingfisher, barn owl, black redstart, little ringed plover].	No licences are available to disturb any birds in regard to development. Licences are available in certain circumstances to damage or destroy nests, but these only apply to the list of licensable activities in the Act and do not cover development. General licences are available in respect of 'pest species' but only for certain very specific purposes e.g. public health, public safety, air safety. Guidance documents: <i>NE Standing Advice for protected species 2013</i>

⁴¹ Deliberate capture or killing is taken to include "accepting the possibility" of such capture or killing

⁴² Deliberate disturbance of animals includes in particular any disturbance which is likely a) to impair their ability (i) to survive, to breed or reproduce, or to rear or nurture their young, or (ii) in the case of animals of hibernating or migratory species, to hibernate or migrate; or b) to affect significantly the local distribution or abundance of the species to which they belong.

⁴³ Lower levels of disturbance not covered by the Conservation of Habitats and Species Regulations 2017 remain an offence under the Wildlife and Countryside Act 1981 although a defence is available where such actions are the incidental result of a lawful activity that could not reasonably be avoided.

11.4 Area of Influence

- 11.4.1. The Area of Influence will hereafter be referred to as 'Ecological Zone of Influence (EZol)' to be consistent with the Guidelines for Ecological Impact Assessment.
- 11.4.2. The EZol is an area defined by the assessment in which there may be ecological features subject to impacts and subsequent effects (both positive and negative) as a result of the Scheme. The EZol is determined through an assessment of many interacting factors.
- 11.4.3. The EZol of the Scheme during both construction and operation has been determined at two stages of the assessment.

Data Gathering (initial EZol)

- 11.4.4. The first stage (initial EZol) is to determine the geographical area for obtaining ecological data through desk and field-based studies based on the potential impacts and effects of the Scheme on ecological features. The initial EZol was based on the Scheme design, construction and operation information available at the time and an initial review of the site conditions and the surrounding landscape using publicly accessible aerial imagery.

Final Ecological Zone of Influence

- 11.4.5. Once the data gathering exercises from both the desk study and field surveys were completed and all Scheme details were available, the initial EZol was finalised for both the construction and operational phases of the Scheme, as detailed below.

Designated Sites and Notable Habitats

- 11.4.6. Owing to the small-scale nature of the Scheme and the generally localised nature and level of impact of the construction and operational works, it was considered appropriate to assess impacts only on those designated sites and notable habitats which are present within or directly adjacent to the site. In setting the EZol for designated sites, and notable habitats, it has been assumed that the Environmental Agency pollution prevention guidelines /guidelines for pollution prevention (PPGs/ GPPs)⁴⁴ and the Construction Industry Research and Information Association (CIRIA)⁴⁵ guidance on the control of water pollution from construction sites will be implemented to prevent any indirect impacts to designated sites and notable habitats. With suitable pollution measures in place, direct impacts to adjacent designated sites and notable habitats are unlikely to occur.

Main Habitats

- 11.4.7. Owing to the scale and nature of the Scheme proposals and the predicted level of the impact of the construction and operational works, it was considered appropriate to assess impacts only on those main habitats which are present within or directly adjacent to the site.

Protected and Notable Species

- 11.4.8. The final EZol for protected and notable species either recorded within, or considered likely to be present within, the site has been defined on a species-specific basis based on the likely effects of the Scheme as detailed in Table 11-4 below (distances are taken from the site boundary).

⁴⁴ Pollution Prevention Guidelines (PPGs) are out of date and a review process is currently underway to replace them with Guidance for Pollution Prevention (GPPs). These documents are available at <http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/>. GPPs provide environmental good practice guidance for the whole UK, and environmental regulatory guidance directly to Northern Ireland, Scotland and Wales only. For businesses in England, regulatory guidance is available from GOV.UK instead.

⁴⁵ The CIRIA documents are a series of publications developed by the Construction Industry Research and Information Association. Each document is targeted at a particular type of business or activity and covers environmental good practice to minimise pollution.

Table 11-4 - Ecological Zone of Influence for Impact Assessment on Protected and Notable Species relevant to the site

Species	Distance from the site boundary		Justification
	Construction	Operation	
Bats	30m	Site boundary	Although bats are known to commute large distances between roosts and foraging habitat, direct construction impacts are only likely to occur on commuting, foraging and roosting habitat within 30m of the site boundary. Minor disturbance is expected to occur to foraging and commuting bats within the site during operation due to the installation of lights.
Birds	Site boundary	Site boundary	The habitats within the site have potential to support common nesting and foraging birds. Due to the legal protection of wild birds and their nests, eggs and young (see Table 11-4), construction impacts on nesting birds must be assessed within the site. Operational effects on birds would be limited to the site.
Notable Invertebrates	Site boundary	Site boundary	The habitats within the site may support notable invertebrates. Construction and operational impacts on invertebrates could occur within the site.

11.5 Baseline Conditions

Methodology

Desk Study

- 11.5.1. A desk study was undertaken in April 2017 and updated in October 2018 to obtain ecological data relevant to the Scheme and the assessment, including records of statutory and non-statutory designated sites and protected and notable species within the initial EZol of the Scheme.
- 11.5.2. In October 2018 Greenspace Information for Greater London (GiGL) was contacted to obtain the following ecological data:
- Records of non-statutory designated sites (Sites of Importance for Nature Conservation (SINCs) within 1 km of the site boundary; and
 - Records of legally protected and notable species (fauna and flora) within 500m of the site boundary, including Species of Principal Importance for the Conservation of Biodiversity listed under Section 41 of the Natural Environment & Rural Communities Act 2006 in the England Biodiversity List⁴⁶. This was extended to 2 km for bats.
- 11.5.3. The Multi-Agency Geographic Information for the Countryside (MAGIC) website (www.magic.gov.uk) was reviewed for the following information:
- Designated sites of nature conservation importance (statutory sites only) within 1km of the site. This was extended to 2km for internationally designated sites; these being Special Protection Areas (SPAs), Wetlands of International Importance (Ramsar sites) and Special Areas of Conservation (SACs);
 - Notable habitats within 500m of the site, these being areas of ancient woodland and 'Habitats of Principal Importance for the Conservation of Biodiversity' included in the England Biodiversity List; and

⁴⁶ Section 40 of the Natural Environment & Rural Communities Act 2006 requires that every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity. The Secretary of State, has drawn up, in accordance with Section 41 of the Act and in consultation with Natural England, a list of habitats and species of principal importance for the purpose of conserving biodiversity in England that is known as the England Biodiversity List

⁴⁷ English Nature (2001). Great Crested Newt Mitigation Guidelines

- Presence of waterbodies within 500m of the site boundary, in order to establish if the land within and immediately surrounding the site could be used as terrestrial habitat for great crested newts. This species typically uses suitable terrestrial habitat up to 500m from a breeding pond⁴⁷. However, there is a notable decrease in great crested newt abundance beyond a distance of 250m from a breeding pond⁴⁸.

11.5.4. A review of local planning policy relevant to the Scheme was also undertaken as part of the desk study.

Extended Phase 1 Habitat Survey

11.5.5. An ecological walkover survey of areas within and adjacent to the site, including land up to 50m from the site boundary where access was allowed (the Survey Area), was undertaken on 5th April 2017 and updated on 17th October 2018 broadly following the Phase 1 habitat survey methodology⁴⁹. The walkover survey records information on the habitats within the Survey Area and was extended to include a search for evidence of the presence of, and an assessment of the potential of each habitat to support, notable and protected species as recommended by the Chartered Institute of Ecology and Environmental Management (CIEEM)⁵⁰.

11.5.6. This survey method records in particular:

- Potential roosting sites for bats within trees and structures (identification of suitable cracks and crevices) - survey undertaken from ground only. The assessment of potential value of the trees and structures for roosting sites for bats were categorised based on good practice guidance as detailed in Bat Survey Methodology;
- Searching for signs of badger activity including setts, tracks, snuffle holes and latrines;
- Assessing the suitability of habitats for nesting birds (including any old nests);
- Assessing the suitability of habitats for common species of reptile (adder, grass snake, slow worm and common lizard);
- Assessing the suitability of habitats for notable invertebrates; and
- Evidence of the presence of certain invasive plants listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) and subject to strict legal control (Japanese knotweed, giant knotweed, hybrid knotweed, giant hogweed, Himalayan balsam, rhododendron and cotoneaster species).

11.5.7. No additional surveys were identified as being required during the ecological walkover survey.

Bat Survey Methodology

11.5.8. The assessment of potential roosting sites for bats was undertaken in accordance with good practice guidance⁵¹ and CIEEM competencies for undertaking bat surveys⁵². Visual examinations of trees and structures within the Survey Area were undertaken from the ground, during daylight hours and were aided with the use of binoculars and a high-powered torch. For trees, the searches looked for features such as woodpecker holes and rot holes, cracked limbs, dense ivy and flaking bark. For structures, the inspections involved looking for potential entry/ exit points for bats or other potential roost locations (e.g. holes in brickwork, cracks and gaps in masonry etc.).

11.5.9. The assignment of bat roost potential was carried out according to good practice guidance which assigns each feature either Negligible, Low, Moderate or High suitability for roosting bats.

Survey Limitation

11.5.10. The extended phase 1 habitat surveys were undertaken in April and October, both were at times of year when certain botanical species are not readily identifiable. The timing of the survey is not considered to be significant limitation to this assessment as sufficient information was obtained on the habitats and potential for notable and protected species present to inform the impact assessment.

11.5.11. Ecological surveys are limited by factors which affect the presence of plants and animals such as the time of year, migration patterns and behaviour. The ecological surveys undertaken to support this assessment have not therefore produced a complete list of plants and animals and the absence of evidence of any particular

⁴⁸ English Nature (2004) An assessment of the efficiency of capture techniques and the value of different habitats for the great crested newt (ENRR576)

⁴⁹ Joint Nature Conservation Committee (2010). Handbook for Phase 1 habitat survey - a technique for environmental audit.

⁵⁰ Chartered Institute of Ecology and Environmental Management (December, 2017). Guidelines for Preliminary Ecological Assessment, Second Edition.

⁵¹ Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition). The Bat Conservation Trust, London.

⁵² CIEEM (April, 2013) Competencies for Species Survey: Bats.

species should not be taken as conclusive proof that the species is not present or that it will not be present in the future. However, the results of these surveys have been reviewed and are considered to be sufficient to undertake this assessment.

- 11.5.12. The list of invasive plant species included on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) is extensive and these plants are found in a range of different habitats, including aquatic habitats. The walkover survey checked for the presence of Japanese knotweed, giant knotweed, hybrid knotweed, giant hogweed, rhododendron, cotoneaster species and Himalayan balsam. Other invasive species may not have been recorded, but it is considered that this survey is sufficient to identify any constraints posed by invasive species.

Existing Baseline Conditions

Designated Sites, Priority Habitats and Ancient Woodland

- 11.5.13. There are no statutory designated sites for nature conservation present within the site and predicted EZoI of the Scheme.
- 11.5.14. **No Ancient woodland was recorded within 500m of the site.**
- 11.5.15. Table 11-6 summarises the non-statutory designated sites for nature conservation and priority habitats⁵³ situated within 1km of the site. These are shown on Figure 11.1 provided in Volume 4.

Table 11-5 - Non-statutory designated sites within 1km of the site

Designated Site	Site Reference	Location of Designated Site ⁵⁴	Features of Interest ⁵⁵
River Thames and Tidal Tributaries Site of Metropolitan Importance for Nature Conservation (SMINC)	M031	Immediately adjacent to the east of the site.	The River Thames contains mud-flats, shingle beach, inter-tidal vegetation, islands and river channel itself support many species from freshwater, estuarine and marine communities which are rare in London. The site is of particular importance for wildfowl and wading birds.
St James' Park, Green Park and Buckingham Palace Gardens SMINC	M104	Approximately 500m northwest of the site.	Three formal parks within London, with St James' Park being approximately 500 m northwest of the site. Large formal park with ornamental lake supporting significant numbers of breeding waterfowls, and numerous winter visitors.
Lambeth Palace Gardens and the Museum of Garden History Site of Borough Importance for Nature Conservation (SBINC).	LaB07	Approximately 300m east of the site, separated by the River Thames.	The gardens within the Palace and Museum are comprised of an allotment, semi-improved neutral grassland, bare ground, hedges, ornamental planting, an orchard, a lake, ruderal vegetation and scattered trees.
Roots and Shoots Nature Gardens SBINC	LaB17	Approximately 850m southeast of the site, separated by the River Thames	Nature garden with habitats including a small area of hazel coppice, a summer meadow, and flower meadow planted to attract invertebrates.
Westminster Abbey, Great Cloister and	WeBI07	Approximately 200m northwest of the site.	Two open areas within the historic grounds of Westminster. The great cloister is a secluded open space containing grassland and

⁵³ Priority habitats are taken as principal habitats for the conservation of biodiversity listed under Section 41 of the Natural Environment and Rural Communities Act 2006.

⁵⁴ Where designated sites are situated outside of the site boundary, the distance and direction is given at the closest point of the designated site from the site

⁵⁵ Citations taken from the GiGL data search

Designated Site	Site Reference	Location of Designated Site ⁵⁴	Features of Interest ⁵⁵
College Garden SBINC Grade I.			wildflowers. The college garden is a large traditional garden that is managed to encourage wildlife. Several mature trees and a wildflower meadow has been developed within the site.
St John's Garden, Westminster Site of Local Importance for Nature Conservation (SLINC).	WeL06	Approximately 200m southwest of the site.	Formal public garden with amenity grassland, scattered mature London plane trees, and flower beds.
Archbishop's Park SLINC	LaL22	Approximately 400m east of the site, separated by the River Thames.	Public park with amenity grassland, semi-improved neutral grassland, bare ground, ornamental planting, ruderal vegetation and scattered trees
Victoria Embankment Gardens: Whitehall Garden SLINC	WeL04	Approximately 700m north of the site.	Public garden adjoining the River Thames. Number of mature trees, with amenity grassland, shrubs and ornamental woodland flower beds.
Lambeth Walk Doorstep Green SLINC	LaL31	Approximately 730m east of the site, separated by the River Thames.	Open space enhanced for wildlife by a relaxed mowing regime and planted wildflowers to encourage a diversity of invertebrates.
Geraldine Mary Harmsworth Park SLINC	SoL15	Approximately 900m east of the site, separated by the River Thames.	Park surrounding the Imperial War Museum. Large open space with mature trees with grassland, wild flowers and a wildlife pond.

Table 11-6 - Priority Habitats within 500m of the site

Priority Habitat	Location of Priority Habitat ⁵⁶	Features of Interest ⁵⁷
Intertidal Mudflats Habitat of Principal Importance (HPI)	Immediately adjacent to the east of the site	Intertidal sediment and gravel/shingle exposed at low-tide on the River Thames foreshore.
Wood-Pasture and Parkland HPI	Approximately 300m east of the site within Lambeth Palace gardens. Separated from the site by the River Thames.	Wood-pasture and parklands are areas that have been managed by the long-established tradition of grazing. Where the site is in good condition, there is the survival of multiple trees, with at least some being veteran trees or shrubs.
Lowland Mixed Deciduous Woodland HPI	Approximately 320m east of the site within Lambeth Palace gardens. Separated from the site by the River Thames.	Lowland mixed deciduous woodland is broad-leaved woodland that grows on a range of soil types.

Main Habitats

- 11.5.16. Table 11-7 details the main habitats situated outside of the site but within the Survey Area.

⁵⁶ Where priority habitats are situated outside of the site boundary, the distance and direction is given at the closest point of the priority habitat from the site

⁵⁷ Feature of interest taken from the UK Biodiversity Action Plan Priority Habitat Descriptions (updated in Dec 2011) available at:

http://jncc.defra.gov.uk/PDF/UKBAP_PriorityHabitatDesc-Rev2011.pdf

11.5.17. All of the main habitats are indicated on the extended Phase 1 habitat survey plan (Figure 11.2 in Volume 4) with specific features highlighted by target notes (TN) on the drawing.

Table 11-7- Main Habitats within Site

Habitat Type	Summary Description of Habitats	Relevant Target Notes (TN)
Amenity Grassland	Areas of regularly mown amenity grassland present throughout the site.	N/A
Broad-leaved Parkland/ Scattered Trees	Mature London plane trees border the east and west sides of the site. The trees are well maintained and in good condition with no visible cracks or crevices. One semi-mature oak sp. (non-native) within a native hedgerow in the north of the site to the south of the parliamentary education centre.	N/A
Introduced shrub	Ornamental herbaceous border understorey (non-native species) along western border of the gardens and around the children's play area.	N/A
Hardstanding	Hardstanding paths throughout the site. Children's play area in the south of the site.	N/A
Buildings	A small, circular, wooden kiosk located near the children's play area in the south of the site. The public toilets has a modern stone/glass entrance with the conveniences underground in the south of the site.	TN3 – Kiosk TN4 – Public toilets
Walls	Stone wall boundary bordering the River Thames to the east of the site. Stone wall around the children's play area to the south of the site.	TN5
Fence	Iron railings intertwined with cherry laurel bordering the north and the west of the site.	N/A

Table 11-8 - Main Habitats outside of the site but within the Survey Area

Habitat Type	Summary Description of Habitat	Location of Habitat ⁵⁸
River Thames	The River Thames is a large river running through London with intertidal mudflats.	Immediately to the east of the site
Buildings	The parliamentary education centre is a modern, rectangular building clad in plastic sheeting with a glazed extension to the rear and a sloping green living roof. The Houses of Parliaments and residential buildings.	Immediately to the north of the site is the parliamentary education centre (TN2). To the north of the site is the House of Parliaments including Victoria tower. To the east of the site opposite the A3212 are residential apartment buildings.
Native species-poor hedgerow	Native species-poor hedgerow consisting of hazel and hawthorn is present immediately south of the parliamentary education centre.	TN1

Protected and Notable Species

11.5.18. The results of the desk study and field surveys (including the extended Phase 1 habitat survey) undertaken for protected and notable⁵⁹ species are detailed below in Table 11-9.

⁵⁸ The distance and direction is given at the closest point of the main habitat from the site

⁵⁹ Notable species are taken as principal species for the conservation of biodiversity listed under Section 41 of the Natural Environment and Rural Communities Act 2006; any species listed in an IUCN Red Data Book; and any other species listed under London BAP.

⁶⁰ Only recent records of species are provided here, where recent is taken to be in the last 10 years

Table 11-9 - Protected and Notable Species within the site and/or Initial EZol

Species or Species Group	Desk Study Records ⁶⁰	Field Survey Results
Bats	GiGL holds 413 recent records of bats present within 2 km of the site for eight species of bat species comprised of: Leisler's, noctule, Daubenton's bat, Natterer's bat, brown long-eared bats, Nathusius' pipistrelle, common pipistrelle and soprano pipistrelle. There are also several roost records returned within 2 km of the site of four species comprised of: Daubenton's bat, Natterer's bat, common pipistrelle and a long-eared bat species (<i>Plectous sp.</i>) ⁶¹	All structures and trees within the site offer negligible potential to support roosting bats. The houses of parliament to the north of the site, and the residential houses to the west of the site currently have high levels of lighting making them unsuitable for roosting bats The mature London plane trees to the east of the site offer suitable commuting/ foraging habitat for bats along the River Thames.
Nesting birds	There are numerous recent records of common species of bird present within 500 m of the site. Several recent records of Schedule 1 species (listed in the Wildlife and Countryside Act 1981 (as amended)) for five bird species comprised of: black redstarts, redwing, little gull, osprey and fieldfare. Two records of breeding black redstarts were returned, and one record of breeding fieldfare have been recorded within 500 m of the site. No records of breeding redwing, little gull or osprey were returned. Redwing and fieldfare are winter visitors to the UK, and little gull and osprey are passage migrants (ospreys breed on large water bodies and the nearest site to London is Rutland Water, and little gulls do not breed in the UK ⁶² .	Parkland trees and hedgerows provide suitable foraging and nesting opportunities for common species of birds. Blackbird, robin, carrion crow and feral pigeons were all recorded foraging within the site during the phase 1 survey. In addition, the buildings within the site offer suitable nesting for birds. The flood defence walls of the River Thames provide potentially suitable nesting habitat for black redstarts. However, there is a lack of suitable foraging habitat within or immediately adjacent to the site. Due to a lack of available suitable foraging habitat, it is unlikely that black redstarts will be present.
Invertebrates	Records of four species of invertebrates were returned within a 10 km grid ref of the site: scarce 7-spot ladybird, Adonis' ladybird, stag beetle and jersey tiger moth. No notable nocturnal or water invertebrates were recorded in the desk study.	No suitable habitat was identified within the site for stag beetles. Stag beetles require decaying wood, and due to the high level of maintenance of the gardens no dead or decaying wood is present within or adjacent to the site. There is a limited amount of suitable habitat for scarce 7-spot ladybird, Adonis' ladybirds and jersey tiger moth within the site. Suitable habitat for these species within the site is the ornamental shrub and hedgerows.

11.6 Method of assessment

Temporal Scope

11.6.1. Potential impacts on ecological features have been assessed in the context of how the predicted baseline conditions within the EZol might change between the surveys and the start of construction.

⁶¹ Records of bat roosts within the search are returned as confidential records from GiGL with no grid references or distances provided.

⁶² Balmer, D., Gillings, S., Caffrey, B., Swann, B., Downie, I. and Fuller, R. (2013) Bird Atlas 2007-11: The breeding and wintering birds of Britain and Ireland. British Trust for Ornithology: Thetford.

- 11.6.2. Construction of the Scheme is currently planned to commence in late 2020 and is estimated to last up to 48 months. This assessment has been undertaken with the understanding the lorries are to be used to transport and remove materials and soil from the site. If other methods are to be explored, advice from an ecologist will be obtained, and the construction impacts reassessed.
- 11.6.3. Once construction is complete, based on discussions with the Client, the assessment has assumed that the operational phase of the development will last for the foreseeable future.

Sensitivity of Receptors

- 11.6.4. A number of criteria have become accepted as a means of assessing the nature conservation value of a defined area of land which are set out in A Nature Conservation Review (Ratcliffe, 1977) and include diversity, rarity and naturalness.
- 11.6.5. The nature conservation value or potential value of an ecological feature is determined within the following geographic context:
- International (such as Special Areas of Conservation, Special Protection Areas, Ramsar sites);
 - National (such as Sites of Special Scientific Interest);
 - Regional for example, Environment Agency regional biodiversity indicators, important features in Natural England Natural Areas;
 - Metropolitan, County, Vice-County or Other Local Authority-wide Area (such as Local Nature Reserves, Sites of Importance for Nature Conservation, ancient woodlands);
 - Borough Grade I and Grade II e.g. Borough grade I and grade II Sites of Importance for Nature Conservation
 - Local (parish) (undesigned ecological features such as old hedges, woodlands, ponds);
 - The Site and its immediate environs e.g., mature tree, scrub and species-poor hedgerow; and
 - Negligible e.g. areas of hardstanding and amenity grassland.

Impact Assessment

- 11.6.6. The assessment of the potential effects of the Scheme takes into account both on-site effects and those that may occur to adjacent and more distant ecological features. Impacts can be permanent or temporary and can include:
- Direct loss of wildlife habitats;
 - Fragmentation and isolation of habitats;
 - Disturbance to species from noise, light or other visual stimuli;
 - Changes to key habitat features; and
 - Changes to the local hydrology, water quality and/or air quality.
- 11.6.7. Effects are unlikely to be significant where features of low value or sensitivity are subject to small or short-term impacts. However, where there are a number of small scale effects that are not significant alone, the assessor may determine that, cumulatively, these may result in an overall significant effect. Significant effects have been determined as being either negative or positive.
- 11.6.8. For designated sites, effects are considered significant when a project and associated activities is likely to either undermine or support the conservation objectives or condition of the site(s) and its features of interest.
- 11.6.9. For ecosystems, effects are considered significant when a project and associated activities is likely to result in a change in ecosystem structure and function.
- 11.6.10. Consideration is given to whether:
- Any processes or key characteristics will be removed or changed;
 - There will be an effect on the nature, extent, structure and function of component habitats; and

- There is an effect on the average population size and viability of component species.
- 11.6.11. Functions and processes acting outside the formal boundary of a designated site has also been considered, particularly where a site falls within a wider ecosystem e.g. wetland sites.
- 11.6.12. Some ecosystems can tolerate a degree of minor changes, such as localised or temporary disturbance or changes in physical conditions, without such changes harming their function or value. For this assessment, ecological effects have been considered in the light of any information available about the capacity of ecosystems to accommodate change.
- 11.6.13. The conservation status of undesignated habitats and species within a defined geographical area has been used in this assessment to determine whether the effects of the proposals are likely to be significant:
- For habitats, conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and its typical species within a given geographical area; and
 - For species, conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area.
- 11.6.14. When assessing potential effects on conservation status, the known or likely background trends and variations in status have been taken into account. The level of ecological resilience or likely level of ecological conditions, that would allow the population of a species or area of habitat to continue to exist at a given level or continue to increase along an existing trend or reduce a decreasing trend, has been estimated where appropriate to do so.
- 11.6.15. The avoidance, mitigation and/ or compensation measures described within the assessment have been incorporated into the design and operational phasing programme and taken into account in the assessment of the significance of effects. These mitigation measures include those required to achieve the minimum standard of established good practice together with additional measures to further reduce any negative impacts of the Scheme. The mitigation measures include those required to reduce or avoid the risk of committing legal offences.
- 11.6.16. The significance of any residual effects is reported in Table 11-10 and Table 11-11 which follows the standard format applied across this Environmental Statement. However, the column of 'Effect before Mitigation' has not been completed as ecological impacts are only assessed in terms of significance of effect once mitigation has been taken into account when applying the CIEEM ecological impact assessment guidance⁶⁵.

Cumulative Impact Assessment

- 11.6.17. The assessment of the significance of cumulative effects of the Scheme has taken into account the combined effects that result from incremental changes caused by other past, present and reasonably foreseeable human induced changes (known as identifiable developments) on the existing environment within a specific geographical area and over a certain period of time.
- 11.6.18. Cumulative effects can be both direct and indirect (sometimes also known as primary and secondary effects) and can result from individually insignificant but collectively significant actions. They are particularly important as many ecological features are already exposed to background levels of threat or pressure and may be close to critical thresholds where further impact could cause irreversible decline. Effects can also make habitats and species more vulnerable or sensitive to change.
- 11.6.19. The Department of Communities and Local Government (DCLG) published an Environmental Impact Assessment consultation draft⁶³ in June 2006 which identified two types of cumulative effects that require consideration within EIA. Although this document wasn't translated into Government guidance, it has been used alongside other guidance documents^{64,65} to define cumulative effects for this assessment:
- Inter-project Effects (additive): combined effects of committed developments within the area on an ecological feature, e.g. impacts on the local bat populations from one development may not be significant when considered alone, but may be significant in combination with other proposed developments; and
 - Intra-project Effects (synergistic): combined effects of different environmental factors from a single development on a particular ecological feature, e.g. an ancient woodland may experience degradation

⁶³ Department for Communities and Local Government (June 2006), Environmental Impact Assessment: A guide to good practice and procedures.

⁶⁴ Renewable UK (June 2013), Cumulative Impact Assessment Guidelines – Guiding Principles for Cumulative Impacts Assessment in Offshore Wind Farms.

⁶⁵ Institute of Environmental Management and Assessment (IEMA) (June, 2011), Special Report – The State of Environmental Impact Assessment Practice in the UK.

in local air quality, hydrology, increases in recreational use and direct habitat loss as a result of one development. The effects singly may be considered acceptable, however together may create an effect that is unacceptable on this ecological feature.

Mitigation Hierarchy

- 11.6.20. The principles of the mitigation hierarchy have been adopted and used when considering impacts and subsequent effects on ecological receptors within the EZol.
- 11.6.21. The principles of the mitigation hierarchy are that in order of preference impacts on biodiversity should be subject to:
- Avoidance;
 - Mitigation; and
 - Compensation.

11.7 Potential Impacts

Sensitivity of Receptors

- 11.7.1. All of the ecological features present or considered likely to be present within the final EZol of the Scheme have been valued in Table 11-10 according to the criteria outlined in Section 11.6 **Error! Reference source not found.**
- 11.7.2. Features outside the final EZol will not be affected by any activities or processes involved in the Scheme and are therefore not considered further in this assessment.

Table 11-10 - Evaluation of Ecological Features within the Final EZol

Ecological Feature(s)	Sensitivity of Receptor	Rational for Valuation
River Thames and Tidal Tributaries SMINC (incorporating the intertidal mudflats HPI)	Metropolitan	The River Thames is a site of metropolitan importance for nature conservation due to mud-flats, shingle beach, inter-tidal vegetation, islands and river channel itself support many species from freshwater, estuarine and marine communities which are rare in London.
Habitats within and directly adjacent to the site (amenity grassland, introduced shrub, native-species poor hedgerow, scattered trees and buildings)	Local	The Site is located within a highly urbanised area of London with limited open greenspace in the surrounding areas.
Commuting and Foraging bats	Borough	Eight species of bat have been recorded as foraging and commuting within 2km of the site. All species recorded are common within London. The mature London plane trees to the east of the site and the River Thames provide a potential commuting and foraging route for bats. This forms part of a wider bat foraging and commuting habitat that is of borough value. There is currently no lighting along the River Thames within the site.
Nesting Birds	Negligible	Common species of birds including blackbird, robin, carrion crow and feral pigeons were all recorded foraging within the site during the phase 1 survey. The footprint of the Scheme is confined to amenity grassland, which is unlikely to support any nesting birds and will be of limited use for foraging birds. There have been 17 records of black redstarts within 2km of the site, including two breeding pairs. The most recent record is from 2013 which recorded black redstart approximately 400m southwest of the site.

Ecological Feature(s)	Sensitivity of Receptor	Rational for Valuation
		Black redstarts have three main requirements for breeding: song posts, nest sites and foraging habitat. Song posts (such as tall buildings) are widespread in the area, and black redstarts are not restrictive with their nesting sites. However, there is a lack of suitable foraging habitat, such as brown field sites, within and adjacent to the site. Therefore, although black redstarts could potentially breed within or adjacent to the site, it is considered unlikely due to a lack of suitable foraging habitat.
Invertebrates	Negligible	Four notable species have been returned in the desk study: scarce 7-spot ladybird, Adonis' ladybird, stag beetle and jersey tiger moth. The records were returned in a 10km grid square. No suitable habitat is present within the site for stag beetles, and the suitable habitat for scarce 7-spot ladybird, Adonis' ladybird and jersey tiger moth is limited to the hedgerow and ornamental shrubs. Due to the lack of suitable habitat within the site, it is unlikely that these species were recorded within the site.

Determination of Important Ecological Features

- 11.7.3. Habitats, species and species groups that are considered to have a nature conservation value in the context of the site and its immediate environs are not considered important ecological features in the context of this assessment. Any impact on such a feature as a result of the Scheme is considered unlikely to have a significant effect on the conservation status of such habitats or species on a local, regional, national or international scale.
- 11.7.4. Therefore, features of nature conservation value in the context of the site, or those considered to have negligible nature conservation value, have been scoped out of the ecological impact assessment. These features are as follows:
- Roosting bats – the site provides no suitable trees or structures suitable for roosting bats. The houses of parliament to the north of the site, and the residential houses to the west of the site currently have high levels of lighting making them unsuitable for roosting bats;
 - Birds – the site provides limited foraging and nesting opportunities for low numbers of common birds. Although the loss of these habitats is not considered to be significant, measures will be put in place to mitigate for potential nesting birds (see Section 11.8). The habitat being lost during the Scheme is amenity grassland, which has negligible potential for nesting birds that are likely to occur within the site; and
 - Notable Invertebrates – the main habitat type being lost which is amenity grassland, which is not suitable for any notable species returned in the desk study. The hedgerow and ornamental shrubs are being retained.
- 11.7.5. The remaining important ecological features for which the potential impacts of the Scheme have been assessed are:
- River Thames and the Tidal Tributaries SMINC (incorporating the intertidal mudflats HPI);
 - Main Habitats within the site; and
 - Commuting and foraging bats.

Construction

- 11.7.6. This assessment has been undertaken with the understanding the lorries are to be used to transport and remove materials and soil from the site. If other methods are to be explored, advice from an ecologist must be obtained, and the construction impacts reassessed.

Designated Sites and Notable Habitats

- 11.7.7. Designated sites are located outside of the site but within the predicted EZol of the Scheme. Potential effects due to construction impacts could include degradation of habitat due to pollution or the disturbance effects of noise or lighting on species.

11.7.8. The River Thames and Tidal Tributaries SMINC (incorporating the intertidal mudflats HPI) is located immediately adjacent to the east of the site. The Scheme does not involve any direct habitat loss within the SMINC. The eastern boundary of the site is comprised of a pedestrian footpath and stone wall separating the site and the boundary of the SMINC.

11.7.9. If pollutants during construction enter the waterway, there is potential that there may be an impact of the designated site and notable habitat.

Main Habitats within the site

11.7.10. The construction of the memorial and learning centre will cause a temporary loss of approximately 25% (0.5 ha) of the habitats within the site. The habitat to be lost is amenity grassland, comprised of commonly occurring species and therefore does not provide much ecological value, although they may be used for foraging bats. Hard standing footpaths located within the construction boundary will be lost. All mature trees are located along the boundary of the site, with none located within the construction footprint. The grassland to the east and north of the site will be retained and protected during construction. Due to the site being located within a highly urbanised area of central London, there is potential that the temporary loss of open greenspace will cause an impact.

Bats

11.7.11. There is the potential for disturbance to commuting and foraging bats during construction as a result of lighting and noise impacts during night time works taken to be 30 minutes prior to sunset and 30 minutes following sunrise) during the time of the year bats are regularly active (taken to be April to October).

11.7.12. There will also be a temporary loss in approximately 25% (0.5 ha) of the foraging habitat within the site. However, bats are more likely to forage within the retained tree lines and River Thames.

11.7.13. The Site is currently unlit at night, with only street light along Millbank to the west of the site. Due to lighting and noise during construction and temporary loss of foraging habitat, there is potential that there may be an impact to bats.

Operation

Designated Sites and Notable Habitats

11.7.14. As the site is located within a highly urbanised area within central London, the site is already subjected to a high amount of foot traffic passing through the site. Although the Scheme will cause an increase in visitors to the site during operation, it is not anticipated that the increase in foot traffic will adversely impact the River Thames and Tidal Tributaries SMINC (incorporating the intertidal mudflats HPI).

11.7.15. There is currently no lighting present within the site, and lighting is only present adjacent to the north, south and west of the site. There is currently no lighting on the eastern Site boundary adjacent to the River Thames. New lighting is to be installed as a part of the Scheme. The lighting strategy for the site has been designed to utilise the use of ground level and directional lighting to minimise potential impacts. Full details about the lighting plan are in DHA Designs UK Holocaust Memorial and Learning Centre. There are four sections of proposed lighting: memorial courtyard, Thames broad walk, secondary pathway and memorial staircase:

- Memorial courtyard: Illuminated handrails with LED strips enclosed in a metal channel to direct lighting downwards, and concealed LED strips recessed into the stair and terrace nosing details. The LED in the stairs and terrace nosing has a metal extrusion and tapping screw on the underside of the steps to direct light downwards;
- Thames broad walk: Bench seats are being installed along the new Thames broad walk which have recessed LED strips underneath. The LED strips are enclosed in a metal channel, directing light downwards to the floor. 950 mm high vertical illumination bollards are being installed along the Thames Broad walk through the site;
- Secondary pathway: The secondary pathway, which is the new curved path that sweeps diagonally across the parkland, will have ground level lighting installed on one side of the path. This lighting will either involve low level continuous lighting using LED strips, or low-level marker lighting. Both types of proposed lighting are ground level with the light directed towards the pathway; and

- Memorial staircase: Within the fins of the memorial LED lights are to be fixed to the top of the memorial fins with light directed downwards towards the staircase. The top of the fins is enclosed, and no light spill is expected.

11.7.16. The Thames broad walk, which is currently unlit, is located directly adjacent to the boundary of River Thames and Tidal Tributaries SMINC (incorporating the intertidal mudflats HPI). The Thames flood defence wall is along the eastern boundary of the Thames broad walk and will act as a barrier for light spill from the new lighting installed onto the River Thames and Tidal Tributaries SMINC.

11.7.17. Due to the low level of lighting to be installed, the use of directional lighting and the walls of the Thames acting as a barrier for light spill into the SMINC or HPI, it is not expected that there will be an adverse impact to the River Thames and Tidal Tributaries SMINC (incorporating the intertidal mudflats HPI).

Main Habitats within the site

11.7.18. The Memorial and Learning Centre footprint will reduce the existing green space area of the gardens from 100% to 85%. The habitats being permanently lost comprise of amenity grassland, which have low conservation value, and hardstanding footpaths which have negligible value. Due to small area and low conservation value of the habitats being permanently lost, it is not expected that there will be an adverse impact.

Bats

11.7.19. At present the Victoria Tower Gardens are unlit at night, with the only lighting along the western boundary of the site along Millbank.

11.7.20. As part of the Scheme, new lighting will be installed throughout the site. At present, the Thames broad walk is unlit and provides a potential commuting corridor for bats. However, the houses of parliament to the north of the site are currently lit at night, with floodlights lighting the eastern façade of the building (located on the River Thames). Victoria Tower, which is in the southern section of the houses of parliament, is also lit via flood lights. To the south of the site is Lambeth Bridge that has streetlights running the entire length of the bridge, and multiple streetlights around the Millbank, Horseferry Road and Lambeth Bridge roundabout. Due to the high amount of lighting present to the north and south of the site, it is unlikely that light sensitive species, e.g. *Myotis*, will be currently using the site.

11.7.21. The lighting strategy has been designed with bats in mind, utilising ground level lighting and the use of channels to direct light downwards to avoid excessive upwards light spill. The proposed lighting on the Thames broad walk is ground level and directional towards the foot path, with bollards designed to minimised upwards light spill. The Thames flood defence wall will act as a barrier for excessive light spill into the Thames, leaving the River Thames corridor unlit and suitable for commuting bats.

11.7.22. Due to the installation of lighting as part of the Scheme, there is potential for bats to be adversely impacted as a result of the Scheme.

11.8 Cumulative Effects

Construction

11.8.1. No elements of the Scheme are likely to give rise to any impacts on the ecological features during the construction phase and there are no minor residual effects to be considered in combination with other developments/ projects. Therefore, no cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects.

Operation

11.8.2. No elements of the Scheme are likely to give rise to any impacts on the ecological features during the operating phase and there are no minor residual effects to be considered in combination with other developments/ projects. Therefore, no cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects.

11.9 Mitigation measures

Construction

11.9.1. The following avoidance, mitigation and/ or compensation measures will be implemented during the construction phase of the Scheme to comply with national and local planning policy, current legislation and good practice:

- General measures to avoid or alleviate negative impacts upon ecological receptors including following the Environmental Agency pollution prevention guidelines /guidelines for pollution prevention (PPGs/GPPs)⁶⁶ and the Construction Industry Research and Information Association (CIRIA)⁶⁷ guidance on the control of water pollution from construction sites;
- Vertical tree barriers will be erected along the edge of the proposed groundworks and development footprint to create a construction exclusion zone for both lines of the retained mature London plane trees that are within the site. These trees will be protected throughout the duration of the construction works through strict adherence to the BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations⁶⁸;
- Where night time working is required (taken to be 30 minutes prior to sunset and 30 minutes following sunrise) for construction activities which are being carried out during the time of year bats are regularly active (taken to be April to October inclusive), temporary lighting required will be directed towards the work area only, to avoid light spill onto the River Thames corridor;
- Any machinery and materials used during construction, including any excavated soil, will be stored away from the boundary of the River Thames and Tidal Tributaries SMINC (incorporating the intertidal mudflats HPI);
- Machinery and materials will be stored towards the western boundary of the site to reduce the impact of security lighting on foraging and commuting bats;
- The construction footprint will be covered with hoarding to reduce noise and pollution. The hoarding will also deter animals from entering the works area. The hoarding will be regularly checked so that animals e.g. foxes, cannot enter the working area; and
- If any nesting birds are identified during the works they will be left in situ for their entire nesting period (the nesting bird season is typically 1st March to 31st August inclusive) and an ecologist should be consulted to provide advice for alternative approaches to the work proposed. This may include leaving an exclusion zone around the nests to avoid disturbance. Pigeons can nest at any time of year, and site team must be vigilant of the potential for this species to nest all year round.

Operation

11.9.2. The following avoidance, mitigation and/ or compensation measures have been incorporated into the design of the Scheme to comply with national and local planning policy, current legislation and good practice:

- New footpaths will be established using a cellular confinement system to allow water filtration through the soil to the root systems of the trees that boarder the gardens;
- The lighting installed on Site will follow the Bat Conservation Trust/Institute of Lighting Professionals Guidance on Bats and artificial lighting in the UK⁶⁹. The appropriate luminaire specification will be considered when choosing luminaires:
 - All luminaires will lack UV elements when manufactured. Metal halide, fluorescent sources must not be used;
 - LED luminaires will be used where possible due to their sharp cut-off, lower intensity, good colour rendition and dimming capability;
 - A warm white spectrum (ideally <2700Kelvin) will be adopted to reduce blue light component;

- Luminaires will feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats⁷⁰;
- Specialist bollards with directional luminaires will be used to retain darkness above. Luminaires will have an upwards light ratio of 0%;
- Luminaires will always be mounted on the horizontal, i.e no upward tilt; and
- Any external security lighting will be set on motion-sensors and short (1min) timers.

- Where possible, the provision of wildflowers and herbaceous perennials which attract pollinating insects will be included in the landscaping design. Plants will be selected to include early, mid and late-flowering species and a grass component. The habitat will be sown from seed, and/ or the species richness of existing grass area increased with the addition of plug plants. There is a wide variety of native species that would be suitable for the site. Species will be native to the region and suited to the soil condition, e.g. ox-eye daisy, knapweeds, scabious, vetches, bird's-foot-trefoil, clovers, cowslip, betony, self-heal, yarrow, wild carrot and yellow rattle;
- The habitat creation measures above will require management, particularly the wildflower element that will thrive under correct cutting regime but will lose value if cut too frequently. A biodiversity management plan will be produced as part of the landscape and ecology design for the Scheme that will set out how habitat creation features will be managed to retain and increase their biodiversity value over at least a 10-year period. The plan will include management responsibilities for and a programme of works; and
- Where possible, bird boxes are to be installed on the mature London Plane trees on the northern section of the site. It is recommended that six boxes are to be installed: four on the mature London Plane trees alongside Thames Boardwalk facing the gardens, and two on the mature London Plane tree on Abingdon street facing the gardens.
- Where possible, bat boxes are to be installed on the mature London Plane trees on the northern section of the site. Six boxes are to be installed: four on the mature London Plane trees alongside the Thames Boardwalk facing the River Thames, and two on the mature London Plane tree on Abingdon street facing the gardens.

11.10 Residual Effects

Construction

11.10.1. This assessment has been undertaken with the understanding the lorries are to be used to transport and remove materials and soil from the site. If other methods are to be explored, advice from an ecologist must be obtained, and the construction impacts reassessed.

Designated Sites and Notable Habitats

11.10.2. Indirect effects associated with water contamination, dust and noise could occur during the construction of the Scheme. However, this is only likely on a small-scale and it will be temporary. Measures to reduce the effects of water, dust and noise pollutants to the River Thames and Tidal Tributaries SMINC (incorporating intertidal mudflats HPI) will be included in the Construction Environmental Management Plan (CMP).

11.10.3. The impact on the River Thames and Tidal Tributaries SMINC (incorporating intertidal mudflats HPI) as a result of the proposed works is considered to be negligible.

Main Habitats within the site

11.10.4. The Scheme will result in a temporary loss of approximately 25% (0.5 ha) of the open greenspace within the site during construction. The retained mature London plane trees will be managed and protected under a CMP, which will outline the measures to protect trees and roots during construction.

⁶⁶ Pollution Prevention Guidelines (PPGs) are out of date and a review process is currently underway to replace them with Guidance for Pollution Prevention (GPPs). These documents are available at <http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/>. GPPs provide environmental good practice guidance for the whole UK, and environmental regulatory guidance directly to Northern Ireland, Scotland and Wales only. For businesses in England, regulatory guidance is available from GOV.UK instead.

⁶⁷The CIRIA documents are a series of publications developed by the Construction Industry Research and Information Association. Each document is targeted at a particular type of business or activity and covers environmental good practice to minimise pollution.

⁶⁸ All work will be undertaken with reference to guidance set out in the British Standard BS 5837 (2012) Trees in relation to design, demolition and construction guidance – Recommendations 69 BCT ILP (2018) Bats and artificial lighting in the UK: Overview of current evidence and mitigation guidance.

⁷⁰ Stone, E.L., Jones, G., Harris, S. (2012). Conserving energy at a cost to biodiversity? Impacts of LED lighting on bats. Glob. Change Biol. 18, 2458–2465.

11.10.5. The habitats temporarily lost during construction is comprised of amenity grassland and footpaths. The grassland to the east and north of the site will be retained and protected during construction, and areas of grassland temporarily lost during construction will be replaced using native species-rich grassland. Due to the small amount of habitat being lost, the proposed works is not considered to have a significant effect.

Bats

11.10.6. Indirect impacts on bats as a result of light and noise night time working, and security lighting of machinery and materials can be affectively mitigated. The Scheme will result in a temporary loss of suitable foraging habitat within the site. However, suitable habitat will be retained to the east and north of the site.

11.10.7. As a result, the proposed works is not considered to have a significant effect on bats.

Operation

Designated Sites and Notable Habitats

11.10.8. No significant effects to the River Thames and Tidal Tributaries SMINC (incorporating the intertidal mudflats HPI) are expected as a result of operation of the Scheme.

Main Habitats within the site

11.10.9. The memorial and learning centre footprint will reduce the existing green space area of the gardens from 100% to 93%. The grassland being temporarily lost during construction will be reinstated with native species-rich grassland mixes suitable for pollinator insects. The new footpaths within the site will have a cellular confinement system to allow water filtration through the soil to the root systems of the trees that border the gardens.

11.10.10. Due to the small area of grassland being permanently loss, and the improvement to the mature London plane trees through the cellular confinement system within the footpaths, no significant effects are expected as a result of operation of the Scheme.

Bats

11.10.11. The lighting strategy has been designed to limit light spill onto the River Thames through the use of ground level directional lighting along the Thames broad walk. The River Thames flood wall will also act as a barrier for excessive light spill onto the River Thames, leaving the adjacent part of the river an unlit corridor suitable for commuting and foraging bats.

11.10.12. The secondary pathway would be curved across the centre of the gardens, connecting the northern entrance of the site on Millbank to the memorial. This path would be lit with ground level directional lighting. The IPL/ BCT guidance on bats and artificial lighting in the UK^{Error! Bookmark not defined.} appropriate luminaire specifications listed above in the operational mitigation will be followed to reduce the effect of the lighting installed on bats.

11.10.13. Given that the lighting installed follows the IPL/BCT guidance on lighting and bats, no significant effects are expected as a result of operation of the Scheme.

11.11 Summary Table

Table 11-11 - Construction phase effects on Biodiversity

Activity	Baseline	Impact assessment			Mitigation	
Impact	Receptor	Receptor Sensitivity	Impact Severity	Effect before Mitigation ⁷¹	Mitigation Measures	Residual Effect
Water contamination, dust and noise	River Thames and Tidal Tributaries SMINC (incorporating the intertidal mudflats HPI)	Metropolitan	Local	N/A	Following pollution prevention guidance/ guidance on pollution prevention methods outlined in the construction environment management plan. Storage of materials and machinery away from the River Thames boundary adjacent to the east of the site.	Not significant
Loss of amenity grassland	Habitats	Local	Within Site	N/A	The grassland to the north and east of the construction footprint is being retained and protected during construction.	Not significant
Night time works, security lighting	Commuting and Foraging Bats	Borough	Local	N/A	Potential lighting and noise impacts may occur during the construction phase of the development. These will be mitigated for by limiting work times, keeping security lighting to a minimum and directed away from the River Thames.	Not significant

Table 11-12 - Operational phase effects on Biodiversity

Activity	Baseline	Impact assessment			Mitigation	
Impact	Receptor	Receptor sensitivity	Impact Severity	Effect before Mitigation ⁷¹	Mitigation Measures	Residual Effect
Permanent loss of amenity grassland.	Habitats	Local	Local	N/A	The grassland being temporary lost during construction will be reinstated with native species-rich grassland mixes suitable for pollinator insects. The new footpaths within the site will have a cellular confinement system to allow water filtration through the soil to the root systems of the trees that boarder the gardens.	Not significant
New lighting installed	Commuting and Foraging Bats	Borough	Local	N/A	The IPL/BCT guidance on bats and artificial lighting in the UK appropriate luminaire specifications will be followed.	Not significant

⁷¹ However, the column of 'Effect before Mitigation' has not been completed as ecological impacts are only assessed in terms of significance of effect once mitigation has been taken into account this step is not appropriate when applying the CIEEM ecological impact assessment guidance.

12 Water Quality and Flood Risk

12.1 Scope of the assessment

- 12.1.1. This Chapter considers the potential effects of the Scheme on surface water features, including water quality and flood risk. Effects on groundwater and hydrogeology are addressed in Chapter 10 and are not discussed in this assessment. The scope of the assessment was developed through the screening report and subsequent scoping study for the Scheme, completed in 2017 and 2018 respectively. The key issues identified at scoping in relation to the water environment were:
- Potential construction impacts on surface water quality from excavation and dewatering works;
 - Potential for pollution of surface waters during construction from leaks or spills to ground from plant and machinery;
 - Potential for pollution of surface waters during construction due to inappropriate site drainage or connections;
 - Potential for secondary or indirect implications of any construction-related pollution for adjacent aquatic ecology and aquatic habitats;
 - Potential construction impacts on the flood risk and any flood defence structures; and
 - Potential impacts on the site's flood risk as a result of climate change.
- 12.1.2. These issues form the basis of the assessment set out in this Chapter.
- 12.1.3. Operational effects on water quality have been scoped out of the assessment, as the built design of the new Memorial and Learning Centre will incorporate appropriate drainage design for foul water and surface water, and no new direct discharges into the River Thames or any other surface waters are required, and consequently, there are no operational pathways for impacts on surface water quality. Reference should be made to the accompanying Drainage Strategy (Appendix L in Volume 5) for details of the proposed permanent drainage arrangements for the Scheme in operation.
- 12.1.4. Preliminary consultation with the Environment Agency in relation to flood risk issues was initiated in March 2017, with a formal preliminary advice letter received from the Environment Agency in April 2017. This highlighted the need for a Flood Risk Assessment (FRA), the requirements of the Thames Estuary 2100 (TE2100) flood risk management strategy, and the need to obtain a Flood Risk Activity Permit (FRAP) for the Scheme. The preliminary advice received from the Environment Agency was incorporated into the initial Level 1 FRA and EIA Scoping Report.
- 12.1.5. The FRA is found in Appendix K in Volume 5.
- 12.1.6. No specific consultee comments were received in response to the Scoping Report in relation to water quality issues associated with the Scheme, and the scope of the assessment of impacts on surface water quality has therefore remained as that identified in the Scoping Report.
- 12.1.7. The Environment Agency provided a formal response to the EIA Scoping on 31 August 2018 relating to the impacts of the proposals on flood risk, and the requirements for the FRA. Relevant comments from the Royal Parks were also received on 22 August 2018. A summary of the relevant points raised by these consultees are provided in Table 12-1.

Table 12-1 - Summary of responses to relevant stakeholder scoping opinions

Stakeholder	Comment	Response
Environment Agency	Confirmed the categorisation of the development as "Less vulnerable" in accordance with relevant planning guidance, and that this is acceptable within Flood Zone 3. Confirmed need for a Flood Risk Assessment and requirements/scope of the assessment. Highlighted Policy 5.12.D of the London Plan that states a requirement for new development to be set back from flood defences.	The FRA has been completed in accordance with the advice provided by the Environment Agency. The River Wall Condition Survey has been prepared to inform a Flood Risk Assessment (FRA) to demonstrate that the flood defence will be remediated or maintained in a robust and sustainable manner and to a suitable level (to reduce the risk of breach) over the

Stakeholder	Comment	Response
	Environment Agency advised that if the minimum of 16m setback is not possible they would expect the applicant to submit evidence to demonstrate that any flood walls/defences are in good enough condition to protect the proposed development for its lifetime, and the requirements / scope of this evidence. Consideration of the construction requirements and possible effects on structural integrity of flood defences, including below-ground elements. The Environment Agency would expect any future planning application to assess the impact of the construction process and the effects it will have on the existing flood defences. This should be informed by the flood defence condition survey where appropriate. Highlighted provision within TE2100 for possible future raising / widening of the adjacent flood defences, and the need to retain adequate access for construction and maintenance of the defences. Highlighted need for a Flood Risk Activity Permit for the construction works, and also responsibilities and Duty of Care in relation to waste.	development lifetime. If any works are proposed within 16m of the flood defence (for example basement works) then appropriate structural assessment will be required to demonstrate the integrity of the flood defence will not be compromised. Typically, this would be undertaken post planning to inform the EA flood risk activates permit. The report prepared is a visual condition survey only. Visible sections of the river wall are generally in good condition (rating 2), with localised defects of a fair condition (rating 3) which require maintenance. Based on the visual condition survey the report recommends maintenance measures alongside future monitoring and inspection works. It is recommended that raising is not undertaken until it is required in the future, however due consideration should be made to ensure there is suitable access to enable raising works (e.g. 16m access as detailed above). A full structural assessment will be carried out at the next phase of development. The relevant Contractor will have responsibility for applying for and obtaining the FRAP, and for complying with all relevant waste legislation.
Royal Parks, Estates Manager	The Royal Parks is aware of a weakness to the river wall where bomb damage was repaired during World War Two with some seepage noticed on previous extreme tides. The FRA must take this into account.	No significant deterioration was noted at this location. Evidence of seepage through the riverward side was noted and is typical of structures of this formation and age. The rate of seepage is often very low however over time can cause bigger issues of wash out within the structure. As such one of the River Wall Visual Condition Survey report recommendations was for patch concrete repairs to be undertaken.

12.2 Relevant planning policy & legislation

Table 12-2 - Policy overview

Scale	Policy Document	Key Considerations for the Scheme
National	National Planning Policy Framework (2018). Part 15 Paragraph 170(e) of the NPPF makes provision for the conservation and enhancement of the natural environment.	The NPPF states that decisions regarding new and existing development should prevent them from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of water pollution. Development should, wherever possible, help to improve local environmental conditions such as...water quality, taking into account relevant information such as river basin management plans.
	National Planning Policy Framework (2018). Part 14 deals with planning for climate change and flooding.	The NPPF sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change. NPPF and supporting planning practice guidance on Flood Risk and Coastal Change explain when and how Flood Risk Assessments

Scale	Policy Document	Key Considerations for the Scheme
		<p>should be used. This includes demonstrating how flood risk will be managed now and over the development's lifetime, taking climate change into account. Local planning authorities refer to this when preparing local plans and considering planning applications.</p> <p>As of 19th February 2016, the government updated the climate change guidance which is to be considered during the planning process. This supersedes the climate change guidance within the Planning Practice Guidance, where typically a 20% allowance on river flows was given. Further details can be found at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances</p>
	Floods Directive (2007/60/EC)	The aim of this Directive is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. It sets the strategic level for flood risk that any development will need to comply with.
Regional	Thames River Basin Management Plan 2015	River Basin Management Plans (RBMPs) are produced under the Water Framework Directive (see section 0), and provide a framework for protecting and enhancing the benefits provided by the water environment. Because water and land resources are closely linked, it also informs decisions on land-use planning. The RBMP describes the current state of the water environment within the Plan area, and sets objectives and outcomes, with detailed measures required to achieve the environmental objectives.
	Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015	These Directions set out the environmental standards to be used for the second cycle of river basin plans. They transpose Directive 2013/39/EC on environmental quality standards for priority substances. They also cover Specific Pollutants which include certain metals that are associated with road drainage.
Local	Westminster's City Plan	Local authorities carried out a Strategic Flood Risk Assessment (SFRA) to assess all forms of flooding within the area and develop strong policies to reduce flood risk. The Embankment Wall and the Thames Barrier provide Westminster with excellent flood defences which decrease flood risk to about 1 in 1000 annual probability.
	Thames Estuary 2100 (TE2100)	Details how the Environment Agency is planning to manage tidal flood risk in the Thames Estuary until the year 2100. It recommends the actions the Environment Agency and others will need to take in the short, medium and long term to protect 1.25 million people and £200 billion worth of property from tidal flood risk. The plan is based on contemporary understanding of predicted climate change but is designed to be adaptable to changes in predictions (including for sea level rise) throughout the century.

Legislation

The Water Resources Act (WRA) 1991 (as amended)

- 12.2.1. The WRA 1991 aims to prevent and minimise pollution of water. Under the WRA it is an offence to cause or knowingly permit any poisonous, noxious or polluting material, or any solid waste to enter any Controlled Water. Polluting materials include silt and soil from eroded areas. If such material is identified to be causing water pollution, the Environment Agency has the powers to prevent or clear up the pollution and recover the damages from the landowner or responsible person.

- 12.2.2. The WRA 1991 aims to prevent and minimise pollution of water. Under the WRA it is an offence to cause or knowingly permit any poisonous, noxious or polluting material, or any solid waste to enter any Controlled Water. Polluting materials include silt and soil from eroded areas. If such material is identified to be causing water pollution, the Environment Agency has the powers to prevent or clear up the pollution and recover the damages from the landowner or responsible person.

- 12.2.3. The WRA regulates water resources, water quality and pollution, and flood defence. The WRA provides the general structure for the management of water resources, explains the controlled waters standards and what is considered water pollution. The WRA also covers information pertaining to mitigation through flood defence.

Water Framework Directive (WFD) 2000, and national enabling legislation

- 12.2.4. The objectives of the WFD are to enhance the status, and prevent further deterioration, of aquatic ecosystems, promote the sustainable use of water, reduce pollution of water and ensure progressive reduction of groundwater pollution in relation to such water bodies. The WFD provides a framework for the protection of surface (fresh) water, estuaries, coastal water and groundwater, and requires all, natural water bodies to achieve both Good Chemical Status (GCS) and Good Ecological Status (GES). River Basin Management Plans (RBMPs) outline the actions required to enable natural water bodies to achieve GES. Artificial and Heavily Modified Water Bodies (A/HMWB) may be prevented from reaching GES due to the modifications necessary to maintain their function. They are, however, required to achieve Good Ecological Potential (GEP), through the implementation of a series of mitigation measures outlined in the RBMP.

- 12.2.5. New activities and schemes that affect the water environment may adversely impact on specific WFD quality elements, leading to a deterioration in water body status. They may also render proposed improvement measures ineffective, leading to the water body failing to meet its WFD objectives for GES/GEP. Under the WFD, activities and schemes must not cause deterioration in water body status or prevent a water body from meeting GES/GEP by invalidating improvement measures.

The Building Regulations 2010 (Statutory Instrument 2010 No. 2214)

- 12.2.6. Schedule 1, Part H3 of the Building Regulations 2010 defines the hierarchy for disposing of surface water as follows:
- Discharge to the ground (for example using soakaways). Where the intention is to discharge to the ground it must be shown to be feasible through an assessment carried out under the Building Research Establishment Digest 365 (BRE 365);
 - Discharge to a surface water body (for example a river or lake); and
 - Discharge to a surface water sewer, highway drain, or another drainage system. Discharge to a combined sewer.

12.3 Area of Influence

- 12.3.1. For the purpose of this Chapter, the proposals considered are limited to the extent of the site as affected by construction and operation, including any temporary works. No new permanent infrastructure will be created outside of the site boundary.

- 12.3.2. The study area for the consideration of the effects of the proposals on surface water quality and surface water resources comprises the site itself, as illustrated on Figure 2.1 in Volume 4, any surface waterbodies within the site or with a direct hydraulic connection to it. For any water bodies with a direct hydraulic connection, the Area of Influence extends up to 1km distance from the site. The 1km boundary has been selected due to the potential for any water pollution incidents to be carried upstream (on a rising tide) or downstream (on an ebb tide) from their potential source, which in this case would be the site.

- 12.3.3. The location of the Scheme is in Victoria Tower Gardens, London, which is situated on the north bank of the River Thames immediately to the south of the Palace of Westminster. Managed by The Royal Parks, Victoria Tower Gardens is a designated Grade II listed garden adjacent to the Westminster World Heritage Site.

- 12.3.4. The site is bounded to the east by the River Thames (360m frontage), designated a 'main river'. St James' Park Lake and The Serpentine (Hyde Park) are the only other waterbodies within the vicinity of the site, situated approximately 600m and 2.5km north-west of Victoria Tower Gardens respectively and are not impacted upon by the construction of this site. Five hidden rivers run through Westminster City, one of

which, 'Long Ditch' is located underneath the northern end of the site. These hidden rivers have been subsumed into the sewerage network and therefore not considered as part of the WFD.

12.4 Baseline Conditions

Surface water quality

- 12.4.1. Victoria Tower Gardens are located immediately adjacent to the River Thames, which is the only surface water body within the Area of Influence that has a potential direct hydraulic connection to the site. The River Thames at this location is tidal and is classified under the Water Framework Directive (WFD) as part of the Thames Middle transitional water body (ID number GB530603911402). This water body covers a large portion of the tidal River Thames, extending from Battersea Bridge downstream to Mucking, Essex (north bank) and Cliffe Marshes, Kent (south bank). The Thames Middle is designated as a Heavily Modified water body, and therefore has other important modifications that are important to maintain. It also means that the catchment has to reach Good Ecological Potential (GEP) rather than Good Ecological Status (GES), which requires different quality elements to more natural water bodies.
- 12.4.2. The water body does not reach GEP currently due to the biological quality elements, physio-chemical quality elements and the supporting elements causing the Ecological Potential to be Moderate. The objective for this water body was only to get to Moderate by 2015, due to the disproportionate costs, benefits and burdens of reaching a higher objective, unknown causes of adverse impacts, and potential significant adverse impacts on use. Moderate Ecological Potential has been achieved.
- 12.4.3. These data were taken from the Environment Agency's Catchment Data Explorer (2018). In the data explorer the reasons for not achieving GEP were given as: physical modification due to land drainage structures, and flood and coastal protection for the Mitigation Measures Assessment getting a Moderate or Less rating. Other identified issues are:
- A rating of 'Fail' for Tributyltin compounds due to a combination of point source pollution from sewage, contaminated land landfill leachate, and diffuse pollution from contaminated water body bed sediments, transport, urban and navigation sources;
 - Point source pollution from sewage resulting in a Moderate rating for dissolved oxygen; and
 - Unknown sources resulting in a Moderate rating for Zinc levels.
- 12.4.4. The River Thames at this location is also designated as a Site of Metropolitan Importance, with the ecological features of interest being the intertidal foreshore (comprising gravel and sand), and the presence of some artificial structures (such as wharves or embankment walls) that provide some roost or nest sites for birds and waterfowl.

Table 12-3 - WFD Classification Data – Thames Middle Transitional Water Body

Water body name	Thames Middle	
Type	Transitional	
Water body ID	GB530603911402	
National Grid Reference	TQ3295080508	
Hydromorphological designation	Heavily modified	
River Basin District	Thames	
Management catchment	Thames TraC	
Operational catchment	Tidal Thames	
Classification	2016 Cycle 2	Objectives
Overall water body	Moderate	Moderate by 2015
Ecological	Moderate	Moderate by 2015
Supporting elements (surface water)	Moderate	Good by 2027

Mitigation Measures Assessment	Moderate or less	Good by 2027
Biological quality elements	Moderate	Moderate by 2015
Angiosperms	Moderate	Moderate by 2015
Fish	Good	Good by 2015
Invertebrates	Good	Good by 2015
Macroalgae	Good	Good by 2015
Phytoplankton	Good	Good by 2015
Physico-chemical quality elements	Moderate	Moderate by 2015
Dissolved Inorganic Nitrogen	Moderate	Moderate by 2015
Dissolved oxygen	Moderate	Good by 2027
Specific pollutants	Moderate	High by 2027
Chemical	Fail	Good by 2015
Priority substances	Good	Good by 2015
Other pollutants	Good	Good by 2015
Priority hazardous substances	Fail	Good by 2015

Environment Agency Catchment Data Explorer

Surface water abstractions

- 12.4.5. A previous "site investigation report" has been compiled in relation to the Scheme and the site (WYG, March 2016), see Appendix I in Volume 5. This was a desk-based study principally relating to geo-environmental conditions that are relevant to the site, but also included data searches relating to surface water elements, including licensed surface water abstractions within 500m of the site. No licensed surface water abstractions are registered within 500m of the site, which is to be expected given the tidal nature of the River Thames at this location (the only notable surface water feature in the vicinity). Further data searches for licensed abstractions of the full 1km boundary set for this assessment have not been undertaken.

Flood risk

- 12.4.6. The Environment Agency Flood Map for Planning identifies the probability of river and sea flooding, ignoring the presence of defences. Flood Zone 1 has the lowest probability of flooding from the rivers or sea, whereas Flood Zone 3b has the highest probability of flooding.
- 12.4.7. The Site is identified (Environment Agency, 2017) as being located in Flood Zone 3, with a ≥ 1 in 100 (1%) annual probability of fluvial flooding or ≥ 1 in 200 (0.5%) annual probability of tidal flooding (see Figure 2 2). It is usual, for planning purposes, to subdivide Flood Zone 3 into 3a and 3b of areas below and above a 1 in 20 (5%) annual probability of flooding, respectively. However, given the presence of extensive flood defences on the River Thames that provide protection in excess of a 1 in 1000 (0.1%) annual probability event, the site is simply referred to as being in Flood Zone 3, as is consistent with the SFRA.
- 12.4.8. The Site is identified as being at low risk of surface water flooding on the Environment Agency Risk of Flooding from Surface Water maps (RoFSW) (Environment Agency, 2017), with an annual probability of flooding between 1 in 1,000 (0.1%) and 1 in 100 (1%) and flood depths below 300 mm. The risk of flooding from sewers has also been identified as low.
- 12.4.9. The Site is not identified as a Critical Drainage Area, or at risk from reservoir flood failure.

12.5 Method of assessment

- 12.5.1. The assessment of the importance of the water environment features and the significance of the predicted effects has been undertaken using a methodology adapted from Volume 11, Section 3, Part 10 of the Design Manual for Roads and Bridges (Department for Transport, 2006). This was originally produced for the assessment of the effect of highways development on the water environment, although the principles

are transferable to other development types. This methodology gives guidance on the assessment and management of the impacts that new construction, improvement, technology and maintenance projects may have on the water environment.

- 12.5.2. The baseline environmental conditions and the features likely to be affected by the Scheme, which includes any existing surface water features, surface water quality data, surface abstractions, were established through desk study. The sensitivity and importance of identified baseline features is first defined, based on consideration of their value / quality to both the human and natural environment. Table 12-4 outlines the criteria used to make this judgement and provides examples for each importance rating.
- 12.5.3. The identification of potential impacts is then undertaken based on review of the relevant baseline data, followed by the identification of any Source-Pathway-Receptor (S-P-R) linkages. The S-P-R approach is defined by the following terms:
- The source relates to an activity or other change from which a potential impact may originate (for example use of temporary fuel storage areas on a site, or ground breaking excavations);
 - The pathway relates to the means by which a source could impact on a potential receptor (for example, infiltration to ground, or run-off along drainage routes); and
 - The receptor that may be affected by the impact, in this case, controlled water features or populations in areas of flood risk, as identified in the baseline.
- 12.5.4. The significance of an effect is then determined by considering the severity of the impact against the sensitivity / importance of the water environment feature. A matrix is used to combine severity and importance to generate the overall significance of the effect (Table 5.5). The definitions of receptor importance/sensitivity, severity of impacts and significance of effects are set out below.
- 12.5.5. A Level 3 FRA for the proposals has been prepared separately (Atkins, 2018). The results of this detailed FRA have been used to develop the assessment of the impacts of the scheme on flood risk for this Chapter, framed using the above EIA terminology for the water environment. The full FRA reports should be referred to for the technical detail of the flood risk impacts of the Scheme.

Sensitivity of the Receptors

- 12.5.6. The sensitivity of receptors assessment aims to define the value of a water feature or resource as indicated in Table 12-4 (taken from Table A4.3 in Annex IV of DMRB Volume 11 Section 3).

Table 12-4 - Sensitivity of Receptors for Water Quality and Flood Risk

Sensitivity of Receptor	Importance / resilience of receptors
Very High	Attribute with a high quality and rarity, regional or national scale. Surface water: EC Designated Salmonid/Cyprinid fishery; WFD Class 'High'; Water dependent nature conservation site with a national or international designation e.g. SSSI, SAC, SPA, Ramsar. Flood risk: Floodplain or defence protecting more than 100 residential properties from flooding
High	Attribute with a high quality and rarity, regional or local scale. Surface water: WFD Class 'Good'; Major Cyprinid Fishery; Aquatic species protected under national or EU wildlife legislation. Flood risk: Floodplain or defence protecting between 1 and 100 residential properties or industrial premises from flooding.
Medium	Attribute with a medium quality and rarity, local scale. Surface water: WFD Class 'Moderate'. Water dependent nature conservation site of local importance, or presence of notable (but not protected) aquatic species. Flood risk: Floodplain or defence protecting 10 or fewer industrial properties from flooding
Low	Attribute with a low quality and rarity, local scale. Surface water: WFD Class 'Poor'. No site designation or protected / notable species.

Sensitivity of Receptor	Importance / resilience of receptors
	Flood risk: Floodplain with limited constraints and a low probability of flooding of residential and industrial properties.

Impact severity

- 12.5.7. The methodology takes into account the severity of predicted impacts on the water environment, where the severity is estimated on the basis of the likely effects and is independent of the importance of the feature, as shown Table 12-3 (taken from Table A4.3 in Annex IV of DMRB Volume 11 Section 3).

Table 12-5 - Impact Severity for Water Quality and Flood Risk

Impact Severity	Description of Impact
Very High	Results in loss of feature. Examples: Loss of important fisheries; change in WFD classification of river reach; loss of flood storage/increased flood risk.
High	Results in adverse impact on integrity of feature or loss of part of feature. Examples: Loss in productivity of a fishery; contribution of a significant proportion of the effluent in the receiving river, but insufficient to change its WFD classification; reduction in the economic value of the feature.
Medium	Results in minor adverse impact on feature. Example: Measurable changes in feature, but of limited size and/or proportion.
Low	Results in an impact on feature but of insufficient magnitude to affect the use/integrity Examples: Discharges to watercourse but no significant loss in quality, fishery productivity or biodiversity; no significant impact on the economic value of the feature; no increase in flood risk.

Significance of Effect

- 12.5.8. The relevance, or significance, of an effect is then determined by considering the severity of the effect against the sensitivity / importance of the water environment feature. A matrix is used to combine importance and severity to generate the overall significance of the effect, as presented in Table 5-5.

12.6 Potential Impacts

Construction

The S-P-R model described in the methodology has been developed for the proposed construction works, and is reported in

- 12.6.1. Table 12-6. The model has been developed on the basis of currently available information regarding the proposed construction of the Scheme, which includes the following key assumptions:
- All construction works will be land-based, and no construction works will take place within the River Thames;
 - No temporary works are required to any of the adjacent river flood walls or the foundations of these structures;
 - The boundary of the construction site will be set back from the river frontage and will be securely enclosed by hoardings or similar fencing; and
 - All transport of materials and waste will be via the road network, and none of the Scheme transport routes will utilise the River Thames.

12.6.2. Any changes to these key assumptions would require a re-evaluation of the S-P-R model and identified impacts.

Table 12-6 - Construction Source-Pathway-Receptor model for water quality and flood risk

Source	Pathway	Receptor	Receptor sensitivity
Refuelling areas or fuel / oil / chemical stores	Direct spills or leaks to ground or drains	River Thames and SMI	Medium
Temporary site drainage and infrastructure (e.g. welfare cabins, toilets)	Inappropriate disposal routes or mis-connections to surface drainage	River Thames and SMI	Medium
	Temporary loss of floodplain storage	Floodplain and populations at risk of flooding	Very High
Stripping of vegetation and topsoil, excavation works	Increased runoff of silt from exposed ground	River Thames and SMI	Medium
	Dust generation settling on adjacent water bodies	River Thames and SMI	Medium
	Mobilisation of historic contamination	River Thames and SMI	Medium
Operation of plant and machinery on site	Direct spills or leaks to ground or drainage routes	River Thames and SMI	Medium
	Transfer of mud from excavations to access tracks or roads, followed by runoff	River Thames and SMI	Medium
Temporary stockpiling of topsoil or storage of excavated overburden material prior to removal	Runoff from stockpiles during wet weather	River Thames and SMI	Medium
	Temporary loss of floodplain storage	Floodplain and populations at risk of flooding	Very High
Dewatering of excavations	Inappropriate disposal of dewatering	River Thames and SMI	Medium
Use of concrete and cement on site	Direct spills or leaks to ground or drains	River Thames and SMI	Medium
Establishment of waste storage areas	Leachate, overflow	River Thames and SMI	Medium
	Temporary loss of floodplain storage	Floodplain and populations at risk of flooding	Very High

Surface Water quality

12.6.3. The S-P-R model highlights that the site establishment, construction activities, storage of materials and waste, excavation and dewatering operations all have the potential to generate impacts on surface water quality; principally by introducing additional suspended solids or other contaminants into surface runoff from construction areas. During construction, the most likely risk that could arise to the water environment is possible pollution of the River Thames due to run-off of silt or other pollutants (e.g. spilt fuel or oil from machinery and plant) from the construction site. Uncontrolled discharge of these (either directly to water or to soils, thus contaminating runoff) can lead to impacts on water quality, with secondary or indirect implications for aquatic ecology and habitats; in this case the River Thames and Tidal Tributaries SMI. Both baseline receptors are considered to be of **medium** sensitivity.

12.6.4. The severity of the potential impacts on water quality (and any consequent secondary impacts on the River Thames and Tidal Tributaries SMI) would be highly dependent on the location, scale and duration of

impacts; for example, a leak from a single machine may have limited potential to result in more than a 'low' severity impact, but a burst hose during a concrete pump or pour resulting in the release of a large volume of concrete could have the potential to generate a higher severity impact. However, using professional judgement and based on the relatively small size of the construction site and the relatively confined nature of the works, which will not take place within or over any surface water bodies, it is considered that the likely severity of any impacts before mitigation would be **low to medium** at most, resulting in a **negligible to minor adverse** (unmitigated) effect.

Flood risk

12.6.5. Although the site is assessed as having a high probability of flood risk related to flooding from the River Thames, this risk is assessed without considering the presence of flood defences. The defences present along the River Thames provide a very high standard of protection, equivalent to a 1 in 1000 year risk or 0.001% Annual Expected Probability. Due to the extensive development present in the adjacent floodplain, the receptor sensitivity is judged to be Very High. Given the presence of the defences, the nature of the proposed construction works and the size of the site it is considered that any impacts of flooding to the site during construction before mitigation would be **low** at most, resulting in a **minor adverse** (unmitigated) effect.

12.6.6. The FRA does not specifically consider the impact of construction works on active construction sites on flood risk, and a qualitative assessment of possible risk has therefore been undertaken for the purposes of the ES. The S-P-R model highlights that the site establishment and storage of materials and waste have the potential to adversely impact on flood risk due to the temporary loss of floodplain storage. However, considering the very high standard of protection offered by the adjacent flood defences (which will not be altered or affected by the construction works), the lack of impermeable surfacing within the site during construction, the nature of the proposed works and the size of the site it is considered that any effects would be **negligible**, and would have no effect on flood risk.

Operation

Flood risk

12.6.7. As for the operation phase, the risk of flooding to the Scheme from the River Thames once constructed and operational is considered to be low, given the presence of the adjacent flood defences. The Scheme has been classified as "Less Vulnerable" to flood risk in accordance with guidance provided in the NPPF. As directed by the Environment Agency, the Scheme design has been set back at least 16m from the flood wall on the River Thames, apart from the cafe area that is just within the 16m set back. This construction will have no pilings that go into the ground and therefore should not impact on the flood defences.

12.6.8. In the event of a breach of the flood defences once the Scheme is completed, the site would be susceptible to flooding to a predominate depth in a 1 in 1000 (0.001%) event. The majority of the site is predicted to experience flooding to <1.5m in the climate change scenario. However, as part of the TE2100 Strategy to manage flood risk from the River Thames to 2100, the Environment Agency is committed to adapting to climate change in this area so that flood risk does not increase. Therefore, the site will remain at a low risk from fluvial and tidal flooding until at least 2100. The operational flood risk to the Scheme is therefore considered to be low at most, resulting in a **minor adverse** (unmitigated) effect.

12.6.9. The development of the Scheme will result in a permanent change in land cover to the site, which is currently greenfield. The Scheme will increase the area of impermeable cover, and this will increase the rate and volume of surface water run-off, increasing the risk of surface water flooding both on the site and potentially in surrounding areas. The FRA has categorised the Scheme as "major development" in accordance with the NPPF and relevant legislation. The severity of the impact, when considered in the context of the overall floodplain of the River Thames, is therefore considered to be medium, resulting in a **moderate adverse** (unmitigated) effect.

12.7 Cumulative Effects

Construction

Surface water quality

12.7.1. Cumulative impacts could arise on surface water quality in the River Thames if there are other construction projects underway simultaneously that are adjacent to, or with potential connections to the river. The mitigation measures proposed in Section 12.8 will manage potential risks to water quality associated with the construction phase of the Scheme. As these measures are all well-established as good construction practice, it is reasonable to expect that similar measures would be employed at other construction sites, and the potential for cumulative impacts would be minimised. This has been verified through a review of other developments and planning applications that may be relevant to surface water quality. The developments and applications within a 1km boundary of the site identified as relevant due to being located in proximity to the River Thames are:

- 13/09737/FULL / 16/06616/FULL – Redevelopment (already commenced) of the Ergon House site to provide a nine-story residential building. Set back from the River Thames by approximately 112m. Demolition and new build works due to be completed by August 2020;
- 14/04757/FUL and 16/01103/VOC – Demolition and site redevelopment (already commenced) for provision of a new mixed use development at 22-29 Albert Embankment, set back approximately 30m from the River Thames. Completion date unknown; and
- 16/00795/FUL – Demolition of petrol station and site redevelopment (not commenced) for provision of a new mixed use development at 36-46 Albert Embankment, set back approximately 65m from the River Thames.
- The Thames Tideway (Albert Embankment) – Development of a new ‘super sewer’ for London, subject to a Development Consent Order with construction already commenced. The works at Albert Embankment are upstream of the Scheme and involve works on the foreshore of the tidal River Thames to drill new shafts to connect the Thames Tideway to existing sewers.

12.7.2. No specific information with regard to provisions for surface water quality has been provided for any of the three ongoing and proposed developments that have been consented through planning applications, although all make general reference to pollution control and emergency response procedures during construction. Given that all are physically separated from the River Thames by roads and / or other existing developments, the risk of a significant direct water pollution event occurring from these developments is considered to be low, and any potential cumulative effects are judged to be **negligible**.

12.7.3. The Thames Tideway (Albert Embankment) works are accompanied by a detailed Code of construction Practice Document (<https://www.tideway.london/media/1681/app20501-code-of-construction-practice-cocp-part-a-general-requirements.pdf>) that gives full details of the proposed river works methodology (Section 4.7), pollution control planning (Section 4.10), the protection of surface water (Section 8.4), flood risk (Section 8.7) and protection of aquatic ecological receptors (Section 11.5). With the identified mitigation and construction controls in place for the Thames Tideway works, the risk of significant water pollution events occurring simultaneously from the two construction sites is considered to be extremely low, and any potential cumulative effects are judged to be **negligible**.

Flood risk

12.7.4. Changes to flood risk (both to and from the construction works) during the construction phase will be minor adverse at most (without mitigation). No specific information with regards to the impact on flood risk from ongoing and proposed developments near to the construction site, but these are all physically separated from the site, and it is understood that they do not involve works to existing flood defences. The risk of a significant cumulative impact on flood risk during construction is therefore considered to be **negligible** and the cumulative effects are judged to be **negligible**.

Operation

Flood risk

12.7.5. The Scheme will not result in any changes to the existing River Thames flood defences adjacent to the site, and there are no other proposed or ongoing developments that would result in any changes to the risk of

flooding to the Scheme from the River Thames, as this would involve a change to the existing flood defence arrangements affecting large areas of floodplain of the tidal River Thames (contrary to current flood risk management policy). There are therefore no possible pathways for cumulative effects to flood risk from the River Thames during operation.

12.7.6. The identified potential operational effect of increased risk of surface water flooding due to an increase in impermeable ground cover associated with the Scheme has the potential to act cumulatively with any other developments that also result in loss of permeable area within the floodplain. However, all consented development must comply with the requirements of the NPPF and ensure that flood risk is not increased. It can therefore be assumed that any other relevant developments will not result in increased flood risk through surface water runoff, and even before mitigation is considered for the Scheme, it is concluded that there will be no cumulative effects to flood risk arising during operation.

12.8 Mitigation measures

Construction

Surface water quality

12.8.1. The identified construction risks to water quality can be managed through the implementation of appropriate construction working methods, the application of good site layouts and working practices, controls on site plant and pollution response planning. There are well-established mitigation methods for construction working that can be employed to effectively manage pollution risks, including works over or adjacent to water. Guidance on pollution prevention was provided in the Pollution Prevention Guidelines (PPG) series produced by the Environment Agency, Northern Ireland Environment Agency and SEPA, which has since been withdrawn from use in England. The PPGs are currently undergoing review by the Northern Ireland Environment Agency, Natural Resources Wales and SEPA, and are gradually being replaced by a new guidance series, the Guidance for Pollution Prevention (GPP). Although the new GPPs and old PPGs are not endorsed in England, they are still considered to represent a reliable source of good practice guidance and are referred to in the absence of equivalent English guidance.

12.8.2. The measures outlined in Chapter 10 to control potential pollution of soils will also be applicable to protecting the water environment.

12.8.3. The following GPPs and PPGs are particularly relevant to the control of water pollution:

- PPG 1 – Understanding your environmental responsibilities – good environmental practices;
- GPP 2 – Above ground oil storage tanks;
- PPG 3 – Use and design of oil separators in surface water drainage systems;
- GPP 4 – Treatment and disposal of wastewater where there is no connection to the public foul sewer;
- GPP 5 – Works and maintenance in or near water; and
- PPG 6 – Working at construction and demolition sites.

12.8.4. The above documents should be referred to (<http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/>) for full details of the recommendations, but the key relevant actions to specifically prevent pollution of water for the Scheme include (but are not limited to):

- All working areas will be defined in detailed site plans and through the use of temporary fencing during construction;
- Any roads being utilised by site traffic will be regularly swept in order to ensure that they are kept free of deposits in order to prevent solids being washed off and into surface drains or watercourses during periods of rainfall;
- Consideration will be given to the need for provision of wheel wash facilities to reduce transfer of mud and solids onto public highways. If these facilities are used, then they will be securely constructed with no overflow and the effluent will be contained for proper treatment and disposal;
- Washing of vehicles or equipment will only take place in controlled areas. Vehicle and equipment wash waters will not be discharged directly into the water environment. The wash water will be contained for proper treatment and disposal;

- The volume of contaminated water generated by the construction will be minimised by diverting clean water away from working areas and preventing it from entering excavations wherever possible, for example by the use of cutoff ditches or walls;
 - Runoff water or water from dewatering operations that is contaminated with silt or other pollutants such as oil must not be pumped or allowed to flow (directly or indirectly) into the water environment without suitable treatment. Discharges of treated water to the environment will require approval from the Environment Agency. Discharges to the public / foul sewer will require the consent of the water and sewerage provider;
 - All materials that could be hazardous to water quality will be stored in suitable areas, more than 8m away from a watercourse, away from site traffic and in suitable containers. Material storage area will be protected from vandalism or other unauthorised access;
 - All waste material will be stored in suitable areas and disposed of in a suitable manner. Open skips for general waste will be covered with a net or suitable tarpaulin to prevent waste from being blown away by the wind and possibly deposited in adjacent water bodies.
 - All re-fuelling of plant will take place in an appropriate bunded area more than 8m away from a watercourse. This will include an impervious base, drip trays and where possible interceptor drains. An adequate supply of spill kits will be kept at all construction sites and any fuel bowsers are to be double skinned or have a bund. Vehicles and equipment are never to be left unattended during re-fuelling;
 - All pumps, generators and similarly fuelled equipment are to be placed on drip trays or in a bunded area. Drip trays will be positioned more than 8m away from any watercourse or drain;
 - All valves, hoses and associated re-fuelling equipment will be regularly inspected. This equipment is to be protected from vandalism and unauthorised interference and will be turned off and securely locked when not in use;
 - All tanks or drums of fuel, oil, grease, chemicals and all other hazardous material will be kept in a secure, bunded area with an impervious base. These will be clearly marked as to their contents and are only ever to contain the substance for which the tank was designed or supplied. Any spillages or leaks are to be dealt with promptly and all waste disposed of in an appropriate manner. Before any tank is removed or perforated, all contents and residues will be emptied by a competent operator for safe disposal at a licensed facility;
 - All bunds or interceptors will be adequate for the amount of spillage that could happen in a worst-case scenario and will be designed to applicable standards. All bunds will have a capacity of at least 110% of the tank volume and will be inspected daily; and
 - All contracting staff (including sub-contractors) who are involved in fuel handling will be given training in the correct procedures for handling this and other potentially polluting material in an appropriate manner and, if required, site specific procedures will be developed that all relevant staff must adhere to when handling such material. Staff will also be trained in the proper use of spill kits.
- 12.8.5. The mitigation measures for risks to surface water quality from general pollution caused by construction site activities will be managed through the Construction Management Plan (CMP) (Appendix C in Volume 5, which will be developed prior to site mobilisation. The mitigation described in this section will be transferred to the CMP and will form part of the contractual documentation to be adhered to during the works.

Flood risk

- 12.8.6. As outlined in the Level 3 FRA, the Scheme type is less vulnerable and lies within Environment Agency Flood Zone 3 and is therefore not appropriate in accordance with the NPPF, however the site is heavily protected from the Thames River flood defences and this will significantly reduce the risk of flooding. The Environment Agency has set a requirement for a minimum 16m development setback from the flood defence wall, which has been achieved through the design apart from the proposed café, which lies just inside the setback zone. The Environment Agency has advised:
- 12.8.7. *“If the minimum of 16m setback is not possible we would expect the applicant to submit evidence to demonstrate that any flood walls/defences are in good enough condition to protect the proposed development for its lifetime. This should be submitted in the form of a survey and should include an assessment of any remedial works or flood defence replacement options required to protect the site from flooding for the lifetime of the development. This survey should assess the impacts of the failing flood defence on the proposed development and demonstrate that it will not be at an unacceptable risk of*

flooding. Any application will also need to demonstrate how suitable access will be maintained for maintenance and improvement works to the flood wall.”

- 12.8.8. The required information has been provided as part of the planning application for the Scheme.
- 12.8.9. It is not possible to eliminate the risk of flooding to the site entirely. In order to ensure that potential risks are mitigated, the Contractor will be required to give details of the actions that would be taken to evacuate the construction site and make it safe in the (unlikely) event of an extreme flood event that exceeds the flood defences on the River Thames occurring during the construction phase. This could include signing up to the Environment Agency’s flood warning service.

Operation

Flood risk

- 12.8.10. As stated above, it is not possible to eliminate flood risk entirely. The Level 3 FRA has identified that the development of the Scheme in Flood Zone 3 is acceptable due to its “less vulnerable” nature and the presence of existing flood defences. However, in recognition of the risk to the Scheme (and visitors and staff in operation), a flood risk evacuation plan will need to be developed alongside any fire escape plan that will cover:
- Access and egress in the event of flooding;
 - Operation and maintenance;
 - Flood warning and Evacuation procedures; and
 - Visitor awareness of these plans.
- 12.8.11. No further mitigation measures will be required.
- 12.8.12. In order to mitigate for the increase in impermeable surfacing (and concurrent increase in surface water flood risk), an outline drainage strategy for the Scheme has been developed (Appendix N in Volume 5). This document states that as part of the development of the site, surface water will be managed to drain the proposed landscape areas of the surrounding footpaths via a combination of ways that are in line with the Sustainable Drainage Systems (SuDS) hierarchy to ensure that the site can accommodate surface water. The outline drainage strategy (WSP UK Limited, 2018) has demonstrated that the site can accommodate surface water run-off during all events up to and including the 100 year plus 40% climate change allowance. This document will continue to be developed through the detailed design stage.

12.9 Residual Effects

Construction

Surface water quality

- 12.9.1. With the identified mitigation measures in place, the risks to surface water quality during construction will be managed and reduced to a **low** potential severity. The proposed construction would only have a ‘significant’ effect on water quality as a result of preventable accidents, spills or poor site management activities. The residual effect is judged to be **negligible**, and not significant.

Flood risk

- 12.9.2. With the current flood defence arrangements in place and proposed emergency response planning for construction, the impacts flood risk during construction both to and from the site will be managed and will be considered to be of **negligible** risk. The residual effect is judged as **negligible**, and not significant.

Operation

Flood risk

- 12.9.3. With the current flood defence arrangements in place and the future plans for adaptation as part of TE2100, flood risk during operation will continue to be managed and is considered low risk. The development of a flood risk evacuation plan for the Scheme in operation will address the residual risk of flooding, which cannot be removed entirely. The residual effect is judged to be **negligible**, and not significant.

12.9.4. The development of the Drainage Strategy (currently outline, WSP UK Ltd, 2018) will address the increased risks of flooding caused by the Scheme due to the increase in impermeable area. Once this Strategy is implemented residual effects are judged to be **negligible**, and not significant

12.10 Summary Table

Table 12-7 - Construction phase effects on Water Quality and Flood Risk

Activity	Baseline	Impact assessment			Mitigation	
Impact	Receptor	Receptor Sensitivity	Impact Severity	Effect before Mitigation	Mitigation Measures	Residual Effect
Site set up and establishment, including vegetation stripping and establishment of storage/refuelling areas creating risks of increased runoff or potential direct sources of pollution.	River Thames and SMI	Medium	Low - medium	Negligible – minor adverse	Good construction planning and practices, and adherence to relevant PPGs and GPPs.	Negligible
Temporary site drainage and infrastructure with inappropriate connections/ disposal routes creating a potential direct source of pollution.	River Thames and SMI	Medium	Low - medium	Negligible – minor adverse	Good construction planning and practices, and adherence to relevant PPGs and GPPs.	Negligible
Pollution from spills and leaks during operation of plant and machinery, including concreting	River Thames and SMI	Medium	Low - medium	Negligible – minor adverse	Good construction planning and practices, and adherence to relevant PPGs and GPPs.	Negligible
Dewatering of excavations with inappropriate treatment or disposal of waste water.	River Thames and SMI	Medium	Low - medium	Negligible – minor adverse	Good construction planning and practices, and adherence to relevant PPGs and GPPs.	Negligible
Flood risk to construction works from the River Thames	Floodplain and populations at risk of flooding	Very High	Negligible - low	Minor adverse	Design of scheme avoids flood defences, contractor to consider and plan emergency response to a flood event.	Negligible
Temporary loss of floodplain storage from site establishment and material storage.	Floodplain and populations at risk of flooding	Very High	Negligible	Negligible	Not required	Negligible

Table 12-8 - Operational phase effects on Water Quality and Flood Risk

Activity	Baseline	Impact assessment			Mitigation	
Impact	Receptor	Receptor Sensitivity	Impact Severity	Effect before Mitigation	Mitigation Measures	Residual Effect
Development of Scheme within Flood Zone 3 – residual flood risk from 0.001% AEP event	Floodplain and populations at risk of flooding	Very High	Low	Minor adverse	Development of flood risk evacuation plan for the Scheme	Negligible
Construction of the Café within the 16m setback requirement by the EA and risk to integrity of flood defences	Floodplain and populations at risk of flooding	Very High	Low	Uncertain	No pilings to be used in the construction of the café. Provision of evidence to the Environment Agency demonstrating any flood walls/defences are in good enough condition to protect the Scheme for its lifetime.	Negligible
Increase in impermeable area from Site development	Floodplain and populations at risk of flooding	Very High	Medium	Moderate adverse	Development of Drainage Strategy and implementation of the SuDs hierarchy and SuDs measures to control surface water runoff	Negligible

13 Traffic and Transport

13.1 Scope of the assessment

- 13.1.1. This chapter of the Environmental Statement (ES) has been prepared by WSP to report the findings of an assessment of the likely significant effects on the surrounding highway and transport networks, as a result of the Scheme.
- 13.1.2. The chapter will consider the effect of the Scheme in the future year assessment (opening year), also including a consideration of cumulative schemes within the vicinity. This chapter will identify the potential impacts of the Scheme, set out an appropriate mitigation strategy and then conclude with an assessment of the residual impacts. It should be noted that this chapter has been produced in coordination with the Air Quality Chapter (chapter 6) and Noise and Vibration assessments (Appendix E in Volume 5) to ensure consistency across the report.
- 13.1.3. The environmental effects of changes in traffic as a result of the Scheme – both during construction and once operational – will be determined using pre-defined significance criteria, as set out within the Institute of Environmental Management and Assessment’ (IEMA) publication ‘Guidelines for Environmental Impact Assessment’ (2004). Those criteria will be based on the net change in journeys as a result of the Scheme. The significance criteria will establish the magnitude of any beneficial or adverse traffic and transport impacts of the Scheme. The data and analysis discussed in this chapter is taken from the Transport Assessment (TA) issued in November 2018 (Appendix O in Volume 5), which has been submitted as part of the planning application.
- 13.1.4. The site is within Victoria Tower Gardens located in the administrative boundary of Westminster City Council (WCC) and is a short walk away from the Houses of Parliament and Westminster Abbey.

13.2 Responses to scoping opinion

Table 13-1 - Summary of responses to stakeholder scoping opinions

Stakeholder	Comment	Response
Westminster City Council	The scoping report indicates that Transport Issues will be covered in the Transport Assessment. The TA should be consistent with the requirements of TRASN14 and TfL Transport Assessment Best Practice Guidance Document.	The Transport Assessment is consistent with the requirements of national, regional and local policy as set out in chapter 2 of the Transport Assessment. The Transport Assessment can be found in Appendix O in Volume 5 of the ES.
	The drafting Chapter 12 implies the focus will be on traffic and vehicle impacts and fails to give sufficient weight to the potential impacts of increased pedestrian activity on the immediate and wider area. Impacts on additional crossing times (particularly of signalised crossing) will need to be assessed, as well as the impact of extra pedestrians on traffic flows.	One of the receptor groups is ‘Existing Users of the Transport Network around Victoria Tower Gardens’, including pedestrians. Paragraphs 13.6.24 and 13.6.25 deal with pedestrian impact specifically.
	There are a number of reports (including ARUP 2017, Baker Langham Operational Business Plan) referenced in Chapter 12 that are unfamiliar to WCC. These must be reviewed prior to it being agreed that they are relevant and robust for further assessments to be based upon. In terms of survey work it is strongly suggested that these should cover 24 hours, 7 day a week activity that occurs in the area.	These reports will be provided as part of the Transport Assessment appendices being submitted concurrently. Servicing for the UKNHM will take place predominantly after closing time but not 24/7; the gardens will remain closed overnight. The only overnight servicing envisaged is in the event of exhibition changeovers which will generate a negligible amount of overnight vehicle movements over the course of a year.

Stakeholder	Comment	Response
		A Delivery and Servicing Plan will be produced post-application.
	It is unclear if there has been discussions with TfL at this stage (para 12.2.1). Discussions with WCC have been limited to date, given the scale and complexity of the proposal.	A TfL Pre-app response was received in November. Additional meetings have taken place with TfL Buses and TfL Coaches. Several meetings have taken place with WCC Highways.
	The majority of the potential mitigation listed on page 56 of the EIA is unclear or potentially undeliverable (based on the limited detail provided within the EIA).	The Transport Assessment contains details of all the mitigation measures proposed, with many of these forming part of the planning application.
TfL	A Transport Assessment/ Statement shall be provided to include level of traffic / pedestrians likely to generate to the proposal; the site is highly accessible by public transport, and due to its location, no additional car parking shall be provided. However, cycle parking for staff/ visitors should be provided with reference to the Draft London Plan cycle parking standards.	A Transport Assessment is being provided containing all the requisites mentioned.
	The applicant shall clarify whether any regular ceremony/ events likely to take place at the proposal which would attract congregation of large crowds which temporary traffic management/ diversion may be necessary. TfL would need to consider whether this would have an impact to traffic movements in the area.	At this stage the application is for a Memorial visited by the general public and small organised groups. Large ceremonies, if they were to be planned in future, would be subject to separate applications.
	Due to the sensitive location of the site, the applicant would need to consider whether there would be a need for additional security measures in the vicinity, in turns which may impact traffic/pedestrians movements on Millbank.	The design incorporates hostile vehicle mitigation (HVM) measures within the site curtilage to minimise the need for incoming vehicles to stop on the highway.
	As para 12 of the scoping report, construction impact for the proposal would need to be fully considered, TfL would expect a Draft Construction Logistics plan be submitted forming part of the formal application submission detailing but not limited loading/ unload of construction materials, time scale, construction access, construction vehicles types and their routing, traffic management and access strategy. In the event that road closure may be needed, alternative traffic route would need to be proposed and impact to traffic capacity would also need to be considered.	An Outline CLP is being submitted as part of the planning application.

13.3 Relevant planning policy & legislation

- 13.3.1. Transport policy and guidance has been reviewed to provide context for assessment of the Scheme. Table 13-2 provides a summary of the relevant policy and guidance.

Table 13-2 - Policy overview

Scale	Policy Document	Key Considerations for the Scheme
National	National Planning Policy Framework (2018)	Promoting sustainable transport nation wide
	Planning Practice Guidance (2014)	Provides guidance on how to write a TA
Regional	The London Plan (various versions)	Promoting active modes and the reduction of travel by private car
	Operating Coaches in London	Provides guidance to coach drivers with regards to operating with obstructing
Local	Westminster City Plan (2016)	Prioritising pedestrian movement and minimising vehicular traffic
	Westminster City Council UDP (2007)	Good facilities for coaches, servicing vehicles and pedestrian movement

13.4 Area of Influence

- 13.4.1. As alluded to, the site falls within the boundary of the Victoria Tower Gardens, as shown in Figure 13-1. The immediate area of influence is therefore the limit of the gardens, entailing the 5 access points and the walking paths.
- 13.4.2. The wider study area has been established based on the likely areas of influence of the various travel modes and where these have the potential to create a significant effect. For instance:
- Travel by foot – the focus is on access to the site including the footways and crossings within the vicinity of Victoria Tower Gardens;
 - Travel by bicycle – the focus is on access to the site including routes to the site, as well as cycle parking provision;
 - Travel by public transport – the focus is on access to bus stops adjacent to the site and the closest underground station where visitors are expected to travel to, namely Westminster Station; and
 - Travel by car – the focus is on local roads, namely Millbank, Dean Stanley Street, Horseferry Road and Great Peter Street.

Figure 13-1 - Site Locations



13.5 Baseline Conditions

- 13.5.1. The baseline conditions of the existing site were established through desktop studies together with a series of site visits and surveys, including the following:
- A series of pedestrian and cycle counts (27th May 2017, 29th May 2017 and 13th September 2017);
 - Kerbside activity surveys (30th September to 3rd October 2017);
 - A Public Transport Accessibility Level (PTAL) assessment of the site;
 - A review of bus, National Rail and London Underground service frequencies; and
 - A review of pedestrian routes and crossing facilities from the site to local public transport nodes (bus stops and rail stations), together with a review of the local cycle network.
- 13.5.2. The Site is located in an area which has a well-established network of footways and formal and informal pedestrian crossing points. Horseferry Road, Dean Stanley Street, Great Peter Street, Lambeth Bridge and Millbank, including a footway along the River Thames, provide the pedestrian routes to the site, and are all in good condition and well lit.
- 13.5.3. Cycle accessibility is also well connected and maintained. Parliament Bridge Street, situated north of the site, forms part of the Cycle Superhighway (CS) 3, providing quick and safe access to Tower Hill and east London. To the south of the site, Millbank forms part of CS8 to Wandsworth and CS5 is in close proximity across Vauxhall Bridge providing access to CS7 which runs from The City to Merton. The nearest Santander Cycle Hire Docking points are located on Abingdon Street (20 docking points), Smith Square (18 docking points), Page Street (23 docking points) and on Horseferry Road (16 docking points).
- 13.5.4. The high level of public transport provision in the vicinity is recognised by the TfL PTAL map of Westminster, indicating that the site has an “excellent” level of access to public transport rated at PTAL 6a.
- 13.5.5. The four conventional bus stops along Millbank and Abingdon Street, namely stops L, M, NB and NK shown above, are all served by buses 3, 87, N3 and N87:

- Route 3 runs from Trafalgar Square / Charing Cross Station terminating in Crystal Palace;
 - N3 runs a longer route from Oxford Circus Station / Margaret Street to Bromley north Station;
 - Route 87 starts at Aldwych / Somerset House and terminates at Wandsworth Plain; and
 - N87 runs a longer route from Fairfield Bus Station to Aldwych / Drury Lane.
- 13.5.6. Westminster, St. James's Park and Pimlico Underground Stations are all located within a short walk of the site. They provide access to the Circle, District, Jubilee and Victoria lines. Westminster, the closest station to the site, has an average of 30 Jubilee line trains per peak hour in each direction, and approximately 26 Circle/District line trains per hour.
- 13.5.7. Charing Cross and Victoria Stations are located close to the site, both under 20 minutes' walking distance. Charing Cross is serviced by Southeastern, while Victoria is serviced by Southern, Southeastern and Gatwick Express, together providing access to a wide range of locations locally and regionally.
- 13.5.8. Millbank Millennium Pier to the south of the site and Westminster Pier north of the site are the closest piers, both within a 10 minute walking distance. They are serviced by the RB1 and RB1X ferries from Battersea Power Station Pier to Greenwich Pier, and the RB2 from Battersea Power Station to London Bridge Pier and the RB6 from Putney Pier to Embankment Pier.
- 13.5.9. The Site is located on the eastern side of A3212 Millbank, which is a 'red route' road and forms part of the Strategic Road Network (SRN) in London and is operated by WCC. A3212 Abingdon Street to the north of the site connects with Parliament Square at its northern end via a signalised gyratory. To the south of the site, Millbank forms the northern arm of a roundabout with the A3203 Lambeth Bridge and the B323 Horseferry Road.
- 13.5.10. Lambeth Bridge lies south of the site and crosses the River Thames, connecting the site to London Borough of Lambeth. It is a single carriageway road with a bus lane on the eastbound carriageway and an on-carriageway cycle lane in the westbound direction.

13.6 Method of Assessment

- 13.6.1. This section assesses the impact of the Scheme in transport terms by considering how the anticipated trip generation of the Memorial and the changes to movement might impact different receptors, both existing and those present in future, together with the extent to which proposed mitigation measures may change the level of impact. The assessment has adopted the following criteria, all of which are consistent with those considered in the TA:

Sensitivity of the Receptors

- 13.6.2. The potential receptors are all people making journeys within the study area as well as existing users of the site. The receptors on the site and within the surroundings that may be affected by the Scheme are:
- Visitors to the Memorial (who are categorised as General Admission visitors, School groups and Special Interest groups);
 - Additional visitors to Victoria Tower Gardens;
 - Existing visitors to Victoria Tower Gardens;
 - Existing users of the transport network around Victoria Tower Gardens;
 - Construction staff; and
 - Staff of the Memorial.
- 13.6.3. General Admission visitors who travel to the site by car, either taxi or blue badge holders travelling by car, are of high sensitivity as they are more likely to be of reduced mobility. Other General Admission visitors, as well as additional visitors to Victoria Tower Gardens, are of low sensitivity.
- 13.6.4. Up to 100,000 school pupils and teachers per year are expected to visit the Scheme. They are of high sensitivity.
- 13.6.5. Up to 60,000 visitors to the Scheme each year are expected to be part of special interest groups. For robustness these are of high sensitivity given that there is a greater likelihood that visitors within this category may be elderly or disabled.
- 13.6.6. Existing visitors to Victoria Tower Gardens are of medium sensitivity, as there is a wide demographic of existing gardens users.

- 13.6.7. Existing users of the footways along Millbank, and the wider transport network, are of low sensitivity, principally comprising commuters.
- 13.6.8. Construction staff and operational staff are a low-sensitivity category of receptor.
- 13.6.9. The criteria that have been used to assess receptor sensitivity are described in Table 13-3.

Table 13-3 - Sensitivity of Receptors for Transport

Sensitivity of Receptor	Importance / resilience of receptors
Very High	Modes of transport which are heavily used (by all users or particularly by vulnerable road users) relative to other modes within the study area or those which have a low capacity to accommodate change without significant effects arising.
High	Modes of transport which are used (by all users or particularly by vulnerable road users) to an average level relative to other modes within the study area or those which have a moderate capacity to accommodate change without significant effects arising.
Medium	Modes of transport which are lightly used (by all users or particularly by vulnerable road users) relative to other modes within the study area or those which have a high capacity to accommodate change without significant effects arising.
Low	Modes of Transport which are very lightly used (by all users or particularly by vulnerable road users) relative to other modes within the study area or those which have a very high capacity to accommodate change without significant effects arising.

Impact severity

Table 13-4 - Impact Severity for Transport

Impact Severity	Description of Impact
Very High	Changes which are likely to be perceptible and which would significantly change conditions which would otherwise prevail to the extent that it would significantly affect travel behaviour.
High	Changes which are likely to be perceptible and which would materially change conditions which would otherwise prevail to the extent that it may affect travel behaviour to a measurable degree.
Medium	Changes which are likely to be perceptible but not the extent that it would materially change conditions which would otherwise prevail.
Low	Changes which are unlikely to be perceptible.

13.7 Impact significance

- 13.7.1. Table 5-4 sets out the significance of impacts in relation to the severity of the impact and the sensitivity of the receptor. Major and moderate effects are regarded as being significant whereas minor and negligible effects are not significant.
- 13.7.2. Examples of how these definitions apply in practice are as follows:
- **Major beneficial or adverse effect** – where the Scheme would cause a significant improvement or deterioration to the existing environment;
 - **Moderate beneficial or adverse effect** – where the Scheme would cause a noticeable improvement or deterioration to the existing environment;
 - **Minor beneficial or adverse effect** – where the Scheme would cause a barely perceptible improvement or deterioration to the existing environment; and
 - **Negligible** – no discernible improvement or deterioration to the existing environment.

13.8 Potential Impacts

- 13.8.1. The demolition and construction works will be undertaken within the curtilage of the site, with construction vehicles directed to approach and depart the site via Millbank. Peak daily construction activity has been considered and construction traffic has been assumed to be generated evenly throughout the day in a 'just in time' approach which minimises the need for storage of materials on-site.

Construction

NHM Visitors and Staff

- 13.8.2. There will be no UK Holocaust Memorial visitors or staff at the site until construction is complete, and therefore they will not be impacted during the construction phase.

Construction Staff

- 13.8.3. As set out in the CMP, all construction staff will be encouraged to travel to and from the site using public transport and use private vehicles only when necessary to transport equipment. The number of construction staff working at the site will be minimal compared to the existing footfall on the pedestrian network and patronage of the public transport network, and therefore impacts will be negligible.

Existing Visitors to Victoria Tower Gardens

- 13.8.4. The construction of the Scheme will take place within a portion of Victoria Tower Gardens. Gates 2 and 4 will be closed to pedestrians, who can instead access the gardens via Gates 1 or 5. Gate 3 will also remain open for access to the western part of the gardens, though it will not be possible to walk between this area and the main gardens area.
- 13.8.5. It is considered that the impact severity is medium given that the majority of the gardens will remain open at all times, including the northern end which is closest to the Houses of Parliament, as well as the footpath along the Thames which represents a popular walking route between Lambeth Bridge and Westminster. Only brief, occasional closures of this footpath may take place in the event of construction activities requiring sections of the path, with pedestrian access retained at all other times. The overall impact on existing visitors to Victoria Tower Gardens during construction of the Scheme is therefore considered to be of medium severity and moderate effect.

Existing Users of the Transport Network around Victoria Tower Gardens

- 13.8.6. The construction Site boundary is within Victoria Tower Gardens and does not extend to the adjacent footway along Millbank. It is therefore expected that there will be a negligible amount of disruption to the footways outside Victoria Tower Gardens, along Millbank and across the wider pedestrian network during construction. The receptors' sensitivity is considered to be low as this route is used particularly by commuters and tourists rather than other vulnerable categories of pedestrian.
- 13.8.7. The construction phase generating the highest number of daily HGV movements is anticipated to be the excavation phase with a duration of three months, during which time there will be approximately 38 HGV movements per day each way through the site access. Construction traffic flows during the remainder of the construction works are expected to be lower.
- 13.8.8. At peak there are expected to be up to 76 HGV movements per day through the site access, each of which would necessitate a temporary interruption of pedestrian flow along the footway. These closures would last approximately one minute each. Footfall along this section of Millbank is modest throughout the day, with an average of four pedestrian movements per minute and a peak of seven pedestrians per minute. The amount of queuing is therefore expected to be insignificant and the presence of construction traffic would have a low impact. The effect during the construction stage of the scheme on pedestrian and cyclist delay is therefore concluded to have a negligible effect of a reversible, temporary, short term nature.
- 13.8.9. Millbank carries approximately 13,500 vehicles per day, and the addition of a maximum of 76 HGV movements per day equates to an increase of 0.5% in traffic flow. To manoeuvre safely in and out of the site access, some short-term traffic management will be required, which may lead to a delay of between one and two minutes. At peak times this may be a high-severity impact, giving rise to an overall moderate adverse effect of a reversible, temporary, short-term nature.
- 13.8.10. There is a southbound bus lane that runs adjacent to the site along Millbank. This lane may be disrupted by construction traffic entering and exiting the site, causing potential delays to bus services on Millbank. These

delays will be infrequent and are of low severity. The effect on this low-sensitivity receptor will therefore be negligible.

- 13.8.11. The enabling works, demolition and construction traffic associated with the construction of the Scheme is expected to generate some disruption to the immediate highway network delay, given the high use of Millbank by existing general traffic. Whilst significant, these would be reversible, temporary, short term adverse effects of negligible magnitude. The details of the vehicular construction trips will be managed as part of the CEMP.

Operation

- 13.8.12. This section assesses the likely significance of effects resulting from the completed and fully operational Scheme.
- 13.8.13. Once occupied, the Scheme will generate additional movements on the surrounding highway and public transport networks.
- 13.8.14. As set out in the Transport Assessment in Appendix I, the principal effect of the operation of the Scheme on the transport network is the generation of additional pedestrian movements, and these constitute the principal source of transport impacts on different categories of receptors.

NHM Visitors and Staff

- 13.8.15. As set out in the Transport Assessment in Appendix I, three categories of visitors have been identified, namely General Admission visitors, School Groups and Special Interest Groups. Each group is composed of distinct demographics, susceptible to varied levels of sensitivity. These are detailed in section 13.5.1.
- 13.8.16. With the exception of blue badge holders, it is not anticipated that other general admission visitors will reach the site by car. The remainder, and vast majority of General Admission visitor trips will be by bus and Underground: the former offers convenience as bus routes 3 and 87 stop adjacent to the entrance (plus additional routes serving nearby Parliament Square), whereas the Underground is easier for visitors unfamiliar with London and is also a faster means of reaching Westminster.
- 13.8.17. While most of General Admission visitors are anticipated to be already on the wider pedestrian network (in particular visiting the Houses of Parliament or Westminster Abbey), the presence of the Memorial will generate a localised increase in footfall along the eastern footway on Millbank, in particular between Gate 1 and Parliament Square.
- 13.8.18. In the most robust scenario, it is expected that the Scheme will lead to an increase of pedestrian flow during the peak hour from 2,823 to 4,229 pedestrians per hour along this section of the Millbank footway. Visitors to the Scheme arriving from Parliament Square are expected to experience a delay at Gate 1; the impact is medium in severity given that the delay has a short duration.
- 13.8.19. Furthermore, this impact applies only to General Admission visitors together with a small proportion of School Group and Special Interest Group visitors travelling on foot along this section of the pedestrian network. The majority of visitors of reduced mobility and of higher sensitivity are instead expected to enter the gardens via Gate 3 as a result of alighting from a coach, taxi or car (blue badge holders) along Millbank. Consequently, the groups of highest sensitivity are anticipated to experience a low severity of impact from pedestrian congestion along Millbank with an overall minor effect.
- 13.8.20. Millbank has an existing vehicular flow of approximately 13,500 vehicles per day, and the additional traffic generated by the Scheme is negligible. Consequently, any delay to visitors travelling by road would be of low impact. The proposed kerbside design includes provision for vehicles to stop along Millbank to unload blue badge holders, thereby ensuring that visitors of reduced mobility travelling by car are not significantly impacted by long walks to drop-off spaces.
- 13.8.21. Cyclists, who can be categorised as being of medium sensitivity, are expected to form a small number of total visitors to the Scheme. Additional public cycle parking will be provided along the western side of Millbank, and cyclists would enter the gardens on foot via Gates 3 or 4. The impact of any pedestrian delay at Gate 1 would therefore be negligible for them.
- 13.8.22. The Memorial is anticipated to employ a small number of staff relative to the number of visitors (as visits will be largely self-guided, given the immersive nature of the Memorial design). Staff are considered to be a low-sensitivity group.
- 13.8.23. Staff are anticipated to travel to the site by public transport, principally via Westminster Station, and would therefore be impacted by the short-term pedestrian congestion at Gate 1. However, the impact of pedestrian delay on staff would be low as a result of staff travel peak times not coinciding with visitor peaks (since the

majority of staff would travel when the Memorial is closed). The effect of pedestrian delay on staff would therefore be minor.

- 13.8.24. The majority of servicing trips associated with the Scheme will take place outside of the hours of operation of the Memorial and will therefore have a negligible impact on visitors. Any deliveries taking place when the Memorial is open would involve vehicles stopping on the highway network and deliveries being undertaken on foot (by hand or by trolley) into the gardens. These would therefore have a negligible impact on visitors.

Existing Users of the Transport Network around Victoria Tower Gardens

- 13.8.25. While the number of people stopping and circulating within Victoria Tower Gardens will increase as a result of the Scheme, the pedestrian modelling analysis has demonstrated that, even at the busiest times, there is ample spare capacity within the park to accommodate the forecast footfall. The existing park visitors, considered to be of medium sensitivity to impacts, are anticipated to experience a medium-severity impact as a result of the Scheme. Pedestrian access to the park will be maintained via all five gates, and the park will continue to function as a through route.
- 13.8.26. There will be an increase in footfall along the eastern Millbank footway north of Gate 1. However, the impact of this increased footfall on existing pedestrians is only expected to be of medium severity given that the pedestrian delay would occur only along a short section of footway. Furthermore, the majority of trip generators along Millbank are considered to be along the western side of the road which accommodates employment land uses. As a result, pedestrians walking between these locations and Westminster may choose to walk along the western footway of Millbank which is wider and will experience a much lower increase in footfall arising from the Scheme. The effect of the operation of the Scheme upon existing pedestrians outside the park is minor.
- 13.8.27. The Scheme includes plans to reduce the operational hours of the Millbank bus lane. Currently the bus lane operates between 07:00 and 19:00 daily. It is proposed to restrict these hours in future to 07:00-10:00 and 16:00-19:00. This will lead to a short increase in delay to bus passengers travelling in the middle of the day, as buses will share the general traffic lane. The Scheme will therefore lead to a negligible impact on bus passengers on routes 3 and 87.
- 13.8.28. It is noted that the proposed highway layout retains a southbound bus cage of sufficient length to accommodate two buses simultaneously, as occurs at present. The bus stop will be relocated a short distance further south along the same section of Millbank. No highway changes are proposed along the northbound side of Millbank.
- 13.8.29. The vehicular traffic generated by the Scheme is negligible, equating to 78 daytime vehicle movements compared to the existing traffic volume of 13,500 vehicles per day along Millbank. The Scheme would therefore have a negligible impact on existing traffic.
- 13.8.30. The majority of visitors to the Scheme – both those entering the Memorial and those viewing it from within Victoria Tower Gardens – are anticipated to be existing trips on the pedestrian network who will therefore not contribute to loading on the public transport network. Of the remaining visitor trips, up to 1,077 people per day – equating to 132 during the peak hour - are expected to travel to and from the Scheme by public transport. Given that Westminster is served by over 100 trains per hour as well as numerous bus routes, the Scheme will have a negligible impact on existing public transport users.
- 13.8.31. There will be no impact to river boat services during operation of the Scheme as river transport will not be used for servicing and there is expected to be no perceptible increase in river boat passenger numbers. River transport users will experience a negligible impact.

13.9 Cumulative Effects

- 13.9.1. There are a number of other schemes in the vicinity of Victoria Tower Gardens which have been granted planning permission but which are not yet operational. These are referred to as cumulative schemes.
- 13.9.2. The effects of the Scheme set out in the preceding section are considered not just in the context of the existing situation (the 'baseline') but also in the context of a future scenario when these cumulative schemes are operational (the 'future baseline').
- 13.9.3. The cumulative schemes are listed in Table 13-5 below:

Table 13-5 - Cumulative Schemes

Application Number	Site	Application Number	Site
17/09368/FULL	57 Whitehall	16/00795/FULL	26 Alexander Street
13/12539/FULL; 16/05060/FULL	1 Queen Anne's Gate	14/04757/FUL; 16/01103/VOC	22 Carlton Hill
17/01327/FULL	19 Dacre Street	15/07690/FULL	Dean Bradley House
14/10496/FULL	Chelsea Barracks	16/06616/FULL	Ergon House
15/07497/FULL	10 Broadway	15/07819/FULL	Gaywood House
14/03631/FULL	Buckingham Green	15/01059/FULL	14 Great Peter Street
16/05216/FULL	Former Westminster Fire Station	17/09875/FULL	The Sanctuary Buildings
15/07778/FULL	32-34 Great Peter Street	DCO WWO10001	Thames Tideway Tunnel
15/11404/FULL	Grenadier House	18/03776/LBC; 18/03775/FULL	Westminster Bridge illumination
16/01796/FULL	29-35 Old Queen Street	18/03778/LBC; 18/03777/FULL	Lambeth Bridge illumination

- 13.9.4. The locations of these cumulative schemes are shown in Figure 15.1 in Volume 3.
- 13.9.5. The assessment of the cumulative schemes is based on the trip distributions presented in the documents accompanying each planning application. Where these trip distributions are not available, a directional assumption has been applied based upon the relative distribution of trip attractors and construction routes as applicable.

Construction

- 13.9.6. Four cumulative schemes closest to the Scheme are anticipated to be served by construction traffic travelling along Millbank; of these, data is available for three sites, while the fourth (15/07819/FULL) is smaller in scale and is considered to have a negligible traffic impact. For sites located further west – which constitute the majority of the cumulative schemes – the preferred routes for construction vehicles are likely to be via Albert Embankment or Vauxhall Bridge Road and would therefore not involve passing along the section of Millbank which falls within the scope of the environmental assessment of the Scheme.
- 13.9.7. The three cumulative schemes closest to the Scheme for which data is available are projected to generate a total of 55 construction vehicle movements each way per day. It is reasonable to assume that no more than 50% of these movements would travel along Millbank past the Scheme.
- 13.9.8. The relative phasing of these schemes is not yet known but, even if a robust assessment were to assume that they would be built concurrently with each other and with the Scheme, the cumulative schemes would add 55 vehicle movements onto an existing section of highway which already carries over 13,500 motor vehicles per day. This construction traffic would therefore have a low impact on traffic movement.
- 13.9.9. The construction programme of the Scheme is not yet known with certainty, but it is expected that the daily construction traffic generated by the Scheme, even at peak, will be less than that generated by the aforementioned schemes. This, coupled with the fact that the peak construction periods at each site are unlikely to coincide, means that the transport impacts of cumulative construction on receptors will be low in severity.

Operation

- 13.9.10. The cumulative schemes overall result in a reduction in daily vehicle movements, with one site a short distance west of the Scheme projected to generate 574 fewer daily car movements in future compared to the previous building. Millbank is one of the main roads providing access to this location and therefore the cumulative scheme would be expected to lead to a reduction in traffic flow along Millbank compared to the existing situation.
- 13.9.11. Overall the cumulative schemes lead to a net reduction in traffic flow within the environs of the Scheme. Given that the Scheme will itself generate negligible volumes of vehicular traffic, the assessment of the

operational phase concludes that receptors will experience a small positive effect arising from cumulative schemes, which will be maintained once the Scheme is operational.

13.10 Mitigation measures

Construction

- 13.10.1. A CMP is being submitted as part of the planning application, setting out the measures proposed to mitigate the transport impacts of the Scheme.
- 13.10.2. Construction staff will be encouraged to travel to and from the site by public transport unless essential, for example when needing to transport equipment.
- 13.10.3. Consideration will be given to the use of river transport during construction of the Scheme, in particular to the removal excavated material. This would further mitigate transport impacts of the Scheme by minimising road vehicle movements.
- 13.10.4. A detailed CMP will be prepared post-planning, when further details regarding the construction process will be available. The detailed CMP will explore mitigation measures in greater depth.

Operation

- 13.10.5. It is proposed to implement an overarching Travel Plan for the Scheme, as well as individual Travel Plans for the Memorial and Café individually. Together, these Travel Plans will involve the implementation of various measures to encourage the use of sustainable travel modes when travelling to the Scheme, including the management of coach operations.
- 13.10.6. An overarching Travel Plan (TP) has been proposed and is appended to the TA. The TP sets out measures of monitoring and supporting sustainable and active travel choices and modal shift away from private car-based trips, which are projected to be very low.
- 13.10.7. A Delivery and Servicing Plan (DSP) will also be produced, setting out management strategy for delivery trips to the site and consolidating activity where possible. A Framework DSP has been produced and is appended to the TA.

Pedestrian Network

- 13.10.8. It is considered that the Scheme design mitigates pedestrian impacts along this footway in several ways:
 - The majority of visitors will approach from the north and can access the Memorial by entering Victoria Embankment Gardens via Gate 1, which is likely to represent a more attractive option given the view of the Thames;
 - The new visitor cycle parking is proposed to be located along the western footway on Millbank, to minimise obstruction of the eastern footway. The cycle parking is located opposite the Memorial and can be easily accessed using Gate 3 and the zebra crossing;
 - Visitors arriving by coach or using the blue badge bays can use Gates 3 or 4; and
 - Visitors approaching from the south or east can enter via Gates 4 or 5.
- 13.10.9. Consequently, the site layout encourages pedestrians to make full use of all the site entrances, with the result that negative impacts on the pedestrian network are minimised.
- 13.10.10. The TP will include measures to advise visitors of the preferred walking routes prior to their arrival at the site, including online when booking an admission slot as well as via measures such as signage at key interchanges such as Westminster. This will further assist in the management of pedestrian flows.

Cyclists

- 13.10.11. It is considered that the Scheme design mitigates cycle impacts in the area by providing more visitor cycle parking spaces (28) than the anticipated maximum number of daily cycle visitors (3). This will also benefit other cyclists not travelling specifically to visit the Memorial by providing additional capacity at existing cycle parking locations on Millbank.
- 13.10.12. The existing bus lane will be safeguarded by retaining its restrictions between 07:00-10:00 and 16:00-19:00 on weekdays, which are the peak times for commuter cycling.

- 13.10.13. Given that the majority of visitors to the Memorial are expected to be tourists, many of whom will be from outside London, the site's proximity to several Santander Cycle Hire docking stations also encourages additional visits by bicycle. Secure, covered cycle parking for staff will also be provided within the curtilage of the Scheme. The TP will further encourage travel to and from the Memorial by bicycle.

Bus Passengers

- 13.10.14. The existing southbound bus lane along Millbank will remain operational during the AM and PM peak hours, and the size of the existing bus cage will remain unchanged.

Coaches and Servicing

- 13.10.15. The proposed highway layout incorporates a loading bay which will avoid the need for any on-site vehicle movements associated with servicing during the hours of operation of the Scheme. The provision of this bay also minimises the likelihood of vehicles serving the Scheme adding pressure to existing servicing facilities in the area.
- 13.10.16. The proposed layout also includes a coach bay which will allow coach drop-offs and pick-ups to take place without reducing servicing capacity. The stringent time restriction for the proposed coach bay minimises the likelihood of it being used by other coaches parking.

13.11 Residual Effects

Construction

- 13.11.1. The residual effects during the construction of the Scheme are set out in Table 13-6.
- 13.11.2. During the construction phase, there remains a moderate (significant) effect on pedestrian amenity to existing users of Victoria Tower Gardens due to a reduction in the useable area of the park. Two of the five accesses will be closed to pedestrians, and there is no connectivity between the two open sections of the park. This effect is temporary (only lasting for a portion of the construction works) and reversible: once construction is complete, all gates of the park will return to public use.
- 13.11.3. In addition, there remains a moderate (significant) impact on traffic delay arising from construction vehicles manoeuvring in and out of the construction site access. These will be very short in duration and temporary in nature

Operation

- 13.11.4. The residual effects during the operation of the Proposed Development are the same as those set out Table 13-5.
- 13.11.5. There will be a moderate (significant) effect on pedestrian amenity experienced by existing park users, as a result of the projected increase in footfall. Whilst the vast majority of the park area will remain freely accessible to the public, the remaining areas will accommodate a much higher number of visitors than at present.

13.12 Summary Table

Table 13-5 - Construction phase effects on Transport

Activity	Baseline	Impact assessment			Mitigation	
Impact	Receptor	Receptor sensitivity	Impact Severity	Effect before Mitigation	Mitigation Measures	Residual Effect
Pedestrian amenity	Existing visitors to Victoria Tower Gardens	Medium	Medium	Moderate (significant)	<ul style="list-style-type: none"> Retention of pedestrian access to gardens via Gates 1, 3 and 5 Retention of pedestrian access along riverside path 	Moderate (significant)
Pedestrian delay	Existing users of the surrounding transport network	Low	Low	Negligible	<ul style="list-style-type: none"> Traffic marshalling No construction along footway 	Negligible
Pedestrian delay	Construction staff	Low	Low	Negligible	<ul style="list-style-type: none"> Traffic marshalling No construction along footway 	Negligible
Traffic delay	Existing users of the surrounding transport network	Low	High	Moderate (significant)	<ul style="list-style-type: none"> Considering use of river transport to reduce HGV numbers 	Moderate (significant)
Traffic delay	Construction staff	Low	Low	Negligible	<ul style="list-style-type: none"> No staff travelling by car unless essential to transport equipment Staff to be advised of sustainable transport options to reach site 	Negligible

Table 13-6 - Operational phase effects on Transport

Activity	Baseline	Impact assessment			Mitigation	
Impact	Receptor	Receptor sensitivity	Impact Severity	Effect before Mitigation	Mitigation Measures	Residual Effect
Pedestrian delay	Visitors to the Memorial – General Admission travelling by car	High	Low	Minor	<ul style="list-style-type: none"> Provision of kerbside loading facilities for mobility impaired visitors 	Minor
Pedestrian delay	Visitors to the Memorial – General Admission travelling by non-car modes	Low	Medium	Minor	<ul style="list-style-type: none"> Investigating potential to increase footway capacity north of Gate 1 	Minor
Transport amenity	Visitors to the Memorial – General Admission travelling by non-car modes	Low	Medium	Minor	<ul style="list-style-type: none"> Retention of existing bus stop capacity High capacity of public transport services Additional public cycle parking on Millbank Retention of peak-hour bus lane operation 	Minor
Pedestrian delay	Visitors to the Memorial – School Groups and Special Interest Groups	High	Low	Minor	<ul style="list-style-type: none"> Coach drop-off adjacent to the entrance 	Negligible
Pedestrian delay	Additional visitors to Victoria Tower Gardens	Low	Medium	Minor	<ul style="list-style-type: none"> Investigating potential to increase footway capacity north of Gate 1 	Minor
Pedestrian delay	Memorial staff	Low	Medium	Minor	<ul style="list-style-type: none"> Investigating potential to increase footway capacity north of Gate 1 	Minor
Pedestrian amenity	Memorial staff	Low	Medium	Minor	<ul style="list-style-type: none"> Memorial visitors accessing the gardens via Gate 1 to minimise footfall along Millbank 	Minor
Transport amenity	Memorial staff	Low	Low	Negligible	<ul style="list-style-type: none"> Retention of existing bus stop capacity High capacity of public transport services Covered on-site cycle parking for staff Retention of peak-hour bus lane operation 	Negligible
Pedestrian delay	Existing visitors to Victoria Tower Gardens	Medium	Medium	Moderate (significant)	<ul style="list-style-type: none"> Investigating potential to increase footway capacity north of Gate 1 	Minor

Activity	Baseline	Impact assessment			Mitigation	
Impact	Receptor	Receptor sensitivity	Impact Severity	Effect before Mitigation	Mitigation Measures	Residual Effect
Pedestrian amenity	Existing visitors to Victoria Tower Gardens	Medium	Medium	Moderate (significant)	<ul style="list-style-type: none"> Memorial visitors accessing the gardens via Gate 1 to minimise footfall along Millbank 	Moderate (significant)
Pedestrian delay	Existing users of the surrounding transport network	Low	Medium	Minor	<ul style="list-style-type: none"> Investigating potential to increase footway capacity north of Gate 1 	Minor
Pedestrian amenity	Existing users of the surrounding transport network	Low	Medium	Minor	<ul style="list-style-type: none"> Memorial visitors accessing the gardens via Gate 1 to minimise footfall along Millbank 	Minor
Transport amenity	Existing users of the surrounding transport network	Low	Low	Negligible	<ul style="list-style-type: none"> Retention of existing bus stop capacity High capacity of public transport services Additional public cycle parking on Millbank Retention of peak-hour bus lane operation 	Negligible

14 Material Assets and Climate Change

14.1 Scope of the assessment

- 14.1.1. This chapter considers the potential impacts of the Scheme on material assets and climate change during construction and operation.
- 14.1.2. Climate change will be divided into two sections to address the climate change requirements outlined in The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (SI 2015/517) which states that the assessment should consider both:
 - The potential effects of the Scheme on climate, in particular, the magnitude of greenhouse gases (GHG) emissions emitted during both construction and operation; and
 - The vulnerability of the Scheme to climate change, in particular, the impacts of extreme weather scenarios on the Scheme during operation.

Material Assets

- 14.1.3. This assessment considers the potential impacts of the Scheme related to material assets during construction and operation. For the purposes of this report, 'material assets' are deemed to be important built infrastructure assets. Key natural land resources such as minerals sites are specifically considered within Chapter 10 and are not included here. With regards to material assets, the assessment will focus on:
 - Water and drainage;
 - Wastewater;
 - Critical infrastructure within and surrounding the site; and
 - Flood Defence Structures and the Thames Estuary 2100 (Tidal defences).
- 14.1.4. The scope of the assessment has been determined following a desk study to confirm the location of nearby receptors that may be sensitive to changes due to the construction and operation of the Scheme.
- 14.1.5. The chapter will establish the baseline environment, followed by a determination of what impacts would arise from the construction and operation of the Scheme, and whether any direct or indirect environmental effects from these impacts would be significant. Mitigation measures will then be identified that seek to minimise significant effects, followed by a prediction of residual environmental effects.

Climate Vulnerability

- 14.1.6. The Climate Vulnerability assessment has considered the impact that climate change will have on the Scheme. The assessment is based on the vulnerability of receptors to specific climate change variables and the magnitude of the potential impacts. It has been carried out in accordance with climate change resilience and adaptation guidance produced by the Institute of Environmental Management & Assessment.
- 14.1.7. The assessment in this Chapter provides:
 - An examination of the current climate baseline using the Met Offices latest regional dataset of 30-year averages;
 - A consideration of the projected future climate baseline for the 2050s, which represents the middle decade of the 30-year climate average from 2040 to 2069, based upon UKCP09 25km grid model runs;
 - An assessment of how the Scheme may be vulnerable to the impacts of climate change during its construction and operation;
 - Identification of specific mitigation to adapt the design and operational processes to reduce the developments potential adverse climate vulnerabilities; and
 - An assessment of the climate change vulnerability of the development that, considers the sensitivity of receptors, their exposure to climate change variables and the magnitude of potential associated impacts.

Climate Emissions

- 14.1.8. A high-level assessment has been carried out to determine the effects of the Scheme on climate, in line with the requirements outlined in the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (SI2015/517). These state that the assessment should consider the potential impact of the Scheme on climate change, in particular, the magnitude of greenhouse gas (GHG) emissions emitted during both construction and operation.
- 14.1.9. The Scheme has the potential to affect the earth's climate by the emission of GHGs into the atmosphere, which will occur during construction and throughout its operational life. The earth absorbs energy from the sun and re-emits it as thermal infrared radiation. GHGs in the atmosphere absorb this radiation, preventing it from escaping into space. The higher the concentration of GHGs, the more heat energy is retained, and the higher global temperatures become. This is a natural process, however, due to human activities the concentration of GHGs in the atmosphere has increased dramatically leading to global warming. This leads to a myriad of indirect impacts as the climate responds to the increased atmospheric temperature.
- 14.1.10. To assess the effects of the Scheme on climate, a study into the likely magnitude of GHG emissions has been conducted. Whilst there are a number of greenhouse gases with a range of different Global Warming Potentials (GWPs)⁷², all emissions are presented as their carbon dioxide equivalent (CO₂e).
- 14.1.11. The scope boundaries of the study have been set to incorporate direct and supply chain emissions for both construction and operational phases of the Scheme. The geographic boundary of the assessment is the red line planning boundary; however, due to the inclusion of supply chain emissions a significant proportion of the emissions will be outside of this, and potentially global in nature. This assessment uses a consumption-based methodology, allocating the emissions associated with goods and services to the final users rather than to the original producers of the emissions.
- 14.1.12. The assessment covers the emission sources described in Table 14-1. These are in line with the emission source categories described in PAS 2070:2013+A1:2014 (Specification of the Assessment of Greenhouse Gas Emissions of a City). The assessment boundary has been set to incorporate sources specifically related to the construction, occupation and operation of the Scheme, and does not include sources indirectly related to the operation of the building (for example consumption of food and other goods and services by residents).
- 14.1.13. Table 14-2 details items excluded from the scope of the assessment.

Table 14-1 - Emission sources included in scope of assessment, with reference to their relevant PAS 2070:2013+A1:2014 emission source categories

Phase	PAS 2070 Category	Scheme-specific Sources
Construction	Mobile energy use	Emissions from transboundary transport of materials and workers to site and associated upstream activities to provide the fuel (well-to-tank emissions).
	Industrial processes and product use	Emissions associated with powering in boundary construction plant.
	Goods and services	Emissions associated with the provision of water used onsite for construction processes.
		Embodied CO ₂ e of construction materials, including emissions from raw material extraction through manufacture.
Operation	Waste and wastewater treatment	Emissions from the collection, treatment and disposal of solid waste.
	Stationary energy use	Emissions from the provision of heat and power to the Scheme.
	Mobile energy use	Emissions from the transboundary transport of visitors to the Scheme.

⁷² The following six gases are currently required for most national reporting under the Kyoto Protocol: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆).

Phase	PAS 2070 Category	Scheme-specific Sources
	Goods and services	Emissions associated with the provision of water used onsite during operation.
	Waste and wastewater treatment	Emissions from the collection, treatment and disposal of solid waste. Emissions from the treatment of liquid effluent.

Table 14-2 - Exclusions from the assessment

Phase	PAS 2070 Category	Scheme-specific Sources	Reason for Exclusion
Construction	Goods and services	Food and drink consumed during the construction phase	These emissions are not specifically related to the design and construction of the Scheme.
Operation	Industrial processes and product use	Use of electronics	These are included under 'stationary energy use' for the Scheme as a whole and are therefore, not presented separately.
	Goods and services	Upstream emissions associated with the provision of food and other goods and services	At this stage in the design, it is not possible to account for items that will be purchased and used during the operational life of the Scheme with any degree of accuracy. Emissions from items such as food will not be directly related to the Scheme itself, as visitors would consume these items whether they visited or not.
	Agriculture, forestry and other land use	Emissions from non-building land uses	This cannot be reliably calculated using the design data available, however, based on expert judgement these emissions are expected to be proportionally minor compared to other source categories and are therefore not assessed.

- 14.1.14. This assessment is intended to be high-level and proportionate to the nature of the Scheme and its stage of design. Much of the data is based on assumptions, and should be taken as indicative of magnitude, particularly considering the outline stage of design.
- 14.1.15. Construction emissions are presented for the whole construction period and per year over the construction programme. Operational emissions are presented per continuous 12-month period.

14.2 Responses to scoping opinion

Table 14-3 - Summary of responses to stakeholder scoping opinions

Stakeholder	Comment	Response
Westminster City Council	Westminster City Council does not consider that 'Material assets (infrastructure) and climate change' should be scoped out. As such these chapters must remain scoped in to the future ES.	Materials assets and climate change have been scoped back into the ES Chapter 14.

⁷³ Department for Communities and Local Government (2012). National Planning Policy Framework. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/740441/National_Planning_Policy_Framework_web_accessible_version.pdf. Accessed 13/11/18.

Stakeholder	Comment	Response
Royal Parks	Impacts of drainage and other critical infrastructure and impacts on material assets in operation of the scheme should be considered.	Materials assets have been scoped back into the ES Chapter 14.

14.3 Relevant planning policy & legislation

14.3.1. A summary of legislative requirements in relation to material assets and climate change and how they apply to the scheme are presented in Table 14-4.

Table 14-4 - Policy overview

Scale	Policy Document	Key Considerations for the Scheme
National	National Planning Policy Framework ⁷³	In relation to drainage, the NPPF states that local planning authorities should only consider development when priority is given to the use of Sustainable Drainage Systems (SuDS). The NPPF includes mitigating climate change as part of its overarching objectives and strategic policy. It provides that the planning system should support the transition to a low carbon future, shaping places in ways that contribute to radical reductions in greenhouse gas emissions.
	The Climate Change Act 2008	Policy CG67/B - Increasing efficiency and resilience sets out to ensure that buildings and infrastructure are designed to adapt to a changing climate, making efficient use of water, reducing impacts from natural hazards like flooding and heatwaves, and avoiding contributing to the urban heat island effect. Requires that emissions of carbon dioxide and other greenhouse gases are reduced. A target to reduce emissions by at least 80% of 1990 levels by 2050 has been set. This assessment considers the Scheme in the context of delivering relevant carbon budgets and overall 80% reduction target.
	Sustainable Design and Construction Supplementary Planning Guidance (April 2014)	The SPG provides guidance on: <ul style="list-style-type: none"> • Energy efficient design; • Meeting the carbon dioxide reduction targets; • Decentralised energy; • How to offset carbon dioxide where the targets set out in the London plan are not met; • Retro-fitting measures; and • An introduction to resilience and demand side response. This assessment considers how the Scheme has applied the above guidance to reduce effects on climate.
	The Town and Country Planning (EIA) Regulations 2017	This requires an assessment of the likely significant effects on climate of greenhouse gas emissions associated with the Scheme. This assessment has been carried out in accordance with the requirements of the Regulations.
	Building Regulations Part L (2013) including 2016 Amendments	<ul style="list-style-type: none"> • Approximate 6% CO₂ reduction over Part L 2010 for dwellings. • Approximate 9% CO₂ reduction over Part L 2010 for non-residential buildings. This assessment summarises the output of the Energy and Resource Statement, which details the design measures required for the buildings to meet the Part L requirements.

Scale	Policy Document	Key Considerations for the Scheme
	Water Framework Directive Directions 2015	The River Thames at this location is tidal and is classified under the Water Framework Directive (WFD) as part of the Thames Middle transitional water body (ID number GB530603911402).
	Urban Waste Water Treatment Directive 2012	Objective of protecting the water environment for the animals and plants that live in and around water, for recreation, and its use as a resource for drinking water, sanitation, industry and commerce.
	National planning practice guidance on water supply, wastewater and water quality	Adequate water and wastewater infrastructure is needed to support sustainable development. A healthy water environment will also deliver multiple benefits, such as helping to enhance the natural environment generally and adapting to climate change.
Regional	The London Plan 2016 ⁷⁴	Chapter Five: London's Response to Climate Change: Policy 5.1 – Policy 5.8: Proposed mitigation measures assessed against the aims and measures set out to achieve a 60% emissions reduction by 2025. This assessment considers the use of the above mitigation measures and targets in the Scheme, as appropriate. 5.13.A. Drainage should be designed and implemented in ways that deliver other policy objectives of this Plan, including water use efficiency and quality, biodiversity, amenity and recreation. 5.14.A. Development proposals must ensure that adequate wastewater infrastructure capacity is available in tandem with development. Proposals that would benefit water quality, the delivery of the policies in this Plan and of the Thames River Basin Management Plan should be supported while those with adverse impacts should be refused. 5.14.D. The development of the Thames Tideway Sewer Tunnels to address London's combined sewer overflows should be supported in principle.
	London Environment Strategy (May 2018)	Proposed mitigation measures assessed against the aims and measures set out to achieve a zero-carbon city by 2050, including: <ul style="list-style-type: none"> • local renewable energy; • zero emission vehicles; • better building insulation; • more efficient heating systems; • smart technology; • new developments to be zero carbon from 2019; • trialling low-carbon technologies; and • supporting low carbon circular economy. This assessment considers the use of the above mitigation measures and targets in the Scheme, as appropriate.
Local	Westminster City Plan ⁷⁵	CM28.1 – Basement Development: In relation to material assets this policy states that applications for basement development need to: <ul style="list-style-type: none"> • Demonstrate that they have taken into account the site-specific ground conditions, drainage and water environment(s) in the area of the development;

⁷⁴ Mayor of London (March 2016) The London Plan: Spatial Development Strategy for Greater London Consolidated with alterations since 2011. Accessed 13/11/2018.
⁷⁵ Westminster City Council (2016). Westminster City Plan. Available at: <https://www.westminster.gov.uk/westminsters-city-plan-strategic-policies>. Accessed 13/11/18.

Scale	Policy Document	Key Considerations for the Scheme
		<ul style="list-style-type: none"> • Incorporate sustainable urban drainage measures to reduce peak rate of run-off or any other mitigation measures recommended in the structural statement or flood risk assessment; and, • Be protected from sewer flooding through the installation of a suitable pumped device. S45 – Flood Related Infrastructure: Development will ensure that flood-related infrastructure is protected and access for maintenance is retained.
	Westminster's Code of Construction Practice ⁷⁶	9.6. Temporary and permanent connections to sewers – the following general requirements will have to be met: <ul style="list-style-type: none"> • All redundant sewer communication pipes should be tested, and a CCTV survey carried out to ensure they are suitable weak concrete, cement grout or other suitable material. This is to prevent any infestation by rodents and avoid the risk of future possible subsidence; and, • In order to prevent rodents or sewer gases reaching the site, temporary sewer communication pipes must be provided with a 'cascade' cast iron interceptor trap to British Standard specification All retained sewer communication pipes should be tested and a CCTV survey carried out to ensure they are suitable for the new development and in good condition. Wherever it is possible the drainage system serving the Scheme or refurbishment should gravitate to the sewer. This will eliminate the need for pumping of foul drainage to the sewer and the associated problems which often occur with this type of installation.
	Thames Estuary 2100 Plan (TE2100) ⁷⁷	Requirements for applications located along the River Thames to demonstrate how the flood defence could be raised in future to meet the demands of climate change. Increasing pressures such as climate change and population growth mean that tidal flood risk will increase over time in London, unless this risk is carefully managed. Flood risk product 4 specifies the need for defences at the site to be raised from 5.41 m to 6.35 m in the future to accommodate the TE2100 modelled climate change water levels. It is important that the Scheme does not prevent this defence raising from taking place in the future.

14.4 Area of Influence

- 14.4.1. The works for the Scheme are to take place in Victoria Tower Gardens in the City of Westminster, situated on the north bank of the River Thames immediately to the south of the Palace of Westminster. The locations of material assets have been identified from a review of maps and relevant websites. The majority area of influence associated with material assets and critical infrastructure are anticipated to be restricted to the Scheme Site itself. Therefore, the study area has been defined as the immediate footprint of the Scheme, and any material assets that lie within the footprint have been identified.
- 14.4.2. The area of influence for assessment of the projects vulnerability to climate change is limited to the project boundary and the immediate area around it.
- 14.4.3. The area of influence for effects on climate is global, as there is a single receptor – the atmosphere – and the overall effect on the climate is determined by the cumulation of emissions from all human activities across the world. There is also only one direct impact – global warming – and although the effects of this vary across the globe, they are not linked to the location of the original emissions source.

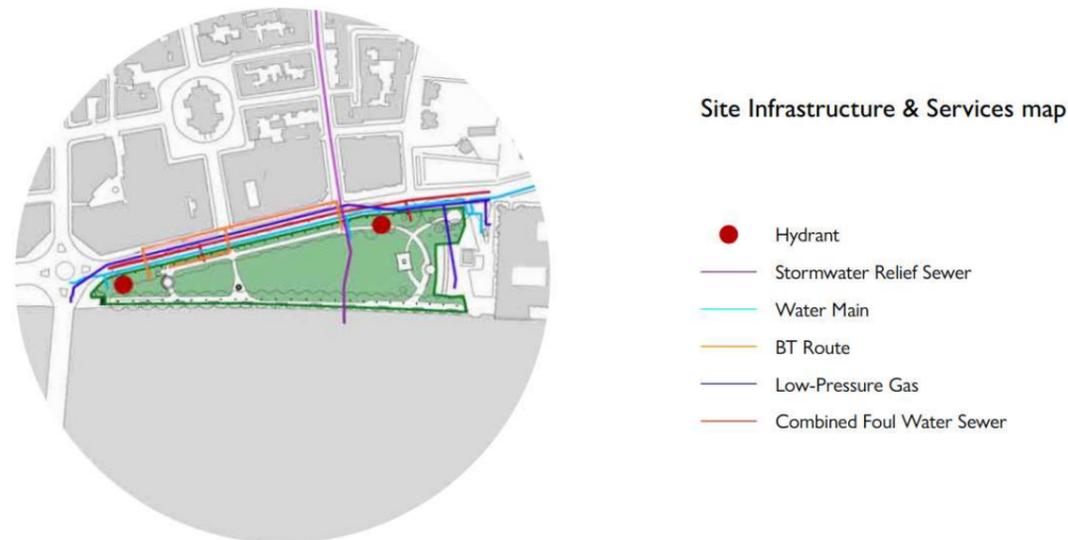
⁷⁶ Westminster City Council (2016) Code of Construction Practice. Available at: http://transact.westminster.gov.uk/docstores/publications_store/planning/code_of_construction_practice.pdf. Accessed 14/11/18.
⁷⁷ Environment Agency (2012) TE2100 Plan. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/322061/LIT7540_43858f.pdf. Accessed 14/11/18.

14.5 Baseline Conditions

Material Assets

14.5.1. A plan of the of the infrastructure and services surrounding the site are detailed in Figure 14-1.

Figure 14-1 - Infrastructure and Services Plan⁷⁸



- 14.5.2. A geophysical survey has detected and mapped numerous cables and pipes crossing the site. The utilities identified on site generally include drainage, British Telecom, Electric and Water. Additional unknown utilities were also identified.⁷⁹
- 14.5.3. It is assumed the site is currently served by a private surface water system in the form of gullies and some surface water flows may also run-off in to the soft landscape areas. Thames Water plans show a 2362mm Combined Water Sewer running parallel to the west side of the site. An existing sewer runs into the site which is assumed to be a combined sewer overflow, this is bisecting the Burghers of Calais and the Buxton Memorial. The sewer is approximately 4.1m below ground level and at least 3m away from the proposed secant pile wall along the northern edge of the Memorial basement.
- 14.5.4. There is currently no known foul water drainage from the gardens. At this stage, it is assumed that all surface and foul water flows from the Scheme will be connected directly into the Thames Water combined sewer.
- 14.5.5. Flood defences are present within 250m of the site. The nearest runs along the east side of the gardens, adjacent to the River Thames. Publicly available flood risk maps for planning, provided by the EA, shows that the area of the study area currently benefits from this flood defence.
- 14.5.6. After consultation with TfL, they have confirmed that London Underground has no assets within 50m of the site. However, there are cable ducts in the area.
- 14.5.7. No other important or critical infrastructure assets (e.g. pumping stations, electrical substations, other utility networks) have been identified within the site.
- 14.5.8. A site investigation of the existing drainage will be conducted to prove that the site is currently served by a private surface water system. A drainage survey using closed circuit television (CCTV) will be undertaken to find the extent of the private drainage system, its condition and to determine if it is feasible to be utilised for the Scheme.

⁷⁸ UK Holocaust Memorial Foundation (2018) UK Holocaust Memorial public exhibition boards. Available at: <https://www.gov.uk/government/publications/uk-holocaust-memorial-public-exhibition-boards>. Accessed 15/11/18.

Climate Vulnerability

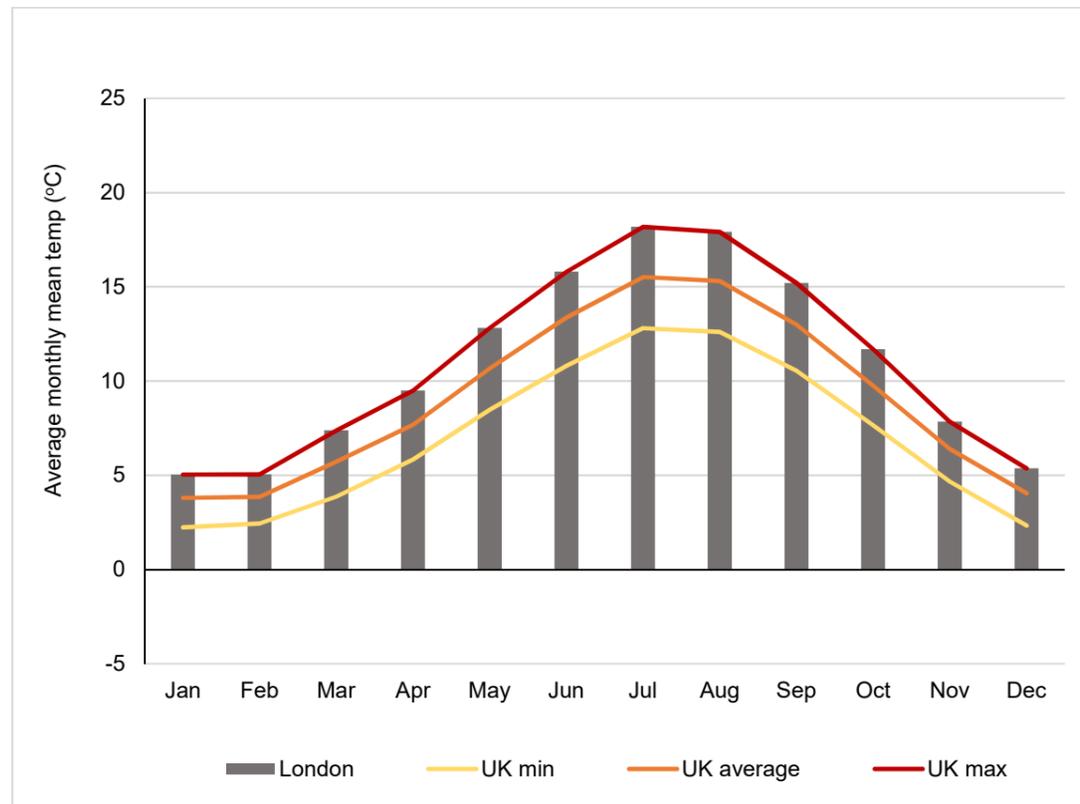
- 14.5.9. To inform adaptation decisions this section presents a summary of the study area's current climate and the likely future changes to it with regard to relevant average and extreme weather variables.
- 14.5.10. Met Office regional data is used to define current climatic conditions in the study area. The Met Office's standard average data tables are used, they show the latest set of 30-year averages covering the period 1981-2010. Context to this regional baseline is provided by including comparison to the Met Office's national baseline data.
- 14.5.11. Future projections are based on the United Kingdom Climate Projections 2009 (UKCP09) for a 25km² area surrounding the site (grid ID: 1666). Data is presented for seasonal averages in the 2050s which represents the middle decade of the 30-year climate average from 2040 to 2069. For temperature and precipitation estimates, except for projections of the wettest day, the figures only show projections for the summer and winter averages in the 2050s as these represent the most relevant and extreme changes in temperature and precipitation in response to climate change.

Temperature

- 14.5.12. As shown in Figure 14-2 and Figure 14-3 the temperatures in the London administrative region are the highest regional averages across the UK, which is partly due to the urban heat island effect.

⁷⁹ WSP (2018) Victoria Tower Gardens – UK Holocaust Memorial: Preliminary Geo-Environmental Risk Assessment (Desk Study). Accessed 20th November 2018).

Figure 14-2 - Long-term average monthly mean temperature (1981-2010)



Precipitation

14.5.13. As shown in Figure 14-4, long-term average monthly rainfall (1981-2010) in the London administrative region is the lowest in the UK. Figure 14-5 shows the long-term average number of days that had rainfall over 10mm. If this is considered as a proxy for heavy monthly rainfall it suggests that the region has experienced fewer heavy rainfall days than the mean of all other administrative regions in the UK.

Figure 14-4 - Long-term average monthly rainfall (1981-2010)

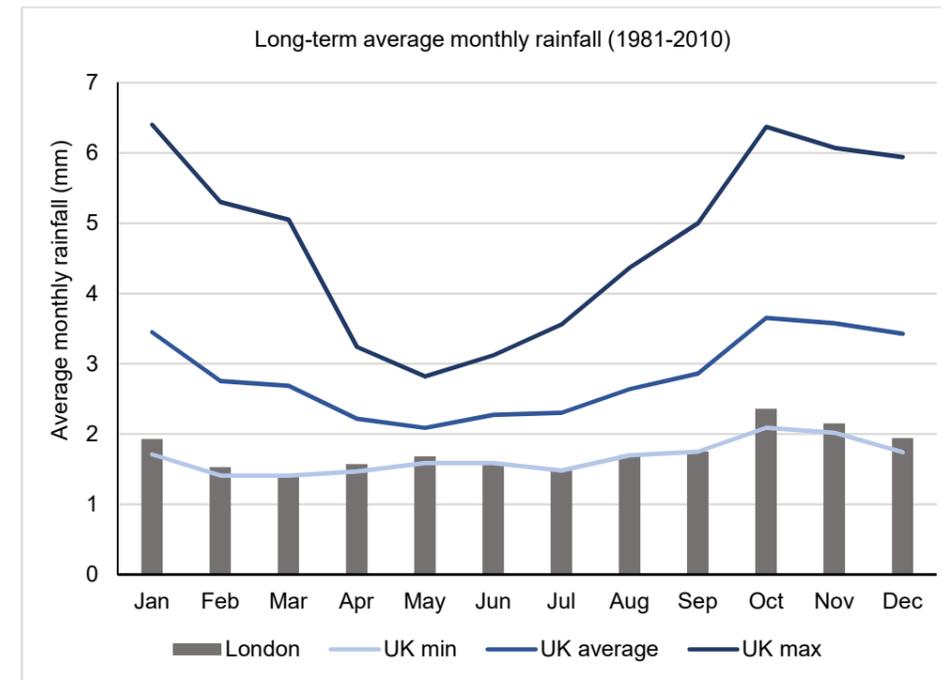


Figure 14-3 - Long-term average monthly maximum temperature (1981-2010)

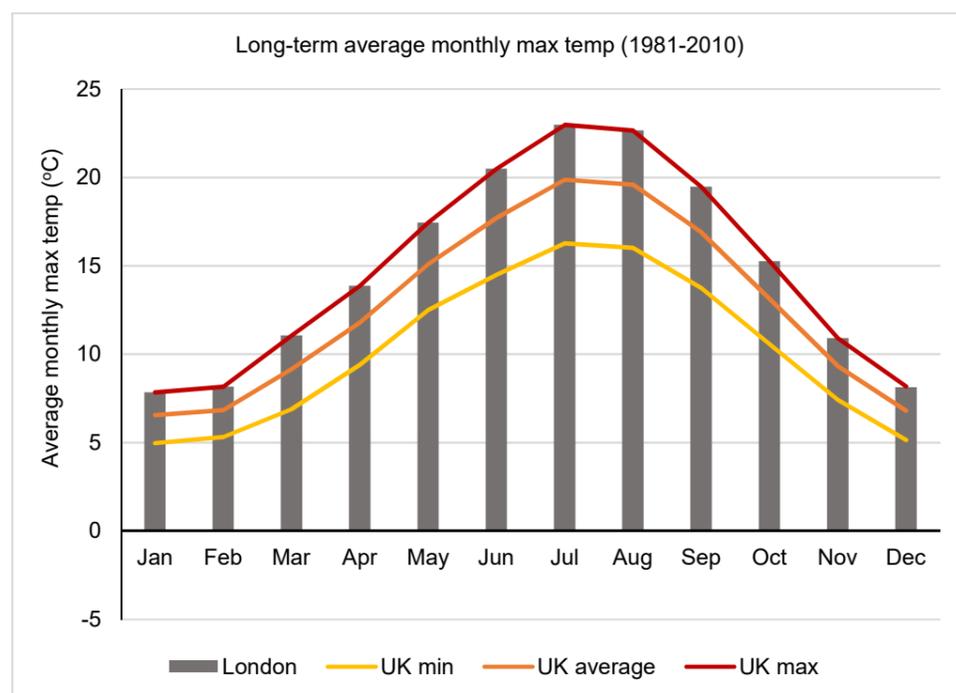
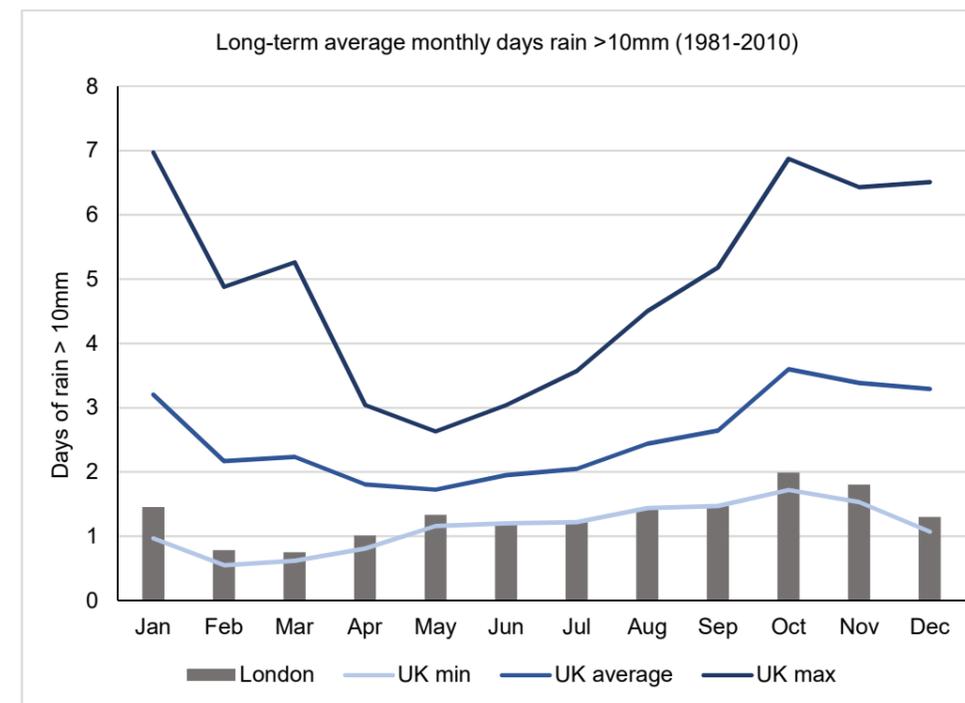


Figure 14-5 - Long-term average days with rainfall above 10mm (1981-2010)



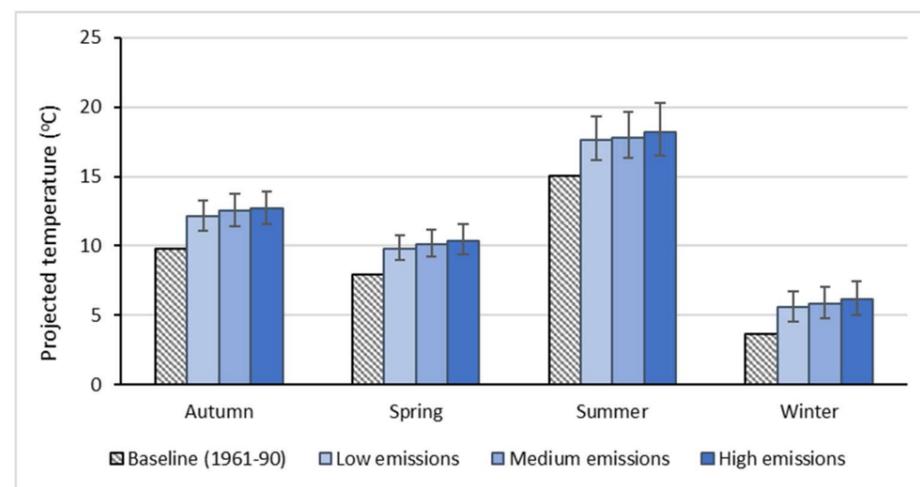
Climate change projections

- 14.5.14. This section presents the output of climate change models that cover the study area.
- 14.5.15. In summary it is widely accepted that, on average, the UK is likely to experience hotter and drier summers and warmer, wetter winters (Jenkins et al., 2010). Alongside these changes in the average conditions, it is likely that climate change will increase the frequency and severity of extreme weather events, such as heavy rainfall, storms and heatwaves.

Hotter Summers

- 14.5.16. Summer temperatures, for the UKCP09 25km² grid square encompassing the study area, will average at approximately 18.2°C under the high emission scenario (Figure 14-6). The uncertainty around this estimate ranges from 16.5°C to 20.3°C.

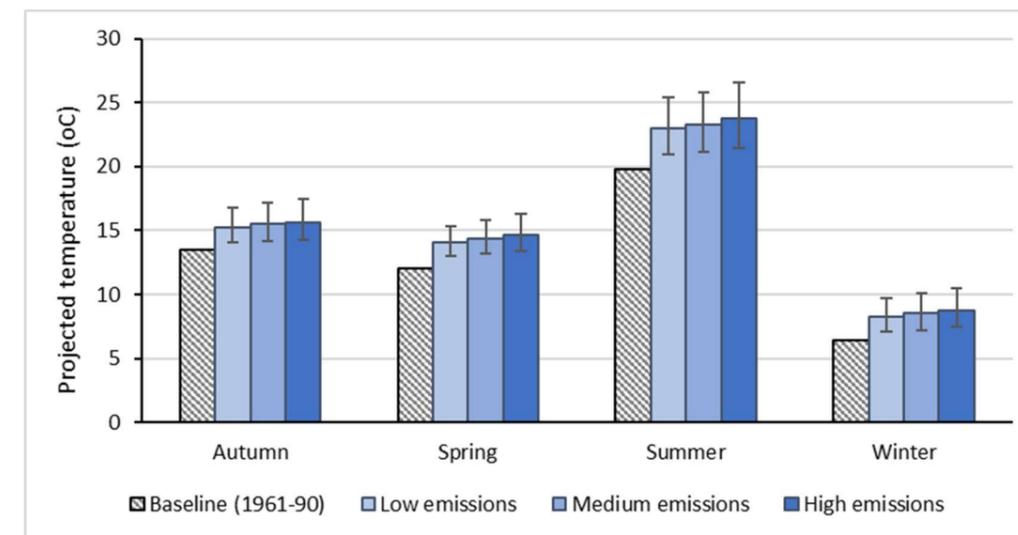
Figure 14-6 - Average mean temperatures by the 2050s



NB - error bars represent 10th to 90th percentile projections

- 14.5.17. UKCP09 provides probabilistic projections for mean daily maximum temperature. Mean daily maximum temperatures are derived by calculating the (change in the) average of the warmest days in each 30-year time-slice. Therefore, it is worth noting that, like with all other climate variables, there is variability around the mean and some days are likely to be even hotter such as in the event of heat waves. As shown in Figure 14-7, the UKCP09 projections suggest an increase in mean daily maximum temperature by the 2050s for all seasons under all emissions scenarios. By the 2050s, summer mean daily maximum temperatures for the study area could be up to ~4°C warmer than the baseline (50th percentile estimate under high emissions).

Figure 14-7 - Average maximum temperatures by the 2050s



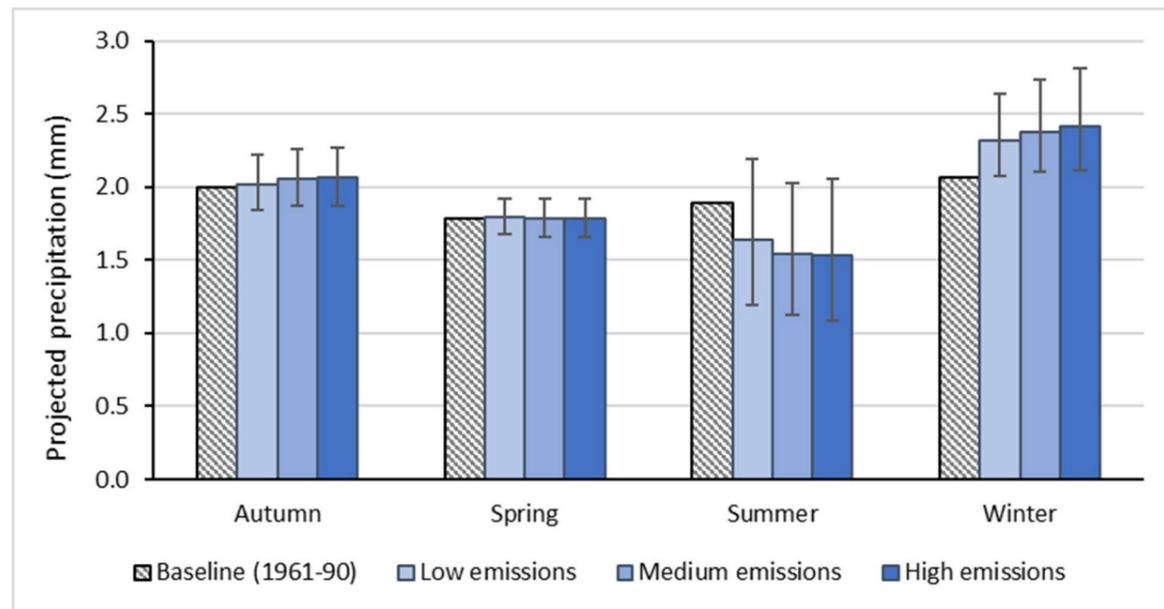
NB - error bars represent 10th to 90th percentile projections

- 14.5.18. Although there is no official definition of a heat wave in the UK, the World Meteorological Organization definition is “when the daily maximum temperature of more than five consecutive days exceeds the average maximum temperature by 5°C, the normal period used to calculate the average maximum temperature being 1961-1990” (Met Office, 2018). Research published by the Met Office Hadley Centre suggests that the European summer heat wave from 2003 could become a normal event by the 2040s (IPCC, 2013). By the 2060s, such a summer would be considered cool according to some climate models.
- 14.5.19. Research has found that it is very likely (confidence level >90%) that human influence has at least doubled the risk of a heat wave exceeding the mean summer temperatures experienced in 2003 (Stott et al., 2004).
- 14.5.20. With regard to the extent of change and the range of uncertainty in the high emissions scenario projection (represented by the 10th and 90th percentile respectively) for the purposes of this report the likelihood of hotter summers is assessed to be high.

Drier summers

- 14.5.21. As shown in Figure 14-8 the central estimate of change in mean summer precipitation, by 2050s, is approximately a 19% decrease under the high emissions scenario for the study area. The uncertainty around this estimate ranges from approximately 43% reduction in rainfall to 8% increase (represented by the 10th and 90th percentile respectively). These projections suggest that there is uncertainty in future average rainfall trends, but it is expected that summer rainfall will decrease.

Figure 14-8 - Average precipitation by the 2050s



NB - error bars represent 10th to 90th percentile projections

14.5.22. With regard to the extent of change and the range of uncertainty in the high emissions scenario projection (represented by the 10th and 90th percentile respectively) for the purposes of this report the likelihood of drier summers is assessed to be medium.

Heavier rainfall

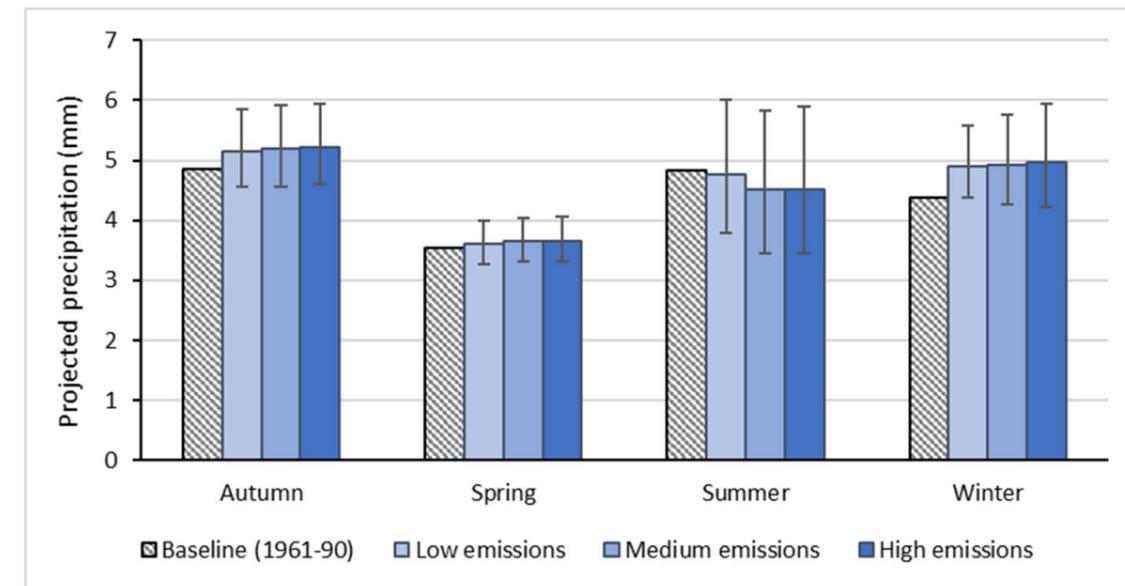
14.5.23. UKCP09 projects that by the 2050s, under the high emissions scenario, the central estimate (50th percentile estimate) of increase in winter mean precipitation is ~16%. The uncertainty around this estimate ranges from ~2% to ~36% (represented by the 10th and 90th percentile respectively). Although this uncertainty range is sizeable, the absolute increase in winter rainfall amounts by 2050, for all emission scenarios, is <1 mm. As shown in Figure 14-8, the projected winter rainfall under high emissions is relatively low (2.41 mm by 2050s at the central estimate, 50th percentile).

14.5.24. Although average rainfall conditions are important, heavy rainfall events are more likely to cause flooding and damage to roads and other infrastructure. UKCP09 does not provide specific projections for flooding, but instead includes probabilistic projections for precipitation on the wettest day defined as the 99th percentile of daily maximum precipitation on a seasonal basis, see Figure 14-9.

14.5.25. The current climatological baseline analysis showed that the highest rainfalls in the study area are in winter months. As shown in

14.5.26. Figure 14-9 in winter the high emission scenario suggests that a central estimate of precipitation change on the wettest day is approximately a 13% increase by the 2050s. The uncertainty around this estimate ranges from approximately 4% decrease to 36% increase (represented by the 10th and 90th percentile respectively). Although the projected percentage changes are large, the baseline rainfall is low and therefore in absolute terms, these projections suggest that the study area could experience winter rainfall on the wettest day of 4.96mm by 2050s (under high emissions) compared to 4.38 mm in the baseline.

Figure 14-9 - Average mean precipitation on the wettest day by the 2050s



NB - error bars represent 10th to 90th percentile projections

14.5.27. Although the 50th percentile projections for summer heavy rainfall shown in Figure 14-9 suggest that this may decrease by the 2050s there is a great range of uncertainty represented by the 10th to 90th percentile projections. For example, under the high emissions scenario the 10th to 90th percentile projections range from a ~29% decrease to ~22% increase.

14.5.28. Also, recent research has found that the UK may experience more heavy summer rainfall events in the future (Convex, 2015). Heavy summer rainfall events are predominantly caused by convective rainfall, brought about by thermal heating and evaporation. These localised convective rainfall events are currently not well replicated in climate models and, as a result, the models cannot provide information directly on how their intensity and frequency might change. Therefore, the UKCP09 projections may be underestimating an increase in heavy summer rainfall as they do not include a potential increase in convective rainfall events caused by warmer summer temperatures.

14.5.29. It is expected that as summer rainfall tends to intensify with temperature, the expected increase in atmospheric temperatures will result in more intense summer rainfall events.

14.5.30. With regard to the extent of change and the range of uncertainty in the high emissions scenario projection (represented by the 10th and 90th percentile respectively) for the purposes of this report the likelihood of heavier rainfall is assessed to be medium.

Changes to extreme weather (storms and high winds)

14.5.31. Future projections of storms and high winds are uncertain. The UKCP09 projections depict a wide spread of future changes in mean surface wind speed, however, there is large uncertainty in projected changes in circulation over the UK and natural climate variability contributes much of this uncertainty (Brown et al., 2012). It is therefore difficult to represent regional wind extreme winds and gusts within regional climate models (Brown et al., 2012). Other studies of future changes agree that confidence in future windiness is low (Thornton, 2010; Pryor and Barthelmie, 2010; McColl et al., 2012).

14.5.32. A storm is defined by the Met Office as a wind event measuring 10 or higher on the Beaufort scale (equivalent to a wind speed of 24.5 m/s or 55 mph). Studies suggest that climate-driven storm changes are less distinct in the Northern than Southern hemisphere (Bengtsson and Hodges, 2005). There is some agreement of a projected poleward shift in storm tracks across the Atlantic Ocean; however, for mid-Atlantic storms, such as those that have affected the UK in early 2014, the signal is more complex (Slingo et al., 2014). Potentially, those mid-Atlantic storms may become more intense, particularly with the long-term warming of the sub-tropical Atlantic that could increase the amount of moisture that those storms carry (Slingo et al., 2014). However, such is the wide range of inter-model variation, robust projections of changes

in storm track are not yet possible and there is low confidence in the direction of future changes in the frequency, duration or intensity of storms affecting the UK.

- 14.5.33. With regard to the extent of change and the range of uncertainty in the high emissions scenario projection (represented by the 10th and 90th percentile respectively) for the purposes of this report the likelihood of changes to extreme weather (storms and high winds) is assessed to be low.

Climate Emissions

Background Emissions

- 14.5.34. Global greenhouse gas emissions, from all sources, amount to approximately 50 billion tonnes of CO₂e⁸⁰ per year. The UK is the world's eighth largest emitter of CO₂e, with the total background UK emissions for 2016 (the last reported year) being 467.9 million tonnes of CO₂e⁸¹. London is responsible for 8.4% of UK emissions. In 2015 (the most recent data year), The City of Westminster's emissions were 2,199 kilotonnes of CO₂e in 2015, approximately 6.5% of London's overall emissions⁸². If London meets the UK Government's Carbon Budget reduction target of 37% of 1990 levels by 2020, by the time the Scheme's construction is complete London's annual emissions will be approximately 28 million tonnes.

Scheme-Specific Baseline Emissions

- 14.5.35. The Site is currently operated as public gardens and is assumed to have negligible GHG emissions for the purposes of this high-level assessment.

14.6 Method of assessment

Material Assets

- 14.6.1. The assessment of issues for this chapter has been undertaken using desktop review to qualitatively assess the environmental impacts to material assets, with impacts assess based on published information. Where significant uncertainty remains with regards to ground conditions it has been necessary to take a conservative approach.
- 14.6.2. The effect significance of potential impacts on the construction and operation of the Scheme is determined by considering the sensitivity of the receptor, the magnitude of impact, the duration of the effect, and any mitigation that could be implemented. The definition of the relevance of any impact is detailed in Table 5-4. The definitions for the sensitivity of receptors and impact severity for material assets are outlined below.

Sensitivity of the Receptors

- 14.6.3. The level of sensitivity of the receptors is determined by four definitions considering their importance and resilience, which consider the importance or rarity of the receptor as well as its resilience to change. These definitions are based on professional judgement and the types of receptors. Table 14-5 provides a summary of the general definitions used for receptors relevant to impacts on material assets.

Table 14-5 - Sensitivity of Receptors for Material Assets and Climate Change

Sensitivity of Receptor	Importance / resilience of receptors
Very High	A material asset of national or city importance is of high vulnerability to damage or interruption to service.
High	A material asset of importance to the Borough of Westminster is of moderate vulnerability to damage or interruption to service.
Medium	A material asset of local scale importance is of low vulnerability to damage or interruption to service.
Low	A material asset at site scale importance only is resilient and not vulnerable to damage or interruption to service.

⁸⁰ <http://themasites.pbl.nl/publications/pbl-2017-summary-trends-in-global-co2-and-total-greenhouse-gas-emissions-2983.pdf>

⁸¹ www.UK.gov 2017 Final UK greenhouse gas emissions national statistics

Impact severity

- 14.6.4. The impact severity has been determined based on factors including the scale, duration, frequency and reversibility of such an impact. Table 14-6 provides these general definitions based on professional judgement.

Table 14-6 - Impact Severity for Material Assets and Climate Change

Impact Severity	Description of Impact
Very High	The impact will have major effects at national or regional scale economy and populations.
High	The impact will have moderate effects at city scale economy and populations.
Medium	The impacts will have minor effects at the Borough scale economy and populations.
Low	The impacts will have no significant impact at a Site only scale.

Climate Vulnerability

- 14.6.5. The assessment method of the Scheme's vulnerability to climate change is set out below. It is based on IEMA climate change resilience and adaptation guidance for EIA.

Defining the baseline

- 14.6.6. Climate is the typical weather conditions experienced in a place over a period of time, conventionally expressed as average weather over a 30-year period.
- 14.6.7. The baseline for climate change vulnerability is presented in two parts, see Section 14.5 above. The first section describes the current climatic conditions in the study area and the second presents a range of future climate projections for that climate. It should however, be noted that climate change is not only a challenge of the future. We are already observing changes in the UK climate, with average temperatures having risen by around 1°C over the last century. The UK is already seeing a trend towards warmer winters and hotter summers, sea levels around our coast are rising by around 3mm a year and there is emerging evidence of changing rainfall patterns.

Identifying the vulnerability of receptors

- 14.6.8. Receptors which may be affected by climate change have been identified with consideration of both extreme weather events and gradual climatic changes in the study area over the projects design life. Impacts on wider social, environmental and economic receptors over time are also considered.

Defining receptor sensitivity

- 14.6.9. Individual receptors are assessed with regard to their sensitivity to climate related impacts. This is done qualitatively using four levels of sensitivity, as set out in the table below.

Table 14-7 - Sensitivity

Sensitivity	Description
Very High	The receptor is directly dependent on existing and/or prevailing climatic factors, and reliant on these specific existing climate conditions continuing in future (e.g. river flows and groundwater level); or only able to tolerate a very limited variation in climate conditions
High	The receptor is dependent on some climatic factors, but able to tolerate a range of conditions (e.g. a species which has a wide geographic range across the entire UK, but is not found in southern Spain)
Medium	Climatic factors have little influence on receptors.
Low	Climatic factors have very little or no influence on receptors.

⁸² London Energy and Greenhouse Gas Inventory (LEGGI 2015 Interim)

Defining exposure

- 14.6.10. Section 14.4 sets out the exposure for individual climate change variables. This considers both extreme events, such as floods and heatwaves, and “slow onset” or gradual changes in climate, such as rising temperatures or sea level rise.
- 14.6.11. The categorisation of exposure is based on a qualitative assessment of the likelihood of a hazard with climate change and for slow onset events based on the changes projected and range of uncertainties presented for the UKCP09 high emissions scenario (represented by the 10th and 90th percentile respectively).

Table 14-8 - Exposure

Exposure	Description
Very High	<ul style="list-style-type: none"> This event occurs multiple times during the lifetime of the project, e.g. approximately annually for a scheme with a 60-year design life; or Almost certain outcome under the high emissions scenario
High	<ul style="list-style-type: none"> The event occurs several times during the lifetime of the project, e.g. approximately once every five years for a scheme with a 60-year design life (typically 12 events); or High confidence in outcome, e.g. 9 out of 10 chance of being correct for the high emissions scenario
Medium	<ul style="list-style-type: none"> The event occurs limited times during the lifetime of the project, e.g. approximately once every 15 years for a scheme with a 60 year design life (typically 4 events); or Medium confidence in outcome, e.g. 5 out of 10 chance of being correct for the high emissions scenario
Low	<ul style="list-style-type: none"> The event occurs once during the lifetime of the project; or Low confidence in outcome, e.g. 1 out of 10 chance of being correct for the high emissions scenario

Using sensitivity and exposure to define receptor vulnerability

- 14.6.12. The matrix below shows how the sensitivity and exposure of individual receptors are combined to define their vulnerability/sensitivity to climate change impacts.

Table 14-9 - Receptor vulnerability/sensitivity matrix

		Exposure			
		Low	Medium	High	Very high
Sensitivity	Low	Low	Low	Low	Medium
	Medium	Low	Medium	Medium	Medium
	High	Low	Medium	High	High
	Very high	Medium	Medium	High	Very high

Scoping potential impacts

- 14.6.13. Potential impacts have been identified by considering whether the effects of the project are likely to be different in the future based on projected changes to the climate. The consequence of impacts is therefore assessed with regard to both the current climate and projected changes in climate. Impacts with a consequence that does not increase under climate change are not assessed in this chapter.
- 14.6.14. With regard to the Scheme’s vulnerability to climate change there are three potential impacts that are not assessed in this chapter. These are outlined below with justification for their exclusion:
- Flood related impacts** - Including flooding associated with surface water (rainfall), groundwater, tidal waters, fluvial water (rivers) and sea level rise. These are all important climate vulnerabilities that

require detailed assessment. The development is in central London adjacent to the River Thames and so accordingly a Flood Risk Assessment (Appendix M in Volume 5), which includes detailed consideration of climate change, has been prepared to examine and reduce all potential flood related impacts. Findings of this assessment are also included in the Water Quality and Flood Risk Chapter of this Report (Chapter 12). Accordingly, impacts associated with projected wetter winters and/or heavier rainfall events are not assessed in this chapter, although for reference these projections are included in this chapter’s baseline. It is noted that one of the objectives of the design is to improve the gardens’ existing soil drainage which currently creates persistent flooding problems;

- Construction related impacts** - Construction of this project is expected to begin in 2020. This date is not sufficiently far into the future for the climate to change so significantly that construction related impacts would be different to those expected in the current climate. Climate change would therefore not intensify construction related impacts and accordingly the Scheme’s construction is not vulnerable to climate change. Weather related construction impacts and associated mitigation are covered elsewhere in this ES; and
- Impacts related to warmer winters** - The only potential impact identified that is associated with the projected increase in winter temperatures and decrease in snowfall is improved public access across the site during winter and a reduction in injuries from accidental slips and trips related to icy surfaces. This is not currently a major issue in central London and so this benefit is negligible.

Defining magnitude of potential impacts

Table 14-10 - Impact Magnitude / severity

Impact Severity	Description of Impact
High	<ul style="list-style-type: none"> Likely major breach in compliance resulting in prosecution; Consequence is activity prohibited and of international concern; Receptor has a very high economic value or international designation;
Medium	<ul style="list-style-type: none"> Possible regulatory non-compliance; Consequence is prohibited and of national concern; Receptor has a high economic value or national designation.
Low	<ul style="list-style-type: none"> Non-compliance of regional or local policy; Receptor has a moderate economic value or is important regionally.
Negligible	<ul style="list-style-type: none"> No relevant statutory controls; No public interest; Receptor has a low economic value or is important locally.

Identifying mitigation

- 14.6.15. Mitigation measures are identified so that risks are mitigated to acceptable levels. They comprise appropriate adaptive measures (key for managing uncertainty), including new design features, alternative construction materials or increased inspection and maintenance that provide an appropriate resilience to increased extreme weather as well as changes in average conditions.

Assessing residual effects

- 14.6.16. Potential climate vulnerability effects are assessed after mitigation so that any likely to remain significant following the implementation of mitigation can be identified.

Assumptions and limitations

- 14.6.17. The assessment provides a broad, high-level indication of potential impacts of climate change on the Scheme based on qualitative assessment and professional judgement.
- 14.6.18. The assessment has been undertaken using data from UKCP09. Updated climate change projections are due to be published in 2018 (UKCP18). The UKCP18 project will update the UKCP09 projections over UK

land areas and update UKCP09 projections of sea-level rise, giving greater regional detail, and provide more information on potential extremes and impacts of climate change. As the exact date for the release of UKCP18 is not known, and were not available at the time of writing, the assessment of the impacts of climate change on the Scheme has used climate data from UKCP09. A study by the Met Office shows that UKCP09 continues to provide a valid assessment of the UK climate and can still be used for adaptation planning.

14.6.19. The projections provided by UKCP09 are probabilistic, which means that rather than a single 'best-guess' of the impact of climate change, they give a range of outcomes based on an 'ensemble' of multiple climate model runs. This better represents the uncertainty of climate prediction science. The UKCP09 probabilistic projections are based on three scenarios of greenhouse gases emissions (Low, Medium and High) and are provided for seven-time periods ('time slices') throughout the 21st century. The analysis of projections for the scheme location is done under the 50th percentile of the high emissions scenario. Additionally, it should be noted that the level of uncertainty of the projections is dependent on the climate variable. For example, there is greater confidence around changes in temperature than there is in wind. The level of certainty of each projection is included in the baseline.

Climate Emissions

14.6.20. It is not possible to meaningfully link individual project emissions with indirect effects on global climate (for example temperature increase) in a quantitative manner. Therefore, assessment of the effects of the Scheme on climate is limited to quantification of the magnitude of emissions, from individual sources and in total, and comparison of these to the baseline.

14.6.21. Emissions from the Scheme have been quantified by calculation and estimation using some direct project data from the developing design, proxies from industry literature, and relevant carbon conversion factors. The methodology used to calculate emissions has been developed with reference to the following technical standards, as appropriate:

- The Greenhouse Gas Protocol – Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories (GPC);
- PAS 2070:2013+A1:2014 – Specification of the Assessment of Greenhouse Gas Emissions of a City; and
- PAS 2080:2016 – Carbon Management in Infrastructure.

14.6.22. Emission calculations have been carried out by multiplying activity data by an emission factor associated with the activity being measured. Activity data is a quantitative measure of an activity that results in emissions for a defined range of an activity or activities (e.g. kilogrammes of materials produced, kilometres driven, kWh electricity consumed, or tonnes waste sent to landfill). An emission factor is a measure of the mass of emissions relative to a unit of activity.

Data collection and assumptions

14.6.23. The data for the assessment has been collected directly from the design team, as producers and/or holders of the latest project data, plus online research for technical details necessary to complete calculations and proxy/benchmark data for items where there is no project-specific information. Table 14-11 summarises the specific data collected for each lifecycle, and the emissions factors used.

Table 14-11 - Data Sources and Collection Methodology

Phase	Emission Sources	Data Sources & Assumptions
Construction	Emissions from transboundary transport of materials and workers to site and their associated upstream activities	The tonnages of materials provided by the design team were translated into transport kilometres. This assumed 17 tonnes of materials transported per load, with each vehicle travelling an average one-way distance of 200km. The emission factor for an average diesel-fuelled HGV was sourced from Defra Carbon Factors 2018.

⁸³ TM46:2008

Phase	Emission Sources	Data Sources & Assumptions
Construction	(well-to-tank emissions)	Worker numbers were sourced from the draft Labour Resource Profile. All workers will be obliged to travel by public transport, therefore the Defra Carbon Factor for the London Underground has been applied.
	Emissions associated with powering in boundary construction plant	An estimate was applied based on industry data published by the Strategic Forum for Construction & the Carbon Trust in 2010, which finds that on-site construction activities produce c.16 tonnes CO ₂ per £M project value, however this can be reduced by 15% with efficient onsite practices. It was assumed that these practices will be in place during construction. Construction cost estimates were sourced from the Cost Plan.
	Emissions associated with the provision of water used onsite during construction	A proxy figure of 118.8m ³ per £M was sourced from literature (WRAP, 2011), with construction cost estimates sourced from the design team. The emission factor for the provision of mains water was sourced from Defra Carbon Factors 2018.
	Embodied CO ₂ e of construction materials, including emissions from raw material extraction through manufacture	Construction materials and quantities were provided by the design team. Data on the following materials were available: <ul style="list-style-type: none"> • steel; and • concrete. While it is known that other materials will be used in the construction of the museum, these are the key materials which will be used in bulk. Emission factors were taken from the Defra Carbon Factors 2018.
	Emissions from the collection, treatment and disposal of solid waste	Waste quantities were based on the lowest BREEAM rating, with 16.2 tonnes per £100k project value. Also included in the waste figure is the estimated 30,000 m ³ excavation arisings. The emission factor for 'average construction waste' was sourced from Defra Carbon Factors 2018. It was assumed that all materials will be recycled.
Operation	Building energy use	CIBSE Energy Benchmark Data ⁸³ was used to approximate annual electricity and gas consumption for the building. The value for 'museum/art gallery/other public building' was selected as the most appropriate. Defra 2018 carbon factors for UK grid electricity and natural gas were used, including well to tank and transmission and distribution emissions.
	Emissions from the transboundary transport of visitors to the Scheme	In line with the information provided in section 12.3.2 of the Environmental Scoping Report, the Scheme has been assumed to generate an additional 280,000 two-way trips per year. 50% have been assumed to arrive by public transport (the emissions factor for the London Underground has been applied to an assumed 10km one-way trip), and the other 50% arriving by coach (assumed 200km one-way trip).

Phase	Emission Sources	Data Sources & Assumptions
	Emissions associated with the provision of water used onsite during operation	A WRAP figure of 1 m ³ per m ² was used. This is applicable to commercial and community buildings. The emission factor for the provision of mains water was sourced from Defra Carbon Factors 2018.
	Emissions from the collection, treatment and disposal of solid waste	Waste quantities were estimated using BS 5906:2005 ⁸⁴ . The value for 'entertainment complex' was selected as most appropriate. These were assumed to be commercial/industrial waste, with 50% recycled and 50% to landfill. Carbon factors were sourced from Defra Carbon Factors 2018.
	Emissions from the treatment of liquid effluent	The volume of effluent to be generated by the building was estimated by applying a standard water industry estimate of 92.5% of water consumption. The emission factor for municipal effluent treatment was sourced from Defra Carbon Factors 2018.

Sensitivity of the Receptors

14.6.24. There is only one receptor, the atmosphere, and it has a consistent sensitivity no matter the location of the emissions source. The atmosphere is a receptor of high sensitivity which will be impacted by all emissions.

Impact severity

14.6.25. There is only one direct impact; global warming. This impact is global in scale, long-term in duration, and irreversible in nature. The impact is also certain, if emissions are released. There is no legal limit for emissions from any one development, although there is global consensus that atmospheric warming should be kept to below 2°C and the UK Government has set overarching carbon budgets to 2032 and an overall target for 2050.

14.6.26. There is no accepted technical guidance for determining a level of significance (i.e. major and minor) of the effect on climate of emissions. However, due to the complex and far-reaching effects of global warming and the presence of a scientifically established and globally agreed environmental limit, it is our expert judgement that all emissions are important and should be mitigated as far as possible.

14.6.27. The level of significance of the impact (i.e. whether it is minor or moderate) is therefore based solely upon the magnitude of emissions generated. Compared with global and UK emissions, the magnitude of any single development of this type will always appear negligible. However, in its 2017 guidance document 'Assessing Greenhouse Gas Emissions and Evaluating their Significance' IEMA states that:

14.6.28. 'GHG emissions have a combined environmental effect that is approaching a scientifically defined environmental limit, as such any GHG emissions or reductions from a project might be considered to be significant.'

14.6.29. As there is no accepted threshold for what magnitude of emissions is considered to have a significant effect on climate, professional judgement has been applied, considering local policy requirements, the scale of emissions compared with annual regional emissions, and whether the Scheme would have a significant impact on the UK's ability to meet its emissions reduction targets.

14.7 Potential Impacts

Material Assets

14.7.1. Impact relevance has been determined based on impact severity and the sensitivity of the receptor concerned in accordance with the matrix in Table 15-4. Impacts relating to construction and operational phases have been considered separately in the following sections and are summarised in Table 14-16. Justifications for sensitivity of receptors and severity of impacts are provided in these sections. Where

multiple impacts have been identified for the same receptor, to avoid duplication, justification for its sensitivity is provided in the first instance only.

Climate Emissions

14.7.2. It should be noted that the following results are intended to be high-level and suggestive of magnitude, due to the early stage of design and therefore lack of specific project information. For example, only the quantities of two material types have been provided. Although these represent the bulk materials involved in the construction, there will be many other materials used. This means that the emissions from material production and transport will actually be higher than presented in this assessment.

Construction

Material Assets

14.7.3. The limited presence of existing material assets and infrastructure across the site means that the likelihood of significant impacts occurring during construction is low. An existing sewer runs into the site, from Great Peter Street and discharges into the River Thames, bisecting the Burghers of Calais statue and the Buxton Memorial. The sewer is approximately 4.1m below ground level. If construction comes into contact with this sewer there is the potential that this pipe could leak or burst causing an inundation of water that poses a risk to nearby infrastructure and people.

14.7.4. The nature of the construction works, with the need for piling and deep excavation works, and their proximity to the river walls of the tidal Thames, which are also formal flood defence structures, has potential implications for flood risk. The construction site is also located with the defended flood plain.

14.7.5. The Scheme has the potential to increase flood risk from surface water, due to the change of land use from amenity grassland and gardens to impermeable surfacing, and the potential for increased sewer flood risk due to loading of the sewer and drainage network due to demands from the new development.

14.7.6. The Scheme will not increase the risk of tidal flooding from the River Thames, provided there is no impingement on the existing defences that could de-stabilise them or impede future maintenance. Therefore, the potential risks to flood and tidal defences are negligible.

Climate Vulnerability

14.7.7. No construction impacts are identified. Construction of this project is expected to begin in 2020. This date is not sufficiently far into the future for the climate to change so significantly that construction related impacts would be different to those expected in the current climate. Climate change would therefore not intensify construction related impacts and accordingly the Scheme construction is not vulnerable to climate change.

14.7.8. Climate Emissions Table 14-12 presents the emissions anticipated to be generated during the construction phase. The baseline is 0 tCO₂e, meaning that the effect of this phase of the Scheme is the **generation of an additional 11,799 tCO₂e**. Over a planned construction programme of 3 years, this equates to on average 3,933 tCO₂e per year. This represents approximately 0.2% of the City of Westminster's 2015 annual emissions and 0.012% of London's total annual emissions. If London achieves the UK Government's Carbon Budget reduction target of 37% of 1990 levels by 2020, the construction work for this project would account for 0.01% of London's annual emissions at the end of the 3-year construction.

Table 14-12 - Magnitude of Construction Phase Emissions

PAS 2070 Category	Scheme-specific Sources	Emissions (tCO ₂ e)
Mobile energy use	Emissions from transboundary transport of materials to site and their associated upstream activities (well-to-tank emissions)	664
	Emissions from transporting workers to site	62
Industrial processes and product use	Emissions associated with powering in boundary construction plant	612
Goods and services	Emissions associated with the provision of water used onsite during construction	2

⁸⁴ BS 5906:2005: Waste management in buildings — Code of practice

PAS 2070 Category	Scheme-specific Sources	Emissions (tCO2e)
	Embodied CO ₂ e of construction materials, including emissions from raw material extraction through manufacture, of which:	10,393
	Concrete	3,394
	Steel	6,999
Waste and wastewater treatment	Emissions from the collection, treatment and disposal of solid waste	66
Total	All construction phase emissions	11,799

Operation

Material Assets

- 14.7.9. Once constructed, the new Learning Centre will need to be served by either the existing or improved or new drainage systems. This is likely to include foul drainage for toilets, and surface water drainage for roofs, footpaths and other areas of new hard standing.
- 14.7.10. It is assumed that any additional surface water flows that arise from increased hardstanding areas will run off in to the soft landscape areas and the existing gullies and will be incorporated into the design of the Scheme.
- 14.7.11. On the assumption that the design of the works will include provision for new foul and surface water drainage, issues relating to material assets in operation of the Scheme are not considered to be significant.
- 14.7.12. Therefore, significant effects are unlikely due to limited presence of existing material assets and infrastructure at the site.

Climate Vulnerability

Hotter summers

- 14.7.13. Hotter summers damage materials and reduce asset lives:
- Extreme temperatures and intense solar radiation during heat waves could shorten asset lives, for example as building facades and pavements suffer deformation, cracking, fading and rutting. This may necessitate additional maintenance and emergency repairs which may have to be undertaken at night when temperatures are lower.
 - The sensitivity of the receptor (new assets) is high (its quality is dependent on some climatic factors, but able to tolerate a range of conditions). Exposure of the receptor to hotter summers is high (see Section 17.6) and so the receptors climate vulnerability is also high. The impact, before mitigation, would be of medium magnitude and the impact is therefore assessed as being of moderate significance.
- 14.7.14. Hotter summers reduce air quality:
- Reduced air quality during heat waves is primarily a result of the formation of ground-level ozone. This requires four key ingredients: nitrogen oxides (NO_x), volatile organic compounds (VOC), heat and sunlight. The first two are emitted directly as a result of human activity, while the last two depend on the weather; as a result, outdoor air quality can be expected to worsen with high temperature, and especially in hot summer days without clouds, where there is also an abundance of sunlight. Additionally, the concentration of secondary PM increases during heat waves (PM produced from the chemical reaction of other air pollutants). This occurs as reactions that lead to its formation are accelerated, just like in the case of ozone. Finally, in extreme scenarios temperature inversions caused by smog can trap air near the ground surface exacerbating these issues causing particularly high pollution levels.
 - Reduced air quality during heat waves has been evidenced in recent heat waves in England. In 2003 the poorest air quality for years was recorded, record breaking levels of pollution were measured “10 consecutive days in August, and ozone pollution reached its highest peak for more than a decade in London. High levels of pollution were again recorded in late July/early August 2004 as temperatures rose to about 30°C” (DEFRA, 2004).

- The sensitivity of the receptor (visitors) is high (wellbeing is dependent on climatic factors, but people can tolerate a range of conditions). Exposure of the receptor to hotter summers is high (see Section 17.6) and so the receptors climate vulnerability is also high. The impact, before mitigation, would be of medium magnitude (possible regulatory non-compliance) and the impact is therefore assessed as being of moderate significance.

14.7.15. Hotter summers adversely affect public welfare:

- Increased exposure of visitors to uncomfortably high temperatures resulting in health problems such as heat stroke.
- The sensitivity of the receptor (visitors) is high (wellbeing is dependent on climatic factors, but people can tolerate a range of conditions). Exposure of the receptor to hotter summers is high (see Section 17.6) and so the receptors climate vulnerability is also high. The impact, before mitigation, would be of low magnitude (no statutory controls) and the impact is therefore assessed as being of minor significance.

14.7.16. Hotter summers increase potential for solar power generation:

- Photovoltaic power generation is not part of the projects concept but will be considered for inclusion during the following more detailed design stages.
- The sensitivity of the receptor (PV infrastructure) would be very high (directly dependent on existing and/or prevailing climatic factors). Exposure of the receptor to hotter summers is high (see Section 17.6) and so the receptors climate vulnerability is high beneficial. If it were included in the design the beneficial impact would be of low magnitude (no statutory targets) and the impact is therefore assessed as being of minor beneficial significance.

Drier summers

14.7.17. Drier summers degrade landscape:

- The expected reduction in summer average rainfalls is likely to lead to increasing soil moisture deficits. This could have negative impacts on the amenity of the site.
- Increasing soil moisture deficits could lead to increased soil erosion due to the drying out of soils and substrate and increased cracking and dust. This could increase sediment debris on pavements as eroded soil is transported via overland flows or wind, leading to increased maintenance costs. It could also lead to silting and sedimentation of drainage, again causing increased maintenance costs and potentially a greater risk of flooding.
- Additionally, increasing soil moisture deficits and drying could have consequences for species, habitats and soil organic carbon. Some species may be unable to adapt quickly enough and those species able to adapt quickly will become more prominent.
- The sensitivity of the receptor (Victoria Tower Gardens landscape) is high (its quality is dependent on climatic factors, but can tolerate a range of conditions). Exposure of the receptor to drier summers is medium (see Section 14.5) and so the receptors climate vulnerability is also medium. The impact, before mitigation, would be of low magnitude (no statutory controls) and the impact is therefore assessed as being of minor significance.

14.7.18. Drier summers reduce availability of water supply and increase water demand:

- Hotter and drier summers increase the risk of drought and increase residential water demand. Residents could be effected more often by water use restrictions. Water efficiency measures such as water efficient fittings and appliances, rainwater harvesting and grey water use should be included in the detailed design.
- The sensitivity of the receptor (water resources) is very high (receptor is directly dependent on existing and/or prevailing climatic factors). Exposure of the receptor to drier summers is medium (see Section 14.5) and so the receptors climate vulnerability is also medium. The impact, before mitigation, would be of low magnitude (no statutory controls) and the impact is therefore assessed as being of minor significance.

14.7.19. Drier summers increase risk of subsistence:

- The expected reduction in summer average rainfall is likely to intensify and extend soil moisture deficits. This desiccation could impact soil stability causing subsistence. This is particularly relevant because the

Scheme include major earthworks to create the desired rising landscape in the southern end of the gardens.

- The sensitivity of the receptor (asset integrity) is high (its quality is dependent on climatic factors, but can tolerate a range of conditions). Exposure of the receptor to drier summers is medium (see Section 14.5) and so the receptors climate vulnerability is also medium. The impact, before mitigation, would be of medium magnitude (new assets have high economic cost) and the impact is therefore assessed as being of moderate significance.

14.7.20. Stormier weather may uproot trees:

- If the Scheme isolates or otherwise exposes existing trees in the gardens these may become more vulnerable to storm damage, this may become increasingly important with time as climate change induces stormier weather.
- The sensitivity of the receptor (protected trees) is high (its quality is dependent on climatic factors, but can tolerate a range of conditions). Exposure of the receptor to stormier weather is low (see Section 14.5) and so the receptors climate vulnerability is low. The impact, before mitigation, would be of low magnitude (receptors important regionally) and the impact is therefore assessed as being of negligible significance.

Climate Emissions

14.7.21. There is currently limited detail available regarding how the building will be operated. For this reason, industry benchmark data has been used to approximate annual GHG emissions from the operation of the museum. These are presented in Table 14-13.

14.7.22. With an existing baseline of 0 tCO₂e, the Scheme produces an impact of **1,895 tCO₂e per year**. This represents 0.09% of the City of Westminster’s annual emissions (2015). If London achieves the UK Government’s Carbon Budget reduction target of 37% of 1990 levels by 2020, the operation of the Scheme would account for around 0.007% of London’s annual emissions when it opens.

14.7.23. Almost 90% of emissions are expected to be generated not by the Scheme itself, but by visitor travel to the museum, particularly those that are expected to travel by coach rather than other available public transport options.

Table 14-13 - Magnitude of Annual Operational Phase Emissions

PAS 2070 Category	Scheme-specific Sources	Emissions (tCO ₂ e)
Stationary energy use	Emissions from the provision of power	70
	Emissions from the provision of heat	136
Mobile energy use	Emissions from the transboundary transport of visitors to the Scheme	1,666
Goods and services	Emissions associated with the provision of water used onsite during operation	1
Waste and wastewater treatment	Emissions from the collection, treatment and disposal of solid waste	20
	Emissions from the treatment of liquid effluent	2
Total	All operational phase emissions	1,895

Significance Assessment

14.7.24. The emission of greenhouses gases from the Scheme will lead to a long-term negative impact (global warming) on a highly sensitive international receptor (the atmosphere). However, emissions during construction and operation are expected to contribute <0.01% of London’s annual total and are therefore considered to be minor on a regional scale. The Scheme is unlikely to cause a significant effect on climate or significantly impact the UK’s ability to meet its emissions reduction targets.

14.7.25. However, due to the complex and far-reaching effects of global warming and the presence of a scientifically established and globally agreed environmental limit, all emissions are regarded as important and should be mitigated as far as possible.

14.8 Cumulative Effects

Material Assets

14.8.1. A number of cumulative schemes have been outlined within Chapter 15 for consideration when determining the likely cumulative effects associated with the site. The potential for significant cumulative effects with regards to material assets is negligible.

14.8.2. Implementation of appropriate best practice measures throughout the demolition and construction phase will ensure that the majority of potential adverse effects are reduced to negligible; therefore, not resulting in any adverse cumulative effects with other committed developments.

14.8.3. Consideration must be made to the possibility that if all utilities and operations cease to work during construction or operation, this would increase the time and resource required to address these issues, which could result in a more severe impact.

Climate Vulnerability

14.8.4. Cumulative effects can be intra-Scheme, for example the combined impact of multiple effects on a single receptor and also inter-Scheme, where more than one scheme is under construction that has potential to effect the same receptor.

14.8.5. With regard to climate change, intra- scheme effects are important. These are considered in Section 14.6, they include combined effects from climate change projections of:

- Heavy rain and wetter winters;
- Drier summers and hotter summers; and
- Warmer winters and reduced snow.

Climate Emissions

14.8.6. The effects of greenhouse gas emissions are essentially cumulative; it is their concentration in the atmosphere, not the actual level of emissions, that determines the warming effect (i.e. it is the ‘stock’ rather than the ‘flow’ which is important (Rhys, 2011)). However, it is the global excess of emissions from human activities all over the world that contributes to the overall effect on climate, not only local emissions. It is therefore not appropriate to assess the cumulative impact of the Scheme with other local developments.

14.9 Mitigation measures

Construction

14.9.1. Based on the assessment result, although potential impacts are negligible, there are design and development best practice that will be adopted to mitigate any possible impacts. All mitigation measures will be outlined in the CMP to protect material assets.

14.9.2. All existing site utility infrastructure should be dealt with appropriately through the design process, and subsequently either fully protected during construction, or suitably diverted or relocated in advance of the works. As the development designs progresses, the following steps should be considered:

Existing Infrastructure

14.9.3. All those involved in the construction should ensure all practical steps are taken to protect existing buildings and infrastructure. The contractor will be required to make their own investigations and to take all appropriate actions to safeguard existing foundations, buildings, structures, walls, roadways, sewers, cables and other services, apparatus and installations from harm, disturbance or deterioration.

Tidal defences

14.9.4. The construction methodology will be developed to ensure safeguarding of the integrity of the tidal flood walls during construction. This will also consider future defence maintenance or raising. Developments will

incorporate the recommendation of the TE2100 plan for the future tidal flood risk management in the Thames estuary.

- 14.9.5. Ensure there will be the availability of a safe evacuation route and or safe area of refuge should a defence breach occur, and the site be inundated.

Flood resilience

- 14.9.6. Construction methodology will assess options for inclusion of flood resilient measures and designs and the safety of all those involved in the construction. Care should also be taken during construction regarding storage of materials and equipment in case of the occurrence of an extreme flood event during the works.

Water drainage strategy

- 14.9.7. The design team will consider the development of a drainage strategy and drainage design as part of the detailed design stage of the Scheme. This should make full use of the Sustainable Drainage System (SuDS) techniques to restrict runoff in line with the requirements of The London Plan (Greater London Authority, 2016) and Local Plan (Westminster City Council, 2016). The SuDS can reduce the impact of urbanisation on watercourse flows and protect water quality. The design team will also follow the drainage hierarchy set out in the London Plan Section 5.13 (Greater London Authority, 2016).

- 14.9.8. Special attention will be given to maintaining the integrity of the combined water sewer running parallel to the west side of the Scheme through coordination with Thames Water. Calculation of the increase in foul water drainage from the Scheme and consultation with Thames Water will determine whether a potential increase in drainage, due to the Scheme, can be accommodated by the existing sewer system or whether further works are required to ensure that the development will not cause an increase sewer flooding risk.

Climate Vulnerability

- 14.9.9. No construction related climate change vulnerabilities have been identified. Mitigation not required.

Climate Emissions

Table 14-14 - Construction phase effects on climate mitigation measures

PAS 2070 Category	Proposed Mitigation Measures
Mobile energy use	Quantities of materials required will be reduced as far as practicable, to reduce the overall tonnage that must be transported. Materials will be specified to be sourced locally wherever possible, to reduce transport distances.
Industrial processes and product use	Energy-efficiency construction processes will be considered at design stage. Construction will be managed with a Construction Environmental Management Plan (CMP), which specified and monitors plant efficiency.
Goods and services	The CMP will also specify and monitor water efficiency. Where possible, low-carbon alternative materials will be specified in the design, for example using a cement substitution and recycled materials. Quantities of materials required will be reduced as far as practicable at the design-stage.
Waste and wastewater treatment	Waste reduction goals / targets could be set, and as many recyclable materials as possible could be used. Limit the amount of composite materials in the design, which often cannot be reused or recycled. The design should correspond with standard materials sizes where possible, to reduce offcut waste and allow for reuse at the end of the Scheme's life. Materials to be ordered to fit requirements, avoiding excess materials being delivered to site. Waste to be properly sorted, stored and managed onsite.

Operation

Material Assets

- 14.9.10. A new pumping station may be required for foul flows due to the Thames Water sewer being too shallow to connect via gravity. If the ground water level is found to affect the underground Learning Centre, a surface water pumping station may also be required. This will be confirmed by forthcoming intrusive ground investigation information. A drainage strategy plan will be designed alongside the detail of the Memorial and Learning Centre.
- 14.9.11. If hardstanding areas are significantly increased, an additional surface water drainage system may be required. This can be confirmed alongside the Scheme detailed design, as well as a site investigation and CCTV survey of any drainage networks on site.
- 14.9.12. An emergency measures plan should be implemented to outline immediate response measures to limit the impact and reduce cumulative effects if all infrastructure and material assets are to fail individually and also at the same time.

Climate Vulnerability

Mitigating against hotter summers damaging materials and reducing asset lives

- 14.9.13. Best practice construction techniques and appropriate material quality standards will be followed to ensure the design lives specified can be met. This will mitigate against reduced asset lives from hotter summers.

Mitigating against reduced air quality in hotter summers

- 14.9.14. To reduce vehicle emissions, the Scheme is proposing a green travel plan to encourage cycling, promote the use of public transport, the use of electric vehicle and low emissions vehicles.
- 14.9.15. The Air Quality Assessment (see Chapter 6) concluded that operational air quality impacts of the scheme are negligible. No further mitigation was presented.
- 14.9.16. In response to climate change the design for mechanical ventilation in the learning centre will include or have flexibility to add NOx filtration if required at a later date.

Mitigation for the adverse effects of hotter summers on public welfare

- 14.9.17. It is of high importance that the design of the learning centre allows its temperature to be maintained at a comfortable level for visitors. The buildings relatively small exposed thermal mass will assist with this by reducing its peak cooling demand.
- 14.9.18. Outdoors the proposed landscaping incorporates shaded areas and existing landscaping that also provides shading will be maintained.

Mitigation to maximise benefits from potential PV opportunities

- 14.9.19. Photovoltaic power generation is not part of the projects concept but will be considered for inclusion during the following more detailed design stages.

Mitigation for the degrading effect of drier summers on landscape

- 14.9.20. The landscape design will not include new large areas of exposed planting.
- 14.9.21. Plant species that are able to adapt to changes in climate will become more prominent in the future. This will be an important consideration during the detailed design for the selection of plants in the project area.
- 14.9.22. Irrigation is not currently considered to be necessary but this will be confirmed following completion of the detailed landscape design.

Mitigation for adverse effects on water supply and demand

- 14.9.23. The projects detailed design will specify water efficient fittings and options for rainwater recycling will be investigated during the detailed design. It is noted that this may not be feasible with regard to the proposed water features on the grounds of public health.

Mitigating against risk of subsistence

- 14.9.24. The design will follow best practice, for example avoiding steep banks.

- 14.9.25. Geotechnical surveys will be undertaken to establish the local ground conditions.
- 14.9.26. The construction will adhere to best practice, for example: correct selection of plant, equipment and construction methods, use of temporary surfacing to spread vehicle loads, appropriate phasing of the works, sufficient compacting and stabilisation of made ground and avoidance of clay soil fills (which are susceptible to swelling and shrinking in wet and dry weather respectively which can cause subsistence).

Mitigating against storm damage to protected trees

- 14.9.27. The design will not isolate any of the existing trees in the gardens. Continued gardens maintenance will identify and proactively manage any trees showing signs of instability. It is noted that vertical tree barriers will be erected along the edge of the proposed groundworks and development footprint to create a construction exclusion zone for both lines of the retained mature London plane trees that are within the site. These trees will be protected throughout the duration of the construction works through strict adherence to the BS 5837:2012 Trees in relation to design, demolition and construction.

Climate Emissions

Table 14-15 - Operational phase effects on climate mitigation measures

PAS 2070 Category	Proposed Mitigation Measures
Stationary energy use	Design will be progressed to include, where possible: <ul style="list-style-type: none"> • High performance building fabric to reduce heating and cooling demand • High efficiency energy systems • Energy efficient lighting, e.g. LEDs • Intelligent Building Management System • Consideration of renewable energy sources and heat recovery
Mobile energy use	Promotion of sustainable transport options. The site is well connected, providing many public transport alternatives for those travelling from any area of London. Lack of parking will discourage visitors from travelling by car.
Goods and services	The quantity of water used at operation stage can be mitigated by installing water-saving technologies, for example low-flush toilets. The emissions from many goods and services relate to the choices of the users and cannot be mitigated at design stage.
Waste and wastewater treatment	The quantity of liquid effluent to be treated can be reduced by installing water-saving technologies. The generation of solid wastes in the operational stage is down to the user and cannot be mitigated at design stage.

14.10 Residual Effects

Material Assets

Construction

- 14.10.1. Following the successful implementation of an approved mitigation strategy, the residual significant effects to material assets arising from the Construction Phase of the Scheme would be reduced to negligible. It is concluded that issues relating to material assets, with appropriate mitigation where required, the Scheme is unlikely to result in any significant effects on these aspects of material assets and critical infrastructure.

Operation

- 14.10.2. Following the successful implementation of an approved mitigation strategy, the residual effects of the Scheme during the operational stage on material assets would be reduced to negligible.

Climate Vulnerability

Construction

- 14.10.3. No construction related climate change vulnerabilities identified.

Operation

Hotter summers damage materials and reduce asset lives

- 14.10.4. After mitigation the impact magnitude would reduce to low / negligible. The residual effect is therefore assessed as minor / negligible.

Hotter summers reduce air quality

- 14.10.5. After mitigation the impact magnitude would reduce to low. The residual effect is therefore assessed as minor.

Hotter summers adversely affect public welfare

- 14.10.6. After mitigation the impact magnitude would reduce to negligible. The residual effect is therefore assessed as negligible.

Hotter summers increase potential for solar power generation

- 14.10.7. The extent to which PV power generation, and other green infrastructure, will be included in the design will be confirmed as the design develops. The residual effect can therefore not be assessed at this stage.

Drier summers degrade landscape

- 14.10.8. After mitigation the impact magnitude would reduce to negligible. The residual effect is therefore assessed as negligible.

Drier summers reduce availability of water supply and increase water demand

- 14.10.9. After mitigation the impact magnitude would reduce to negligible. The residual effect is therefore assessed as negligible.

Drier summers increase risk of subsistence

- 14.10.10. After mitigation the impact magnitude would reduce to low/negligible. The residual effect is therefore assessed as minor / negligible.

Stormier weather may uproot trees

- 14.10.11. After mitigation the impact magnitude would reduce to negligible. The residual effect is therefore assessed as negligible.

Climate Emissions

- 14.10.12. Mitigation measures against effects on climate form an inherent part of the project's design, therefore the assessment of emissions in this ES already takes into consideration the mitigation described in Section 14.8. For the majority of factors, the residual effects on climate are the same as those described in Section 14.6.

14.11 Summary Table

Table 14-16 – Construction and Operational phase effects on Material Assets and Climate Change

Activity	Baseline	Impact assessment			Mitigation	
Impact	Receptor	Receptor Sensitivity	Impact Severity	Effect before Mitigation	Mitigation Measures	Residual Effect
Material Assets						
Tidal defence failure	Critical infrastructure	Very High	High	Minor	Inclusion of safeguarding proposed and existing infrastructure in construction methodology.	Negligible
Tidal defence failure	Visitors	High	High	Minor	Safe evacuation plan and safe refuge area.	
Tidal defence failure	Construction Workers	High	Medium			
Surface water flood	Critical infrastructure	Very High	High	Moderate	Flood resilient measures in construction methodology.	
Surface water flood	Visitors	High	High	Moderate	Safe evacuation plan and safe refuge area.	
Surface water flood	Construction materials	Medium	High	Minor	Pumping station.	
Damage to sewer	Critical infrastructure	Very High	Medium	Moderate	SuDS design and strategy	
Damage to sewer	Visitors	High	Medium	Moderate	Safe evacuation plan and safe refuge area.	
Damage to sewer	Construction materials	Medium	Medium	Minor	SuDS design and strategy	
Failure of critical infrastructure	Critical infrastructure	Very High	High	Negligible	Emergency measures plan	
Failure of critical infrastructure	Visitors	High	High	Negligible	Safe evacuation plan and safe refuge area.	
Failure of critical infrastructure	Construction materials	Medium	High	Negligible	Emergency measures plan	
Climate Vulnerability						
Hotter summers damage materials and reduce asset lives	New assets	High	Medium	Moderate	- Best practice; - Strict material quality standards; Appropriate design.	Minor / negligible
Hotter summers reduce air quality	Visitors	High	Medium	Moderate	Particle filtration in mechanical ventilation	Minor
Hotter summers adversely effect public welfare	Visitors	High	Low	Minor	- Appropriate design; - Air conditioning; Landscaping in the gardens will provide shading.	Negligible
Hotter summers increase potential for solar power generation	PV generation capability	High	Low	Minor beneficial	<i>The extent to which PV power generation, and other green infrastructure, will be included in the design will be confirmed as the design develops. The residual effect can therefore not be assessed at this stage.</i>	
Drier summers degrade landscape	Gardens amenity	Medium	Low	Minor	Appropriate plant selection and placement.	Negligible
Drier summers reduce availability of water supply and increase water demand	Water resources	Medium	Low	Minor	- Water efficient fittings; Options for rainwater recycling will be investigated during the detailed design	Negligible
Drier summers increase risk of subsistence	Asset integrity	Medium	Medium	Moderate	- Best practice design, for example avoiding steep banks; - Geotechnical survey; Best practice construction techniques, for example compacting and stabilising ground sufficiently and avoiding the use of clay soil fills.	Minor / negligible

Activity	Baseline	Impact assessment			Mitigation	
Appropriate plant selection and placement	Negligible	Low	Low	Negligible	- The design will not isolate any of the existing trees in the gardens. Continued gardens maintenance will identify and proactively manage any trees showing signs of instability.	Negligible
Climate Emissions						
Release of greenhouse gas emissions leading to global warming.	The atmosphere.	All emissions will contribute to global warming, meaning the atmosphere could be described as a receptor of high sensitivity.	Although the impact (global warming) is global in scale, long-term in duration and irreversible in nature, due to the relatively small magnitude of emissions released, the severity of the impact is deemed to be low.	The Scheme will have an adverse impact on the atmosphere, causing global warming. However, due to the relatively small magnitude of the emissions released, the relevance is deemed to be minor.	NA	NA

15 Cumulative effects

15.1 Introduction

- 15.1.1. This chapter considers the in-combination and cumulative effects of the Scheme. The Environmental Impact Assessment (EIA) Directive and the Infrastructure Planning (EIA) Regulations 2017 ('EIA Regulations') require an ES to include the assessment of the inter-relationship between environmental topics and an assessment of cumulative effects with other development.
- 15.1.2. This assessment draws upon the guidance provided within the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 2, Part 5: Assessment and Management of Environmental Effects' (originally produced for the assessment of the effect of highways development on the water environment, although the principles are transferable to other development types) and the Planning Inspectorate (PINS) 'Advice Note Seventeen: Cumulative Effects Assessment' (December 2015), which are considered to represent best practice for cumulative effects assessments.
- 15.1.3. As set out in IEMA Guidance (2011), in-combination (synergistic) and cumulative (additive) effects are defined as:
 - Intra-projects effects or 'in-combination effects' (synergistic): These effects occur between different environmental topics within the same proposal and as a result of the development's direct effects i.e. combined effects from a single project (the inter-relationship between different environmental factors); and
 - Inter-project effects or 'cumulative effects' (additive): These effects occur as a result of the combined action of a number of different projects (defined as 'other development') cumulatively with the project being assessed and on a single resource or receptor i.e. cumulative effects from the other developments (with the project being assessed).
- 15.1.4. This chapter summarises both the cumulative effects that arise from the Scheme with other projects and the interaction between these effects and the in-combination (synergistic) effects of the scheme (for example, changes in air quality and visual impact) on groups of key receptors.

15.2 Method of assessment

In-combination Effects

Study Area

- 15.2.1. The study area for the assessment of in-combination effects of the Scheme reflects the study areas, also termed the spatial Zones of Influence (ZOI), identified within the relevant topic chapters of this ES as set out in Table 15-1 below.

Table 15-1 - Zones of Influence

Environmental Topic	Zone of Influence
Air Quality	350m
Built Heritage, Townscape and Visual	500m
Archaeology	250m
Population and Human Health	500m
Soils, Geology and Hydrogeology	350m
Biodiversity	1km

Methodology

- 15.2.2. The methodology for the in-combination effects follows DMRB Volume 11, Section 2, Part 5: Assessment and Management of Environmental Effects.
- 15.2.3. The assessment methodology for in-combination effects requires the identification of impact interactions associated with the Scheme on key environmental receptors. This ensures that the ES is not a series of separate assessments collated into one document, but rather a comprehensive assessment drawing together all the environmental effects of the proposals.
- 15.2.4. The effects identified within the technical topic chapters (chapters 6-14) have been assessed to identify potential in-combination effects using professional judgement and a qualitative assessment approach.
- 15.2.5. The receptors considered in the ES have been sub-divided into the following groups:
 - Human - residents, including community and private assets, sensitive receptors and vulnerable groups;
 - Human - all travellers, i.e. vehicle travellers, cyclists, and pedestrians;
 - Ecological receptors – protected species and existing habitats;
 - The water environment;
 - Heritage assets;
 - Geology and soils; and
 - Landscape and townscape.
- 15.2.6. Within these broad groups, individual receptors or groups of receptors that could be affected by the proposals have also been considered. The potential effects acting upon these receptors are primarily changes in traffic, noise, air quality, visual effects, and the physical environment (i.e. water, ecology, heritage). The assessment considers residual effects after mitigation has been taken into account. Receptors that are significantly adversely affected by two or more residual effects have then been identified and the range of effects likely to impact upon specific groups of receptors is described.
- 15.2.7. Combined effects of Moderate Adverse or Beneficial and above are considered significant.

Cumulative Effects

Study Area

- 15.2.8. The study area for the identification of 'other developments' for inclusion in the assessment of cumulative effects is based upon thresholds and spatial areas. These thresholds and spatial areas are based upon professional judgement and taking into account the nature and location of the Scheme and the ZOIs for individual environmental topics.
- 15.2.9. The thresholds and spatial areas have been defined as follows, recognising that larger, more significant, developments will have wider ranging environmental effects than smaller and more local developments:
 - NSIPs – All projects listed on the PINS programme of Projects - 10 km from the Scheme boundary;
 - Regionally Significant Projects and major development – 1.5 km from the Scheme boundary; and
 - Minor development – within or adjacent to the Scheme boundary.
- 15.2.10. Nationally significant projects are those that are listed on the PINS Programme of Projects.
- 15.2.11. Regionally significant projects and major developments are defined as developments which include more than 10 new houses, a site area of 0.5 ha and all mineral and waste developments.
- 15.2.12. The assessment of cumulative effects is based on a topic-by-topic identification of where the ZOIs for the Scheme and ZOIs for 'other developments' overlap, and therefore have potential for cumulative effects.

Methodology

- 15.2.13. To enable a reasonable and proportionate assessment, the following selection criteria has been used to identify and determine 'other development' which could result in potential cumulative effects with the Scheme in accordance with Table 3 in Advice Note 17:
 - Projects on the Infrastructure Planning Commission's (IPC)1 Programme of Projects;
 - Trunk road and motorway projects which have completed the statutory planning processes, including those under construction;

- Other development projects under construction or with valid planning permissions, and for which formal EIA is a requirement or for which non-statutory EIA has been undertaken;
 - Applications for consent which have been made, but which have not yet been determined;
 - Projects identified in the relevant emerging or adopted Development Plans, with appropriate weight given as they move closer to adoption, recognising that information on these proposals may be limited at present; and
 - Projects identified in other plans and programmes which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.
- 15.2.14. The developments in the above categories will only be considered in the assessment if they are considered to be 'reasonably foreseeable' and 'committed', in line with the guidance in DMRB Volume 11, Section 2, Part 5 HA 205/08.
- 15.2.15. The 'other developments' identified will then be grouped into tiers in accordance with PINS Advice Note. This grouping reflects the likely degree of certainty attached to each development, with Tier 1 being the most certain and Tier 3 being the least certain and most likely to have limited publicly available information to guide the assessment. A description of the tiers is provided in Table 15-2.

Table 15-2 - 'Other Development' for inclusion in the CEA

Tier	Likely Degree of Certainty	
Tier 1	<ul style="list-style-type: none"> a) Under construction⁸⁵. b) Permitted application(s) whether under the Planning Act 2008 or other regimes but not yet implemented. c) Submitted application(s) whether under the Planning Act 2008 or other regimes but not yet determined. 	Decreasing level of detail likely to be available 
Tier 2	a) Projects on the Planning Inspectorate's Programme of Projects where a Scoping Report has been submitted.	
Tier 3	<ul style="list-style-type: none"> a) Projects on the Planning Inspectorate's Programme of Projects where a Scoping Report has not been submitted. b) Identified in the relevant Development Plan (and emerging Development Plans – with appropriate weight being given closer to adoption) recognising that information on any relevant proposals will be limited. c) Identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals where such development is reasonable likely to come forward. 	

- 15.2.16. Rather than reporting every interaction, the methodology for the assessment of cumulative effects concentrates on the main significant effects, and aims to differentiate between permanent, temporary, direct, indirect and secondary effects, positive or negative.
- 15.2.17. Where significant cumulative effects, beyond those identified as residual effects from the Scheme in isolation, have been identified, additional mitigation measures are recommended.
- 15.2.18. The significance of cumulative effects on each environmental receptor group has then been made based on the balance of scores and using professional judgement.

15.3 Significance Criteria

- 15.3.1. The assessment of significance of in-combination and cumulative effects has been undertaken in accordance with guidance in DMRB Volume 11, Section 2, Part 5 (HA205/08). The value and magnitude of impact has been determined by the criteria set within the individual topic chapters of this ES and applied to any residual effects. The description of significance also takes account of the guidance in PINS Advice Note

17 to consider the capacity of environmental resources and receptors to accommodate any changes that are likely to occur. Paragraph 3.4.8 states that consideration should be given to the following:

- The duration of effect (temporary or permanent);
- The extent of effect (the geographical area of an effect);
- The type of effect, whether additive (e.g. loss of two areas of woodland of 1 ha, resulting in 2 ha cumulative woodland loss) or synergistic (e.g. two discharges combine to affect a species which is not affected by a single discharge);
- The frequency of the effect;
- The 'value' and resilience of the receptor affected; and
- The likely success of mitigation.

- 15.3.2. Table 15-3 provides typical descriptors of effects in determining the significance of effect category for the combined and cumulative effects assessment. Effects are significant if Moderate, Large or Very Large.

Table 15-3 - In-Combination and Cumulative Effects Significance Descriptors

Significance Category	Typical descriptors of effects resulting from the in-combination or cumulative effects of the scheme.
Very Large (Adverse or Beneficial)	Effects that the decision-maker must take into account as the receptor/resource is irretrievably compromised. Effects would be: <ul style="list-style-type: none"> • Permanent and far reaching for receptors of very high value • Key factor in decision making proves • Damaging impact for site or feature of international, national or regional importance • May include major change in a site or feature of local importance
Large (Adverse or Beneficial)	Effects that may become key decision-making issue. Effects would be: <ul style="list-style-type: none"> • Permanent and far reaching for receptors of high value • Localised for a receptor of very high value • Temporary for receptor of very high value • Very important consideration and material in the decision-making process
Moderate (Adverse or Beneficial)	Effects that are unlikely to become issues on whether the project design should be selected, but where future work may be needed to improve on current performance. Effects would be: <ul style="list-style-type: none"> • Permanent and far reaching for receptors of medium value • Localised for receptors of high value • Temporary for a receptor of high value • Effects may be important, but are not likely to be key decision-making factors
Slight (Adverse or Beneficial)	Effects that are locally significant. Effects would be: <ul style="list-style-type: none"> • Permanent and far reaching for receptors of low value • Localised for receptors of medium value • Temporary for a receptor of medium value • Unlikely to be critical in the decision-making process

⁸⁵ Where other projects are expected to be completed before construction of the proposed scheme and the effects of these projects are fully determined, effects arising from them should be considered as part of the baseline and may be considered as part of the construction and operation assessment.

Neutral	Where the positive or negative effects of the Scheme or the combined effects of the Scheme in association with other existing or more than likely / near certain future major developments would balance. No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.
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Table Source: Based on Table 2.6 of DMRB Volume 11 Section 2 Part 5 HA 205/08

15.4 Other Developments

- 15.4.1. As part of Stage 1 which comprises the identification of the ZOI and a Long List of 'Other Development', a provisional list of 'Other Development' was compiled through searches of local authority planning webpages for planning applications and consents and a review of allocated and proposed sites in local plans. In accordance with guidance in DMRB, the relevant Local Planning Authorities (Westminster City Council and Lambeth London Borough Council) were also consulted to determine whether any other developments in the vicinity of the Scheme should be taken into consideration and when they believe these to be likely to come forward. The Stage 1 Long List of 'Other Development' is included in Appendix N in Volume 5 presented in a tabular format in accordance with the methodology in PINS Advice Note 17.
- 15.4.2. As part of Stage 2 (identify Shortlist of 'Other Development'), the Long List of developments was then reviewed and filtered against the threshold criteria identified in the Methodology section above. The projects shortlisted for further consideration at Stage 2 are indicated in the table in Appendix N in Volume 5 and summarised in Table 15-4 below. The Local Planning Authorities were then consulted on the proposed Stage 2 Short List.
- 15.4.3. The locations of the Stage 2 Short List developments, in relation to the Scheme and the respective ZOIs that these developments fall into, are shown on Figure 15.1 in Volume 4.
- 15.4.4. Figure 15.2 in Volume 4 shows the location of each of the 'other developments' in relation to the Scheme and the respective ZOIs that these developments fall into.
- 15.4.5. The list of proposed developments to be considered in the cumulative effects assessment is presented in Table 15-4 below. This has been developed with the knowledge and information available at the time of publishing the ES.

Table 15-4 - Short List of 'Other Development'

Development	App. No.	Distance from site (km)	Description
9 Ergon House	16/06616/FULL	0.22	Construction of residential building on the site of Ergon House of nine storeys above ground to provide up to 108 residential units, provision of ground floor level retail unit (Class A1) and associated basement works, Deed of Variation to the S106 legal agreement for planning permission 13/09737/FULL in order to apply relevant provisions to this current application. (9 Millbank and The Gatehouse, Dean Bradley Street and demolition of Ergon House to be implemented under planning permission reference 13/09737/FULL)
63 Buckingham Gate	14/03631/FULL	0.65	Recladding and reconfiguration of the tower building to provide 65 residential flats, Class B1 office use and Class A1 retail. Construction of six storey building for B1 office use and Class A retail (A1 and A2 or A3) on Caxton Street and four storey building comprising B1 office use and Class A1 retail on Buckingham Gate. Retention of existing basement levels. Associated works including highway works, new mechanical plant, car and cycle parking provision and loading facilities.
29 Great Peter Street	15/07819/FULL	0.13	Removal of existing roof and construction of new roof extension incorporating roof level plant; construction of extensions at lower ground to fifth floor level within rear lightwell; associated alterations

Development	App. No.	Distance from site (km)	Description
			to front and rear facade in association with the use of the building as 14 residential flats (Class C3).
55 Broadway	14/10496/FULL	0.55	Change of use of 55 Broadway on part first to thirteenth floors from offices to private residential (77 units) including extensions at tenth floor level; use of part first floor as B1 offices and reconfiguration of ground floor retail. Part demolition and redevelopment of 100 Petty France and Wing Over Station to provide affordable residential accommodation (35 units) and associated car parking (43 spaces).
8 Broadway	15/07497/FULL	0.50	Demolition of existing buildings and erection of mixed use development comprising office (Class B1) and retail (Classes A1 & A3) across x2 four storey podiums, each with three residential buildings above (total of x6 residential buildings) ranging from 14 to 20 storeys high, providing residential units (including affordable residential units). Provision of new walkway and landscaping between the podiums and a retail pavilion at ground level. Erection of up to three basement levels comprising residential facilities, cycle storage (commercial and residential), plant and parking spaces.
32-34 Great Peter Street	15/07778/FULL	0.37	Demolition of the existing building and redevelopment of the site to provide 21 residential units (15 x private residential units and 6 x affordable residential units) (Class C3) in a new eight storey building (basement with sub-basement, ground plus seven upper floors) with the provision of car parking, plant and associated works.
99-105 Grenadier House	15/11404/FULL	0.54	Demolition and redevelopment of the site to provide a residential complex comprising 36 units of self-contained assisted living accommodation integrated with facilities including communal kitchen-cafe, storage areas, wellness centre/spa, guest accommodation, staff accommodation, staff offices, in two linked buildings of six storeys each, internal courtyard, roof terraces, excavation to create basement storage and 36 car parking spaces with access from Horseferry Road.
29-35 Old Queen Street	16/01796/FULL	0.48	Use of the building to provide 16 self-contained flats and associated external alterations including remodelling of existing mansard, creation of a roof extension, associated plant and roof terrace and replacement of windows.
14 Great Peter Street	15/01059/FULL	0.23	Use of building for residential purposes comprising 29 units (Class C3). Construction of extension to rear at lower ground to third floor level and roof extension at sixth floor level with roof terrace. Relocation of roof top plant.
4 Greycoat Place	16/05216/FULL	0.60	Use of the Fire Station (ground floor) as Class A3 and (four upper floors) as Class C3 use (6 flats) with associated internal and external alterations. Demolition of the existing rear buildings and replacement with a five-storey residential building to provide 11 flats with balconies, excavation of one storey basement under the entire footprint of the site to accommodate A3 use and residential use. Installation of photovoltaic panels to roof level of rear building. Rebuilding of the existing rear tower with installation of plant on top.
19 Dacre Street	17/01327/FULL	0.46	Erection of a two-storey roof extension and infill extension at rear ground to fifth floor levels to provide additional office accommodation (Class B1). Use of the basement and ground floor levels to provide retail (Class A1) and restaurant (Class A3) uses. Complete facade refurbishment to all elevations. Provision of

Development	App. No.	Distance from site (km)	Description
			terraces at rear second to seventh floor levels. Installation of mechanical plant and lift overrun within an enclosure at roof level.
Old War Office Whitehall	17/09368/FULL	0.93	Variation of Conditions 1, 13, 16, 7(a), 9, 38 and removal of Condition 40 of planning permission dated 10 July 2017 (16/09548/FULL) for alterations to the existing building including creation of new entrances; alterations to bottle balustrades & parapets; extensions to create three additional storeys; two additional basement storeys; partial demolition & reconstruction of the central wing; demolition, reconstruction & extensions to the Triangular Courtyard facades; external alterations to Quadrangle facades; creation of external terraces at fourth, fifth, sixth & seventh floor levels; addition of entrance canopies; alterations to security walls & bollards & the removal & replacement of street trees; all in connection with change of use from offices (Class 81) to a hotel (Class C1) comprising up to 125 hotel bedrooms/suites with flexible hotel/retail/restaurant/bar use at part ground floor (Class C1/A1/A3/A4), flexible hotel/restaurant use at part lower ground, part ground & part second floors (Class C1/A3); flexible hotel/bar use at part fifth & part sixth floors (Class C1/A4); flexible retail, leisure, restaurant or bar use at part ground floor (Class A1/D2/C1/A3/A4), leisure/spa facilities within the basement levels & part lower ground floor (Class D2/C1) ancillary ballroom, event space & meeting rooms, food & beverage facilities, back of house facilities & associated car & cycle parking & servicing facilities; creation of up to 88 residential dwellings (Class C3) with ancillary communal amenities, & associated car parking, cycle parking & servicing facilities; NAMELY a reduction in residential dwellings (Class C3) from up to 88 to up to 85; amendments to the Quadrangle & Triangular Courtyard; additional excavation to create up to two additional basement storeys; additional roof level plant; & associated external alterations
1-3 Queen Anne's Gate	13/12539/FULL and 16/05060/FULL	0.54	Demolition behind retained facade of 1-3 Queen Anne's Gate including rebuilding of mansard; facade retention of No. 9 Dartmouth Street up to second floor level; demolition and reconstruction of Dartmouth Street corner of 1-3 Queen Anne's Gate, former No. 8 and No. 11 Dartmouth Street and demolition and redevelopment of 12-15 Dartmouth Street and 12-14 Carteret Street to provide a building of two basements, lower ground, ground and five upper floors comprising 36 residential units (including 12 affordable/ intermediate rented units) (7 x 1-bed, 17 x 2-bed, 10 x 3-bed, 1 x 4-bed and 1 x 5-bed units) with car parking for 33 cars in an automated car stacker system at basement level accessed from Carteret Street and plant enclosure at roof level. (Site includes 1-3 Queen Anne's Gate; 8, 9, 11 and 12-15 Dartmouth Street; and 12 - 14 Carteret Street).
52 Horseferry Road	15/07690/FULL	0.25	Demolition of Dean Bradley House and redevelopment to provide a building of double basement, ground, and nine upper floors accommodating 263 sqm of retail floorspace (Class A1/A3) at ground floor level, 975 sqm of office floorspace (Use Class B1) at first floor level and 45 residential units (Class C3) at second to ninth floor levels (14 x 1 bed units; 18 x 2 bed units; 12 x 3 bed units; and 1 x 4 bed unit) with balconies, with car and cycle parking at basement level. Creation of a separate gatehouse building comprising 3 residential units (Class C3) at first and second floors (2

Development	App. No.	Distance from site (km)	Description
			x 1 bed units and 1 x 2 bed duplex unit) accessed from Romney Street. Installation of plant at ninth floor level. Landscaped communal areas and servicing area.
20 Great Smith Street	17/09875/FULL	0.27	Demolition of roof plant room and roof light structure; construction of office (B1) floor at level 9 with plant above; remodelling of mansard at level 8; installation of window openings to the Abbey Orchard Street elevation; alterations to Great Smith Street elevation at ground floor level; change of use to cafe (Class A3) at part ground floor level; and associated internal alterations. Provision of a terrace at sixth floor level fronting Great Smith Street and at ninth floor level fronting Great Smith Street and Abbey Orchard Street [Site includes Sanctuary Buildings, Orchard House and Park House].
22 – 29 Albert Embankment	14/04757/FUL and 16/01103/VOC	0.73	Demolition of existing buildings and redevelopment to provide a part 12, part 18 and part 30 storeys mixed-use development comprising flexible A1, A3, B1 uses and C3 residential units, together with associated access, car parking, cycle parking, refuse storage, and landscaping
36-46 Albert Embankment	16/00795/FUL	0.89	Demolition of all structures associated with the petrol filling station and redevelopment of the site to provide a residential led, mixed use development, comprising the retention and refurbishment of vintage house and development of ground plus 24 storeys in the form of two no. towers, linked at ground to fifth floor, and consisting of retail/restaurant use (Use Class A1/A3), office (Use Class B1), up to 166 residential units (Use Class C3), basement car and bicycle parking, resident amenities and all necessary ancillary and enabling works
Thames Tideway Tunnel (and Albert Embankment)	DCO Application and 18/02641/TTT for foreshore works.	0.50	Thames Tideway Tunnel (Albert Embankment): Work comprises construction of a new area of reclaimed land in the foreshore, in front of Camelford House for a shaft approximately 48 metres deep with an internal diameter of approximately 16 metres. Connection to the existing sewers will be made within a second new area of reclaimed land underneath Vauxhall Bridge and in front of the Vauxhall Cross building. These two areas will be connected via a pipe constructed under the foreshore. The shaft is required to transfer sewage flows from the combined sewer overflows to the main tunnel. Associated works (18/02641/TTT): Application for approval of extent of new foreshore structure, under Schedule 3 Requirement ALBEF2 Part 2 of the Thames Water Utilities Limited (Thames Tideway Tunnel) Order 2014 (as amended).
Westminster Bridge	18/03776/LBC and 18/03775/FULL	0.40	The architectural illumination, as part of the Illuminated River proposal, of the Westminster Bridge, including the installation of fixtures, fittings and ancillary equipment and associated works. (Town Planning ref: 18/01991/EIAFUL and Listed Building Consent ref: 18/01992/LB applications received).
Lambeth Bridge	18/03778/LBC and 18/03777/FULL	0.07	The architectural illumination, as part of the Illuminated River proposal, of Lambeth Bridge, including the installation of fixtures, fittings and ancillary equipment and associated works. (Planning and Listed Building Consent Applications 18/01993/EIAFUL and 18/01994/LB).

15.5 In-Combination Effects Assessment

15.5.1. The baseline for each environmental topic is described in detail for Air Quality; Built Heritage, Townscape and Visual (HTVIA); Archaeology; Population and Human Health; Soils, Geology and Hydrogeology; Biodiversity; Water Quality and Flood Risk; Traffic and Transport; and Material Assets and Climate Change in the preceding chapters (Chapters 6 to 14) of this ES.

Construction

- 15.5.2. Slight adverse (not significant) in-combination effects are anticipated to occur on human receptors (residents) as the result of previously assessed significant and temporary adverse effects on human health and the additional effects on wellbeing as a result of loss of visual amenity. The additional effect of the loss of visual amenity on human health is small, temporary and not significant. Similarly, slight adverse in-combination effects are anticipated for humans (all travellers) as a result of reduced pedestrian amenity and potential loss of views for all travellers, which would add to this amenity effect.
- 15.5.3. No additional in-combination effects are anticipated on heritage assets as these are already fully assessed within the HTVIA.
- 15.5.4. No in-combination effects are anticipated to affect ecological receptors, the water environment, geology and soils, or landscape and townscape.
- 15.5.5. The overall in-combination effect during construction is **sight adverse**.

Table 15-5 - Residual in-Combination Effects during Construction

Receptor	Air Quality	Built Heritage, Townscape & Visual	Archaeology	Population and Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets	Significance of Combined Effects
Human - residents, including community and private assets, sensitive receptors and vulnerable groups;	Negligible	Temporary Minor Adverse effects on View nos. 9, 11, 12, 13, 22, 18, 19, 21, 20, 16 and 17. The effects on the other medium to distant views are negligible- nil.	None	Inherently takes into account in-combination effects from health determinants e.g. noise, air quality. Significant adverse effects on Population and Human Health via impacts on open space, recreational and leisure-time facilities during construction and reduced green space and land blight during operation, which could lead to a minor detrimental impact on physical health, mental and social wellbeing, particularly for vulnerable groups.	Minor adverse-Vibration due to piling, earthworks and plant movement affecting neighbouring structures and buildings (e.g. listed buildings, memorials and river wall)	None	Negligible	None	N/A	Slight Adverse: Population and Human Health chapter is inherently an in-combination effects assessment. However, additional in-combination effects arising from loss of visual amenity may occur. As noted in the P&HH chapter this may have detrimental effects on mental and social wellbeing. Visual effects are not considered to play a significant role in health effects. Health effects would principally be concerned with loss of open and green space. This effect would be temporary and localised in nature and the in-combination significance of loss of visual amenity and health effects on human residents is considered to be slight adverse additional in-combination effects on those already assessed.
Human - all travellers, i.e. vehicle travellers, cyclists, and pedestrians;	None	Temporary Minor Adverse effects on View nos. 9, 11, 12, 13, 22, 18, 19, 21, 20, 16 and 17. The effects on the other medium to distant views are negligible- nil.	None	Inherently takes into account in-combination effects from health determinants e.g. noise, air quality. Significant adverse effects on Population and Human Health via impacts on open space, recreational and leisure-time facilities during construction and reduced green space and land blight during operation, which could lead to a minor detrimental impact on physical health, mental and social wellbeing, particularly for vulnerable groups.	Minor adverse effect on off-site pedestrians and school children visiting the education centre due to wind-blown dust Minor adverse effect on construction workers and off-site pedestrians due to unexploded ordnance detonation.	None	Negligible	Medium adverse effect on pedestrian amenity for existing visitors to Victoria Tower Gardens. Low for all other receptors	N/A	Slight Adverse: Soils and geology residual effects may affect off-site pedestrians; however, the Traffic and Transport assessment already considers loss of amenity on pedestrians (including dust) therefore any further in-combination effect assessment would constitute a duplication of assessment. However, the amenity assessment does not consider loss of visual amenity on pedestrians. There may be additional in-combination effects resulting in reduced amenity between reduced access and temporary loss of views. Therefore, slight adverse effects have been assessed. In the event of detonation of unexploded ordnance, it is not considered that the nearby area would be used for open space, recreational and leisure time facilities and therefore in-combination effects are not considered in this scenario.
Ecological receptors – protected species and existing habitats;	None	None	None	None	None	Not significant	None	None	N/A	No significant in-combination effects

Receptor	Air Quality	Built Heritage, Townscape & Visual	Archaeology	Population and Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets	Significance of Combined Effects
The water environment;	Negligible	None	None	None	None	Not significant	Negligible	None	N/A	No significant in-combination effects
Heritage assets;	None	Moderate adverse (temporary) effect on the Victoria Tower Gardens Registered Park (Grade II) and Buxton Memorial Fountain (Grade II*). Temporary minor adverse effect on the heritage value of the following receptors: <ul style="list-style-type: none"> - Statuary Group of the Burghers of Calais (Grade I) - Statue of Mrs Emmeline Pankhurst (Grade II) - River Embankment from the Houses of Parliament to Lambeth Bridge (Grade II) - Westminster Abbey and Parliament Square Conservation Area All other heritage receptors experience Negligible or Nil effects.	Negligible	None	Minor adverse-Vibration due to piling, earthworks and plant movement. Minor adverse-Detonation of unexploded ordnance on neighbouring structures.	None	None	None	N/A	No additional significant in-combination effects: The HTVIA assessment inherently assesses construction activities including vibration effects. Therefore, assessing these as in-combination effects would be a duplication of the HTVIA assessment.
Geology and soils; and	None	None	None	None	Minor adverse effect due to regional requirements on off-site reuse of soil; Minor adverse on regional landfill availability due to disposal to landfill	None	None	None	N/A	No significant in-combination effects
Landscape and townscape	None	Temporary Moderate Adverse effect on Character Area 1: Victoria Tower Gardens. All other townscape receptors experience Negligible or Nil effects.	None	None	None	None	None	None	N/A	No significant in-combination effects
Overall in-combination effect during construction phase										Slight Adverse

Operation

15.5.6. Human receptors (residents) may experience in-combination moderate beneficial effects, which would be considered significant. It is considered that the Scheme would encourage activity in the area and the landscaping and architectural value would enhance the character of the area, whilst being in-keeping with the current function and uses. The proposed slope would enhance visitor's enjoyment of the relationship between the park and the world heritage site, by providing enhanced views. The Scheme will provide additional opportunities for social interaction, learning and employment which will have beneficial health effects on residents.

15.5.7. Human receptors (all travellers) would similarly benefit from local improvements to landscaping and improvements to footpaths, as well as an improvement to amenity of routes due to reduced traffic flows. Subsequently, a moderate beneficial in-combination effect is anticipated, though where there is a reduction in visual amenity this may be reduced to slight beneficial.

15.5.8. Ecological receptors, the water environment, heritage assets, geology and soils, and landscape and townscape are not anticipated to experience in-combination effects.

15.5.9. The overall operational phase for the Scheme is considered to have **moderate beneficial** in-combination effects.

Table 15-6 - Residual in-Combination Effects during Operation

Receptor	Air Quality	Built Heritage, Townscape & Visual	Archaeology	Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets	Significance of Combined Effects
Human - residents, including community and private assets, sensitive receptors and vulnerable groups;	Negligible	Medium to distant visual impacts are limited in nature and are minor beneficial in their effect, or negligible Moderate adverse (View no. 13) to moderate beneficial (View Nos. 14, 16, 17, 18, 20 and 22)	None	Significant beneficial effects on Population and Human Health during operation via improved social cohesion and lifetime neighbourhoods, social norms and attitudes, access to work and training, and provision of a high-quality Memorial and Learning Centre designed with health, safety security and wellbeing in mind, for wider and vulnerable groups to enjoy. This would improve physical health, mental and social wellbeing.	Minor adverse effect on neighbouring basements due to groundwater flooding due to obstruction by new underground structures.	None	Negligible	None	N/A	Moderate Beneficial: In-combination effects are likely to be beneficial for residents with improved social cohesion and lifetime neighbourhoods through the provision of the Memorial and Learning Centre. However, this may be reduced by the reduction in visual amenity at some locations to Slight Beneficial. Groundwater flooding would affect private dwellings and as such this would not constitute an in-combination effect.
Human - all travellers, i.e. vehicle travellers, cyclists, and pedestrians;	None	Medium to distant visual impacts are limited in nature and are minor beneficial in their effect, or negligible Moderate adverse (View no. 13) to moderate beneficial (View Nos. 14, 16, 17, 18, 20 and 22)	None	Significant beneficial effects on Population and Human Health during operation via improved social cohesion and lifetime neighbourhoods, access to work and training, improved footpath and cycle lane environment., This would improve physical health, mental and social wellbeing	None	None	Negligible	Medium beneficial effect on pedestrian amenity for existing visitors to Victoria Tower Gardens due to reduced traffic flows. Low to all other receptors.	N/A	Moderate Beneficial: In-combination effects are likely to be beneficial with improved footpath and cycle lane environment and improved pedestrian amenity. However, this may be reduced by the reduction in visual amenity at some locations to slight beneficial.
Ecological receptors – protected species and existing habitats;	None	None	None	None	None	Not significant	None	None	N/A	No significant in-combination effects
The water environment;	None	None	None	None	None	None	Negligible	None	N/A	No significant in-combination effects

Receptor	Air Quality	Built Heritage, Townscape & Visual	Archaeology	Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets	Significance of Combined Effects
Heritage assets;	None	<p>Moderate Beneficial effect on the heritage value of the following receptors:</p> <ul style="list-style-type: none"> - Palace of Westminster, Westminster Abbey and St Margaret's Church World Heritage Site - Houses of Parliament and the Palace of Westminster (Grade I) - Statuary Group of the Burghers of Calais (Grade I) - Buxton Memorial Fountain (Grade II*) - Victoria Tower Gardens Registered Park (Grade II) - Westminster Abbey and Parliament Square Conservation Area <p>Minor Beneficial effect on the heritage value of the following receptors:</p> <ul style="list-style-type: none"> - River Embankment from the Houses of Parliament to Lambeth Bridge <p>All other heritage receptors experience Negligible or Nil effects.</p>	Minor adverse effect on Palaeo-environmental remains due to dewatering during construction, effect continues into operation phase (mitigation only in construction phase).	None	Minor adverse effect on neighbouring basements due to groundwater flooding due to obstruction by new underground structures.	None	None	None	N/A	No significant in-combination effects. Whilst no definitive lateral extent for effects of groundwater flooding on neighbouring basements is given, it is understood that the effects would be limited to the immediate vicinity of the Scheme and is therefore unlikely to have in-combination effects on heritage assets.
Geology and soils; and	None	None	None	None	None	None	None	None	N/A	No significant in-combination effects
Landscape and townscape	None	Moderate Beneficial effect on Character Area 1: Victoria Tower Gardens and Character Area 2: Westminster World Heritage Site and Parliament Square.	None	None	None	None	None	None	N/A	No significant in-combination effects

Receptor	Air Quality	Built Heritage, Townscape & Visual	Archaeology	Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets	Significance of Combined Effects
		Minor Beneficial effect on the following townscape receptors: <ul style="list-style-type: none"> - Character Area 3a: Millbank - Character Area 4: The River Thames - Character Area 5: St Thomas' Hospital - Character Area 7: Albert Embankment - Character Area 10: Smith Square All other townscape receptors experience Negligible or Nil effects.								
Overall in-combination effect during operation phase										Moderate Beneficial

15.6 Cumulative Effects Assessment

Construction

15.6.1. No significant cumulative effects are anticipated across the topics and across the shortlisted developments. The Geology and Soils assessment has concluded that there is potential for adverse cumulative effects between the Scheme and 9 Ergon House due to the groundwater and soils suspected to be present below

the site. There is the potential for the mobilisation of contaminants at 9 Ergon House and surplus off-site material during construction, however, these effects are not anticipated to be significant.

Table 15-7 - Summary of Cumulative Effects between 'Other Developments' and the Scheme during Construction

Development	Distance from Site (km)	Air Quality	Built Heritage, Townscape & Visual	Archaeology	Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets and Climate Change
9 Ergon House	0.22	None	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments. None	Inherently takes into account cumulative effects due to incorporation in findings of technical chapters on which human health is assessed e.g. noise, air quality. Traffic congestion, dust and noise may reduce amenity temporarily, however mitigation and best practice would be	Based on the soils and groundwater suspected to be present below the site there may be adverse cumulative effects from the mobilisation of contaminants at this neighbouring site, as well as movement of surplus material off-site during the construction works.	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	<u>Surface Water Quality</u> Identified as potential cumulative effect risk. Standard best practice for pollution control and emergency procedures during construction noted in application. Physically separated from River Thames and therefore considered to have cumulative effects of negligible significance. <u>Flood Risk</u>	This site if built concurrently may result in construction vehicle movements along Millbank. However, this is anticipated to have a low impact on traffic movement. Transport impacts of cumulative construction on receptors will be low in severity. Negligible	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible.

Development	Distance from Site (km)	Air Quality	Built Heritage, Townscape & Visual	Archaeology	Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets and Climate Change
					anticipated to reduce this effect to negligible. Negligible	Adverse		Negligible cumulative effect. Negligible		
63 Buckingham Gate	0.65	None	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments. None	None	None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	<u>Surface Water Quality</u> No cumulative effects anticipated. <u>Flood Risk</u> Negligible cumulative effect. Negligible	Transport impacts of cumulative construction on receptors will be low in severity. Negligible	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible.
29 Great Peter Street	0.13	None	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments. None	Inherently takes into account cumulative effects due to incorporation in findings of technical chapters on which human health is assessed e.g. noise, air quality. Traffic congestion, dust and noise may reduce amenity temporarily, however mitigation and best practice would be anticipated to reduce this effect to negligible. Negligible	None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	<u>Surface Water Quality</u> No cumulative effects anticipated. <u>Flood Risk</u> Negligible cumulative effect. Negligible	Not able to assess as construction management plan did not state vehicle numbers, however if built concurrently may have low impact on traffic movement along Millbank. Transport impacts of cumulative construction on receptors will be low in severity.	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible.
55 Broadway	0.55	No significant cumulative effects anticipated due to appropriate mitigation used at both schemes.	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments. None	None	None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	<u>Surface Water Quality</u> No cumulative effects anticipated. <u>Flood Risk</u> Negligible cumulative effect. Negligible.	Transport impacts of cumulative construction on receptors will be low in severity. Negligible	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible.

Development	Distance from Site (km)	Air Quality	Built Heritage, Townscape & Visual	Archaeology	Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets and Climate Change
8 Broadway	0.50	None	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments. None	None	None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	<u>Surface Water Quality</u> No cumulative effects anticipated. <u>Flood Risk</u> Negligible cumulative effect. Negligible.	Transport impacts of cumulative construction on receptors will be low in severity. Negligible	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible.
32-34 Great Peter Street	0.37	No significant cumulative effects anticipated due to appropriate mitigation used at both schemes.	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments. None	Inherently takes into account cumulative effects due to incorporation in findings of technical chapters on which human health is assessed e.g. noise, air quality. Traffic congestion, dust and noise may reduce amenity temporarily, however mitigation and best practice would be anticipated to reduce this effect to negligible. Negligible	None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	<u>Surface Water Quality</u> No cumulative effects anticipated. <u>Flood Risk</u> Negligible cumulative effect. Negligible	Transport impacts of cumulative construction on receptors will be low in severity. Negligible	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible.
99-105 Grenadier House	0.54	None	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments. None	None	None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	<u>Surface Water Quality</u> No cumulative effects anticipated. <u>Flood Risk</u> Negligible cumulative effect. Negligible	Transport impacts of cumulative construction on receptors will be low in severity. Negligible	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible.
29-35 Old Queen Street	0.48	None	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other	Inherently takes into account cumulative effects due to incorporation in findings of technical chapters on which human health is	None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with	<u>Surface Water Quality</u> No cumulative effects anticipated. <u>Flood Risk</u>	Transport impacts of cumulative construction on receptors will be low in severity. Negligible	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability

Development	Distance from Site (km)	Air Quality	Built Heritage, Townscape & Visual	Archaeology	Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets and Climate Change
				concurrent developments. None	assessed e.g. noise, air quality. Traffic congestion, dust and noise may reduce amenity temporarily, however mitigation and best practice would be anticipated to reduce this effect to negligible. Negligible		other developments/projects. None	Negligible cumulative effect. Negligible		Negligible.
14 Great Peter Street	0.23	None	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments. None	Inherently takes into account cumulative effects due to incorporation in findings of technical chapters on which human health is assessed e.g. noise, air quality. Traffic congestion, dust and noise may reduce amenity temporarily, however mitigation and best practice would be anticipated to reduce this effect to negligible. Negligible	None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	<u>Surface Water Quality</u> No cumulative effects anticipated. <u>Flood Risk</u> Negligible cumulative effect. Negligible	This site if built concurrently may result in construction vehicle movements along Millbank. However, this is anticipated to have a low impact on traffic movement. Transport impacts of cumulative construction on receptors will be low in severity. Transport impacts of cumulative construction on receptors will be low in severity. Negligible	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible.
4 Greycoat Place	0.60	None	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments. None	None	None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	<u>Surface Water Quality</u> No cumulative effects anticipated. <u>Flood Risk</u> Negligible cumulative effect. Negligible	Transport impacts of cumulative construction on receptors will be low in severity. Negligible	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible.
19 Dacre Street	0.46	None	No material cumulative effect anticipated.	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme	Inherently takes into account cumulative effects due to incorporation in findings of technical chapters on which human health is	None	No cumulative effects on the ecological features are anticipated when the Scheme is	<u>Surface Water Quality</u> No cumulative effects anticipated. <u>Flood Risk</u>	Transport impacts of cumulative construction on receptors will be low in severity.	Negligible cumulative effects with regards to material assets.

Development	Distance from Site (km)	Air Quality	Built Heritage, Townscape & Visual	Archaeology	Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets and Climate Change
			None	combined with other concurrent developments. None	assessed e.g. noise, air quality. Traffic congestion, dust and noise may reduce amenity temporarily, however mitigation and best practice would be anticipated to reduce this effect to negligible. Negligible		combined with other developments /projects. None	Negligible cumulative effect. Negligible	Negligible	Negligible cumulative effects on climate vulnerability Negligible.
Old War Office Whitehall	0.93	None	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments. None	None	None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments /projects. None	<u>Surface Water Quality</u> No cumulative effects anticipated. <u>Flood Risk</u> Negligible cumulative effect. Negligible	Transport impacts of cumulative construction on receptors will be low in severity. Negligible	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible.
1-3 Queen Anne's Gate	0.54	None	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments. None	None	None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments /projects. None	<u>Surface Water Quality</u> No cumulative effects anticipated. <u>Flood Risk</u> Negligible cumulative effect. Negligible	Transport impacts of cumulative construction on receptors will be low in severity. Negligible	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible.
52 Horseferry Road	0.25	No significant cumulative effects anticipated due to appropriate mitigation used at both schemes.	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments. None	Inherently takes into account cumulative effects due to incorporation in findings of technical chapters on which human health is assessed e.g. noise, air quality. Traffic congestion, dust and noise may reduce amenity temporarily, however mitigation and	None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments /projects. None	<u>Surface Water Quality</u> No cumulative effects anticipated. <u>Flood Risk</u> Negligible cumulative effect. Negligible	This site if built concurrently may result in construction vehicle movements along Millbank. However, this is anticipated to have a low impact on traffic movement. Transport impacts of cumulative construction on receptors will be low in severity. Transport impacts of cumulative	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible..

Development	Distance from Site (km)	Air Quality	Built Heritage, Townscape & Visual	Archaeology	Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets and Climate Change
					best practice would be anticipated to reduce this effect to negligible. Negligible				construction on receptors will be low in severity. Negligible	
20 Great Smith Street	0.27	No significant cumulative effects anticipated due to appropriate mitigation used at both schemes.	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments. None	Inherently takes into account cumulative effects due to incorporation in findings of technical chapters on which human health is assessed e.g. noise, air quality. Traffic congestion, dust and noise may reduce amenity temporarily, however mitigation and best practice would be anticipated to reduce this effect to negligible. Negligible	None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	<u>Surface Water Quality</u> No cumulative effects anticipated. <u>Flood Risk</u> Negligible cumulative effect. Negligible	Transport impacts of cumulative construction on receptors will be low in severity. Negligible	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible.
22 – 29 Albert Embankment	0.73	None	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments. None	None	None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	<u>Surface Water Quality</u> Identified as potential cumulative effect risk. Standard best practice for pollution control and emergency procedures during construction noted in application. Physically separated from River Thames and therefore considered to have cumulative effects of negligible significance. <u>Flood Risk</u> Negligible cumulative effect. Negligible	Transport impacts of cumulative construction on receptors will be low in severity. Negligible	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible.
36-46 Albert Embankment	0.89	No significant cumulative effects anticipated due to appropriate mitigation used at both schemes.	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments.	None	None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other	<u>Surface Water Quality</u> Identified as potential cumulative effect risk. Standard best practice for pollution control and emergency procedures during construction noted in application. Physically separated from River	Transport impacts of cumulative construction on receptors will be low in severity. Negligible	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible.

Development	Distance from Site (km)	Air Quality	Built Heritage, Townscape & Visual	Archaeology	Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets and Climate Change
				None			developments /projects. None	Thames and therefore considered to have cumulative effects of negligible significance. <u>Flood Risk</u> Negligible cumulative effect. Negligible		
Albert Embankment Foreshore	0.50	None	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments. None	None	The depth of the tunnel in this location means that cumulative effects are unlikely. None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments /projects. None	<u>Surface Water Quality</u> No cumulative effects anticipated. <u>Flood Risk</u> Negligible cumulative effect. Negligible	Transport impacts of cumulative construction on receptors will be low in severity. Negligible	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible.
Westminster Bridge	0.40	None	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments. None	Inherently takes into account cumulative effects due to incorporation in findings of technical chapters on which human health is assessed e.g. noise, air quality. Traffic congestion, dust and noise may reduce amenity temporarily, however mitigation and best practice would be anticipated to reduce this effect to negligible. Negligible	None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments /projects. None	<u>Surface Water Quality</u> No cumulative effects anticipated. <u>Flood Risk</u> Negligible cumulative effect. Negligible	Transport impacts of cumulative construction on receptors will be low in severity. Negligible	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible.
Lambeth Bridge	0.07	None	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments. None	Inherently takes into account cumulative effects due to incorporation in findings of technical chapters on which human health is assessed e.g. noise, air quality. Traffic congestion, dust and noise may reduce amenity temporarily,	None	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments /projects.	<u>Surface Water Quality</u> No cumulative effects anticipated. <u>Flood Risk</u> Negligible cumulative effect. Negligible	Transport impacts of cumulative construction on receptors will be low in severity. Negligible	Negligible cumulative effects with regards to material assets. Negligible cumulative effects on climate vulnerability Negligible.

Development	Distance from Site (km)	Air Quality	Built Heritage, Townscape & Visual	Archaeology	Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets and Climate Change
					however mitigation and best practice would be anticipated to reduce this effect to negligible. Negligible		None			

Operation

15.6.2. Local residents, road users and visitors are likely to experience an overall non-significant slight beneficial cumulative effect once the Scheme and other development are operational due to reduced traffic and improvements to access to open space, nature, work and training and improved opportunities for social cohesion and lifetime neighbourhoods. This occurs across all developments within 500m, whilst traffic cumulative benefits from reduced traffic are anticipated across all developments.

15.6.3. Negligible to minor adverse effects are anticipated due to potential increases in climate vulnerability in the future. This is due to climate change which may result in hotter summers, wetter and warmer winters, which

may reduce the asset life of the Scheme as well as reducing amenity for visitors due to extreme weather conditions and worsening of air quality associated with climate change. These effects are not considered to be significant.

15.6.4. No significant adverse effects are anticipated as a result of cumulative effects arising from any cumulative development and this Scheme.

Table 15-8 - Summary of the Cumulative Effects between 'Other Developments' and the Scheme during Operation

Development	Distance from Site (km)	Air Quality	Built Heritage, Townscape & Visual	Archaeology	Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets and Climate Change
9 Ergon House	0.22	Negligible	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments during operation. None	Beneficial cumulative effects due to access to open space and nature, work and training, social cohesion and lifetime neighbourhoods. Slight Beneficial	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	No cumulative effects relating to flood risk. None	Receptors will experience a small positive effect arising from cumulative schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Negligible cumulative effects with regards to material assets. Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
63 Buckingham Gate	0.65	Negligible	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments during operation. None	None	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	No cumulative effects relating to flood risk. None	Receptors will experience a small positive effect arising from cumulative schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Negligible cumulative effects with regards to material assets. Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
29 Great Peter Street	0.13	Negligible	No material cumulative	No cumulative effects on the archaeology identified resulting from the impacts	Beneficial cumulative effects due to access to open space and nature,	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is	No cumulative effects	Receptors will experience a small positive effect arising	Negligible cumulative effects with regards to material assets.

Development	Distance from Site (km)	Air Quality	Built Heritage, Townscape & Visual	Archaeology	Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets and Climate Change
			effect anticipated. None	of the Scheme combined with other concurrent developments during operation. None	work and training, social cohesion and lifetime neighbourhoods. Slight Beneficial		combined with other developments/projects. None	relating to flood risk. None	from cumulative schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
55 Broadway	0.55	Negligible	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments during operation. None	None	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	No cumulative effects relating to flood risk. None	Receptors will experience a small positive effect arising from cumulative schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Negligible cumulative effects with regards to material assets. Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
8 Broadway	0.50	Negligible	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments during operation. None	Beneficial cumulative effects due to access to open space and nature, work and training, social cohesion and lifetime neighbourhoods. Slight Beneficial	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	No cumulative effects relating to flood risk. None	Receptors will experience a small positive effect arising from cumulative schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Negligible cumulative effects with regards to material assets. Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
32-34 Great Peter Street	0.37	Negligible	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments during operation. None	Beneficial cumulative effects due to access to open space and nature, work and training, social cohesion and lifetime neighbourhoods. Slight Beneficial	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	No cumulative effects relating to flood risk. None	Receptors will experience a small positive effect arising from cumulative schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Negligible cumulative effects with regards to material assets. Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
99-105 Grenadier House	0.54	Negligible	No material cumulative effect anticipated.	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined	None	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is	No cumulative effects	Receptors will experience a small positive effect arising from cumulative	Negligible cumulative effects with regards to material assets.

Development	Distance from Site (km)	Air Quality	Built Heritage. Townscape & Visual	Archaeology	Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets and Climate Change
			None	with other concurrent developments during operation. None			combined with other developments/projects. None	relating to flood risk. None	schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
29-35 Old Queen Street	0.48	Negligible	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments during operation. None	Beneficial cumulative effects due to access to open space and nature, work and training, social cohesion and lifetime neighbourhoods. Slight Beneficial	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	No cumulative effects relating to flood risk. None	Receptors will experience a small positive effect arising from cumulative schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Negligible cumulative effects with regards to material assets. Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
14 Great Peter Street	0.23	Negligible	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments during operation. None	Beneficial cumulative effects due to access to open space and nature, work and training, social cohesion and lifetime neighbourhoods. Slight Beneficial	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	No cumulative effects relating to flood risk. None	Receptors will experience a small positive effect arising from cumulative schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Negligible cumulative effects with regards to material assets. Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
4 Greycoat Place	0.60	Negligible	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments during operation. None	None	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	No cumulative effects relating to flood risk. None	Receptors will experience a small positive effect arising from cumulative schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Negligible cumulative effects with regards to material assets. Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
19 Dacre Street	0.46	Negligible	No material cumulative effect anticipated.	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined	Beneficial cumulative effects due to access to open space and nature, work and training, social	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is	No cumulative effects	Receptors will experience a small positive effect arising from cumulative	Negligible cumulative effects with regards to material assets.

Development	Distance from Site (km)	Air Quality	Built Heritage. Townscape & Visual	Archaeology	Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets and Climate Change
			None	with other concurrent developments during operation. None	cohesion and lifetime neighbourhoods. Slight Beneficial		combined with other developments/projects. None	relating to flood risk. None	schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
Old War Office Whitehall	0.93	Negligible	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments during operation. None	None	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	No cumulative effects relating to flood risk. None	Receptors will experience a small positive effect arising from cumulative schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Negligible cumulative effects with regards to material assets. Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
1-3 Queen Anne's Gate	0.54	Negligible	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments during operation. None	None	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	No cumulative effects relating to flood risk. None	Receptors will experience a small positive effect arising from cumulative schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Negligible cumulative effects with regards to material assets. Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
52 Horseferry Road	0.25	Negligible	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments during operation. None	Beneficial cumulative effects due to access to open space and nature, work and training, social cohesion and lifetime neighbourhoods. Slight Beneficial	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	No cumulative effects relating to flood risk. None	Receptors will experience a small positive effect arising from cumulative schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Negligible cumulative effects with regards to material assets. Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
20 Great Smith Street	0.27	Negligible	No material cumulative	No cumulative effects on the archaeology identified resulting from the impacts	Beneficial cumulative effects due to access to open space and nature,	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is	No cumulative effects	Receptors will experience a small positive effect arising	Negligible cumulative effects with regards to material assets.

Development	Distance from Site (km)	Air Quality	Built Heritage, Townscape & Visual	Archaeology	Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets and Climate Change
			effect anticipated. None	of the Scheme combined with other concurrent developments during operation. None	work and training, social cohesion and lifetime neighbourhoods. Slight Beneficial		combined with other developments/projects. None	relating to flood risk. None	from cumulative schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
22 – 29 Albert Embankment	0.73	Negligible	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments during operation. None	None	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	No cumulative effects relating to flood risk. None	Receptors will experience a small positive effect arising from cumulative schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Negligible cumulative effects with regards to material assets. Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
36-46 Albert Embankment	0.89	Negligible	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments during operation. None	None	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	No cumulative effects relating to flood risk. None	Receptors will experience a small positive effect arising from cumulative schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Negligible cumulative effects with regards to material assets. Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
Albert Embankment Foreshore	0.50	Negligible	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments during operation. None	None	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments/projects. None	No cumulative effects relating to flood risk. None.	Receptors will experience a small positive effect arising from cumulative schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Negligible cumulative effects with regards to material assets. Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
Westminster Bridge	0.40	Negligible	No material cumulative effect anticipated.	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined	Beneficial cumulative effects due to access to open space and nature, work and training, social	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is	No cumulative effects	Receptors will experience a small positive effect arising from cumulative	Negligible cumulative effects with regards to material assets.

Development	Distance from Site (km)	Air Quality	Built Heritage. Townscape & Visual	Archaeology	Human Health	Soils, Geology & Hydrogeology	Biodiversity	Water Quality & Flood Risk	Traffic and Transport	Material Assets and Climate Change
			None	with other concurrent developments during operation. None	cohesion and lifetime neighbourhoods. Slight Beneficial		combined with other developments /projects. None	relating to flood risk. None	schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.
Lambeth Bridge	0.07	Negligible	No material cumulative effect anticipated. None	No cumulative effects on the archaeology identified resulting from the impacts of the Scheme combined with other concurrent developments during operation. None	Beneficial cumulative effects due to access to open space and nature, work and training, social cohesion and lifetime neighbourhoods. Slight Beneficial	No cumulative effects anticipated.	No cumulative effects on the ecological features are anticipated when the Scheme is combined with other developments /projects. None	No cumulative effects relating to flood risk. None	Receptors will experience a small positive effect arising from cumulative schemes due to a reduction in traffic flows, which will be maintained once the Scheme is operational. Slight Beneficial	Negligible cumulative effects with regards to material assets. Minor/Negligible cumulative effects on climate vulnerability relating to heavy rain and wetter winters, drier and hotter summers, and warmer winters and reduced snow. Negligible to Minor Adverse.

15.7 Mitigation measures

Construction

- 15.7.1. No further mitigation measures are proposed during construction as no significant adverse in-combination or cumulative effects are anticipated.

Operation

- 15.7.2. No further mitigation measures are proposed during operation as no significant adverse in-combination or cumulative effects are anticipated.

15.8 Residual Effects

Construction

- 15.8.1. No significant residual construction in-combination or cumulative effects anticipated.

Operation

- 15.8.2. Significant moderate beneficial in-combination effects are anticipated for human receptors (residents and all travellers).
- 15.8.3. No significant residual operational cumulative effects anticipated.

15.9 Summary

- 15.9.1. In the construction phase of the Scheme, there is the potential for slight adverse in-combination effects affecting amenity of residents and travellers. Therefore, the overall assessment is for slight adverse effects during the construction phase. Operational in-combination effects are anticipated due to the cultural and social value that the Memorial and Learning Centre is anticipated to bring, as well as resulting from the careful architectural and landscaping design of the Scheme.
- 15.9.2. Slight adverse (not significant) cumulative effects are anticipated during construction phase on geology and soils as a result of the Scheme and development of 9 Ergon House. No other cumulative construction effects are anticipated. During operation, local residents, road users and visitors may experience cumulative beneficial effects of improved access and enjoyment of open space, nature, work and training opportunities, though these are not anticipated to be significant. Minor adverse cumulative effects may occur due to an increased vulnerability to climate, arising from climate change. No significant adverse cumulative effects are anticipated from any development during operation.
- 15.9.3. Moderate beneficial (significant) in-combination effects are anticipated in the operational phase due to improved vibrancy and activity of the area, an anticipated increase in the number of visitors to the park, improved amenity for pedestrians and cyclists, opportunities for enhanced social cohesion and interaction, as well as learning and employment opportunities.
- 15.9.4. No other significant adverse or beneficial effects are anticipated.

16 Conclusions

16.1 Overview

- 16.1.1. The primary purpose of an ES is to gather, assess in a systematic manner and collate information on the anticipated significant effects of a development on the environment in the form of an Environmental Impact Assessment, in order that this information can be properly considered by the planning authority before a decision on the development is made.
- 16.1.2. The assessment of significant effects has been undertaken in the previous chapters of the ES, and in this chapter the information has been summarised to reflect the overall conclusions of the assessment.
- 16.1.3. This document presents the ES which has been prepared within the EIA procedure to accompany the planning application. It outlines the Scheme, the likely significant environmental effects and any mitigation proposals necessary to reduce adverse effects.

16.2 Summary of significant effects

- 16.2.1. With the implementation of mitigation measures that are outlined within the topic chapters above the majority of effects on the environment from the construction and operation of the Holocaust Memorial and Learning Centre are not significant.
- 16.2.2. The Holocaust Memorial and Learning Centre will result in beneficial effects on heritage assets within and surrounding the gardens once completed as it will attract new visitors and create new views and visual character within and surrounding the gardens towards Westminster. The Scheme may also provide benefits to the local community in the form of employment and education opportunities.
- 16.2.3. Although the design of the Holocaust Memorial and Learning Centre has been carefully considered to ensure there are minimal impacts on the gardens, users of the gardens and the local area, some significant effects will remain during the construction and operation of the Scheme which are outlined in Table 16-1 and Table 16-2 below. All construction effects will be temporary. During operation, two moderate adverse effects remain. Regular visitors to the gardens will experience an increased number of people using the gardens and pedestrians and road users will experience a restricted view of the River Thames and gardens from Dean Stanley Street.

Table 16-1 - Summary of Significant Temporary Construction Effects

Topic	Impact	Receptor	Residual Effects	Details
Traffic and Transport Population and Human Health	Pedestrian amenity Health and wellbeing	Existing visitors to Victoria Tower Gardens	Moderate (Significant)	During the construction phase, there remains a moderate effect on pedestrian amenity to existing users of Victoria Tower Gardens due to a reduction in the useable area of the park. Two of the five accesses will be closed to pedestrians, and there is no connectivity between the two open sections of the park. This effect is temporary (only lasting for a portion of the construction works) and reversible: once construction is complete, all gates of the gardens will return to public use. This also has a temporary population and human health effect on the wellbeing of regular users of the gardens.
Traffic and Transport	Traffic delay	Existing users of the surrounding transport network	Moderate (Significant)	During construction there remains a moderate impact on traffic delay arising from construction vehicles manoeuvring in and out of the construction site access. These will be very short in duration and temporary in nature.

Topic	Impact	Receptor	Residual Effects	Details
Heritage	Increased noise, vibration, dust and traffic	Victoria Tower Gardens and around the Buxton Memorial	Moderate (Significant)	During the construction phase, a moderate effect on the Victoria Tower Gardens Registered Park (Grade II) and Buxton Memorial Fountain (Grade II*) will remain due to increased noise and areas of the park being enclosed by hoardings reducing available space. This effect will be temporary as once construction is complete the noise from construction will reduce and the gardens will return to public use.
Townscape	Construction activities	Character Area 1 – Victoria Tower Gardens	Moderate (Significant)	During construction, a moderate effect on the townscape of the gardens will remain due to activities within and around the site. This effect will be temporary as once construction is complete all activities will be finished, and the gardens will return to public use.

Table 16-2 - Summary of Significant Operational Effects

Topic	Impact	Receptor	Residual Effects	Details
Traffic and Transport Population and Human Health	Pedestrian amenity Health and wellbeing	Existing visitors to Victoria Tower Gardens	Moderate (Significant)	During operation there will be a moderate effect on pedestrian amenity experienced by existing park users, as a result of the projected increase in footfall. Whilst the vast majority of the gardens will remain freely accessible to the public, the open space will accommodate a much higher number of visitors than at present. This also has a population and human health effect on the wellbeing of regular users of the gardens.
Visual	Reduced view the River Thames and change of view from Dean Stanley Street	Pedestrians and road users	Moderate (Significant)	A moderate effect on View 13 from Dean Stanley Street towards the gardens is anticipated to remain as the bronze fins from the Memorial will block the view to the River Thames and the character of the view will change from open parkland to one focussed on the built form of the memorial. This is one of 22 views assessed, the range of visual effects on relevant views span the category of moderate adverse (View no. 13) to moderate beneficial (View Nos. 14, 16, 17, 18, 20, 21 and 22).

Glossary of terms

- AONB: Area of National Beauty
- APA: Archaeological Priority Area
- AQAP: Air Quality Action Plan
- AQMA: Air Quality Management Area
- AQS: Air Quality Strategy
- BGS: British Geological Survey
- BREEAM: Building Research Establishment Environmental Assessment Method
- CCTV: Closed Circuit Television
- CMP: Construction Management Plan, this document outlines the measures required for environmental management at the construction stage.
- CIEEM: Chartered Institute of Ecology and Environmental Management
- CifA: Chartered Institute for Archaeologists
- CIRIA: Construction Industry Research and Information Association
- CO_{2e}: carbon dioxide equivalent
- COMAH 2015: Control of Major Accident Hazards Regulations 2015
- CS: Cycle Superhighway
- DCLG: Department for Communities and Local Government
- DEFRA: Department for Environment, Food & Rural Affairs
- DMP: Dust Management Plan
- DMRB: Design Manual for Roads and Bridges
- DS: Delivery and Servicing Plan
- EA: Environment Agency
- EHO: Environmental Health Officer
- EIA: Environmental Impact Assessment as defined by the Town and Country Planning (Environmental Impact Assessment) Regulations 2011.
- EPUK: Environmental Protection United Kingdom
- ES: Environmental Statement which reports on the findings of the EIA.
- EU: European Union
- EZoI: Ecological Zone of Influence
- FRA: Flood Risk Assessment
- GA: General Admissions
- GFA: Gross Floor Area
- GHG: greenhouse gases
- GIA: Gross Internal Area
- GiGL: Greenspace Information for Greater London
- Greater London Authority: GLA
- GLAAS: Greater London Archaeological Advisory Service
- GLHER: Greater London Historic Environment Record
- GPC: Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories
- GPP: guidelines for pollution prevention
- GPR: ground penetrating radar
- GWP: Global Warming Potentials
- HDV: Heavy Duty Vehicle
- HER: Historic Environment Record
- HGV: Heavy Goods Vehicle
- HPI: Habitat of Principal Importance
- HVM: hostile vehicle mitigation
- IEMA: Institute for Environmental Management and Assessment
- IAQM: Institute of Air Quality Management
- IPCC Intergovernmental Panel on Climate Change
- LAEI: London Atmospheric Emissions Inventory
- LAQM: Local Air Quality Management
- LAQN: London Air Quality Network.
- LED: Light Emitting Diode
- MAGIC: Multi-Agency Geographic Information for the Countryside
- MHCLG: Ministry of Housing, Communities and Local Government
- NE: Natural England
- NDGB: Non-Departmental Government Body
- NERC: Natural Environment and Rural Communities
- NHLE: National Heritage List for England
- NIEA: Northern Ireland Environment Agency
- NO₂ (nitrogen dioxide): a secondary pollutant produced by the oxidation of nitric oxide.
- NOx: Nitric Oxide
- NPPF: National Planning Policy Framework
- NRMM: Non-Road Mobile Machinery
- NRR: National Nature Reserve
- OD: Ordnance Datum
- PM_{2.5}: Particulate matter measuring less than 2.5 µm in diameter.
- PM₁₀: Particulate matter in vehicle exhaust gases consists of carbon nuclei onto which a wide range of compounds are absorbed. These particles are generally very small (1-10 µm), and include those in the size range referred to as PM₁₀.
- PPG: Pollution Prevention Guideline
- PTAL: Public Transport Accessibility Level
- SAC: Special Area of Conservation
- SBINC: Site of Borough Importance for Nature Conservation
- Scheme: Scheme that would be the subject of the planning application
- SEPA: Scottish Environmental Protection Agency
- SINC: Sites of Importance for Nature Conservation
- Site: Area that would be the subject of the planning application.
- SLINC: Site of Local Importance for Nature Conservation
- SMINC: Site of Metropolitan Importance for nature conservation, an ecological designation of local importance
- SPA: Special Protection Areas
- SPG: Supplementary Planning Guidance

- SRN: Strategic Road Network
- SSSI: Site of Special Scientific Interest, an ecological designation of national importance
- SuDs: Sustainable Drainage Systems
- TA: Transport Assessment
- TEB: Transport Emissions Benchmark
- TP: Travel Plan
- TRAVL: Trip Rate Assessment Valid for London
- VOCs: volatile organic compounds
- WFD: EU Water Framework Directive
- WHO: World Health Organisation
- UKCIP: UK Climate Impacts Programme
- UKCP09: United Kingdom Climate Projections 2009
- UKHMF: UK Holocaust Memorial Foundation
- UNESCO: United Nations Educational, Scientific and Cultural Organisation
- UXO: Unexploded ordnance
- WCC: Westminster City Council
- WHS: World Heritage Site
- WSI: Written Scheme of Investigation

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