Victoria Station Upgrade

Environmental Statement: Main Report

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Environmental Statement: Main Report

Approved By	Signature	Date
Jane Barron		15th November 2007

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List of Abbreviations and Glossary of Terms

Abstraction	The process of taking water from any source, either temporarily or permanently
AOD	Above Ordnance Datum
AQAP	Air Quality Action Plan
AQEG	Air Quality Expert Group
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
ATD	Above Tunnel Datum
bgl	Below Ground Level
BGS	British Geological Society
BREEAM	Building Research Establishment Environmental Assessment Method
BS	British Standard
CAZ	Central Activities Zone
CDM	Construction (Design Management)
CE	Church of England
CEEQUAL	Civil Engineering Environmental Quality Assessment and Award Scheme
CLEA	Contaminated Land Exposure Assessment
CMP	Construction Management Plan
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CoCP	Code of Construction Practice
CoPA	Control of Pollution Act 1974
COSHH	Control of Substances Hazardous to Health
CoW	City of Westminster Council
CPZ	Controlled Parking Zone
CSD	Corner Site Development
dB	Decibel
D&C line	District and Circle line
DCLG	Department of Communities and Local Government
DEFRA	Department for Environment Food and Rural Affairs
DfT	Department for Transport
DoE AL	Department of the Environment Advisory Leaflet
DTI	Department of Trade and Industry
EA	Environment Agency
EDM	Environmental Design Management
Effect	The consequence of the change to the baseline environment, or impact, on the environmental receptor or particular value or sensitivity.
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMMP	Environmental Management and Monitoring Plan

EPA	Environmental Protection Act
ES	Environmental Statement
FSC	Forest Stewardship Council
FTE	Full Time Equivalent
GDS	Geotechnical Desk Study
GLA	Greater London Authority
GLSMR	Greater London Scheduled Monument Register
GPDO	General Permitted Development Order
GPR	Ground Penetration Radar
HAZOP	Hazard and Operability Study
HFC	Hydrofluorocarbon
HSE	Health, Safety and Environment
HSG	Health Service Guidelines
IC	Interchange
ICE	Institution of Civil Engineers
IEMA	Institute of Environmental Management and Assessment
Impact	A predicted change to the baseline environment
ISO	International Standards Origination
KSPS	King's Scholars Pond Sewer
kW	Kilowatt
LAeq	The LAeq Index. [The equivalent continuous sound level LAeq is the level of a notional steady sound, which at a given position and over a defined period of time, would deliver the same A-weighted acoustic energy as the fluctuating noise.]
LBAP	Local Biodiversity Action Plan
LDC	London Development Corporation
LEZ	Low Emission Zone
LFCDA	London Fire and Civil Defence Authority
LFEPA	London Fire and Emergency Planning Authority
LLAU	Limits of Land to Acquired or Used
LNR	Local Nature Reserve
LP	London Plan
LPA	Local Planning Authority
LSF	Low Smoke and Fume
LSOH	Low Smoke and zero Halogen
LU	London Underground
M&E	Mechanical and Electrical
MM	Mott MacDonald
MoLAS	Museum of London Archaeology Service
NB	Northbound
NE	Natural England
NHS	National Health Service
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NOC	Network Operations Centre

NO_X	Nitrogen Oxides
NPV	Net Present Value
NR	National Rail
NRA	National Rivers Authority
NTH	North Ticket Hall
ODPM	Office of the Deputy Prime Minister
PAH	Polycyclic Aromatic Hydrocarbons
PAL	Paid Area Link
PCB	Polychlorinated biphenyls
pEMP	Project Environmental Management Plan
Piezometry	The science and practice of pressure measurement.
PM_{10}	Particulate Matter with a diameter less than 10 micrometers µ
PPE	Personal Protective Equipment
PPG	Planning Policy Guidance
PPP	Public Private Partnerships
PPS	Planning Policy Statement
PRM	Persons of Reduced Mobility
QUENSH	LU Standard Contract QUENSH Conditions
QUEST	Quantitative Engineering Sustainability Tool
Receptor	Recipient of an effect
RIBA	Royal Institute of British Architects
SA	Sustainability Appraisal
SAM	Scheduled Ancient Monument
SCL	Sprayed Concrete Lining
SEMP	Site Environmental Management Plan
SER	Signalling Equipment Room
SGI	Site Ground Investigation
SGV	Soil Guideline Values
SI	Site Investigation
SINC	Site of Importance for Nature Conservation
SMS	Short Messaging Service
SPG	Supplementary Planning Guidance
SQE	Safety, Quality and Environment
sq. m	Square metre
SRDF	Sub-Regional Development Framework
SSSI	Site of Special Scientific Interest
STH	South Ticket Hall
SWMP	Site Waste Management Plan
T2025	Transport 2025
TCP	Tunnel Cooling Programme
TfL	Transport for London
TPH	Total Petroleum Hydrocarbons
TWA	Transport and Works Act
TWAO	Transport and Works Act Order

TWUL	Thames Water Utilities Limited
UDP	Unitary Development Plan
US EPA	United States Environmental Protection Agency
UXO	Unexploded Ordnance
VAPB	Victoria Area Planning Brief
VBR	Vauxhall Bridge Road
VL	Victoria line
VLU	Victoria Line Upgrade
VPT	Victoria Palace Theatre
VSU	Victoria Station Upgrade
VTI	Victoria Transport Interchange
WAC	Waste Acceptance Criteria
WB	Westbound
WIS	Water Industry Specifications
ZoI	Zone of Influence
ZVI	Zone of Visual Influence

1 Introduction

1.1 Background

1.1.1 Victoria Underground and National Rail Station (which for the purpose of this report has been defined as the 'Victoria Station Complex') is one of the busiest transport interchanges in London and a principal National Rail gateway. The numbers of passengers currently using Victoria Underground Station during the morning peak reaches 70,000. It is forecast in the London Plan that demand growth will increase by a further 20% by 2016. Without a significant increase in capacity, station control measures such as gateline restrictions and station closures, which are currently used in to safely manage congestion, will continue to be used but with increase frequency causing delay and discomfort for passengers. In order to address this and issues relating to access LU is proposing to implement a scheme known as the Victoria Station Upgrade (VSU).

1.1.2 The VSU scheme will involve the provision of a new north ticket hall below Bressenden Place, extension of the existing ticket hall (the South Ticket Hall) and the construction of a new underground links connecting the existing Victoria line ticket hall and new Northern ticket hall. New lifts for persons of reduced mobility and stairways and escalators will also be provided together with new emergency services access and evacuation core.

1.1.3 The VSU scheme will increase the capacity of Victoria Underground station so that it is fit for purpose for handling present and forecast demand, to minimise passenger journey time and improve quality of access, interchange and ambience.

1.1.4 The development site lies within the administrative area of the City of Westminster (CoW). The works will require the demolition of buildings at the corner of Bressenden Place and Victoria Street and major construction activity above and below-ground for a period of approximately six years. However, once the works are complete the main changes will have been made to the below ground station layout with changes made to new and existing station entrances. The vacant land that will remain post-construction (where the existing buildings will be demolished) is the subject of a proposed development, known as the Corner Site Development (CSD), being promoted by London Underground (LU), for which a separate planning application for this scheme has been submitted to the CoW. Other buildings, as listed in Paragraph 2.8.5, will also be demolished. In order to address the effects of their demolition a Site Reinstatement Strategy is currently being developed. This strategy will address the land use at these sites during the construction of the scheme and in the longer term.

1.1.5 LU considered it prudent to design a building to occupy the corner site that demonstrates how the successful integration of the above ground elements

of VSU in this location could be achieved in a way that fully respects the setting of the VPT and the general location and which conforms to the Victoria Area Planning Brief.

1.1.6 A site location plan and plan of proposals are provided as Figure 1.1 and 1.2 respectively.

1.1.7 LU is applying to the Secretary of State under the Transport and Works Act 1992 for permission to construct and operate the VSU scheme. This is explained in further detail in Section 1-2. This Environmental Statement (ES) supports this application to the Secretary of State. The ES has been prepared in accordance with the Transport & Works (Applications and Objections Procedure) (England & Wales) Rules 2006 and describes the details of the proposed scheme and the effects the VSU scheme would have on the environment. Information regarding the legislative framework of the ES is provided in Section 1-3 and further detail regarding the content of the ES can be found in Sections 1.5 and Section 3.

1.2 The Transport and Works Act Order Application

1.2.1 LU is part of Transport for London (TfL) which was created in 2000 as the integrated body responsible for the Capital's transport system. The primary role of TfL, a functional body of the Greater London Authority (GLA), is to implement the Mayor of London's Transport Strategy and manage transport services across the Capital.

1.2.2 LU is applying to the Secretary of State for an Order under the Transport and Works Act 1992 that will authorise the proposed development works for the Victoria Station Upgrade (VSU).

1.2.3 The application for the VSU scheme includes the following key components:

- a new subterranean North Ticket Hall (NTH) at the junction of Bressenden Place and Victoria Street;
- an enlarged existing Victoria line ticket hall (known as the South Ticket Hall (STH));
- three new banks of escalators (each bank comprising three escalators);
- a new interchange tunnel, referred to as the Paid Area Link (PAL). This new pedestrian tunnel will connect the NTH to the STH;
- new lifts providing step free access for persons of reduced mobility (PRM) between the street, ticket hall and platform levels, for the NTH and STH and for interchange between the District & Circle line and Victoria line platforms;

- improved emergency services access and evacuation core in the NTH;
- improved access between the National Rail and Underground stations through increased escalator and lift provision;
- utilities diversions; and
- demolition of some buildings of some buildings for the purposes of the works.

1.2.4 The works will predominantly be located underground and are discussed in further detail in Section 2. The area of works related to construction of the scheme is illustrated on Figure 1.2.

1.2.5 Figure 1.3 provides a 3D visualisation of the main components of the completed upgrade scheme.

1.2.6 To enable construction of the VSU scheme, numbers 120 to 124 Victoria Street and 3 to 11 Bressenden Place will need to be demolished. Future consent for the CSD is the subject of a separate planning application submitted to CoW. If the CSD was built, it would house the new western entrance to the NTH of the Victoria Underground Station with a retail component and a 7/8 storey office development above.

1.3 Legislative Framework for the Environmental Statement

1.3.1 Environmental Impact Assessment (EIA) is the process whereby 'environmental information is collected, publicised and taken into account in reaching a decision on a relevant planning application' (DETR[1], 1999). This ES has been prepared to document the EIA of the proposed works briefly described above. It is being submitted as part of the application under the Transport and Works Act 1992 (TWA).

1.3.2 This ES has been prepared in accordance with the Transport and Works (Applications and Objections Procedure) (England and Wales) Rules 2006 (SI 2006 No. 1466) (herein referred to as the 'TWA Rules'), which implements the requirements of EC Directive 85/337/EEC, as amended by EC Directive 97/11/EC[2] (the 'Directive'), as regards proposals to be authorised under the TWA.

1.3.3 The VSU scheme is considered to be an Annex II development under Paragraph 10 (c) of the Directive. In accordance with the TWA Rules, due to the potential significant environmental impacts, an EIA is required for the VSU scheme, unless the Secretary of State directs otherwise. No such

[1] Department for Environment, Transport and the Regions
[2] Council Directive 97/11/EC of 3 March 1997 amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment.

direction has been sought and in view of the potential for significant effects, LU has appointed Mott MacDonald (MM) to undertake an assessment and report the findings in this ES.

1.3.4 The EIA process is essentially a systematic procedure, using the best techniques and available sources of information to determine the potential impacts of a proposed development (both beneficial and adverse) and their significance, and to provide an opportunity for public scrutiny of the environmental aspects of the scheme. This enables the importance of predicted effects to be evaluated by the Secretary of State before a decision to make a TWA Order (TWAO) is taken.

1.4 Scoping Process

1.4.1 In accordance with the TWA Rules, a formal scoping exercise has been undertaken at the outset of the EIA process. A request was submitted to the DfT for a formal scoping opinion on the information to be included in the ES. To accompany the request for a formal scoping opinion, MM prepared and submitted a scoping report.

1.4.2 Prior to the appointment of MM, LU and their previous consultants prepared and submitted a scoping report (August 2006) to accompany a request for a formal scoping opinion. This was received following consultation with statutory consultees in September 2006.

1.4.3 Following the appointment of MM, the design of the scheme changed and a scoping exercise undertaken, which reviewed and updated the scoping report, incorporating comments from the scoping opinion. The results of this scoping exercise were documented in a scoping report (June 2007) which is located in Annex A of the ES. This report describes the nature and the purpose of the scheme and its potential environmental effects. It also provides details on the scope of works and approach of the EIA and the methodologies used to undertake the specialist assessments.

1.4.4 In July 2007, the scoping report accompanied a formal request to the Secretary of State for a scoping opinion under Rule 8 of the Transport and Works Act Orders (Applications and Objections Procedures) England and Wales Rules 2006.

1.4.5 As a result of this process, a formal scoping opinion was issued to LU in July 2007. The issues highlighted in the scoping opinion have been fully considered within this ES. Further information in this regard is provided in Section 3.4 of this document.

1.5 Structure of the Environmental Statement

1.5.1 The ES fulfils the requirements of Schedule 1 of the TWA Rules. The TWA Rules require that the ES should describe the likely significant effects of the proposed scheme on the environment and, in accordance with DETR guidance, this has been done in the ES on a *'realistic basis and without unnecessary elaboration'* (DETR, 1999). As a result, the content of this ES has focused on the potential significant residual environmental effects, which will occur following the implementation of incorporated mitigation, of the proposed scheme.

1.5.2 The structure of the ES and supporting documentation is presented in Table 1-1.

Table 1-1: Structure of the Environmental Statement

Volume	Description
Environmental Statement	
VSU ES Non Technical Summary	This provides a summary of the main findings of the ES in non-technical language.
VSU ES Main Report	This main report introduces the following: • a description of the VSU scheme; • the justification for the upgrade of the Victoria Underground Station; • an outline of the scheme development including alternatives; • the methodology that has been adopted in undertaking the EIA; • a description of the likely magnitude and significance of the predicted environmental effects after incorporated mitigation has been implemented (both adverse and beneficial); • details of the incorporated mitigation measures intended to prevent, reduce or offset any adverse effects; • a summary of the key environmental effects; and • recommendations to further prevent, reduce or offset any residual adverse effects. The structure of the ES main report is discussed further in Section 1.6.
VSU ES Report Figures	This volume will present all figures associated with the Main Report.
VSU ES: Technical Appendices Volume 1 of 4	This will comprise the following: • Traffic and Transport Technical Appendix; and • Transport Assessment.

Table 1-1: Structure of the Environmental Statement	
Volume	**Description**
VSU ES: Technical Appendices Volume 2 of 4	This will comprise the following: • Noise and Vibration Technical Appendix; and • Air Quality Technical Appendix.
VSU ES: Technical Appendices Volume 3 of 4	This will comprise the following: • Townscape and Visual Amenity Technical Appendix; • Built Heritage Technical Appendix; • Archaeology and Heritage Technical Appendix; • Contaminated Land Technical Appendix; • Demolition and Excavated Materials, and Waste Management Plan; and • Water Resources Technical Appendix.
VSU ES: Technical Appendices Volume 4 of 4	This will comprise the following: • Socio-Economics Technical Appendix; and • Community Technical Appendix.

Other Supporting Documents	
VSU Health Impact Assessment	This report documents the outcome of the health impact assessment undertaken for the VSU scheme.
VSU Energy Demand Assessment	This report addresses the feasibility of energy conservation measures that could be implemented within the VSU scheme.
VSU Design and Access Statement	Completed to accompany the Listed Building Applications being submitted in relation to the VSU scheme and as required by CoW.
VSU CEEQUAL Pre-Assessment Report	This report documents the likely CEEQUAL rating that the project will attain.
Project Sustainability Appraisal	This comprises a project level sustainability appraisal of the VSU scheme.

1.6 Structure of the ES Main Report

1.6.1 The structure of the ES Main Report is presented in Table 1-2. A description of each section has also been provided.

Table 1-2: Structure of the Environmental Statement	
Section	**Description**
1	**Introduction** This section comprises an introduction to the VSU scheme, a brief account of the TWA process and the legislative basis of the ES, the scope of the assessment, an overview to the overall structure of the ES, a list of documents that are being submitted to support the draft Order and information about where the ES can be found and where comments may be addressed.

Table 1-2: Structure of the Environmental Statement	
Section	**Description**
2	**Scheme Description** The section lists the objectives of the project, provides an overview of the site location, setting, history and existing facilities. The section also presents a detailed description of the VSU scheme, including details of the construction process and traffic management and information on other schemes proposed within the vicinity of the VSU scheme.
3	**Approach and Methodology** This section provides an account of the approach that has been taken to ensure stakeholder involvement, how key issues have been identified and addressed within the ES and the approach that has been taken for the EIA process. Also included within this section is an account of sustainable development and its incorporation into the VSU scheme.
4	**Project Need and Alternatives** This section comprises an account of the strategic and project level needs for the VSU scheme. This includes an account of the transport challenges currently facing London. The section also presents information on alternatives and the reasons for which this scheme has been identified.
5	**Planning Policy** This section sets the planning policy context of the VSU scheme and also assesses how the scheme performs within the context of the relevant planning framework. The section considers the VSU scheme in the context of national, regional and local planning policies.
6	**Assessment of Effects** This section presents the assessment of effects on the environmental topics identified for inclusion in the ES. The format of each section is as follows: • Introduction • Baseline • Works Affecting the Baseline • Mitigation and Significant Residual Effects The latter two sections are further sub-divided into construction and operation. This section is supported by the technical appendices for each environmental receptor.
7	**Cumulative Effects** This section will present an account of the way in which the VSU scheme and other schemes that are planned within the Victoria area interact with one another.
8	**Summary of Key Environmental Effects and Mitigation** This section draws the ES to a close and presents a summary table that details the impact, effect, mitigation measures, significant residual effect and supplementary mitigation measures on each of the environmental topics covered by the ES.

1.6.2 The ES Main Report is supported by technical appendices[3] for each environmental topic considered, with the exception of ecology. These technical appendices provide the detailed assessment of the scheme in the context of each environmental topic included within the ES. The format of the technical appendices follows that set out within the environmental scoping report, which is included as an appendix to the ES.

1.6.3 It is not the intention of this ES Main Report to provide a detailed analysis of the environmental effects of the VSU scheme. Rather, it presents a summary of the baseline and the works affecting it, prescribed mitigation measures and the resultant significant residual effects. The detailed assessments are provided within the specialist technical appendices.

1.7 ES Availability and Comments

1.7.1 Information on where to view or obtain the ES documentation can be sought from:

Pam Thompson
Bircham Dyson Bell
50 Broadway
London
SW1H 0BD
Tel: 020 7227 7080

1.7.2 A charge may be made to cover part of the production costs.

1.7.3 Alternatively, the ES documentation is available to download at:

http://www.tfl.gov.uk/vsu

1.7.4 Comments or queries should be sent to:

The Consultation Manager
Victoria Station Upgrade
1st Floor, North Wing
55 The Broadway
London
SW1H 0BD

Or to vsu@tube.tfl.gov.uk

[3] A technical appendix has not been prepared for ecology, as due to the limited scope of assessment it was determined that the assessment could not be meaningfully expanded upon beyond that which has already been presented in this ES Main Report.

2 Scheme Description

2.1 Introduction

2.1.1 The Victoria Station Complex is one of the London's main transport hubs with over 80 million people passing through it each year. It comprises a mainline rail station (the National Rail Station), two Underground lines (Victoria and District and Circle), a bus station and a taxi rank with substantial associated pedestrian movements. The National Rail station also provides a dedicated link to Gatwick Airport through the Gatwick Express rail service. London's main coach station, the Victoria Coach Station (VCS) lies close to Victoria Station on Buckingham Palace Road.

2.1.2 Currently Victoria Underground station has approximately 70,000 passengers during the morning peak, this is forecast to rise by 20% to 84,000 passengers by 2016. To accommodate this demand, safely manage passenger numbers on the platforms during peak hours and prevent crowding, gateline restrictions and ticket hall closures are currently enforced on a regular basis.

2.1.3 The Victoria Station Upgrade (VSU) scheme LU is now developing the November 2004 Baseline Scheme[4]. The completion of the VSU scheme will enable the full benefits of the Victoria Line Upgrade (VLU) scheme to be realised. The VLU is a scheme being delivered by LU to ensure the predicted increase in future volumes of passengers are adequately served by providing an increase in the number of trains serving the line. Further information regarding the scheme is presented in Section 2.6 of this report.

2.1.4 The District and Circle (D&C) line was originally opened as the Metropolitan District Railway in 1868, constructed below the surface (6m to platform level) using cut and cover techniques. The D&C lines are some distance north of the National Rail Station on an east-west alignment close to the surface. The area between the D&C and National Rail Stations is occupied by Victoria bus station. Buildings have been erected above the D&C line such that most of the air space above the station is covered.

2.1.5 The Victoria line was constructed in the 1960s and a new sub-surface ticket hall was constructed immediately north to north-east of the National Rail station as part of the works.

[4] The "November 2004 Baseline Scheme" referred to is the Ove Arup & Partners Ltd Victoria Transport Interchange LU phased Implementation Phase 1-3 option described in the July 2004 Final Report.

2.2 Project Objectives

2.2.1 The principle objective is:

'To increase the capacity of Victoria Underground station so that it is fit for purpose for handling present and forecast demand, and to minimise passenger journey time and improve the quality of access, interchange and ambience, to the maximum extent practicable within physical, schedule and financial constraints.'

2.2.2 The following are key objectives of the scheme (see Table 2-1).

Table 2-1: Background to Key Objectives

Key Objective	Background
Congestion relief	• demand for the northbound Victoria line is very high during AM and PM peak periods; • station control and closures are common every weekday morning. Passengers entering the station from the National Rail station are regularly disrupted by gate-line controls and station closures; and • up to 60% of passengers use the southern half of the train and platforms where the escalators feed onto the platforms as bunching at this point prevents many people reaching the far end of the platform.
Increased capacity to address future demand	By 2016 demand is forecast to rise by around 20% from current levels. Without any investment in the station: • levels of passenger satisfaction will not be improve; and • there will be greater discomfort and frustration for the passengers. Addressing future demand: • use of the station is forecast to grow from 70,000 during the morning peak (07.00 – 10.00) to 84,000 in 2016; • passenger demand forecasts are based on the Transport for London strategic planning model, Railplan. Design year forecasts represent demand levels in 2016 plus an additional 20% (100,800). With this extra margin factored in it is not expected that the upgraded station will need to consider redevelopment until 2055. Taking a worst-case scenario, the forecast does not consider the potential network-wide impact of the construction of Crossrail line 1 or Thameslink Programme projects, the implementation of which would have a beneficial impact on the volume and pattern of flows through Victoria station; and • the aim is to ensure that after the completion of the VSU scheme, the station maintains acceptable passenger flow conditions for at least a further 40 years.

Table 2-1: Background to Key Objectives	
Key Objective	**Background**
Minimise passenger journey time	At present: • with the existing station, passengers originating from Victoria Street have to walk to the closest Victoria line entrance at Wilton Road; • there is a regular requirement for ticket hall and gateline closures to manage passenger numbers safely and prevent overcrowding; and • the existing station entrances were not designed for the current and forecast levels of passenger demand.
Accessibility	The Victoria line is relatively inaccessible for Persons of Reduced Mobility. The scheme will provide step-free access between Victoria line platforms and street level and step-free interchange between Victoria line and D&C line platforms.
Safety	• emergency evacuation times need to improve in line with current best practice guidelines; and • there is no dedicated fire fighting access

2.3 Site Location and Setting

2.3.1 Victoria Underground station is located in central London in the City of Westminster (CoW), approximately 1km north of the River Thames. The location of the VSU scheme and its surrounding area is shown in Figure 1.1. The Victoria transport facilities (including the National Rail Station, London Underground and Bus Terminus) form a part of what is described in the CoW's Adopted Unitary Development Plan (2007) as the 'Central Activities Zone' (CAZ).

2.3.2 The 'Central Activities Zone' extends beyond Buckingham Palace, St James's Park and Green Park to the north and east. Pimlico, Belgravia, Chelsea and Knightsbridge lie to the south and west.

2.3.3 Victoria Underground Station and running tunnels are located to the north of the National Rail Station and are concealed below the dense urban fabric of central Westminster. The District and Circle line Underground station and sub-surface running tunnels are located on the north side of Terminus Place.

2.3.4 Numerous main roads surround the Victoria transport facilities including Victoria Street to the north, Bressenden Place and Allington Street to the north/northeast, Wilton Road to the east and Buckingham Palace Road to the west. Terminus Place, where Victoria bus station and the taxi rank are situated, lies partly above the South Ticket Hall.

2.3.5 The area surrounding the station is heavily dominated by retail uses located

on the main roads, in the National Rail station and in the new Cardinal Place development on Victoria Street. There are also a number of residential areas and office spaces, including those of LU and National Rail, and a number of government department offices. Residential areas have been grouped into the following zones, as presented in Paragraph 6.13.14:

- Allington Street;
- Vauxhall Bridge Road to Ambrosden Avenue;
- Buckingham Palace Road;
- Palace Street;
- Ambrosden Avenue to Howick Place; and
- Southern Periphery.

2.3.6 A number of conservation areas also surround the station which include the following:

- Birdcage Walk;
- Westminster Cathedral;
- Grosvenor Gardens;
- Belgravia; and
- Royal Parks.

2.3.7 There are several listed buildings in the area including the Victoria Palace Theatre (VPT), the Little Ben Clock Tower and the National Rail Station façade (Figure 2.1).

2.3.8 The King's Scholars' Pond Sewer runs approximately north to southeast under the eastern edge of VPT, heading south and to the east of Vauxhall Bridge Road and King's Scholars' Passage. It lies at a depth of 1 - 1.5m below ground level (bgl). A second sewer, the Western Deep Sewer, runs north to south through the site, and is located at an approximate depth of 27m below existing ground level. These sewers, in particular the former, together with existing LU infrastructure, are significant constraints to further sub-surface development.

2.4 Site History

2.4.1 Historic maps show the area was predominately marshes and fields. It was developed in 1827 to include a reservoir and subsequently a canal and basin. The River Tyburn, that once crossed the site, was culverted to form the King's Scholar's Pond Sewer in the 1890s.

2.4.2 The Victoria Railway Station, known as the National Rail station, was built in the canal basin area to provide rail links to Brighton and the south coast.

Opened in 1860, initially there were two separate, adjacent stations but these were brought together as one in 1925. The footprint of the National Rail Station forecourt and Terminus Place was defined in 1816 when Shaftesbury Terrace was built and replaced the canal basin and wharf, which formerly occupied the site. The Thistle Victoria Hotel (formerly The Grosvenor Hotel) was built adjacent to the western end of the National Rail station in 1861.

2.4.3 The surrounding land use consisted of streets lined with terraced houses and included the Stag Brewery immediately to the northeast of the site. The brewery was founded in 1641 and occupied the site just east of Bressenden Place. It closed in 1959 when the site was redeveloped after World War II. Entertainment venues arrived in the area, including the VPT in 1911.

2.4.4 Following the development of rail infrastructure in the area, Victoria Street increasingly became a sought after location in the years which followed, with developments occurring along the south side and latterly on the north side of this street. In the early 1960s, part of the area surrounding the Victoria transport complex was redeveloped with additional roads and buildings constructed. There has been ongoing development of the area since the 1960s; the most recent development is Cardinal Place (to the north east of the Victoria transport facilities), which was completed in 2005 with apartments, shops and offices.

2.5 Existing Facilities

2.5.1 Below is a brief explanation of the different facilities that are found within and in the immediate vicinity of the Victoria Station Complex.

National Rail Station

2.5.2 There are 19 platforms in the National Rail station, which serve Medway towns, the Kent coast, Sussex and the south coast as far as Portsmouth and Southampton. Network Rail manages the station, with rail services operated by Southern Railway, Southeastern Railway and Gatwick Express. The National Rail station area includes two large concourses, shops, food and drink outlets, a ticket hall, toilets, lost property, left luggage, a British Transport Police station and Network Rail offices.

2.5.3 The National Rail station with its ornate north facing façade, overlooking the bus station and taxi rank, is a Grade II listed building. Adjoining the western end of the National Rail station is the Thistle Victoria Hotel, which is a Grade II* building built in 1861 and subsequently refurbished and extended in 1892 and 1907.

Victoria Underground Station

2.5.4 Victoria Underground station provides links to King's Cross, the West End

and the City of London. It is one of the busiest stations on London's Underground network. Below ground, the Victoria line lies under the VPT in a northeast/southwest direction across the site at a depth of approximately 88m ATD[5]. The District & Circle lines run east to west through the north of the site, along Victoria Street and crossing Terminus Place.

2.5.5 The Victoria line covers a total of 21 km with 16 stations. Trains run from Walthamstow Central in the north to Brixton in the south. With the exception of the depot in Northumberland Park (Northeast London), the entire line is underground. The first section of the line (in Northeast London) opened in 1968 and was subsequently extended southwards, reaching Victoria in 1969 and Brixton in 1971. Currently 28 trains per hour operate at peak times in both directions. It is anticipated that this number will increase to 33 per hour in 2013 following completion of the Victoria Line Upgrade (VLU).

2.5.6 The existing ticket hall entrances for the Victoria line are located immediately north of the National Rail station and on Wilton Road. The District & Circle line ticket hall entrance is to the north side of Terminus Place integrated within a group of buildings, which include Victoria Arcade and Victoria Station House.

2.5.7 Facilities in Victoria Underground station include: a ticket office, cash machines, small retail units, offices, station control room, plant room, staff accommodation, information and help points, CCTV cameras and intercom speakers.

Bus Station

2.5.8 The bus station is a major hub for bus services and, in conjunction with stops on surrounding streets, has 18 different daytime bus routes operating through it serving most of central London and many outer areas. At night there are nine services, which operate from or run through the station across London. Additionally there are another two services that operate 24 hours a day.

2.5.9 The bus station is a one-way system, accessed from the west from Buckingham Palace Road. It acts as a terminus and an interchange, with buses entering from Buckingham Palace Road picking up passengers along Terminus Place, and exiting onto Victoria Street or Vauxhall Bridge Road. Bus stops are also located in Wilton Road and Victoria Street.

Taxi Service

2.5.10 The main taxi set-down and pick-up is provided on Terminus Place, immediately in front of the main entrance to the National Rail station. At present taxis enter Terminus Place from Wilton Road to the east and exit left onto Buckingham Palace Road west of the National Rail Station. Taxis also

[5] ATD - Above Tunnel Datum (Tunnel Datum equates to Ordnance Datum -100m).

utilise the bus stand area within Terminus Place to double back on themselves and exit onto Vauxhall Bridge Road. This movement allows access to the west and southwest.

2.5.11 Taxis queue by the Victoria Underground entrance on Wilton Road whilst waiting to join the main taxi rank outside the station. There are also taxi set-down and pick-up areas south of the main railway buildings just off Belgrave Road.

2.6 Developments in Proximity of the VSU Scheme

Victoria Line Upgrade

2.6.1 The Victoria Line Upgrade (VLU) is an LU scheme currently being delivered as part of Transport for London's £10bn 5 year Investment Programme. The scheme will provide passengers with safer, more reliable and quicker journeys as faster new trains and an improved signalling and control system will be delivered. The principal driver for VLU is to improve the service on this line thereby responding to the projected increase in passenger numbers.

2.6.2 The VLU is a key LU project. Forty seven new, bigger and faster trains will be brought into service between 2009 and 2013 as part of the VLU. The new trains will have greater capacity and will run faster than the existing stock. Other improvements include an improved signalling system, tracks and control system. These improvements aim to deliver safer, more regular and reliable customer journeys with better information provision and accessibility.

2.6.3 The new trains will have the following key features:

- increased passenger capacity by approximately 15%;
- improved acceleration that may result in reduced journey times;
- improved accessibility;
- CCTV coverage in each carriage; and
- enhanced on-train customer information.

2.6.4 Other features include:

- energy efficient trains;
- vehicles designed for easier maintenance to reduce maintenance and repairs costs;
- hard wearing vandal resistant materials to provide longer lasting and easier to clean exterior and interior environment; and
- lighting, heating and ventilation systems for passengers.

2.6.5 The changes will lead to a 17 per cent increase in peak frequencies and 16

per cent improvement in journey time. The completion and benefits of this scheme have been included in the VSU base case for the VSU and therefore have been given due consideration in this assessment.

2.6.6 The VSU and VLU schemes are both important elements of the TfL's Investment Programme and the improvements to Victoria Underground station proposed by the VSU scheme are essential for the full benefits of the VLU project to be realised.

Other Planned Developments

2.6.7 There are a number of projects that have either been approved for development or are currently being planned within the area surrounding the VSU site. These developments could potentially be developed at the same time as the VSU scheme. Section 7 of this ES identifies all potential projects (both approved and in the pipeline) and highlights those that are likely to be constructed at the same time as the VSU. It examines the potential cumulative effects both during construction and at the start date of completion. The locations of these developments are illustrated on Figure 2.2. Section 7 also addresses a number of planning briefs that have been prepared for the area by the CoW. These include; the redevelopment of Chelsea Barracks (adopted 2006) and Victoria Street, Buckingham Gate and Palace Street (under consultation).

2.7 Proposed VSU Scheme

2.7.1 The proposed works comprise the following:

- a new subterranean North Ticket Hall (NTH) at the junction of Bressenden Place and Victoria Street improving access from the north and east of the station;
- an enlarged existing Victoria line ticket hall (known as the South Ticket Hall (STH)) providing greater ease of passenger movements inside the station;
- three new banks of escalators (each bank comprising three escalators);
- a new interchange tunnel, referred to as the Paid Area Link (PAL). This new pedestrian tunnel will connect the NTH to the STH;
- new lifts providing step free access for persons of reduced mobility (PRM) between the street, ticket hall and platform levels, for the NTH and STH and for interchange between the District & Circle line and Victoria line platforms;
- improved emergency services access and evacuation core in the NTH;

- improved access between the National Rail and Underground stations through increased escalator and lift provision;
- utilities diversions; and
- demolition of some buildings for the purposes of the works.

2.7.2 New lifts for Persons of Reduced Mobility (PRM) will connect the Victoria line platforms to street level and provide interchange between the Victoria line and the D&C lines. The works will include utilities diversions, mechanical and electrical installations, and architectural works.

2.7.3 The proposed development and main components are shown in Figure 1.2 and are described further in Section 2.8. Table 2-2 below summarises how the identified objectives have been addressed through the proposed development.

Table 2-2: Key Objectives and how the Proposed Development Contributes Towards their Achievement

Key Objective	Background
Congestion relief	• The introduction of the North Ticket Hall will provide a major alternative entrance that will encourage passengers to use the entire length of the Victoria line platform, as the platform will be fed from both ends.
To increase capacity to address future demand	• Additional escalators and linking routes to and from the Victoria line will add significantly to the overall capacity of the station; and • The London Plan forecasts a increase in passenger numbers from 70,000 to 84,000 by 2016 during the morning peak period. This has been addressed through the increase of facilities, including stairs, gatelines, escalators, new and extended ticket halls and Paid Area Link.
Minimise passenger journey time	• The new North Ticket Hall will ensure walking time for customers coming from Victoria Street to the Victoria line will be quicker than going via the existing Wilton Road station entrance; and • The station will be able to improve passenger flows and reduce the need for ticket hall and gateline closures.
Access for PRM	• There will be a total of seven lifts associated with the North Ticket Hall and South Ticket Hall, two of which will lead to the D&C lines platforms.

2.8 Description of Works

Utilities Diversions

2.8.1 The area affected by the VSU Scheme contains many sub-surface utilities and services. The location of the existing utilities services have been determined by the use of topographical surveys, archive record drawings and ground penetration radar (GPR) techniques. From these location surveys it has been determined that a number of key utilities within proximity of the VSU worksites will require diversion, strengthening or protection in advance of the main upgrade works to Victoria Underground Station. Whilst powers are being sought under the TWA Rules to carry out all the utilities diversions, it is the intention that the utilities works are completed prior to the commencement of the main works for VSU.

2.8.2 A list of the major utilities requiring diversion, strengthening and protection measures is shown below. The locations of these utilities are identified on Figures 2.5(A1-1) – 2.5(A6).

- 760mm diameter Thames Water trunk water main (Victoria Street to Wilton Road);
- Kings Scholar's Pond Sewer;
- Western Deep Level Sewer;
- Other Thames Water brick and cast iron sewers and water mains in (Wilton Road, Terminus Place, Victoria Street, Bressenden Place and Allington Street);
- National Grid; and
- BT Openreach and other telecommunication services in Victoria Street, Bressenden Place.

2.8.3 This list is not exhaustive. There is the requirement for works to be undertaken on telecommunications systems, electricity systems, water and gas distribution mains. These works involve the construction of new manhole and inspection chambers, construction of a combined pumping station and the inspection/cleaning of existing combined sewers. Many of these works will typically involve the diversion to a temporary, protectable location for re-diversion during the main VSU works and will be undertaken within the existing carriageway and footway areas.

2.8.4 These works are included within the draft Order application and have therefore been included in this assessment notwithstanding that they may be carried out prior to the commencement of the main works i.e. before September 2009 (i.e. not under the TWA Order).

Demolition

Buildings to be Demolished

2.8.5 The RIBA Stage D1 design is based on the demolition of the following buildings to allow for the construction of the VSU scheme:

- 175 to 179, and 120 to 124 Victoria Street;
- 3 to 11 Bressenden Place;
- Elliot House;
- Subway and public lavatories under Bressenden Place;
- Roof structure for South Ticket Hall (STH);
- Cardinal Place basement structure (part);
- National Rail Basement (part); and
- Electricity Substation in Allington Street.

2.8.6 There are other properties where part of the building will be encroached upon and where partial demolition may be required. This is still the subject of further investigation and discussion with property owners.

2.8.7 Underpinning designs are being developed so that 4 to 7 Victoria Buildings, 22 Terminus Place and 181 to 183 Victoria Street can be retained.

2.8.8 It will also be necessary to undertake underpinning and strengthening works to the Duke of York public house. This building will need to be vacated during construction works.

2.8.9 Underpinning works will also be considered for the VPT foundations closest to the paid area link tunnels.

2.8.10 The locations of the buildings to be demolished are indicated on Figure 2.3.

Key Demolitions Associated with the NTH

2.8.11 The scheme has been developed on the basis that the existing buildings located at Numbers 3-11 Bressenden Place and Numbers 120-124 Victoria Street will be demolished to provide the necessary space to construct the North Ticket Hall (NTH) and to make temporary traffic diversions. The existing Bressenden Place public subway will be demolished as it lies partly within the proposed footprint of the NTH. Part of the existing Cardinal Place basement structure will have to be demolished to make way for the proposed Cardinal Place entrance stairs to the NTH. It is anticipated that the works will require the relocation of gas and power apparatus contained within this basement. However, it is not envisaged that existing foundations to Cardinal Place will require alteration as a result of these works.

Key Demolitions Associated with the STH

2.8.12 The VSU scheme has been developed on the basis that the eastern side of the existing LU Victoria line ticket hall structure including the existing retaining walls, roof, base slab, Wilton Road entrance stairs and ventilation shaft will be demolished to allow for its expansion. Part of the National Rail station basement will also be demolished.

Key Demolitions Associated with Tunnels

2.8.13 The tunnels associated with VSU assumes the demolition of Elliot House and 175 to 179 Victoria Street. Other buildings which are likely to be affected by tunnelling include the Duke of York public house and there will also mitigation measures to the VPT.

Construction of Tunnels and Shafts

Description of Activities

2.8.14 The description of the tunnels and shafts associated with the VSU scheme are summarised in Table 2-3 below. A detailed account of the works, shaft/tunnel dimensions and construction methods associated with the development of the tunnels and shafts are provided in the Conceptual Design Statement for Tunnels and Shafts (Document Ref: MMD-V047-1159-TUN-DOC-50001 (July 2007)) The scheme layout and the numbering system (#) used in this summary is shown on Plate 2.1[6] and should be referred to in conjunction with Table 2-3.

[6] This plan is labelled as per the project naming convention within the Order Application.

Plate 2.1: Tunnels and Shafts Reference Plan

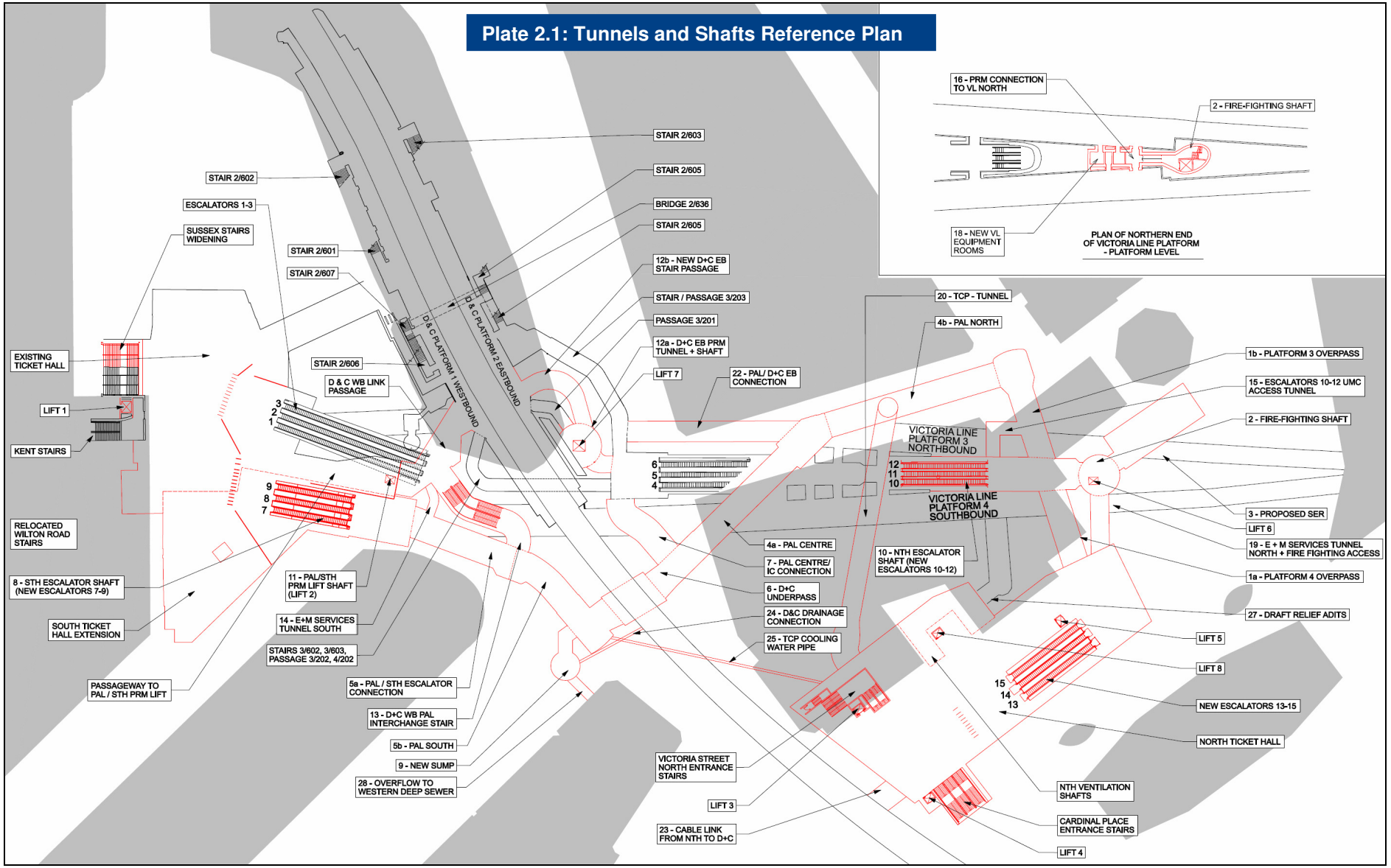


Table 2-3: Summary of Tunnels and Shafts		
Tunnel/Shaft Reference	**Description**	**Clearances/Interfaces with Other Structures**
Victoria Line Overpass (#1)	The Victoria Line Overpass (#1) tunnel traverses the Victoria line platform tunnels at the northern end of the station. The tunnel will form a passageway connecting the PAL tunnel (#4) to the NTH and the new NTH escalator shaft (#10) serving the northern end of the Victoria line platforms. There will also be a connection into the Fire-fighting Shaft (#2) for access to the fire-fighting lift.	• **Victoria Line Platform Tunnels:** At the location of the overpass tunnel, the crowns of the northbound and southbound platform tunnels are approximately 13.4m below ground level. Clearance between the crown of the Victoria line platform tunnels and the invert of the overpass tunnel will be approximately 1.6m. • **Elliot House:** It is envisaged that the Victoria line Overpass (#1) tunnel crown will pass approximately 1m beneath the bottom of the piles of Elliot House. The design is based on the demolition of Elliot House prior to construction of the Victoria Line Overpass (#1). • **Kings Scholars Pond Sewer:** The tunnel will pass beneath the sewer with a clearance of approximately 3.2m. Ground treatment will be required to stabilise the soils beneath the sewer in advance of the tunnelling.
Fire Fighting Shaft (#2) and M&E Services Tunnel North and Fire Fighting Access Tunnel (#19)	The fire-fighting shaft (#2) and access tunnel (#19) provide a fire and emergency services route to the northern end of the Victoria line platforms, via an entrance adjacent to the NTH. The upper section of the shaft is circular and the lower section elliptical with internal dimensions sufficient to house a lift, single width stairs and a services riser. The access tunnel (#19) provides a	• **Victoria Line Running Tunnels and Platform Tunnels:** The shaft sidewalls will be constructed within approximately 1m of the existing Victoria line running tunnels. • **Kings Scholars Pond Sewer:** The shaft will be constructed less than 0.5m from the Kings Scholars Pond Sewer. Temporary protection to the sewer will be required during shaft construction. Surveys of this sewer will be carried out during the detailed design prior to commencement of the works to confirm location, condition and construction. The fire-fighting access tunnel will pass

Table 2-3: Summary of Tunnels and Shafts		
Tunnel/Shaft Reference	**Description**	**Clearances/Interfaces with Other Structures**
	dedicated route from the NTH to the fire-fighting shaft.	beneath the sewer with a clearance of approximately 1.5m.
PRM Connection to Victoria Line North (#16) and new Victoria Line Equipment Rooms (#18)	An adit extends from the lower level of the fire-fighting shaft to provide a connection for PRM from the lower level of the lift to the Victoria line platform tunnels (#16) and to new Victoria Line (VL) Equipment Rooms (#18).	• **Victoria Line Running Tunnels and Platform Tunnels:** The tunnels will be constructed within 1m of the existing Victoria line platform tunnels and endwalls.
Paid Area Link North and Centre (#4)	The PAL North and PAL Centre tunnels provide a passenger route from the Interchange Concourse and northern end of the D&C underpass to the Victoria line overpass tunnel.	• **VPT:** The tunnel alignment has been selected to minimise impact on the VPT. Record drawings of the theatre indicate the lowest internal level to be +101.16mATD, assuming the front foyer of the theatre is at the same level at the Victoria Street pavement outside. Details of the foundations as shown on archive drawings will be verified during the detailed design using trial pits... A structural depth of 1.5m has been taken for preliminary analysis. Based on these assumptions, the vertical clearance between the crown of the tunnel and underside of the foundation at the closest point is approximately 2.5m. Ground improvement measures to protect the building foundation will be required. • **Pilot Tunnels:** The alignment of the PAL Centre comes close to the eastern of the two pilot tunnels. To ensure sufficient space for ground improvement around the new tunnel, the alignment has been chosen to provide a minimum of 300mm clearance from theoretical tunnel

Table 2-3: Summary of Tunnels and Shafts

Tunnel/Shaft Reference	Description	Clearances/Interfaces with Other Structures
		excavation line (i.e. not including tolerances) to the pilot tunnels. Coring is proposed to determine the exact location of the pilot tunnels. • Victoria Line Platform Tunnels: The PAL Centre tunnel crosses above the Victoria line platform tunnels along a skewed alignment. At its closest, the invert of the PAL is 400mm above the crown of the northbound Victoria line platform tunnels. • **Duke of York Public House:** The tunnel traverses beneath the Duke of York public house: Assuming a 1m deep foundation and a finished floor level in the basement of +101.9mATD, the vertical clearance between the crown of the tunnel and underside of the foundation at the closest point is approximately 3.6m. Current design assumes that the Duke of York is vacated during the construction works to allow for underpinning, internally propping the building and constructing the tunnel beneath. This requirement is based on the present condition of the building. • **Interchange Escalator:** The interchange escalator is constructed of cast-iron bolted linings. At its closest point the PAL Centre tunnel is less than 1m from the transition between the escalator barrel and lower machine chamber.
NTH Escalator Shaft (#10) and UMC Access (#15)	The NTH escalator shaft (#10) houses the new bank of three heavy duty semi compact escalators that descend to the	• **Victoria Line Platform Tunnels:** The escalator shaft is located between the two platform tunnels. The minimum clearance between the platform tunnels and the escalator

Table 2-3: Summary of Tunnels and Shafts

Tunnel/Shaft Reference	Description	Clearances/Interfaces with Other Structures
	Victoria line platform level from the Victoria line overpass tunnel (#1) at the north end of the station. The shaft falls from a floor level of at the Victoria line overpass tunnel (#1) to platform level. The NTH escalator shaft will consist of the upper machine chamber, inclined shaft and the lower machine chamber. Access to the UMC is provided via a small adit from the Victoria line Overpass tunnel (#1).	shaft will be less than 0.5m. At the upper level of the shaft, a junction will be formed with the Victoria line overpass tunnel. At the lower level, the shaft will connect to the existing concourse tunnel leading passengers to both Victoria line platforms. The lower section of the shaft requires breakout of an existing cross passage and concourse tunnel.
Paid Area Link/District and Circle Eastbound Connection (#22)	The PAL/D&C eastbound connection will provide a passenger route from the PAL to the existing stairs linking to the D&C eastbound platform.	• **Allington House:** The PAL / D&C eastbound connection tunnel passes beneath Allington House. • **Passage 3/203:** During the congestion relief work carried out in 1992, a 4.5mID passageway was built to connect the D&C Eastbound platform to the Interchange Concourse. The PAL/ D&C Eastbound connection tunnel will join this passageway along the straight section of the passageway, between the Interchange Concourse and the lower flight of stairs.
Tunnel Cooling Project Tunnel (#20)	The TCP tunnel will provide a route for the cooled air from the NTH to the crown of the north and southbound Victoria line platform tunnels. A tunnel runs from a shaft excavated beneath the NTH base slab,	• **VPT:** The tunnel alignment passes beneath the VPT. The vertical alignment has been selected to ensure that adequate cover to the clay/gravel interface is provided. • **Victoria Line Platform Tunnels and Lower Interchange**

Table 2-3: Summary of Tunnels and Shafts		
Tunnel/Shaft Reference	**Description**	**Clearances/Interfaces with Other Structures**
	beneath the Victoria line platform tunnels and concourse tunnel, and connects to a shaft extending down from the PAL invert below Allington Street. From the shaft a route for the cooling air is provided to the northbound Victoria line via a small hand excavated heading. Breakout into the crown of the northbound platform tunnel will be from this heading. The cooling air for the southbound Victoria line platform tunnel runs along the invert of the PAL Centre tunnel (#4a). A breakout is made in the invert of the PAL tunnel to provide a route into the crown of the Southbound Victoria line platform tunnel.	**Concourse:** The tunnel alignment passes beneath the Victoria line Platform Tunnels and Lower Interchange Concourse.
Paid Area Link Centre/ Interchange Concourse (IC) Connection (#7)	This tunnel creates a passenger link from the PAL tunnels to the Interchange Concourse.	• **Victoria Line Platform Tunnels:** To allow the link to be formed with the Interchange Concourse, the tunnel must pass directly over the southbound Victoria line platform tunnel. The clearance between the underside of this tunnel and the crown of the Victoria line platform tunnel is 2.3m. • **Interchange Escalators:** The upper machine chamber for the interchange escalators is located beneath the floor of the Interchange Concourse, which is housed within a

Table 2-3: Summary of Tunnels and Shafts		
Tunnel/Shaft Reference	**Description**	**Clearances/Interfaces with Other Structures**
		9.9m diameter cast iron tunnel. Prior to making the breakthrough into the concourse, preparatory works will be required to relocate the Upper Machine Chamber access stairs. These are currently located in the south-east corner of the chamber and will be relocated on the opposite side, along the west wall. • **Thames Water Sewer Chamber:** The western end of this connection is beneath a Thames Water sewer chamber located in Victoria Street. The clearance to the tunnel crown is approximately 2.5m (based on assumptions).
District and Circle Underpass (#6)	The D&C Underpass connects the PAL Centre and PAL South. This will allow passengers to travel from the new bank of STH escalators to the Interchange Concourse and the northern end of the Victoria line platforms. It is proposed that the crown of the underpass will be formed by strengthening the invert to the D&C tunnel.	• **District & Circle Line:** The archive drawings indicate a depth of approximately 1.6m from top of rail to the underside of the tunnel walls. Further survey of this area is proposed, including coring to determine the form of the invert of the D&C line tunnel.
Paid Area Link South (#5b) and Paid Area Link/STH Escalator Connection (#5a) and M&E Services Tunnel South (#14)	The PAL South (#5b) and PAL/STH Escalator Connection (#5a) provide passenger access from the new STH escalators to the D&C Underpass. The M&E Services Tunnel South (#14) provides a dedicated route for the services	• **Victoria Line:** At the southern end of this link, the tunnel connects to the STH escalator shaft. Close to the STH escalator shaft connection, the tunnel passes over the Victoria line southbound tunnel with a clearance of approximately 1.5 m. • **Abford House:** At its closest point the tunnel is

Table 2-3: Summary of Tunnels and Shafts

Tunnel/Shaft Reference	Description	Clearances/Interfaces with Other Structures
	from the STH running through the PAL tunnels. A review of the services routing will be carried out in later design stages with the aim of eliminating the requirement for this tunnel by routing the services through the D&C westbound PAL Interchange Stair (#13).	approximately 1m from an existing footing of Abford House.
District and Circle Westbound Paid Area Link Interchange Stair (#13)	This tunnel will provide a link from the PAL South via stairs from the PAL to the westbound D&C platform.	• **Victoria Line:** The tunnel passes over the Victoria line southbound tunnel with a clearance of approximately 2m. • **Drainage Tunnel:** This tunnel alignment clashes with the 900mm diameter drain leading from the D&C line running tunnel to the sump pump. A drainage diversion scheme is to be provided whereby the flows into the existing drain will be diverted via a new D&C Drainage Connection (#24) into a new sump (#9).
STH Escalator Shaft (#8)	The STH escalator shaft houses the new bank of three escalators (escalators 7-9) leading from the new STH extension down to the new PAL tunnels. The escalator shaft comprises an inclined shaft and a tunnelled section to house the lower machine chamber.	• **Victoria Line:** The bottom of the inclined shaft and tunnelled section will be located approximately 1m from the existing Victoria line southbound tunnel and the cross passage that connects the northbound and southbound tunnels. • **Abford House:** At its closest point the escalator shaft is within 1m of the footing of Abford House.
New Sump (#9), D&C Drainage Connection (#24), TCP Cooling Water Pipe (#25) and	The new sump is required due to a clash between the new D&C westbound (WB) interchange stair (#13) and the existing drainage pipe for the section of the D&C	• **No 173 Victoria Street:** No 173 Victoria Street, built in the early 1990s, has piled foundations bridging over the King's Scholars Pond Sewer. A transfer shaft between the King's Scholars Pond Sewer and the Western Deep

Table 2-3: Summary of Tunnels and Shafts

Tunnel/Shaft Reference	Description	Clearances/Interfaces with Other Structures
Overflow to Western Deep Sewer (#26)	line to the east of the D&C underpass. The new sump will be located to the south of the D&C underpass. Water from the D&C invert is diverted through a drainage pipe from the sump (#24). Some of the water is then pumped via a 200mm main to the NTH for the Tunnel Cooling Project (#25) whilst the remainder is pumped to a sewer in Vauxhall Bridge Road.. An overflow pipe (#26) is also provided in the case of pump failure. This overflow pipe leads to a transfer shaft connecting the Kings Scholars Pond Sewer (KSPS) to the Western Deep Sewer. The sump needs to be operational before construction of the D&C underpass, or construction of the D&C WB link passage piling works and the construction of the interchange tunnel (#13) begins. The sump is located beneath the level of the PAL tunnels, enabling M&E equipment to be located at PAL level above. A small passage will provide access to the sump from the PAL.	Sewer is located within the footprint of the building.
Paid Area Link/STH Lift (#11)	The lift adjacent to the STH Escalator will serve three levels. It will allow step-free	• **Victoria Line:** The shaft will be located adjacent to the new STH escalator, approximately 1m from the existing

Table 2-3: Summary of Tunnels and Shafts		
Tunnel/Shaft Reference	**Description**	**Clearances/Interfaces with Other Structures**
	access from the STH floor level to the PAL level, to the bottom of the STH escalator shaft floor level and to the westbound platform of the D&C line. The lift will be housed within an approximately 4m wide shaft.	Victoria line tunnels.
D&C Eastbound Lift (#12a) and D&C Eastbound Stair Passage (#12b)	This lift shaft will allow step-free access from the Interchange Concourse level to the eastbound platform of the D&C line. The lower section, from interchange concourse level to Victoria line will be housed within a shaft. The D&C eastbound stair passage connects from the shaft to the eastbound platform of the D&C line.	• **D&C Line:** The shaft will be located to the north of the D&C line platform. The large diameter upper section of the shaft will be constructed using sprayed concrete lining (SCL), using the wall of the D&C platform to prop the southern side. The central section of the original passageway from the D&C eastbound to the Interchange Concourse will be removed to provide space for the lift and waiting area. The 1992 passageway from the D&C eastbound for the Interchange Concourse (passage 3/203) will be maintained as existing however passage movement along the tunnel will be restricted to suit the construction of the new link tunnel.. • **Victoria Line:** At Victoria line platform level the lift will take up one of the existing cross-passages (5/216).
Cable Link from NTH to D&C (#23)	A cable link is to be provided for the EDF power link cables from D&C line to the NTH.	• The cable link tunnel connects between the D&C line and the North Ticket Hall.
D&C Westbound Link Passage	This tunnel provides a connection to the existing D&C platform from the new ticket hall.	• **D&C Line:** The D&C westbound link passage will interface with the westbound D&C platform tunnel.

Proposed Methods of Construction

Ground Improvement

2.8.15 Ground improvement measures will be applied to improve the ground characteristics and achieve the following:

- Reduce the permeability of the terrace gravel deposits locally around the new tunnels excavated at this level;
- stabilise the face and ground around the periphery of the tunnel excavation;
- provide support to building foundations where underpinning is required;
- limit ground movements and settlements; and
- improve safety.

2.8.16 At this stage in the design process, the following ground treatment methods for the construction of the tunnels and shafts have been considered.

2.8.17 **Permeation Grouting** can be carried out in soils with sufficient permeability to be susceptible to grouting. In general, the unmodified Terrace Deposits are likely to be groutable however, the high sand and silt contents in local deposits will limit the applicability of permeation grouting with traditional cementitious grouting material. At this stage it is considered that the design cannot be based on this method of ground treatment when using the Sprayed Concrete Lining (SCL) method for tunnelling due to the variable nature of the ground. Further consideration will be given to the use of microfine cement and silicate grouting in later design stages and following additional site investigation.

2.8.18 **Jet Grouting** can be used to improve the ground to stabilise granular soils. In general, vertical application of jet grouting from the ground surface is envisaged in all tunnel sections accessible at ground level, e.g. from Allington Street, Victoria Street and Wilton Road.

2.8.19 Where new tunnels are to be constructed in close proximity to the foundations of the buildings such as the VPT, Duke of York public house, and Allington House inclined jet grouting is proposed to the maximum extent possible. However, to achieve the full coverage of ground improvement required for tunnelling, jet grouting from the basement of the Duke of York public house will be required. Jet grouting trials are proposed to provide verification of the practicality and feasibility of use.

2.8.20 **Ground Freezing** can be used for the construction of the new tunnels however the detailed design will need to consider the influence that freezing may have on surrounding third party assets and services. If this method was to be used, horizontal freeze pipes would be installed from within a tunnel

enlargement and a section of ground frozen in advance of driving the tunnel. This procedure would be repeated when the excavation comes to the end of the frozen block of ground. Ground freezing would involve the formation of a controlled frozen soil arch (intermittent freezing) surrounding the future tunnels which would tie into the clay surface. Freezing of London Clay will not be performed.

2.8.21 The exact form of ground treatment will be developed during later stages of design and will be subject to several factors including:

- additional site investigation (SI);
- grouting trials;
- location of certain utilities;
- assumptions regarding access to certain properties to carry out the works;
- structural surveys for properties and services affected by the works; and
- third party approvals and consents, i.e. traffic, pedestrian and working hours.

2.8.22 It will also be necessary to install tunnel pre-supports during excavation. The main objectives of this activity are to:

- reduce overbreak and stabilise the ground around the periphery;
- allow quick adjustment to changing ground conditions; and
- maximise work safety.

2.8.23 The following pre-support methods have been considered and can be used during the tunnel construction:

2.8.24 **Grouted Pipe Arch:** Horizontal installation of grouted pipes forming an arch may be used to stabilise the ground ahead. Thick walled steel pipes will be installed using “lost bit” drilling methods.

2.8.25 It is envisaged that a grouted pipe arch will be used systematically for all tunnels except where ground freezing is used as the main ground stabilisation method.

2.8.26 **Spiling Method:** Grouted pipe spiles may be used as an additional means of stabilising the ground (typically 2-4 advances ahead of the tunnel face).

Sprayed Concrete Lining Construction

Vertical Shafts

2.8.27 The following vertical shafts will be constructed using the sprayed concrete lining technique:

- fire fighting shaft (#2);
- upper section of D&C eastbound PRM shaft (#12a);
- shaft beneath Allington Street from the PAL tunnel to the TCP tunnel (#20); and
- Temporary access shaft in Allington Street adjacent to Elliot House.

2.8.28 In each case, the shafts will be excavated through the water-bearing granular deposits overlying the London Clay. These deposits will be pre-treated by jet grouting from the ground surface to significantly reduce groundwater inflows and stabilise the ground prior to excavation. Any small inflows will be dealt with by sump pumping.

Tunnels

2.8.29 The tunnels range in diameter from approximately 3.6m (Tunnel Cooling Project #20) to approximately 7m (enlargement for D&C Underpass #6). Generally the invert of the PAL tunnels is located in the London Clay and the majority of the tunnel face in the Terrace Deposits. To reduce the risk of ground-borne hazards during tunnelling, advanced ground improvement will take the form of jet grouting from the surface, where possible (see above). The jet grouting will improve the ground above the London Clay to a distance of 2m radially from the required excavation line. On all tunnels systematic forward probing will be applied.

2.8.30 Construction of the tunnels will be sequenced to minimise exposed face area and to enable early ring closure where necessary. The following excavation stages are envisaged for large tunnels:

- top heading (with or without a temporary invert) that may be divided into two halves;
- bench excavation (with or without a temporary invert); and
- invert excavation to complete the full excavation section with final ring closure.

2.8.31 For smaller tunnels it is envisaged that the excavation will be in principle in two steps:

- top heading (with or without a temporary invert); and
- bench and invert excavation together.

2.8.32 A distinct advantage of the sprayed concrete method for tunnel driving is that the arrangement and size of tunnels will permit the use of mechanical excavation equipment and robotic spraying equipment, thus avoiding or at least minimising the use of hand methods.

Escalator Shafts

2.8.33 The inclined shafts are approximately 9m in diameter. It is envisaged that ground improvement will be carried out by jet grouting and pre-support measures will be used for these large tunnels. Additional grouted spiles (see above) can be added if required by the ground conditions. On all escalator shafts systematic forward probing will be applied.

2.8.34 Construction of the escalator shafts will be sequenced to minimise exposed face area. The final sequence will be determined in the detailed design stage. The following three-stage excavation is in principle envisaged:

- top heading (with or without a temporary invert) that may be divided into two halves or a pilot tunnel;
- bench excavation or first stage enlargement from the pilot tunnel (the first stage enlargement may or may not be enhanced by a temporary invert); and
- invert excavation to complete the full excavation section and final ring closure.

Other Tunnelling Methods

D&C Underpass

2.8.35 Prior to constructing the new D&C underpass, the existing invert to the D&C line tunnel will be strengthened. The strengthened invert is required to span the underpass and sustain operational loads from passing underground trains. The strengthened invert would then form the roof of the underpass, allowing the area beneath the D&C line to be fully utilised for gaining maximum headroom to the underpass tunnel itself. It is proposed that the strengthening of the D&C line tunnel invert will be achieved by removing the ballast, concrete invert and brickwork that currently exists and replacing these with in-situ reinforced concrete. It is anticipated that the depth of this new concrete invert will be governed by the height restrictions in the underpass.

2.8.36 The new invert will consist of four steel beams spanning approximately 10m in the direction of the D&C line tracks, encapsulated in concrete. The beams will be founded on pre-installed micropiles. The loads from the tunnel walls will be carried by new sidewall beams, which will replace the lower part of the brick lining. The new sidewalls together with the concrete encapsulated steel beams will form a monolithic concrete slab. The sidewalls will be constructed as an underpinning operation in 1m increments with couplers installed between each section. After all 1m sections have been cast they will form a

continuous beam.

2.8.37 Following completion of the ground treatment, a sump will be constructed for the future construction of the new drainage connection thrust bore tunnel leading to the new sump. This drainage connection will need to be installed before any strengthening works can commence.

2.8.38 A detailed construction sequence has been developed for the D&C underpass works and are available in the Conceptual Design Statement for Tunnels and Shafts (Document Ref: MMD-V047-1159-TUN-DOC-50001.)

Spheroidal Graphite Iron (SGI) Linings

2.8.39 SGI linings are currently proposed for:

- Connection tunnel between the sump and the connection to the Western Deep Sewer (#26);
- D&C Eastbound staircase passage (#12b);
- D&C Westbound PAL interchange stair (#13);
- M&E services tunnel south (#14);
- PRM connection to Victoria line north (#16);
- New Victoria line equipment rooms (#18);
- Draught relief adits (#27); and
- Rebuilding of the VL running tunnels adjacent to the new fire-fighting shaft (#2).

Square Work

2.8.40 The following tunnels are currently envisaged to be excavated as square work:

- Connection adits from TCP (#20) and PAL invert (#4a) to crowns of Victoria line northbound and southbound tunnels;
- Escalator 10-12 UMC access tunnel (#15); and
- Cable link from NTH to D&C line (#23).

Pipe Jacking and Microtunnelling

2.8.41 It is proposed to use pipe jacking and microtunnelling techniques for the following tunnels:

- D&C Drainage Connection (#24); and
- TCP Cooling Water Pipe (#25).

Other Shaft Construction Methods

Pre-cast Concrete Segmental Linings

2.8.42 The shaft for the new sump (#9) will be constructed with a pre-cast concrete segmental lining.

Square Work

2.8.43 The lower sections of the PRM lifts (#12a and #14) will be constructed using square work.

Construction of Structural Elements

2.8.44 A detailed account of the works and construction methods associated with the development of the structural works associated with the scheme are provided in the Conceptual Design Statement for Structural Works (Document Ref: MMD-V047-1159-STR-DOC-50001 (July 2007)).

North Ticket Hall

Description of Proposed Works

2.8.45 The proposed North Ticket Hall (NTH) is a 3-storey subsurface structure located below Bressenden Place and the current location of Numbers 3-11 Bressenden Place and Numbers 120-124 Victoria Street which are to be demolished. The NTH is an irregular shape in plan with 76m maximum length and 33m maximum width. It has a constant excavation depth of 17.4m from ground level (105.0mTD) to formation level (87.6mTD).

2.8.46 The proposed NTH is constrained on all sides by existing structures and the proposed future buildings of the Victoria Transport Interchange (VTI). Portland House and the recently constructed Cardinal Place development lie along the eastside of the proposed NTH location and their basements are in close proximity to the proposed secant pile wall. VPT, Elliot House, the LU Draft Relief Shaft, Thames Water King's Scholar Pond and Western Deep sewers lie to the westside of the NTH.

2.8.47 Access to and from the NTH is proposed from two new entrance structures; one near Victoria Street adjacent to the VPT and the other on the corner of Bressenden Place and Victoria Street adjacent to the Cardinal Place development. Access will be provided by stairs and PRM lifts from existing street level (105.0mTD) to ticket hall level (99.8mTD). The VSU station plant rooms will be located at Level -2.

2.8.48 A new ventilation shaft and fire and emergency access lift core is proposed along the western side of the NTH which will be accessed at street level. The new ventilation shaft will also be utilised for heavy plant access into the NTH.

2.8.49 The architectural design of the NTH aims to provide a large open space above the escalators between ticket hall and paid area link levels.

Construction Methodology

2.8.50 The proposed method of construction for the main NTH is by top-down construction. The proposed outline construction sequence is as follows:

i. Divert existing services in Bressenden Place.

ii. Strengthen or install protection measures for adjacent buildings and sewers where required by the detailed deign.

iii. Install and commence instrumentation and monitoring of adjacent buildings and utilities. Some monitoring will have been installed as advanced works

iv. Demolish the existing 2-storey buildings located at 3-11 Bressenden Place, buildings at 120 and 124 Victoria Street, and the 6-storey building at 122 Victoria Street. Demolish and backfill underpass and toilets under Bressenden Place.

v. Divert traffic to the east side of Bressenden Place.

vi. Excavate to underside of roof slab level (approximately 102.8mATD).

vii. Install westside perimeter secant pile walls and western half of northside and southside perimeter secant pile walls.

viii. Install foundation (compression and tension) piles within westside of NTH with cut–off level at base slab level and steel columns (plunge piles) extending to roof slab level.

ix. Construct the westside roof slab with connections to the secant pile walls and plunge columns and making provision for monolithic connection to the east side roof slab. Provide covered openings in roof slab for construction access.

x. Re-establish road above newly constructed west side roof slab and divert traffic to the west side of Bressenden Place.

xi. Repeat 6 to 9 for eastside secant pile walls, foundation piles, plunge columns and roof slab forming monolithic connection with the west side roof slab.

xii. Re-establish road above newly constructed eastside roof slab and divert traffic back to the eastside of Bressenden Place.

xiii. Excavate beneath roof slab to Level -1 (ticket hall) slab formation level sealing any water ingress through the perimeter pile walls with shotcrete and/or grouting behind the wall.

xiv. Place Level -1 (ticket hall) slab and the diaphragm grillage and permanent steel props (at escalator position) with connections into the perimeter pile wall and internal plunge columns.

xv. Repeat 13 and 14 for Level -2 (station plant room).

xvi. Repeat 13 and 14 for Level -3 (EDF and TCP plant rooms) including drainage sump(s) and connection of base slab to foundation piles below.

xvii. Encase steel plunge columns with concrete to form permanent columns with necessary fire protection, form ventilated drainage cavity to all perimeter pile walls, construct internal non-load bearing walls and fit out station.

xviii. Construct new load bearing support wall within the existing Cardinal Place basement and demolish existing basement wall and roof slab within footprint of the Cardinal Place entrance stairs.

xix. Install temporary sheet pile wall support system and excavate in bottom-up construction adjacent to the existing Cardinal Place basement to form the Cardinal Place entrance stairs and canopy above.

xx. Construct Victoria Street North entrance structure at ground level (to be incorporated into CSD construction).

Clearances/Interfaces with Other Structures

2.8.51 Construction of the NTH will structurally impact the following existing structures:

- Cardinal Place (modification of part of the basement);
- LU Draft Relief Shaft (redirected ventilation through connection into the NTH); and
- Bressenden Place Public Subway (to be demolished).

Construction of the NTH is also likely to impact the following structures:

- VPT (Grade II Listed);
- Duke of York Public House;
- Portland House;
- LU D&C line Brick Arch Tunnel;
- Thames Water Utilities King's Scholar Pond Sewer; and
- Thames Water Utilities Western Deep Sewer.

NB: The design is based on the demolition of Elliot House to allow tunnelling of the Paid Area Link (PAL).

2.8.52 Impacts on the above structures are likely to occur due to ground movements, and noise and vibration associated with construction. Measures will be taken during construction to ensure that the works do not have a detrimental effect on the existing surrounding structures.

South Ticket Hall

Description of Proposed Works

2.8.53 The proposed STH is a 2 and 3-storey subsurface structure located below 'the Beach' area of Terminus Place and partly below Wilton Road. The Beach is an area of public realm that lies in front of the National Rail Station. The STH extension is approximately triangular in plan with 32m maximum length and 32m maximum width. The majority of the station is a 2-storey substructure with an approximate excavation depth of 10.9m from ground level (104.5mATD) to formation level (93.6mATD). There is a localised third basement on the eastside with an approximate excavation depth of 15.5m from ground level to formation level (89.0mATD).

2.8.54 The proposed STH is constrained on the southside by the existing mainline station building and on the eastside by traffic and utility requirements in Wilton Road. The STH will form an extension of the existing Victoria line ticket hall to the westside, part of which will be removed and replaced. Abford House and the Apollo Theatre lie along the eastside of the proposed STH and their basements are in close proximity to the proposed secant pile wall. The Victoria line southbound running tunnel lies below the proposed STH.

2.8.55 Access to and from the new STH is proposed from the two existing staircases into the National Rail Station concourse - the 'Sussex' and 'Kent' Stairs – and relocated Wilton Road Stairs to street. The 'Sussex' Stairs will be widened and a new in-situ reinforced concrete wall provided. A new PRM lift will be constructed in reinforced concrete from the National Rail Station concourse to LU ticket hall level (100.18mTD) between the 'Sussex' and 'Kent' Stairs through the floor area currently occupied by Threshers. A new passageway from the STH to the D&C westbound platform level and the new Paid Area Link (PAL) tunnel level via a further PRM lift will also be provided.

2.8.56 The STH internal structure will be constructed with in-situ reinforced concrete throughout, with the exception of the roof which will be composite steel and reinforced concrete and the columns which are will be structural steel H-sections encased in concrete for the permanent works.

2.8.57 The new Wilton Road entrance will form an integral part of the STH between roof and ticket hall levels. The roof canopy structure is proposed to be constructed in structural steel, metal cladding and reinforced glass. The works will be phased to ensure that impact on the operation of the existing station will be minimised. The existing Wilton Road entrances will be utilised throughout the works and will only be decommissioned when the new entrance stairs becomes operational.

Construction Methodology

2.8.58 The proposed method of construction for the STH is a combination of bottom-up and top-down construction. The proposed outline construction sequence, incorporating construction of the cut-and-cover passageway connection to the westbound District and Circle line, is as follows:

i. Divert existing services in Wilton Road and Terminus Place and relocate mechanical and electrical (M&E) equipment within eastern rooms of existing ticket hall to be demolished.

ii. Strengthen or install protection measures for adjacent buildings and utilities (if necessary).

iii. Install and commence instrumentation and monitoring of Victoria line running tunnels, adjacent buildings and utilities. Some monitoring will have been installed as advanced works

iv. Construct extension to 'Sussex' stairs and PRM lift adjacent to 'Kent' stairs.

v. Restrict Wilton Road to single lane and install secant pile wall to northern section of passageway to District and Circle line and form roof slab. Install perimeter secant pile wall to north east side of STH, together with tension piles/plunge columns where accessible.

vi. Close Wilton Road, complete perimeter secant pile wall for passageway to District and Circle line and roof slab. Form door frame collar and partial roof structure in Wilton Road for site access and reopen single lane of Wilton Road.

vii. Excavate to Level -1 (Ticket Hall Level), including demolition of the National Rail basement and existing ticket hall rooms up to existing pedestrian passage to Wilton Road stairs, erecting a weatherproof barrier between the functioning area of the ticket hall and construction site.

viii. Install perimeter secant pile wall to southern wall and tension piles/plunge columns where accessible, from Level -1 (Ticket Hall Level). Install and commission temporary Wilton Road stairs.

ix. Demolish/excavate existing Wilton Road stairs and STH up to interface between new and old, erecting a weatherproof barrier between the functioning area of the ticket hall and construction site. Complete perimeter secant pile wall to west side.

x. Place RC slab at Level -1 (Ticket Hall Level), leaving escalator UMC open with appropriate propping. Excavate by top-down to Level -2 (Upper Plant Room Level) and place RC floor/base slab.

xi. Construct escalator and connected tunnel works (#5a and 5b) via escalator UMC, together with passageway to westbound District and Circle line and PRM lift to intermediate level.

xii. Locally excavate by top-down to Level -3 (Lower Plant Room Level) via independent openings through Level -1 (Ticket Hall Level) and Level -2

(Upper Plant Room Level) and form base slab.

xiii. Complete Level -1 (Ticket Hall Level) RC slab over escalator UMC. Construct permanent Wilton Road stairs with temporary access and place roof slab over all except UMC and temporary Wilton Road stair locations.

xiv. Encase steel plunge columns with concrete to form permanent columns with necessary fire protection, form ventilated drainage cavity to all perimeter pile walls, construct internal non-load bearing walls and fit out station.

xv. Re-direct pedestrians to new Wilton Road stairs, remove temporary stairs and complete roof slab.

2.8.59 Complete roof slab over escalator UMC following delivery of escalators and major items of plant (if appropriate). Open entire new Wilton Road stair route and complete architectural and M&E fit out within ticket hall and surface features.

Clearances/Interfaces with Other Structures

2.8.60 Construction of the STH will structurally impact the following existing structures:

- National Rail Station Building; and
- existing LU Victoria Line Ticket Hall.

2.8.61 Construction of the STH is also likely to impact the following structures:

- Apollo Theatre;
- Abford House;
- Southbound Victoria line running tunnel; and
- Northbound Victoria line running tunnel/ start of step junction.

2.8.62 Impacts on the above structures are likely to occur due to ground movements, and noise and vibration associated with construction. Measures will be taken during construction to ensure that the works do not have a detrimental effect on the existing surrounding structures.

Signalling Equipment Room

Description of Proposed Works

2.8.63 The proposed Signal Equipment Room (SER) is a single storey subsurface structure located in a new RC cut-and-cover structure above the Victoria line running tunnels north of the station platforms. The proposed SER will replace the existing SER located between the platform tunnels at the northern end of the station. The proposed SER is rectangular in plan 21m long by 8.5m wide and an approximate excavation depth of 9.5m from ground level (104.5mTD)

to formation level (95.0mTD).

2.8.64 The proposed SER location is constrained on the west side by the proposed VTI Building No. 6, on the eastside by the existing King's Scholar Pond Sewer, and on the south side by the proposed London Fire and Emergency Planning Authority (LFEPA) shaft. The Stag Pub is adjacent to the proposed SER on the west side. The proposed SER is located above the Victoria line northbound running tunnel and in close proximity to the southbound running tunnel.

2.8.65 Permanent access to and from the proposed SER will be from access stairs within the proposed adjoining LFEPA shaft which will be accessed from a link tunnel to the NTH. As the SER is to be relocated at the start of the VSU scheme construction programme, ahead of completion of the NTH, temporary access to the SER will be provided from Victoria line platform level and up through the LFEPA shaft.

2.8.66 The location of the existing signal equipment room is currently a major constraint on the design of the proposed NTH Escalator Shaft (#10) for escalators 10-12 down to Victoria line platform level. The aim at detailed design stage is to optimise the design of this proposed escalator shaft to negate the need to relocate the SER.

Construction Methodology

2.8.67 The proposed method of construction for the SER is bottom-up construction. The proposed outline construction sequence is as follows:

i. Divert existing services in Bressenden Place and Allington Street.

ii. Strengthen or install protection measures to Victoria line running tunnels, adjacent buildings and utilities (if necessary).

iii. Install and commence instrumentation and monitoring of Victoria line running tunnels, adjacent buildings and utilities.

iv. Divert traffic in Allington Street and Bressenden Place as necessary.

v. Install perimeter secant pile walls.

vi. Dewater, excavate and install temporary props to formation level and install base slab.

vii. Install reinforced concrete columns and roof slab removing temporary props as necessary.

viii. Make connection into LFEPA shaft.

ix. Backfill over roof slab and reinstate ground/road surface above.

x. Form ventilated drainage cavity to all perimeter pile walls, construct internal non-load bearing walls and fit out room.

Clearances/Interfaces with Other Structures

2.8.68 Construction of the SER is likely to impact the following structures:

- LU Victoria line running tunnels;
- Thames Water King's Scholar Pond Sewer; and
- The Stag Public House.

2.8.69 The design is base on the demolition of Elliot House to allow tunnelling of the Paid Area Link (PAL).

2.8.70 Impacts on the above structures are likely to occur due to ground movements, and noise and vibration associated with construction. Measures will be taken during construction to ensure that the works do not have a detrimental effect on the existing surrounding structures.

Phasing of Utilities Works, Demolition and Construction Activities

2.8.71 With a construction period of approximately six years (including the works to protect and/or strengthen the utilities infrastructure), construction phasing for the VSU scheme is complex i.e. construction activities are not restricted to a single area of the site at any one time. For the purpose of environmental assessment, the traffic management phasing of the utilities and main works has been used and simplified by apportioning construction activities into discrete traffic management phases (presented in Table 2-4 and Table 2-5).

2.8.72 The phases relating to the main works together with the location of the respective worksites are illustrated on Figures 2.4(1) – 2.4(6) and therefore this table should be read in conjunction with these figures.

Table 2-4: VSU Scheme Main Works Construction Phases

Phase	Work site	Activities	Worksite Periods
Phase 1	**A**	Demolition of Elliot House.	Oct'09 to May'10
	B	Demolition of 3-11 Bressenden Place & 120-124 Victoria Street.	Oct'09 to Jul'10
	C	Preparation and piling along Wilton Road.	Oct'09 to May'10
	D	Construction of extension to Sussex stairs and lift for PRM.	Oct'09 to Jun'10
	E	Piling and formation of top slab to D&C westbound link passage.	Oct'09 to Apr'10

Table 2-4: VSU Scheme Main Works Construction Phases

Phase	Work site	Activities	Worksite Periods
	F	Demolition/infilling of existing underpass and toilets.	Oct'09 to May'10
Phase 2	**A**	Site establishment and jet grouting for shafts and tunnels. Piling for SER. Jet grouting in Allington Street	May'10 to Oct'10
	B	Piling for North Ticket Hall box.	May'10 to Oct'10
	C	Piling, demolition of NR basement and part existing ticket hall area. Excavation to ticket hall level. Formation of part of roof slab adjacent to Wilton Road. Continuation of piling and top slab to D&C westbound link passage. Jet grouting for escalator collar and Paid Area Link.	May'10 to Oct'10
Phase 3 **Phase 3a**	**A**	Jet grouting in Allington Street. Construction of SER and LFEPA shaft. Completion of SER Construction of re-aligned Allington Street	Oct'10 to Mar'11
	B	Form roof slab to west section of North Ticket Hall box.	Oct'10 to Mar'11
	C	Preparation and piling from ticket hall level.	Oct'10 to Mar'11
	G	Sink shaft and commission new pumping system. Start construction of D&C underpass.	Oct'10 to Mar'11
	M	Jet grouting for tunnels.	Jan'11 to Feb'11
	H	Construct PRM lift shafts, passage and connections.	Feb'11 to Nov'11
Phase 4	**A**	Construction of tunnels. Construction of LFEPA shaft and connections to Victoria line tunnels. Completion of SER. Construction of re-aligned Allington Street.	Mar'11 to Nov'11
	B	Pile and form roof slab to east section of North Ticket Hall box.	Mar'11 to Nov'11
	C	Complete piling and continue construction of South Ticket Hall.	Mar'11 to Nov'11
	G	Continue construction of D&C underpass.	Mar'11 to Nov'11

Table 2-4: VSU Scheme Main Works Construction Phases

Phase	Work site	Activities	Worksite Periods
	H	Construct PRM lift shafts, passage and connections.	Feb'11 to Nov'11
Phase 5	A	Construction of tunnels. Complete construction of LFEPA shaft and connections to Victoria line tunnels and commission SER.	Nov'11 to Nov'13
	B	Construct North Ticket Hall by top down.	Nov'11 to Nov'13
	C	Continue construction of South Ticket Hall. Construct escalator and tunnels from South Ticket Hall.	Nov'11 to Nov'13
	F	Construct Cardinal Place stairs.	Oct'12 to Jul'13
Phase 5a	G	Continue construction of D&C underpass.	Nov'11 to Nov'12
Phase 5b	H	Construct PRM lift shaft, passage and connections.	Nov'11 to May'12
Phase 5c	J	Jet grouting for tunnels.	May'12 to Jul'12
Phase 5d	K	Jet grouting for tunnels.	Aug'12 to Sep 12
Phase 5e	L	Jet grouting for tunnels.	Jul'12 to Aug'12
Phase 6	A	Completion of tunnels and fit out.	Nov'13 to Approx. Nov'15
	B	Completion of North Ticket Hall and fit out.	Nov'13 to Approx. Nov'15
	C	Completion of South Ticket Hall and fit out.	Nov'13 to Approx. Nov'15

2.8.73 The phases relating to the utilities works together with the location of the respective worksites are illustrated on Figures 2.5(A1) – 2.5(6) and therefore this table should be read in conjunction with these figures.

Table 2-5: VSU Scheme Utilities Works Phases

Phase	Work site	Activities	Worksite Period
A1	D1	760mm water main, diversion of brick egg sewer (up to 3000mm deep) and small utilities diversions to eastern carriageway half-width.	Mar'08 to Mid Apr'08
	B1	New pumping station (location to be confirmed subject to W7 & VTI layout coordination) (Maximum excavation depth 5000mm).	
	C1	760mm water main, sewer (up to 4500mm deep) and small utilities diversions to accommodate 10m diameter shaft.	
	G1 & E1	Small utilities diversions.	
	A1	New 1200mm Bressenden Place combined drainage manhole and sewer diversion (up to 4500mm deep), small utilities diversions.	
	A2	New 1200mm Bressenden Place combined sewer (up to 4500mm deep) and small utilities diversions.	
	A6	Thames Water control cabinet relocation.	
	A7	Diversion of small utilities to temporary location on east footway of Bressenden Place.	
A1-1	D1	760mm water main, diversion of brick egg sewer (up to 3000mm deep) and small utilities diversions to eastern carriageway half-width.	Mid Apr'08 to May '08
	B1	New pumping station (location to be confirmed subject to W7 & VTI layout coordination) (Maximum excavation depth 5000mm).	
	C2	760mm water main, sewer (up to 4500mm deep) and small utilities diversions.	
	A3	New 1200mm Bressenden Place combined sewer (up to 4500mm deep) and small utilities diversions.	

Table 2-5: VSU Scheme Utilities Works Phases

Phase	Work site	Activities	Worksite Period
	A6	Thames Water control cabinet relocation.	
	A8	Diversion of small utilities to temporary location on east footway of Bressenden Place.	
A2	**D2**	760mm water main, brick egg sewer (up to 3000mm deep) and small utilities diversions to eastern carriageway half-width.	Jun'08 to Aug'08
	B1	New pumping station (location to be confirmed subject to W7 & VTI layout coordination) (Maximum excavation depth 5000mm).	
	D3	As worksite B1.	
	A4	New 1200mm Bressenden Place combined sewer (up to 4500mm deep) and small utilities diversions.	
	A5	Diversion of small utilities to temporary location on east footway and construction of raised footway/utility bridge in Bressenden Place.	
A3	**D5**	760mm water main diversion crossing in Wilton Road. Set-back and realign kerb at Victoria Street junction.	Sep'08 to Jan'09
	A4	New 1200mm Bressenden Place combined sewer (up to 4500mm deep) and small utilities diversions.	
A4	**D4**	New manhole construction and launch-pit for thrust-bored 750mm diameter combined sewer connection (up to 3500mm deep) and diversion in Terminus Place to worksite C, small utilities diversions.	Feb'09 to Apr'09
	A4	New 1200mm Bressenden Place combined sewer (up to 4500mm deep) and small utilities diversions.	
A5	**B2**	Construction of new manhole (up to 4500mm deep) over thrust-bored 750mm diameter sewer installed from worksite D4.	May'09 to Jun'09
	C3	Access to Thames Water sewers for temporary diversions, inspection and	

Table 2-5: VSU Scheme Utilities Works Phases

Phase	Work site	Activities	Worksite Period
		strengthening works.	
	F1	D&C pumping station small utility diversions.	
	G3	Access to Thames Water sewers for storage, inspection and strengthening works.	
	G2	Access to Thames Water sewers for storage, inspection and strengthening works.	
A6	C3	Access to Thames Water sewers for temporary diversions, inspection and strengthening works.	Jul'09 to Sep'09
	F1	D&C pumping station small utility diversions.	
	G3	Access to Thames Water sewers for inspection and strengthening works.	
	C4	Access to Thames Water sewers for inspection and strengthening works.	
	C5	Access to Thames Water sewers for inspection and strengthening works.	

2.9 Key Design Assumptions

2.9.1 The assessment presented within Section 6 of this ES and within the detailed Technical Appendices has been based on the broad description of the scheme presented in Section 2.7 and the detailed description of the scheme, construction methods and phasing discussed in Section 0. Specific key design assumptions that have formed the basis of the assessment are discussed below.

Utilities

2.9.2 The works regarding the utilities diversions will be undertaken in advance of the main works. The utilities to be affected are presented in Figures 2.5(A1.1) – 2.5(A.6). The assessment is based on the diversion of the utilities discussed in Paragraphs 2.8.1 - 2.8.4 of this ES. Further mitigation measures will be discussed with the relevant Utility companies during the detailed design phase.

Demolition and Underpinning

2.9.3 The assessment considers the demolition and underpinning of various buildings discussed in Paragraphs 2.8.5 and 2.8.6-**Error! Reference source not found.** respectively. The locations of these buildings are demonstrated in Figure 2.3.

Tunnels and Shafts

2.9.4 The assessment is based on the construction of the tunnels and shafts presented within Paragraph 2.8.14 and Table 2-3 of this ES and those discussed within the Conceptual Design Statement for Tunnels and Shafts (DOC: MMD-VO47-1159-TUN-DOC-50001 (July 2007)) and illustrated on Plate 1 of this ES.

Description of Works and Construction Methods

2.9.5 The assessment is based on the description of works of each element of the scheme and it associated construction methodology as presented throughout Paragraphs 2.8.15-2.8.70 and within any references documents therein.

Construction Phasing

2.9.6 The assessment is based on the phased approached discussed throughout Paragraphs 2.8.71 -2.8.73 and demonstrated in Figures 2.5(A1.1) – 2.5(A.6). This is also discussed and presented within the construction programme which accompanies the Order application and forms part of the basis of this assessment.

2.9.7 The assessment is based on a construction start date of October 2009 with completion programmed for November 2015.

Incorporated Mitigation

2.9.8 The assessment considers that the incorporated mitigation measures discussed in Paragraph 3.5.7 and throughout Section 6 have been included within the design.

3 Approach and Methodology

3.1 Introduction

3.1.1 This section provides an overview of the approach taken to determine the scope of the EIA, as well as the general approach and methodology undertaken to consider the likely significant environmental effects of the VSU scheme. This has been addressed under the following headings:

- stakeholder involvement and consultation – details the consultation that has been undertaken;
- sustainability – provides an account of the approach that has been taken to incorporating the principles of sustainable development into the VSU scheme;
- key issues to be addressed in the Environmental Statement – summarises the key issues raised during consultation and provides an indication of where these have been addressed within this ES; and
- approach to EIA – describes the generic approach that has been adopted in assessing the potential environmental effects of the station upgrade works.

The detailed methodologies for undertaking each individual specialist assessment are provided in the scoping report (Annex A).

3.2 Stakeholder Involvement

3.2.1 This forms part of LU's best practice procedures and is considered best practice in line with the TWA Rules. Consultation has therefore formed an integral part of the pre-application process.

Consultation

General Consultation

3.2.2 Consultation undertaken during the development of the scheme, including the EIA process, has provided interested parties with an opportunity to comment upon it and in doing so, has also influenced the development of the proposals. The consultation undertaken was for the purposes of informing interested parties of the scheme in its entirety and was not isolated to the EIA process. Consultation for the VSU scheme has included:

- over 1100 letters, introducing the project and providing a point of contact, sent to stakeholders including local residents and businesses, user groups, accessibility groups and statutory consultees;
- regular meetings with key stakeholders for the VSU scheme (including CoW, Greater London Authority, Land Securities, VPT, Network Rail, the promoters of the Abford House redevelopment scheme and relevant utility companies);

- stakeholder presentations/briefings, including London Travel Watch (LTW), Department for Transport (DfT), London First, Disabled Persons Transport Advisory Committee (DPTAC), Apollo Theatre, Victoria Interchange Group (local residents group) John Lewis and the Thistle Victoria Hotel;
- progress updates sent out to all stakeholders to coincide with major project milestones and/or changes; and
- joint workshops and technical meetings with relevant transport consultees, including Transport for London Street Management, Transport for London Network Assurance, Transport for London Road Network Management, Transport for London Directorate of Traffic Operations, Transport for London Bus Priority Unit, London Buses, Public Carriage Office, and CoW.

3.2.3 Summary information on the scheme development has been made available on the LU website http://www.tfl.gov.uk/vsu. This website is continually updated as the project progresses.

3.2.4 The principles of the consultation process are contained in the 'Report on Consultation' submitted as part of the TWAO submission.

Public Exhibition

3.2.5 Two public exhibitions were held to provide the public (i.e. local residents, businesses, community groups and LU customers) with information on the VSU scheme. Both exhibitions were located at a currently unoccupied shop opposite Victoria National Rail station (175-179 Victoria Street). The first exhibition ran between Thursday 17th and Saturday 19th May (from 11am to 7pm Thursday to Friday and 10am to 1pm on Saturday).

3.2.6 The second public exhibition was held between Tuesday 17th and Saturday 21st July (on weekdays from July 11am to 7pm and on Saturday from 10am to 1pm). In addition more detailed plans were made available along with LU's response to key questions from the first exhibition.

3.2.7 In total approximately 1400 people attended the exhibitions and LU received 122 completed feedback forms.

3.2.8 The events provided local residents, stakeholders and other interested parties with the opportunity to raise any issues they may have with regard to the developments, as well as to voice any initial concerns.

3.2.9 The exhibitions were advertised on the TfL website, in the Metro newspaper, via leaflets handed out at the Underground station, posters displayed at the station complex and letters were sent to approx 1100 stakeholders including local residents and businesses. Reply paid cards inviting comments or

questions were attached to the leaflet. Feedback forms were also available at the exhibition.

3.2.10 Information regarding the scheme was provided through a series of information boards and visual aids, with key members of TfL's project team being present at all times to respond to any queries. Other visual aids included photomontages, large scale overview plans and an architectural model.

3.2.11 The exhibition panels used at the exhibitions can be downloaded from www.tfl.gov.uk/corporate/projectsandschemes/stationsandinterchanges/5145.aspx.

3.3 Approach to Sustainable Development

General

3.3.1 There are several definitions of sustainable development, or 'sustainability', the most widely used of which is:

'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs[7]'.

3.3.2 The UK Government Sustainable Development Strategy, 'Securing the Future', (2005) states that 'the goal of sustainable development is to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life, without compromising the quality of life of future generations'. The document contains several guiding principles which further explain the concept of sustainable development, including:

- 'Living within Environmental Limits – respecting the limits of the planet's environment, resources and biodiversity – to improve our environment and ensure that the natural resources needed for life are unimpaired and remain so for future generations' and,
- 'Ensuring a Strong, Healthy and Just Society – meeting the diverse needs of all people in existing and future communities, promoting personal well being, social cohesion and inclusion, and creating equal opportunities for all.'

3.3.3 Planning Policy Statement 1: Delivering Sustainable Development states that 'sustainable development is the core principle underpinning planning' in England. Further detail is provided through a variety of Government Planning Policy Statements covering issues including biodiversity (PPS9), renewable energy (PPS22), pollution control (PPS23) and flood risk (PPS25). PPG 13 (Transport) also contains details on sustainability.

[7] World Commission on Environment and Development (Brundtland Commission), 1987.

3.3.4 At a regional level, Policy 2A.1 of the London Plan (2004) states that a variety of sustainability criteria will be used by the Mayor to assess planning applications and Policy 4B.6 states that developments should meet the highest standards of sustainable design and construction. A variety of more detailed policies are contained within the London Plan, including those on energy efficiency and renewable energy (Policy 4A.7 and 4A.9), water efficiency (Policy 4A.11), nature conservation and biodiversity (Policy 3D.12).

3.3.5 'Essential standards' and the 'Mayor's preferred standards' for a variety of sustainable design and construction issues are stated in the Mayor of London's Supplementary Planning Guidance on Sustainable Design and Construction (2006). These encompass a variety of issues, including building on previously developed land, energy efficiency and renewable energy, water efficiency, biodiversity and waste management.

3.3.6 Westminster's Unitary Development Plan (UDP), January 2007 sets out the CoW's planning policies for developing land, improving transport and protecting the environment in Westminster for the next 10-15 years. Sustainable development remains one of the main themes of the plan and is a theme embedded in the concept of working towards a more sustainable city (Policies STRA 32-37). Policy STRA 32, The Sustainable Development of Westminster, encourages use of an external appraisal such as BREEAM (the 'Building Research Establishment's Environmental Assessment Method') for larger developments to ensure that a wide range of environmental issues are considered in new developments.

3.3.7 BREEAM (or equivalent) is also cited as an important tool for measuring environmental performance in the Mayor of London's Supplementary Planning Guidance on Sustainable Design and Construction (2006)[8].

Sustainable Design Philosophy

3.3.8 Sustainability is important to TfL in making a significant contribution to the achievement of the Mayor's vision for a sustainable London. As LU is a part of TfL, it embraces the importance that TfL puts on sustainability. TfL, and therefore LU, is committed to achieving three key objectives for sustainability:

- supporting economic development;
- improving social inclusion; and
- tackling climate change and enhancing the environment.

3.3.9 TfL aims to deliver sustainability through its operations and projects, and is currently building sustainability into its policies, strategies and processes.

3.3.10 TfL's Health, Safety and Environment (HSE) Policy (January 2007) aims to improve TfL's HSE performance through its implementation by:

[8] Supplementary Planning Guidance: Sustainable Design and Construction (2006). Mayor of London, Greater London Authority.

- Complying with the spirit and letter of HSE legislation;
- Setting progressive objectives and targets to improve HSE management and performance;
- Taking account of HSE risks and benefits in decision making and business planning processes;
- Striving to realise environmental benefits, in addition to pollution prevention, with a focus on managing emissions and mitigating the effects of, and adapting to climate change; and
- Actively supporting the Mayor in delivering the environmental strategies on air quality, ambient noise, biodiversity, energy and municipal waste.

Ensuring Sustainability of the Station Upgrade

Two documents have been produced which address sustainability issues and support the TWA application for the VSU scheme.

Project Sustainability Appraisal

3.3.11 A Sustainability Appraisal (SA) has been produced to demonstrate the measures incorporated into the scheme design and operation proposals which promote sustainable development through the integration of social, environmental and economic considerations. The SA will aid the Secretary of State in determining the extent to which the scheme meets with, or supports, the sustainability objectives of the CoW UDP and the wider Mayor of London objectives. In addition, the Greater London Authority (GLA) will seek information in relation to the London Plan, Policy 4B-6 'Sustainable design and construction' and the GLA draft SPG on 'Sustainable Design and Construction'.

3.3.12 The approach adopted for the project SA was based on the Office of the Deputy Prime Minister (now Department of Communities and Local Government) SA guidance, combined with the MM in-house project sustainability management system, QUEST. It also takes into consideration the objectives of the Sustainable Development Commission and the London Plan.

3.3.13 The SA developed for the VSU scheme summarises the review of the design proposals to establish the sustainability benefits and disbenefits of the project and identifies mitigation measures which could deliver a more sustainable outcome. The SA report will also enable increased awareness of sustainability issues during the design and construction process. The report is a supplementary document which supports the application for a TWAO for the VSU scheme.

3.3.14 As part of the SA process, a scoping exercise was undertaken which identified and reviewed the range of relevant plans, programmes and

sustainability objectives relevant to the VSU scheme. The next stage of the process included the identification of the prevailing baseline social, environmental and economic conditions in the CoW. The report appraises the VSU scheme in the form of a sustainability matrix, based on a number of strategic objectives and targets. The process identifies a number of mitigation measures to potentially assist in improving the sustainability aspects of the VSU scheme. The report concludes by examining the need for sustainability design aims and targets, as well as future consultation and monitoring arrangements for the project.

3.3.15 Key sustainability issues for the VSU scheme have been identified as the following:

- development of specific project sustainability objectives within the context of the national, regional and local sustainability objectives;
- support to wider GLA sustainability policies;
- delivery of key topic based approaches such as energy efficiency, renewable energy, materials and resource management; and
- delivery of the project sustainability objectives through the Environmental Design Management (EDM) procedure.

3.3.16 The sustainability appraisal will function as a stand-alone document although it fully integrates with the suite of environmental assessment documents and takes into account information presented specifically within this ES.

CEEQUAL

3.3.17 The UK Government actively encourages the attainment of environmental excellence in projects such as the VSU scheme. This project should therefore be delivered in accordance with the 2005 Government strategy on sustainable development (Securing the Future) and applicable Government guidance namely, Building a Better Quality of Life: a Strategy for More Sustainable Construction (DETR 2000). Other government initiatives such as the Government Construction Clients Panel's Sustainability Action Plans and Toolkit also should be taken into consideration. Throughout its lifetime, the scheme, where possible, should be aligned with the Government principles and ensure that compliance can be achieved by undertaking an assessment using a Green Building Rating Tool such as BREEAM or CEEQUAL.

3.3.18 CEEQUAL (Civil Engineering Environmental Quality Assessment and Awards Scheme) is an awards scheme assessing the environmental quality of civil engineering projects. The key objective of the CEEQUAL scheme is to encourage the attainment of environmental excellence in civil engineering projects, and thus deliver improved environmental performance in project specification, design and construction.

3.3.19 CEEQUAL uses a credit-based assessment framework, which is applicable to any civil engineering project and includes environmental aspects such as the use of water, energy and land as well as ecology, landscape, nuisance to neighbours, archaeology, waste minimisation and management, and community amenity.

3.3.20 A CEEQUAL award publicly recognises the achievement of high environmental performance. Awards are made to projects in which the clients, designers and contractors go beyond the legal and environmental minima to achieve distinctive environmental standards of performance.

3.3.21 In support of Policy STRA 32 of the CoW UDP (January 2007), Table 9.2 (Chapter 9, CoW UDP) indicates that a major transport interchange is considered a 'large development' and Table 9.3 confirms that an independent sustainability appraisal is required. The undertaking of a pre-advisory CEEQUAL Assessment satisfies this requirement.

3.3.22 Following the CEEQUAL scheme will facilitate the specification, design and construction of the proposals to achieve environmental excellence, and thereby to deliver improved environmental performance. Undertaking a CEEQUAL assessment will be complementary to the environmental assessments that have been ongoing since the outset of the project.

3.3.23 To summarise, CEEQUAL will:

- promote improved environmental performance in specification, design and construction of the VSU scheme;
- demonstrate the commitment of LU to environmental quality; and
- celebrate the achievement of high environmental standards in the completed scheme.

3.3.24 In support of the application for a TWAO and to ensure that the principles of sustainable design have been taken into account from the offset of the scheme design, the CEEQUAL process has been followed with the results documented in a CEEQUAL Pre-assessment Advisory Report.

3.4 Development of Environmental Statement

Environmental Scoping Study

3.4.1 Details on the Environmental Scoping Study have been discussed in Section 1.4. The Environmental Scoping report is provided in Annex A of this document.

Environmental Issues Addressed in the ES

3.4.2 The scoping exercise and the responses received from statutory consultees identified the likely significant environmental effects associated with the VSU scheme. Details of the findings of the EIA process are discussed in Section 6 of this ES.

3.4.3 With reference to the Scoping Report (Annex A), likely significant environmental effects were identified as follows:

3.4.4 Traffic and Transport effects identified are:

- beneficial effects of capacity improvements for passengers;
- generation and movement of traffic during construction;
- site access and disruption to traffic flows on surrounding routes;
- temporary disruption to normal operations of buses, taxis, pedestrians (including PRM), freight traffic, private vehicles and cyclists; and
- improved road safety, predominantly with regard to pedestrians who statistics show are particularly vulnerable around the Victoria station complex.

3.4.5 Noise and Vibration effects identified are:

- noise and vibration from activities carried out at surface worksites during construction;
- secondary groundborne and structure-borne noise and vibration from subsurface works during construction and the operation of machinery following scheme completion; and
- noise associated with off-site traffic during construction and from changes in road traffic once the scheme becomes operational.

3.4.6 Air Quality effects identified are:

- effects on air quality during the construction phase through the generation and subsequent release of dust;
- effect on air quality during operational activities due to a change in vehicle movement within the area; and
- generation and emission of greenhouse gases from operational plant and construction vehicles.

3.4.7 Townscape and Visual Amenity effects identified are:

- temporary and/or permanent loss of features, buildings or street space as a result of the need for land take;
- effect of permanent new features (e.g. new shaft structures or entrances to Underground infrastructure) on surrounding townscape

character, including the setting of listed buildings and conservation areas; and

- potential benefits to townscape attributable to introduced infrastructure and associated works.

3.4.8 Built Heritage effects identified are:

- potential temporary and permanent effects on the building fabric and/or heritage setting of sensitive features; and
- effects on heritage features as a result of ground disturbance and consequential settlement as a result of excavation and subsurface works.

3.4.9 Archaeology and Cultural Heritage effects identified are:

- potential disturbance, damage or loss of access to buried archaeological features, especially of the post-medieval period; and
- contamination of resources due to construction activities, more specifically accidental spillage of contaminating substances.

3.4.10 Demolition and Excavated Materials, and Waste effects identified are:

- No significant constructional or operational effects have been identified. Issues relating to the generation of materials and waste will be dealt with through the Demolition & Excavated Materials, and Wastes Management Plan associated with this scheme.

3.4.11 Contaminated Land effects identified are:

- potential mobilisation and migration of contaminated soil or groundwater through new pathways such as stations and shaft structures; and
- contamination of groundwater during station and tunnel construction and associated groundworks.

3.4.12 Water Resources effects identified are:

- potential effects on surface and groundwater quality, flow rates and pathways due to construction activities; and
- potential effects on surface hydrology and flood risk by reducing surface water runoff from impermeable areas.

3.4.13 Ecology effects identified are:

- potential disturbance of urban bird population through demolition, construction and operation activities associated with the scheme; and
- the need for tree removal.

3.4.14 Socio-Economics effects identified are:

- direct effects on employment and trading during the construction phase;
- improved accessibility to employment during operation and potential for increased employment opportunities; and
- indirect effects on employment.

3.4.15 Community effects identified are:

- effects on community as a result of temporary footway, road and access closures and diversions during the construction phase of the scheme; and
- changes in access and pedestrian movements once the scheme becomes operational.

3.4.16 In undertaking the EIA, these potential impacts have been given due consideration and are addressed within this main report as follows:

- Section 6.2 - Traffic and Transport;
- Section 6.3 - Noise and Vibration;
- Section 6.4 - Air Quality;
- Section 6.5 - Townscape and Visual Amenity;
- Section 6.6 - Built Heritage;
- Section 6.7 - Archaeology and Cultural Heritage;
- Section 6.8 - Demolition and Excavated Materials, and Waste;
- Section 6.9 - Contaminated Land;
- Section 6.10 - Water Resources;
- Section 6.11 - Ecology;
- Section 6.12 - Socio-Economics; and
- Section 6.13 - Community.

3.4.17 Each of the topics above is supported by a corresponding technical appendix. This is discussed in further detail within Section 0. This is with the exception of ecology as there was no need for additional information to further support the results of the assessment.

3.4.18 In addition to this ES, MM has prepared a draft Environmental Management Strategy (EM Strategy). The strategy comprises three volumes; a Main Statement; Volume I, Design; and Volume II Construction. The Main Statement summarises the purpose of the strategy and its structure. Volume I, Design, demonstrates how the design of the scheme and the consideration for the environment has been integrated and where the design has been

influenced by environmental aspects.

3.4.19 Volume II, Construction, acts as a signposting document for contractors to use during the preparation of the Site Environmental Management Plan (SEMP). This strategy acts as the bridging document between the ES and the SEMP and ensures that all mitigation measures prescribed within this ES are implemented. Other documents that Volume II, Construction, considers are:

- ISO 14001 Standard;
- TfL 2006 Environmental Report;
- LU Standard Contract QUENSH Conditions;
- VSU Scheme Code of Construction Practice;
- TfL Health, Safety and Environment Policy;
- VSU Scheme Environment & Sustainability Risk Register, which supports this strategy;
- Waste Management Strategy; and
- CEEQUAL Pre-assessment Report.

3.5 Approach to Environmental Impact Assessment

General Approach

3.5.1 A team of suitably qualified and experienced environmental specialists from MM and sub-consultants MoLAS and Alan Baxter & Associates have undertaken the EIA.

3.5.2 This ES has been prepared in accordance with the TWA Rules and was carried out with due regard to:

- DETR Circular 2/99 to the Town & Country Planning (EIA Regulations);
- Department of the Environment Planning Research Programme – Preparation of Environmental Statements for Planning Projects that Require Environmental Assessment – A Good Practice Guide. 1995;
- Department of the Environment Planning Research Programme – Evaluation of Environmental Information for Planning Projects that Require Environmental Assessment – A Good Practice Guide 1994;
- Institute of Environmental Management and Assessment, Guidelines for Environmental Impact Assessment, 2004; and
- EC Directive 85/337/EEC as amended by EC Directive 97/11/EC.

3.5.3 The final ES has been produced as result of a rigorous assessment process,

which began with the scoping phase, included an integrated design and assessment team workshop, close liaison with the client and continual communication between the assessment team specialists, the EIA Co-ordinator and the design team.

Definition of Environmental Effects

3.5.4 An environmental **'effect'** (positive or negative) results from a change (or **'impact'**) that influences a resource or receptor. The precise nature of the effect and its 'significance' will depend on the interaction between the degree of impact (for example, its extent, duration, magnitude or permanence) and the sensitivity, value or number of the resources or receptors in each case. Where appropriate, thresholds of significance are identified in the individual environmental topic sections.

3.5.5 Effects may also be temporary or permanent, adverse or beneficial, and several, including those generated by other projects, may create cumulative effects (see below). There can also be secondary effects, which arise as a result of an initial effect of the proposed development.

Mitigating Adverse Effects

3.5.6 Schedule 1 of the TWA Rules states that an ES should include "a description of the measures envisaged to prevent, reduce and where possible remedy any significant adverse effects on the environment" (Para 5). Such measures, referred to as mitigation, may include the following:

- mitigation incorporated into the design of the proposed developments during the design development process;
- additional mitigation applied to the proposed developments by means of physical measures; and
- mitigation through controls on operational or construction procedures.

Incorporated Mitigation

3.5.7 The approach adopted from the outset of the EIA has been to integrate appropriate measures within the design as it emerges rather than to provide 'bolt-on' solutions at the end of the design process. However, it is not possible within the ES to describe or reproduce each iteration of the design as it has evolved in response to predicted environmental effects. The fundamental aim of mitigation is to reduce the significance of the environmental effects; where mitigation fails to reduce the significance of any (negative) environmental effect, the remaining component of the effect is known as the residual effect.

Mitigation Measures to be adopted during Construction

3.5.8 In relation to the construction phase, the mitigation is defined in the draft

Code of Construction Practice (CoCP). The draft CoCP applies to control potential adverse effects arising from the construction of VSU. The draft CoCP sets out standards and procedures for managing the environmental impacts of construction activities associated with the VSU scheme. It covers the environmental, public health and safety aspects of the project that may affect the interests of local residents, businesses, the general public and the surroundings in the vicinity of the construction site.

3.5.9 The Draft CoCP is split into two parts. Part A sets out:

- the context and underlying principles of the Draft CoCP;
- the principal obligations on contractors and developers when undertaking work;
- the general measures to be used during construction, and how they will be applied by the contract and enforced by CoW; and
- the details of the measures for each relevant environmental topic.

3.5.10 Part B supplements Part A and identifies detailed site-specific measures, taking into account the environmental issues at each worksite, such as site set up and servicing arrangements. Part B includes:

- conditions imposed on planning permissions;
- assurances given in relation to planning and other consents;
- SEMP and other Environment Management Plans to be produced/coordinated by the main contractor; and
- consents obtained under Section 61 of the Control of Pollution Act.

3.5.11 The Draft CoCP aims to assure residents and other affected parties that impacts to the environment are being taken into account according to best practice. Overall, it has been produced to mitigate nuisance to the public and to safeguard the environment.

3.5.12 The Draft CoCP is provided as a supporting document and is being developed in consultation with City of Westminster. Once finalised the Draft CoCP will form part of the contractual documents that the principal contractor must adhere to and implement. The provision of this document also presents how the commitments to mitigation and best practice made within this ES will be delivered.

4 Project Need and Alternatives

4.1 Project Need

London's Transport Challenges

4.1.1 The VSU scheme responds directly to the significant transport challenges arising from the major growth in the population and the increased levels of employment growth in the capital. London has a unique role to play in the UK economy. The City is the country's financial powerhouse and generates a disproportionate share of economic growth which benefits the country as a whole. The City is set to grow and prosper in the future, with over 800 000 extra people and around 900 000 extra jobs forecast over the next 20 years[9].

4.1.2 Transport 2025 (T2025) has been prepared by the Mayor of London, and identifies the investments and policies that will be required to ensure that London continues to thrive and the benefits are widely felt as a result of this population and employment growth. Three objectives for T2025 have been set:

- supporting economic growth;
- tackling climate change and enhancing the environment; and
- improving social inclusion.

4.1.3 T2025 identifies that to support this economic development there are two inter-related transport challenges. The first is to improve London's public transport system to accommodate the growth of employment. The second challenge is to effectively manage the road network, reduce traffic congestion and reduce carbon dioxide (CO_2) emissions. Total travel is projected to increase by four million journeys every day by 2025. When the modal shift from car travel is taken into account, an additional five million daily journeys will need to be supported by public transport, walking and cycling.

4.1.4 In addition to T2025, The Mayor has also prepared a Transport Strategy (2001), which supports the aims of the London Plan (Paragraphs 5.3.2-5.3.3). The fundamental policy direction of the Mayor's Transport Strategy is to support investment in public infrastructure and public services, which will be necessary to accommodate London's growing population and economic activity in a sustainable way. The strategy is discussed in further detail in Paragraphs 5.3.31 -5.3.32.

Current Constraints

4.1.5 Victoria Underground Station is used by 80 million people every year, and with two thirds of all public transport trips through Victoria using the

[9] Transport 2025 – Transport Vision for a Growing World City (T2025).

Underground it is one of London's busiest stations. Addressing problems and opportunities on the Underground is expected to have a major impact on the interchange overall. This is especially prevalent given that the number of passenger journeys at Victoria Underground Station is expected to rise to 100 million by 2016.

4.1.6 The projected rise in demand coupled with the severe capacity constraints currently experienced, mean that without major investment, control measures such as gateline restrictions and station closures will continue to be used but with increased frequency. Theses control measures are used so LU can maintain passenger flows and safely prevent congestion. It is acknowledged that this is not a practical solution in the long term as it causes delay and discomfort for passengers. Therefore proposals for Victoria Underground were developed to meet this need.

Contribution of the VSU Scheme

4.1.7 The VSU scheme will contribute directly to the challenges identified within T2025, and more immediately, will respond to the need to alleviate severe capacity constraints within the station and the wider transport interchange. The need for the proposals is also supported by the following key concepts:

- together with the completion and operation of the VLU scheme, the efficient operation of Victoria Underground Station will encourage and support this modal shift thereby contributing to a reduction of CO_2 emissions arising from the road network;
- the underground station improvements are acknowledged as an essential catalyst to the area's regeneration; and
- the improvements to the underground station, together with the other proposals within the station area will be a key contributor in supporting and maintaining the status of London as a World City by providing a world class transport system.

4.2 Alternatives

General

4.2.1 Rule 11 (1) (2) of the TWA Rules states that the ES should include:

"an outline of the main alternatives studied by the applicant and an indication of the main reasons for his choice, taking into account the environmental effects".

4.2.2 The DfT Guide to the Transport and Works Act Procedures (2006) emphasises that when preparing an ES:

"applicants should bear in mind that if they can demonstrate that they have properly considered possible alternatives, and can present a convincing

case for their preferred choice of route or location having regard to the environmental effects, this might well limit the scope of, or need for, subsequent discussion of alternatives" (para 2.47).

Approach to Considering Alternatives

4.2.3 This section addresses the requirements above and presents the approach taken to evaluating and reporting alternatives. The alternatives outlined below were evaluated in the light of the project objectives presented in Section 0. Given the project objectives and the requirement to undertake works in a specific area, no entirely different locations could be considered for this project so this alternative is discounted.

4.2.4 Since 1996 more than 60 scheme options, sub options and variations have been identified, reviewed, developed further and then rejected prior to confirmation of the preferred scheme for which consent is now being sought. For the purpose of clarity Paragraphs 4.2.6 -4.2.9 (Table 4-1) addresses the previous scheme alternatives which were considered and rejected by LU during the development phases. Paragraphs 4.2.10-4.2.15 (Table 4-2) addressed the scheme alternatives that have been considered by MM and LU during later design stages and explains why they were rejected.

4.2.5 The alternatives assessment process discussed in the following sections led to the identification of the final preferred option.

Alternatives to the Scheme

Historical Scheme Development

4.2.6 Victoria Underground station has suffered severe capacity constraints for many years and there have been numerous studies started in the 90s to develop a viable scheme to alleviate it. In light of this, Victoria is a priority station for LU and feasibility studies for the Underground station and the wider Victoria Transport Interchange (VTI) were undertaken by Transport for London following it's formation. These studies, undertaken by a number of consultants but latterly Arup, looked at proposals for the whole interchange as well as the Underground station. There were a number of large-scale and complex proposals, which included cut-and-cover boxes as well as tunnelling infrastructure. These proposals were considered unaffordable however, in the context of other investment priorities for TfL and LU.

4.2.7 As LU was keen to continue to develop a solution for the Underground station only, further feasibility studies were undertaken by Arup. In 2004, it was concluded that there was a viable congestion relief scheme for the Underground station, principally within the Victoria line areas of the station. This scheme was known as the Phase 1-6 Scheme. Phases 1-3 were aimed at the Victoria line congestion relief improvements whilst Phases 4-6 addressed the D&C line areas of the station. Further work by Arup showed

that Phases 1-3 had a very good business case and was considered affordable by TfL, although Phases 4-6 did not have an acceptable business case.

4.2.8 In October 2004, TfL considered that Phases 1-3 was the most appropriate solution for the LU station, to principally address congestion for the Victoria line areas of the station. Further development of Phases 4-6 was abandoned as LU were already committed to delivering a station modernisation through the PPP contract, so that the entire LU station would undergo both congestion relief works in the critical Victoria line areas of the station and additionally, station modernisation works for both the D&C line and Victoria line station areas. TfL included funds to further develop Phases 1-3 within the 2005-2010 TfL 5-Year Investment Programme. Phases 1-3 was then renamed Victoria Station Upgrade (VSU) and London Underground Strategy and Service Development (S&SD) Directorate took over sponsorship of VSU from April 2005.

4.2.9 As TfL was unable to identify an acceptable business case for any schemes to improve the VTI interchange, TfL decided not to progress the scheme. However, in early 2005, Land Securities proposed to the Mayor a major mixed-use development for Victoria and the Victoria Transport Interchange scheme was re-established within the TfL Major Projects Interchange team during the spring of 2005, to evaluate the opportunity presented by their proposals. Work continues on VTI in parallel with VSU.

4.2.10 The main alternatives to the scheme included the following:

- upgrade of the whole underground station including the Victoria line and District & Circle line ticket halls (Alternative 1);
- bolt on to alternative 1 with additional open access below the National Rail Station concourse (Alternative 2);
- construction of a new ticket hall on the site of Elliot House (Alternative 3);
- pedestrian access tunnel from the south side of Victoria Street to the new North Ticket Hall (Alternative 4);
- construction of an additional underground train tunnel with new platforms (Alternative 5);
- increasing the diameter of the existing tunnels (Alternative 6); and
- extension of the Victoria line platforms (Alternative 7).

4.2.11 The numbering above corresponds to Table 4-1, where further details of the options are provided.

4.2.12 Due broadly to the nature of the long term heavy engineering works involved, any alternative options have similar effects on the environment within the vicinity of the VSU scheme. Differences between the schemes relate to the

extent and the duration of the works. Optioneering revealed that the greater the extent of the scheme and the longer the duration of the construction process the greater the adverse environmental effects associated with alternatives. The greater the extent and duration of the construction process would also result in higher costs. The optioneering process therefore showed that in general, the higher the cost of the scheme, the greater the environmental effects.

4.2.13 Six main alternatives (Nos. 1-3 and 5-7).were considered in the early development phases. These alternatives and the reasons for rejection are presented in Table 4-1.

Table 4-1: Main Alternatives to the Proposed Scheme

Alternative	Reason for Rejection
The initial optioneering process started by looking at just upgrading the existing ticket halls. A number of variations and sub options were considered but essentially the alternatives are as described under Options 1 and 2 below. These options were subsequently rejected.	
1. Upgrade the whole underground station which includes the Victoria line ticket hall and the D&C lines ticket hall. Elements included new access to street level; new underground passageway links to the National Rail Station concourse; and access to Crossrail line 2 (also known as the Chelsea and Hackney line).	• High cost. • considerable disruption for passengers with station closures during construction of the works. • major impact on the operation of Terminus Place bus terminal and the Victoria Station taxi rank. • high level of construction complexity making construction difficult and expensive. • no government commitment to progress Crossrail line 2 (Chelsea and Hackney line).
2. This alternative is a “bolt on” to Alternative 1, but could equally apply to the current scheme. It provides new open access under the concourse of the National Rail Station with retail development in part of the main line station basement.	• The option would affect operation of the National Rail Station requiring additional works and causing disruption to the travelling public during construction. • This option could be constructed in the future if the construction impacts can be managed.
In order to achieve greater capacity and relieve congestion further than that provided by Alternative 1, new north ticket hall options were considered (see below).	
3. This alternative includes construction of a new ticket hall on the site of Elliot House in Allington Street.	• This alternative would locate the north ticket hall in a less advantageous location away from Victoria Street, resulting in longer passenger journey times.

Table 4-1: Main Alternatives to the Proposed Scheme	
Alternative	**Reason for Rejection**
	• This option would also incur the additional cost of purchasing and demolition of Elliot House which was not then considered necessary.
A "bolt on" alternative to the original proposed scheme for the north ticket hall was considered and then rejected.	
4. Provision of a pedestrian access tunnel from the south side of Victoria Street to the new north ticket hall. This was also a sub option of the currently proposed scheme.	• This option was rejected due to the difficulty in fitting a new station entrance within the townscape on the south side of Victoria Street without disruption to pedestrians, residents and traffic. • The pedestrian tunnel would need to pass over the District and Circle lines and then descend to the level of the new ticket hall. It would therefore require steps making it difficult for persons of reduced mobility to use. • Pedestrian access is available via the pedestrian crossing.
To achieve greater Victoria line platform capacity in the south ticket hall area, the following alternatives were considered and then rejected.	
5. Construction of an additional underground train tunnel with new platforms.	• This would increase the capital costs of the project considerably. • This would involve a long closure and suspension of train services on the Victoria line. • This option would cause significant disruption to the operation of the underground station over a period of several years. • The option would be difficult to construct resulting in considerably increased costs.
6. Increased capacity is achieved by increasing the diameter of the existing tunnels enabling the platform width to be increased.	• This option would result in closure of the Victoria line during construction causing disruption of services over a period of several years. • It would not be possible to safely construct the tunnel and platform extensions under the Victoria line escalators. • The construction works would also be very expensive.

Table 4-1: Main Alternatives to the Proposed Scheme	
Alternative	**Reason for Rejection**
7. Increased capacity is achieved through an extension of the Victoria line platforms further south.	• This option would result in extended closures of the Victoria lines during construction causing disruption to services over a period of several years. • The construction works would be very expensive.

Alternatives to the Proposed Scheme

4.2.14 An initial assessment of the alternative options of the proposed scheme was carried out at an optioneering workshop held between MM and the LU project team in January 2007. This lead to the alternatives detailed in Table 4-2 being rejected for the reasons indicated.

Table 4-2: Initial Assessment Alternatives		
Option	**Description**	**Reason of Rejection**
A1	Deep tunnels	• Down and up passenger flow. • Large, difficult to construct concourse. • Consequent settlement issues. • Option A3 considered better deep tunnel option.
A2	Overland	• Not in the control of LU. • Excessive passenger flow past front of VPT.
A3	New southbound running tunnel with old as concourse.	This was rejected on cost, TWA effects and ground movement basis. In addition due to the rapid curvature of the running tunnels around to the east towards Pimlico Underground Station it would be impossible to provide a compliant alignment with a straight or near straight passenger tunnel.
A5	Increase length of eastern connection tunnel to west to enable D&C underpass to be lowered.	Not pursued due to poor passenger routing.

Table 4-2: Initial Assessment Alternatives

Option	Description	Reason of Rejection
A5/1 and A5/2	Tunnels tight above the Victoria line with stairs to the Victoria line platforms	• Tunnels have too many right angle bends. • Encroaches on properties owned by Land Securities. • Stairs not desirable. • Beneath VPT. • Upper sections of tunnels still above London Clay. • Probable lack of run-off space.
A7	Victoria Line Overpass (VTO) – split tunnel for fire/passengers	To be carried forward as a layout option.

4.2.15 The workshop considered the project objectives and this enabled detailed final option selection criteria to be developed. This lead to the alternatives in Table 4.2 being rejected as they did not meet the criteria. The resulting criteria which were agreed with LU are listed as follows:

- journey time (operational safety and quality);
- programme;
- project cost;
- buildability;
- operational impacts;
- stakeholder impacts;
- utilities; and
- environmental impacts.

4.2.16 All alternatives not meeting mandatory parameter[10] limits for the following criteria were immediately rejected:

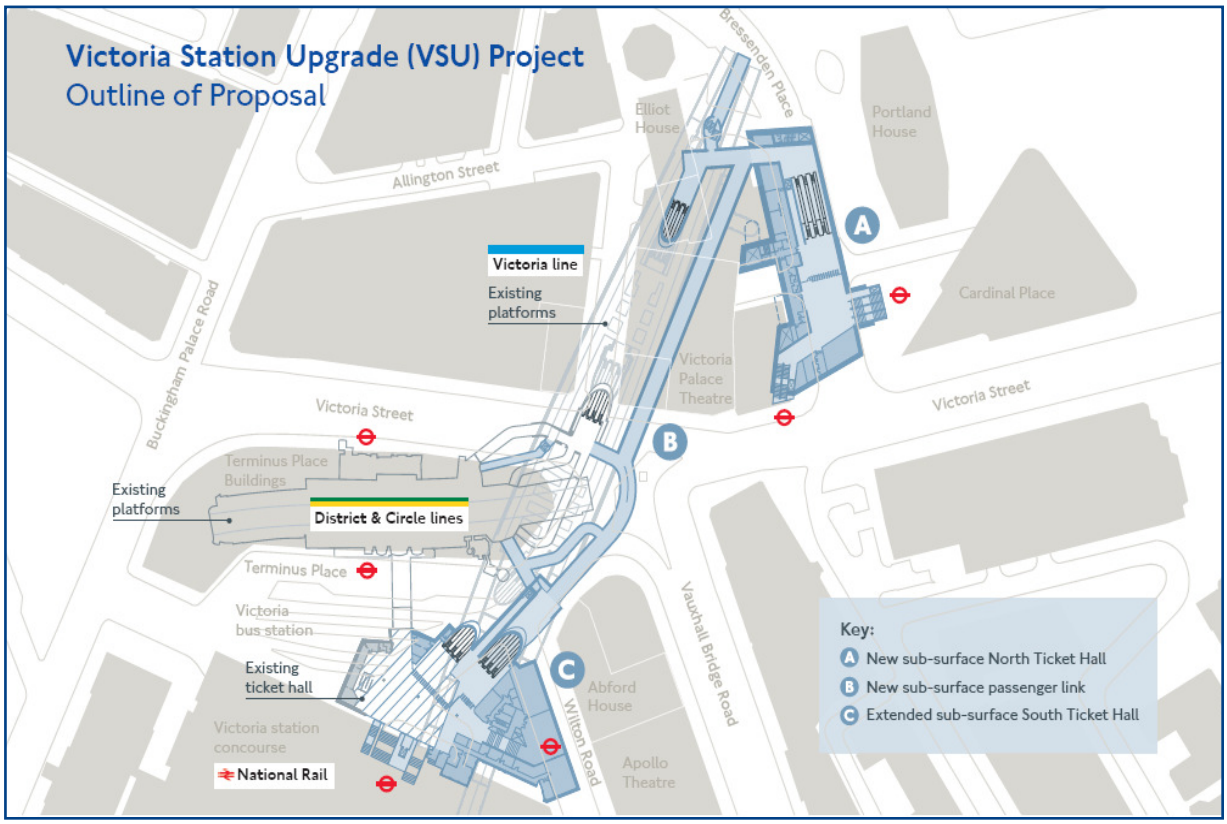
- journey time (operational safety and quality);
- programme;
- project cost;
- buildability (in terms of maintaining site/public safety); and
- operational impacts.

4.2.17 The process discussed above lead to the rejection of alternatives in Table 4.2 and identified six further options to take forward. These were considered in

[10] Limits that must not be exceeded for each selection criteria were established, for example a programme duration time was identified.

further detail in a second optioneering workshop held between MM and the LU project team in January 2007. These are as detailed in Table 4-3. The option illustrated on in Plate 4.1 is the MDC1 RIBA Stage D Scheme. This formed the point of reference for the development of alternatives.

Plate 4.1: Outline of RIBA Stage D Proposal



4.2.18 Options 4 and 6 presented in Table 4-3 were demonstrated to have the potential to meet the required project criteria, including environmental impact. Option 6 was selected for design development on the basis of the additional operational flexibility offered beyond Option 4.

Table 4-3: Detailed Assessment Alternatives

Option	Previous Reference	Outline Description Relative to MDC1 RIBA Stage D Scheme	Reason for Rejection
#0	MDC1 Stage D	No change (see Plate 4.1)	***F. Stakeholder Impacts:*** Disadvantage of tunnelling at shallow depth directly beneath VPT.
#1	A4*	Paid Area Link realigned to west	***A. Journey Time (Operational safety and quality):*** Reduced operational flexibility relative to Option 6.

Table 4-3: Detailed Assessment Alternatives			
Option	**Previous Reference**	**Outline Description Relative to MDC1 RIBA Stage D Scheme**	**Reason for Rejection**
#2A	A6*	Paid Area Link realigned from north end of D&C underpass to south end of NTH.	***A. Journey Time (Operational safety and quality):*** Excessive passenger journey time due to indirect routes relative to existing Stage D Design.
#2B/C	A6*	Variants on old A6 option. Paid Area Link realigned from base of new South Ticket Hall escalators, running parallel and immediately south of D&C line, new D&C underpass connecting to south of North Ticket Hall.	***A. Journey Time (Operational safety and quality):*** Excessive passenger journey time due to indirect routes relative to existing Stage D Design.
#2D	A6	Variant on old A6 option. Paid Area Link aligned directly from base of new South Ticket Hall escalators into North ticket hall. Section of Paid Area Link beneath D&C line passes at depth in London Clay, requiring a second bank of escalators within the Paid Area Link.	***A. Journey Time (Operational safety and quality):*** Excessive passenger journey time relative to existing Stage D design. Significant elevation changes for passengers traversing through Paid Area Link. No significant reduction in tunnelling risk as only short length of the area link in London Clay.
#3A	M1	Provide open central concourse to Victoria line by removal of interchange concourse escalators. Enhance D&C overbridge. Paid Area Link from D&C to Victoria overpass.	***A. Journey Time (Operational safety and quality):*** Insufficient escalator capacity from north end of Victoria line platforms.
#3B	M2	Provide open central concourse to Victoria line by removal of interchange concourse escalators. Maintain existing D&C/Victoria line interchange	***A. Journey Time (Operational safety and quality):*** Insufficient escalator capacity from north end of Victoria line platforms.

Table 4-3: Detailed Assessment Alternatives			
Option	**Previous Reference**	**Outline Description Relative to MDC1 RIBA Stage D Scheme**	**Reason for Rejection**
		concourse. Paid Area Link from interchange concourse to Victoria Line Overpass.	
#4	NA	New D&C Overpass adjacent to D&C ticket hall connected to New West Link to Victoria Line Overpass.	***A. Journey Time (Operational safety and quality):*** Insufficient escalator capacity from north end of Victoria line platforms.
#5	NA	Enhanced D&C Overpass from D&C ticket hall connected to New West Link to Victoria Line Overpass.	***A. Journey Time (Operational safety and quality):*** Insufficient escalator capacity from Victoria line platforms. Difficulty in providing M&E service routes from North ticket hall to South Ticket Hall.
#6	**NA**	**Paid Area Link realigned to west (i.e. as Option 1), passive provision for future construction of Paid Area Link to D&C eastbound connection.**	**Selected Option**

4.2.19 The current scheme (Option #6) meets the criteria set out in Paragraph 4.2.16 therefore has been progressed through the detailed design as the preferred scheme. The ES assesses this scheme design which is illustrated in Figure 1.2.

5 Planning Policy Context

5.1 Introduction

5.1.1 This section identifies the local, regional and national planning policy and guidance relevant to the EIA for the VSU scheme. These policies have informed the development of this proposal.

5.1.2 For the purposes of clarity, the planning policy context has been dealt with here in one distinct section rather than considering it within each individual environmental topic section, as initially stated within the Scoping and Methodology Report (Annex A).

5.2 National Planning Policy

5.2.1 Planning policy at a national level is delivered through Planning Policy Guidance notes (PPGs) and Planning Policy Statements (PPSs). All regional and local planning documents should be in compliance with these guidance notes and statements. The key PPGs and PPSs of relevance to the proposed VSU scheme are identified below:

- PPS1: Delivering Sustainable Development;
- PPG4: Industrial and Commercial Development and Small Firms;
- PPS6: Planning for Town Centres;
- PPS9: Biodiversity and Geological Conservation;
- PPS10: Planning for Sustainable Waste Management;
- PPG13: Transport;
- PPG15: Planning and the Historic Environment;
- PPG16: Archaeology and Planning;
- PPS22: Renewable Energy;
- PPS23: Planning and Pollution Control;
- PPG24: Planning and Noise; and
- PPS25: Development and Flood Risk.

Planning Policy Statement 1: Delivering Sustainable Development (PPS1)

5.2.2 PPS1 sets out the Government overarching planning policies on the delivery of sustainable development through the planning system. The VSU scheme accords with the principles in PPS1 by contributing to sustainable economic development and ensuring that the development supports existing communities and contributes to the creation of safe, sustainable, liveable and mixed communities with good access to jobs and services. The VSU scheme

will benefit the local economy, local residents and workers, and the wider London area.

5.2.3 The Government requires planning authorities to ensure the achievement of high quality and inclusive design for all development including individual buildings, public and private spaces and wider area development schemes. The Government encourages good design which should:

- address the connections between people and places by considering the needs of people to access jobs and key services;
- be integrated into the existing urban form and the natural and built environments;
- be an integral part of the processes for ensuring successful, safe and inclusive villages, towns and cities; and
- create an environment where everyone can access and benefit from the full range of opportunities available to members of society.

5.2.4 In addition, paragraph 1 of PPS1 highlights 'the maintenance of high and stable levels of economic growth and employment' as one of the four aims of sustainable development. Paragraph 23 reinforces this by stating that 'the Government is committed to promoting a strong, stable, and productive economy that aims to bring jobs and prosperity for all. Planning authorities should:

i. Recognise that economic development can deliver environmental and social benefits;

ii. Recognise the wider sub-regional, regional or national benefits of economic development and consider these alongside any adverse local impacts; and

iii. Actively promote and facilitate good quality development, which is sustainable and consistent with their plans'.

5.2.5 The proposed scheme is a clear expression of confidence in providing for economic growth in this location in support of the local, regional and national Government aims.

Planning Policy Guidance Note 4: Industrial and Commercial Development and Small Firms (PPG4)

5.2.6 Although 14 years old, PPG4 remains an important material consideration in the consideration of the proposal subject to this application. It mirrors PPS1's identification of the importance of economic growth and notes that *'economic growth and high quality environment have to be pursued together'*. In addition, the guidance notes the importance that industry and commerce places on location. Paragraph 9 states *that 'business often gives high priority to good access to roads, and sometimes rail, airports and ports'*. Given the central location of Victoria Underground Station and its role as a major

commuter and transport hub, the VSU scheme will be of benefit to existing businesses and will also help make the area more attractive to prospective businesses.

Planning Policy Statement 6: Planning for Town Centres (PPS6)

5.2.7 PPS6 promotes growth and managing change in town centres. Some of the guidance contained in PPS6, such as the need to demonstrate that there are no more centrally located sites for the development, is not relevant to the VSU scheme. However, the proposed re-development will improve accessibility and safety, and will provide a high-quality environment to ensure the Victoria area remains competitive and attractive to inward investment.

Planning Policy Statement 9: Biodiversity and Geological Conservation (PPS9)

5.2.8 The introduction to this policy states that '*biodiversity is the variety of life in all its forms*' as discussed in the UK Biodiversity Action Plan. Geological conservation relates to the sites that are designated for their geology and/or geomorphological importance.

5.2.9 One of the key principles outlined in this policy statement is (vi) which states that 'the aim of planning decisions should be to prevent harm to biodiversity and geological conservation interests.'

5.2.10 Paragraph 13 promotes the re-use of brownfield land and states that this makes a major contribution to sustainable development by reducing the amount of countryside and undeveloped land that needs to be used. Public realm and landscaping improvements have been incorporated as part of the VSU proposals.

Planning Policy Statement 10: Planning for Sustainable Waste Management (PPS10)

5.2.11 The VSU scheme complies with PPS10 and the National Waste Strategy 2007. The scheme will require excavated materials to be handled, collected and disposed of in a sustainable manner. Opportunities to re-use and recycle materials generated during the construction phase will be explored wherever possible. The VSU scheme will demonstrate that it complies with local and regional waste policies such as the Mayors' Municipal Waste Strategy. Waste Management Plans (WMPs) will become mandatory for all construction projects over £250,000 on the 6th April 2008, under Section 54 of the Clean Neighbourhood and Environment Act 2005. Currently their production constitutes good environmental practice. For the VSU scheme, a Demolition & Excavated Materials, and Wastes Management Plan has been produced (Technical Appendices Volume 3, Appendix G).

5.2.12 PPS10 is addressed in more detail in the technical appendix for water resources (Technical Appendices Volume 3, Appendix I) and in the

supporting Project Sustainability Appraisal.

Planning Policy Guidance 13: Transport (PPG13)

5.2.13 PPG13 guides local planning authorities on transport issues for the preparation of development plans and in the consideration of planning applications. Paragraph 6 notes the importance of making the '*fullest use of public transport*' and of *'focusing major generators of travel demand…near to major public transport interchanges'*. Victoria National Rail and Underground stations are two of the busiest stations in London. The VSU scheme will enhance and develop the function of the Victoria Public Transport Interchange, which provides an existing interchange between the Victoria Underground and National Rail Stations, taxi ranks, and bus station. Paragraph 21 of PPG13 reiterates this guidance and advises local authorities to '*be proactive in promoting intensive development in these areas*'.

5.2.14 PPG13 is addressed in more detail in the Transport Assessment (Technical Appendices Volume 1).

Planning Policy Guidance Note 15: Planning and the Historic Environment (PPG15)

5.2.15 PPG15 states that developments close to, but outside a Conservation Area, which would affect views into or out of the area, should be a material consideration in determining development applications. It also states that, when considering planning applications, detailed plans and drawings of proposed new development are required.

5.2.16 The VSU scheme is near the Westminster Cathedral Conservation Area and Grosvenor Gardens Conservation Area, and within sight of Victoria National Rail Station, the façade of which is listed. The above-ground structures that form part of the VSU scheme will be designed sensitively so as not to detract from the rich architectural heritage of the area and at a minimum preserve, and aspire to enhance, the setting of the existing station. Public realm improvements will be incorporated as part of the VSU scheme. PPG15 is addressed in detail in the technical appendix for built heritage (Technical Appendices Volume 3, Appendix E).

Planning Policy Guidance 16: Archaeology and Planning (PPG16)

5.2.17 Paragraph 12 states that 'the key to informed and reasonable planning decisions…is for consideration to be given early, before formal planning applications are made, to the question whether archaeological remains exist on a site where development is planned and the implications for the development proposal'.

5.2.18 The VSU scheme involves substantial sub-surface excavation and cut-and-cover construction for the overpass tunnel and NTH. This may result in

issues related to the archaeology of the area, which is addressed in the technical appendix for archaeology and cultural heritage (Technical Appendices Volume 3, Appendix F).

Planning Policy Statement 22: Renewable Energy (PPS22)

5.2.19 PPS22 sets out the Government's policies for renewable energy, to which planning authorities should have regard when preparing local development documents and when making planning decisions. PPS22 (August 2004) is addressed in the Energy Demand Assessment and the CEEQUAL Pre-Assessment, submitted as supporting documents to the Order application.

Planning Policy Statement 23: Planning and Pollution Control (PPS23)

5.2.20 This policy statement outlines the relationship between the planning system and pollution control. Paragraph 11 states that ‘close co-ordination between planning authorities, transport authorities and pollution control regulators is essential to meet the common objective that where development takes place, it is sustainable.’

5.2.21 Advice in paragraph 26 highlights the local authority responsibilities for integrating land use planning with plans and strategies for the control, mitigation and removal of pollution. Contaminated land is defined by the Environment Act 1995 in terms of substances in, on, or under land where significant harm is or would be caused. The Act sets down a regime for dealing with contaminated land to treat past contamination problems and prevent its occurrence in the future.

5.2.22 PPS23 is addressed in more detail in the technical appendices for water resources and contaminated land (Technical Appendices Volume 3, Appendix I and H respectively) and the Project Sustainability Appraisal.

Planning Policy Guidance Note 24: Planning and Noise (PPG24)

5.2.23 PPG24 is of limited relevance, but paragraph 10 states that ‘much of the development which is necessary for the creation of jobs and the construction and improvement of essential infrastructure will generate noise. The planning system should not place unjustifiable obstacles in the way of such development. Nevertheless, local planning authorities must ensure that development does not cause an unacceptable degree of disturbance’.

5.2.24 Assessment of the potential noise effects resulting from the VSU scheme and measures mitigate these effects are detailed in the noise and vibration technical assessment (Technical Appendices Volume 2, Appendix B) and in the CoCP.

Planning Policy Statement 25: Development and Flood Risk (PPS25)

5.2.25 PPS25 on development and flood risk was published in December 2006. The policy states that flood risk should be considered as part of any planning application in order to limit risk of future damage to property and life due to flooding. Paragraph 3 of the background to the guidance states that: *"All forms of flooding and their impact on the natural and built environment are material planning considerations. Planning Policy Statement 1: Delivering Sustainable Development sets out the Government's objectives for the planning system, and how planning should facilitate and promote sustainable patterns of development, avoiding flood risk and accommodating the impacts of climate change."* The "Precautionary Principle" should be applied to the issue of flood risk. The Precautionary Principle states that: *"Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost effective measures to prevent environmental degradation"* (ODPM, 2001: paragraph 13).

5.2.26 In relation to development control decisions, advice in paragraph 26 seeks to ensure that 'local planning authorities, (LPAs), advised by the Environment Agency and other relevant organisations, should determine applications for planning permission taking account of all material considerations, including the issue of flood risk, the Flood Risk Assessments (FRA) prepared by the developer (when required) and proposals for reducing or managing that risk'. The site is identified in the Westminster UDP as being within the flood zone. An assessment of flood has been carried and a commentary is provided in the technical appendix for water resources (Technical Appendices Volume 3, Appendix I).

Other National Policy Documents

5.2.27 In addition to the PPSs and PPGs, other national planning policy documents relevant to the VSU scheme include:

- **The Transport Act 2000:** Sections 108 and 113 require major metropolitan areas to produce transport strategies and plans for their areas. In London, this was required of the Mayor by the Greater London Authority Act 1999, which also established Transport for London (TfL). Under Section 141 (1) of the Greater London Authority Act 1999, the Mayor of London has a general duty to develop and implement policies to promote and encourage safe, integrated, efficient and economic transport facilities and services to, from and within London. Under Section 154 (3b), TfL has a duty to facilitate the discharge of these duties.

- **White Paper "A New Deal for Transport: Better for Everyone" (July 1998):** This paper seeks to achieve higher priority for walking, cycling and public transport, improved facilities for people to make connections and better information for passengers. It recognises that improved interchanges and connections between rail services and between rail and other means of transport, including walking and cycling, are essential to an integrated system. It seeks to achieve better safety and personal security through reducing crime and the fear of crime.

5.2.28 The White Paper seeks to ensure that Local Implementation Plans "*should consider interchange facilities*", which should include reliable/punctual and frequent services to reduce waiting times, short walking distances and clear directional signs, good time table displays, staff availability, well maintained infrastructure, including public conveniences and baby changing facilities, good personal security and accessibility.

- **Transport 2010 - The 10 Year Plan:** The plan promotes partnership between the public and private sectors to provide a modern integrated high quality transport system.

5.2.29 Transport 2010 sets out a vision for the transport system by 2010. It aims to provide:

- modern, high quality public transport, both locally and nationally;
- more light rail systems and attractive bus services that are fully accessible and integrated with other types of transport;
- easier access to jobs and services through improved transport;
- links to regeneration areas and better land use planning;
- a well-maintained road network with real-time driver information for strategic routes and reduced congestion;
- safer and more secure transport accessible to all; and
- a transport system that makes less impact on the environment.

The VSU scheme supports these policies as it will result in the modernisation and improvement of the Victoria Underground Station and will improve the integration with other transport links.

5.3 Regional Planning Policy

5.3.1 The key regional planning documents of relevance to the VSU scheme are the adopted London Plan (February 2004), the Mayor's Transport Strategy (July 2001) and the Central London Sub-regional Development Framework (Draft 2007).

The London Plan

5.3.2 The London Plan (LP) functions as regional planning policy. It is a statutory document that has development plan status and forms a primary policy document for assessing development applications. It was adopted in February 2004 and sets the direction for local planning policy (developed by London Borough Councils). The LP has been revised and a draft (Draft London Plan) was published in September 2007 for which public consultation ended on 22 December 2006. It is envisaged that a revised plan, currently termed 'Further Alterations' will be adopted in early 2008. The most relevant proposals to this scheme are:

- **Objective 3:** to make London a more prosperous city with strong and diverse economic growth;
- **Objective 5:** to improve London's accessibility. This includes improving and expanding London's public transport through increased and phased investment in services and infrastructure, minimising growth of journey lengths and integrating development with public transport to ensure that there is a proper fit between development and the capacity of the public transport network to service; and
- **Objective 6:** to make London a more attractive, well-designed and green city.

5.3.3 The VSU scheme is in accordance with these objectives. The development will support sustainable economic growth in the area by tackling congestion and unreliability at the Underground station, whilst providing improved access by public transport, walking and cycling. Careful construction management through the VSU scheme CoCP will minimise disruption whilst the works are being carried out.

Sustainable Development

5.3.4 Policy 2A.1 (sustainability criteria) states criteria to be used in developing sub-regional development frameworks and to be considered in UDPs and planning applications. These include:

- using a design-led approach to optimise the potential of sites;
- ensuring that development occurs in locations that are currently, or are planned to be, accessible by public transport, walking and cycling; and
- ensuring that development takes account of the capacity of existing or planned infrastructure including public transport.

5.3.5 The VSU scheme uses sensitive design and construction methods to minimise visual impact on the listed structure of Victoria National Rail Station, whilst ensuring that the benefits of the Victoria Public Transport Interchange as a major transport hub are fully optimised by increasing capacity of the Underground Station.

5.3.6 LP policy 2A.3 (Areas for Intensification) states that 'UDP policies should identify Areas for Intensification. Policies for development should exploit their public transport accessibility and potential for increases in residential, employment and other uses, through higher densities and more mixed and intensive use.' Map 2A.1 in the London Plan identifies Victoria as an Area for Intensification. Supporting paragraph 2.10 adds that estimates of housing and employment growth for the plan period are provided for each Area of Intensification in Table 5B.2. This policy estimates that 2,000 new jobs and 200 new residential units will be provided up to 2016 within the 41 hectares of land at Victoria falling under the Area for Intensification designation. Policy 5B.5 (Areas for Intensification in Central London) states that *'to help accommodate growth, boroughs…should promote development opportunities through higher density redevelopment at key transport nodes of good accessibility'.* The VSU scheme is within the Area of Intensification and it will provide improved public transport interchange at Victoria.

5.3.7 Policy 2A.2 (Areas of Opportunity) states that 'as part of the process of producing Sub-Regional Development Frameworks, strategic partners should work with the Mayor to prepare, and then implement, spatial planning frameworks for Opportunity Areas, which contribute towards maximising access in London by public transport. Map 2A.1 in the draft Further Alterations to the London Plan identifies Victoria as an Opportunity Area.'

5.3.8 This will provide wider benefits for the Area of Intensification by improving accessibility to the transport system and the Area of Opportunity.

Economic Context

5.3.9 LP policies 3B.1 (Developing London's Economy), policy 3B.2 (Office Demand and Supply) and policy 3B.3 (office provision) state the importance of developing London's economy and the provision of suitable office accommodation and business premises to meet the identified demand. The VSU scheme will help achieve these aims by providing better, more integrated transport links thus attracting inward investment.

Closer Integration of Transport and Spatial Development

5.3.10 The adopted LP policy 3C.1 (Integrating Transport and Development) states that 'the Mayor will work with TfL, the DfT, the government, boroughs and other partners to ensure the integration of transport and development'. This includes:

- encouraging patterns and forms of development that reduce the need to travel especially by car; and
- seeking to improve public transport capacity and accessibility where it is needed, for areas of greatest demand and areas designated for development and regeneration, including the Central Activities Zone Areas for Intensification and town centres.

5.3.11 LP policy 3C.1 and policies 3C.3 (Sustainable transport in London) and 3C.4 (Land for Transport Functions) require sufficient land and sites for development of an expanded transport function to serve London's economic, social and environmental needs. The VSU scheme includes substantial extension of the existing subsurface ticket hall, the provision of a new ticket hall and improved pedestrian access, which supports these policies.

5.3.12 The draft 'Further Alterations' to the London Plan has minor amendments to policy 3C.1. This includes an additional objective that states *'encouraging integration of the major transport infrastructure plans with improvements to the public realm, particularly in key areas around major rail and Underground stations and interchanges, using land assembly powers where necessary.'*

5.3.13 The draft 'Further Alterations' to the London Plan has minor amendments to policy 3C.4 (Land for transport) which states that the Mayor will, and boroughs and other strategic partners should, ensure the provision of sufficient land for transport. There is also specific mention of the Underground and Interchange improvements. The revised plan advice in paragraph 3.167 is that *'transport interchanges should contribute to the quality and attractiveness of local areas through upgrades and good quality design with particular attention to safety, pedestrian movement and integration with public spaces.'*

5.3.14 The principles of the proposed VSU scheme support the policies discussed above.

Enhancing International, National and Regional Transport Links

5.3.15 LP policy 3C.5 seeks to improve and expand London's international, national and regional transport links for passengers while mitigating adverse environmental effects. The VSU scheme, with the VLU, will significantly improve the capacity of the existing transport hub and strengthen the transport links between the mainline railway, LU services, and Victoria Coach Station. The National Rail Station is used by passengers travelling to and from the south-east and international travellers en route to or from Gatwick. The Victoria Coach Station is used by international travellers, and people from areas across the UK. Thus the scheme clearly accords with this policy.

5.3.16 Other policies to which the VSU scheme accords to are 3C.8 (improving strategic rail services); 3C.9 (Increasing the Capacity, Quality and Integration of Public Transport to Meet London's Needs), which states that *'the Mayor will work with other strategic partners to increase the capacity of public transport in London by up to 50 % over the plan period and to improve integration, reliability, safety, quality, accessibility, frequency and attractiveness of the existing public transport system.'* Policy 3C.10 (phasing of transport infrastructure); and 3C.12 (improved Underground and DLR services).

5.3.17 The draft 'Further Alterations' to the London Plan has added a new policy 3C.9i (Public transport security), which states that 'the Mayor will work with TfL, government, transport operators, the Police and other strategic partners to coordinate the implementation of security measures to ensure that London's transport network and services are as secure as is reasonably practicable and are as safe as possible in the operation of services and facilities.'

5.3.18 It also advises in Paragraph 3.181(i) that proposals for better public transport in London will be developed over time and set out in revisions to the Transport Strategy. The new title to revised policy 3C.10 is *'phasing of transport infrastructure provision and improvements'*, which includes a new paragraph 3.183i which advises that *'improvements to the Underground and National Rail networks will benefit large areas of inner and outer London'*.

5.3.19 It also emphasises in policy 3C.12 the delivery of better public transport in London and advises in paragraph 3.191i that the Underground has undertaken, through several Private Public Partnership contracts, to increase capacity, improve greater reliability and meet growing demand including:

- Victoria line upgrade providing an increase in capacity of about 35 per cent with new rolling stock by 2013; and
- Sub-surface upgrades (District, Circle and City line) providing a capacity increase of about 19 per cent and rolling stock replacement.

5.3.20 The objectives of the VSU scheme strongly accords with these policies and proposals. The Transport Assessment addresses the additional policies contained within the London Plan, which relate to road scheme proposals.

Improving the Use of Energy

5.3.21 LP policy 4A.7 (Energy Efficiency and Renewable Energy) states that 'boroughs should support the Mayor's Energy Strategy and its objectives of reducing carbon dioxide emissions, improving energy efficiency and increasing the proportion of energy used generated from renewable sources'. This includes:

- improving the integration of land use and transport policy and reducing the need to travel by car;
- requiring the inclusion of energy efficient and renewable energy technology and design; and,
- minimising electric light lost to the sky, particularly from streetlights.

5.3.22 The draft 'Further Alterations' to the London Plan has made some amendments to improving air quality and has added new policies which address adaptation and climate change such as policy 4A.5iii (Adaptation to Climate Change) which seeks to minimise overheating and solar gain (policy 4A.5iv) and reduce flood risk (policy 4A.5vii).

5.3.23 The VSU scheme will improve the efficiency of passenger and pedestrian movement through Victoria Underground station by reducing the need for station closures. The development has also been designed to minimise the energy required in accordance with policy 4A.8 (Energy Assessment). This is explained in an Energy Demand Assessment which will be submitted as a supporting document.

Design for a Compact City

5.3.24 LP policy 4B.6 (Sustainable Design and Construction) states that 'the Mayor will, and boroughs should, ensure future developments meet the highest standards of sustainable design and construction and reflect this principle in UDP policies'. The VSU scheme incorporates measures to reduce the impact of flooding and micro-climatic effects and ensure that developments are comfortable and secure for users. A CEEQUAL assessment has been undertaken and will be submitted as a supporting document.

5.3.25 LP policy 4B.5 (Creating an Inclusive Environment) details the need for 'all future development to meet the highest standards of accessibility and inclusion. UDP policies should integrate and adopt the following principles of inclusive design that will require that developments:

- *can be used easily by as many people as possible without undue effort, separation, or special treatment;*
- *offer the freedom to choose and the ability to participate equally in the development's mainstream activities; and*
- *value diversity and difference'.*

5.3.26 It states that boroughs should require development proposals to include an access statement showing how the principles of inclusive design, including the specific needs of PRM, have been integrated into the proposed development and how inclusion will be maintained and managed. These principles, and the requirements of the adopted LP policy 3A.14 (Addressing the needs of London's diverse population), should be adopted by all responsible for changing or managing the built environment. The VSU scheme is in accordance with this policy. A Design and Access Statement has been prepared which details the principles and design features used to ensure inclusive access. These include:

- widened gateline and additional escalators parallel to the existing Victoria line ticket hall at the southern end of the Underground station;
- provision of step-free access comprising lifts serving all key movements from street level to ticket halls and platforms; and
- improved access between the National Rail Station and the existing Victoria line ticket hall comprising widened staircases and new PRM lifts.

5.3.27 The draft 'Further Alterations' to the London Plan has made some

amendments to the principles of design for a compact city and has added new policies which address sustainable urban design such as policy 4A.2i (Sustainable design and construction), which seeks to make the most effective use of existing land and buildings. The policy echoes concerns raised in the revised policies on Adaptation to Climate Change.

5.3.28 The VSU scheme is also in accordance with adopted LP policies 4B.7 (Respect local context and communities), and 4B.10 (London's built heritage) which have not been amended in their entirety in the draft 'Further Alterations' to the London Plan. The adopted LP policy 4B.11 (Heritage conservation) recognises the importance of historic assets and their context. The revised policy 4B.11 emphasises that context includes the relationship to adjoining areas. The VSU scheme demonstrates an understanding of and respect for the historic environment. The new above ground entrances will improve the character and special quality of the Victoria area by removing street clutter, improving views of the listed Victoria National Rail station façade, providing well designed and safer entrances to the Underground and reducing pedestrian congestion.

Central London Strategic Priorities (Policy 5B.1)

5.3.29 The VSU scheme is in accordance with, and will help meet, the strategic priorities for the Central London sub-region of which the CoW is part. These include the need to:

- identify capacity to accommodate new job and housing opportunities and appropriate mixed-use development. This is especially important in relation to the Central Activities Zone, Opportunity Areas and Areas for Intensification, while recognising the overall strategic development priority to the east;
- co-ordinate skills development, transport and planning to improve access to jobs for people from deprived communities in Central London and neighbouring parts of other sub-regions;
- promote and intensify retailing, services, employment, leisure and housing in town centres and opportunities for mixed-use development;
- improve the variety, quality and access to available employment sites, especially within Strategic Employment Locations, to meet the identifiable demands for employment land; and
- ensure that new development is sustainable, safe, secure and well designed, improves the environment, particularly air quality, and takes account of the sub-region's outstanding heritage.

The TfL Business Plan 2005/6 – 2009/10: Transport for London 5-Year Investment Programme

5.3.30 In 2005 TfL released a 5-year business plan to help overcome problems associated with an ageing transport network. Over the next five years TfL is

planning to invest £10 billion to address these problems. As part of the business plan there are several areas that have been highlighted for improvement. These will include, as part of the VSU scheme, a new entrance at Bressenden Place for the new Underground ticket hall along with additional escalators to Victoria line platforms, with widened access staircases to National Rail and lifts for PRM.

Mayor's Transport Strategy

5.3.31 The Mayor's Transport Strategy was published in July 2001. Paragraph 5.18 states that funding for LU is excluded from the Government's 10-year strategy. The Mayor's strategy is being implemented through Transport for London's 5 Year Investment Programme (2005/2006 – 2009/2010). The main highlights of this Investment Programme include the implementation of significant station modernisations and refurbishments, and focus on accessibility improvements, including those within Victoria Underground Station. The VSU scheme is a significant part of this Investment Programme. The new ticket halls and additional access provision directly tackle the issue of accessibility and provide improvements to the existing conditions.

5.3.32 The key objectives in the Mayor's Transport Strategy relevant to the VSU scheme are:

i. **Ensure that, where possible, current service levels are maintained:** congestion is currently a problem across the whole Victoria Station area, (especially during peak hours). Existing facilities are inadequate to maintain the existing levels of service, not taking into account any growth in passenger numbers. The proposed works will significantly enhance the quality of service provided at the interchange, reducing passenger waiting times and increasing the capacity of the Underground station.

   It is also stated that investment in transport will aid sustainable economic growth by strengthening London's regional, national and international links. The section on 'Impacts on Passengers', addresses the proposals for transport management to minimise the disruption to services that result from the VSU scheme.

ii. **Meet the demand and growth on the existing network:** the needs of passengers are set out in paragraph 4C.42 of the Mayor's Transport Strategy and are related to delays, overcrowding, security, better access and cleanliness. The VSU scheme is in line with the aims of this policy. As paragraph 4C.47 of the Transport Strategy states, the stations that are most in need of renewal should be made a priority and modernised first. It is noted in paragraph 4C.47 that Victoria Underground Station is in need of major works in order to deal with the problems of congestion and the general increase in usage that is expected (note – the VSU scheme complements the concurrent Victoria Line Upgrade scheme which will increase the overall capacity of the line).

   Section 4C 'London Underground' of the Mayor's Transport Strategy identifies the problems of an unreliable service and overcrowding on the

Underground. The problem of overcrowding extends throughout the day, as paragraph 4C.5 highlights, and delays are becoming more frequent and of greater duration. The VSU scheme will ease current capacity constraints, through the creation of a new ticket hall and the expansion of the existing station and with implementation of the VLU, will improve passenger journey times. In turn the service that is provided to the passengers will be more reliable, easy to use, safe and secure, as envisaged in Policy 4C.2.

iii. **Enhance the quality of service available:** Policy 4C.3 of the Transport Strategy states that a sound public transport system is one of London's most essential infrastructure assets and, for this reason, the sole objective of any development should be to deliver a safe, efficient and reliable service. The upgrading of Victoria Underground Station will make a significant contribution towards this policy.

iv. **Accommodate London's growth by focusing on regeneration:** Victoria is mentioned in the TfL Investment Programme as an area that requires regeneration. The VSU scheme will help reduce the long-standing problem of congestion, meet the objectives of the Mayor's Transport Strategy, and expand the capacity of the Underground station to meet the requirements of London's growth. The VSU scheme improves access within London, and to the South. Victoria National Rail station also acts as the gateway from Gatwick and Southampton airports, underlining its importance on a regional and an international level.

Paragraph 3.39 of the Mayor's Transport Strategy states that, not only must new major projects help stimulate economic growth, but measures must be adopted to address deficiencies in the existing public transport network. Both the Victoria National Rail and Underground stations are highlighted in TfL's 5 Year Investment Programme as a station in need of improvement works. The VSU scheme will help address current deficiencies in the station's infrastructure.

Other Mayoral Strategies

5.3.33 Other strategies produced by the Mayor of relevance to the VSU scheme include:

- Energy Strategy: Green Light to Clean Power (addressed in the Sustainability Appraisal);
- SPG: London View Management Framework (addressed in Townscape and Visual Amenity);
- SPG: Sustainable Design and Construction (addressed in the Sustainability Appraisal);
- SPG: Accessible London: Achieving an Inclusive Environment (addressed in Design and Access Statement);

- Interim strategic planning guidance on tall buildings, strategic views and the skyline in London (addressed in the technical appendix for townscape and visual amenity (Technical Appendices Volume 3, Appendix D); and
- The Mayor of London's Climate Change Action Plan 'Action Today to Protect Tomorrow' (February 2007).

Central London Sub-regional Development Framework (Draft)

5.3.34 The Central London Sub-Regional Development Framework (SRDF) provides guidance on implementing strategic policies in Local Development Frameworks and other plans.

5.3.35 The VSU scheme has been identified in the SRDF as one of the principal projects for improving public transport within Central London. The VSU scheme is therefore in accordance with this Framework.

5.4 Local Planning Policy

CoW Adopted Unitary Development Plan

5.4.1 The CoW has an adopted Unitary Development Plan (UDP) (24 January 2007), which is the development plan for Westminster. The UDP is a material planning consideration and therefore must be taken account of in determining applications for development.

5.4.2 The UDP is guided by six planning aims:

- enhancing the attraction of central London;
- fostering economic vitality and diversity;
- building sustainable communities;
- integrating land use and transport policies and reducing the environmental impact of transport;
- ensuring a high quality environment; and
- working towards a more sustainable city.

5.4.3 The VSU scheme supports these aims. The following policies are of particular relevance.

Westminster's Central Activities Zone

5.4.4 The UDP strategic policy STRA 3 states that the City Council's aim is to protect and enhance the strategic role, historic character, and social and cultural importance of the central part of Westminster through the designation of a Central Activities Zone and Central Activities Zone Frontages.

5.4.5 Victoria is one of eight sub-areas located within Central Activities Zone. Due to its transport interchange function, it is identified as a gateway for people arriving in the area and is thus fundamental in shaping people's perceptions of the area as they arrive. As such, the Council seeks opportunities to improve the station and local environmental quality. The following policies are particularly relevant to the VSU scheme:

- **Policy CENT 1**: identifies for the Central Activities Zone (CAZ) in which Victoria Underground Station is located. Paragraph 1.25 of the adopted UDP states that *'the railway, Underground, bus and coach stations at Victoria provide the gateway for many people arriving in the area. The railway station is the busiest mainline terminus in London, and the Underground station is also the busiest in London'*;
- **Policy CENT 4**: resists the loss of uses supporting Central London Activities where such uses contribute to the character and function of these areas. Table 1.2 identifies appropriate Central London Supporting Uses and Local Services which include *'Tube, bus and rail stations'*; and
- **Policies SS14 - SS17** aim to improve the appearance, attractiveness, and safety of shopping streets in Westminster. By easing pedestrian congestion on the streets around the Victoria Station complex (such as Bressenden Place and Victoria Street), the VSU scheme will help ensure that the shopping streets will be a more comfortable and enjoyable environment in which to shop.

5.4.6 Furthermore, Policy STRA 5 (regeneration and economic development) states that growth in Westminster's economy will be supported and encouraged, particularly where such growth is environmentally sustainable and increases residents' opportunities and improves access to employment though reduced pedestrian congestion and the more efficient transport facilities.

5.4.7 The VSU scheme is in accordance with these policies by enhancing the attractiveness of Victoria to businesses, visitors, workers and shoppers. The scheme also includes the demolition of life-expired buildings and provides enhanced public realm on 'the Beach' area in front of Victoria National Rail station.

Transport and Environmental Impact

5.4.8 Policies STRA 20, 21 and 22 in Part 1 of the UDP concern the integration of land use and transport and reducing its environmental impact. STRA 20 aims to *'reduce the need to travel, whilst improving access to facilities and services'*, whilst policy STRA 21 supports proposals that integrate, improve and extend bus, Underground and rail networks. STRA 22 aims to *'protect and improve environmental quality, by reducing the use of all motorised vehicles and encouraging alternative modes of transport…which cause less pollution and congestion'*.

5.4.9 The VSU scheme is in accordance with these policies.

5.4.10 The introduction to Chapter 4 (Transport) of the UDP stresses that the existing transport networks do not always meet this need. Paragraph 4.16 acknowledges that *'although most of Westminster is well served by public transport, problems are exacerbated by the perception that the rail systems are overcrowded, expensive and regularly disrupted and that these problems are getting worse.'*

5.4.11 The VSU scheme will help address this deficiency and accord with policies TRANS 1, which includes the need to *'give higher priority to walking, cycling and the use of public transport'*, and TRANS 4 – TRANS 8, which have an overall aim of *'improving the quality, reliability and accessibility of public transport of all modes to make it more attractive than the private car'*.

5.4.12 In particular, TRANS 5 (A) seeks to 'support improvements to the main line rail termini, Underground stations and associated interchange facilities, including improved access to and capacity of stations and interchanges' and (E) also 'recognises that the construction of new facilities and the achievement of associated community benefits may cause some disruption and the City Council will work with promoters and operators to protect the environment, listed and other valued buildings' from these adverse impacts.

5.4.13 In accordance with policy TRANS 14, a Transport Assessment has been carried out, which explains all proposed traffic management measures in detail (this is presented in (Technical Appendices Volume 1).

5.4.14 The proposals will also support policy TRANS 15 (Traffic Reduction). Increasing the capacity of Victoria Underground Station will improve efficiency and provide a viable alternative to the car by encouraging the use of public transport. The proposals will therefore help meet the traffic reduction targets set out in the Mayor's Transport Strategy and the London Plan.

Urban Design and Conservation

5.4.15 Policy DES 1 aims to 'ensure the highest quality in the form and quality of new development in order to preserve or enhance the townscape of Westminster; to provide adequate access; to reduce crime and improve security.' The policy includes three areas:

- architectural quality, local distinctiveness and sustainable development;
- amenity, accessibility and community safety; and
- applications.

5.4.16 UDP policy DES 1 (C) requires applications and development proposals to demonstrate how they have taken into account:

- architectural quality, local character and distinctiveness;
- the location and nature of existing and potential links to and through the site and to amenities beyond the site;
- townscape features within the site and features which border the site;
- local views through and within the site and landmark features visible in the vicinity of the site;
- accessibility, inclusive design and security measures;
- regard to supplementary design guidance produced by CoW;
- waste storage and disposal; and
- sustainable building principles in accordance with policy ENV 1: Sustainable and resource efficient buildings.

5.4.17 Furthermore, Westminster UDP policy STRA 27 aims 'to promote the highest standards of sustainable urban design and architecture, and to encourage inventive architecture in the context of Westminster's unique local distinctiveness.' These issues are addressed in the technical appendix for townscape and visual amenity (Technical Appendices Volume 3, Appendix D).

5.4.18 Improvements included in the VSU scheme will comprise clearance of street clutter in 'the Beach'; area. Pavement lights will provide direction to the National Rail Station. These design features will thus improve views of Victoria's north façade as well as enhance the overall aesthetic impression and perception of the area.

5.4.19 The adopted UDP policy STRA 26 aims 'to ensure that all users and visitors have access to individual buildings and developments. Particular regard should be paid to the needs of people with disabilities.' The VSU scheme supports these policies by proving new lifts for PRM connecting the Victoria line platforms to street and interchange between the Victoria and D&C lines and access to ticket halls. Further details in relation to service access and the impact on pedestrian or other traffic are provided in the technical appendix for traffic and transport (Technical Appendices Volume 1).

Crime and Security

5.4.20 UDP policy STRA 18 aims 'to reduce the fear of crime, actual crime and nuisance for residents, businesses and visitors.' Further principles and measures are set out in CoW SPG: 'Designing Out Crime in Westminster' (19/11/2004).

5.4.21 The VSU scheme has been designed to maximise security and reduce crime.

Listed Buildings and Archaeology

5.4.22 UDP policy STRA 28 aims 'to preserve or enhance the built and landscaped environment of Westminster; paying particular regard to its historic character and appearance.' STRA 29 includes the aim 'to preserve or enhance listed buildings and their settings and investigate, record and protect Westminster's archaeological heritage'. The VSU scheme is located adjacent to and within the vicinity of various listed buildings (Victoria National Rail Station, Apollo Victoria Theatre, VPT (adjacent) and the Little Ben Clock Tower). Measures to address the presence of these buildings are discussed in the technical appendix for built heritage (Technical Appendices Volume 3, Appendix E). The proposals are in accordance with these policies since it adopts design features which respect the historic environment. For example, the new above-ground entrances will improve the character and special quality of the Victoria area by removing street clutter (at the Wilton Road entrance), thus improving views of the Victoria National Rail station façade and providing well-designed, safer entrances to Victoria Underground Station.

Views

5.4.23 UDP policy STRA 30 aims 'to protect or enhance important and acknowledged views across or within Westminster and to resist inappropriately designed or intrusively located high buildings and other structures.' Policy DES 15 on 'Metropolitan and Local Views' resists developments, which would have an adverse effect upon important views of listed buildings, landmark buildings, monuments and statues, and squares and gardens. The VSU scheme does not impact on existing views or conservation areas. The VSU scheme has dealt with the design of the works sensitively in support of DES 1: Principles of urban design and conservation. This is discussed in the townscape and visual amenity technical appendix (Technical Appendices Volume 3, Appendix D).

Sustainability and Environmental Performance

5.4.24 Chapter 9 of the UDP outlines the key policies for environmental performance, this includes:

- ENV1: Sustainable and resource-efficient buildings;
- ENV2: Environmental appraisal;
- ENV5: Air pollution;
- ENV6: Noise pollution;
- ENV7:Controlling noise from plant, machinery and internal activity;
- ENV9: Water quality and conservation; and
- ENV13: Protecting amenities, daylight and sunlight and environmental quality.

5.4.25 These are addressed by the EIA and are documented throughout the ES. Other policies include:

- STRA32: Sustainable development of Westminster, which seeks to 'achieve sustainable development and to meet the economic, social and environmental needs of the City in an integrated and balanced way';
- STRA33: Sustainable design, construction and management of buildings, promoting efficient use of materials and reduce energy and water consumption; and
- STRA34: Pollution-Air, water and land, which includes the aim of improving air quality through Westminster's Air Quality Management Plan and other measures.

5.4.26 The sustainability planning requirements of the UDP related to the VSU scheme are as follows:

- Completed Sustainable Buildings Sections of Environmental Performance Statement (EPS) to be submitted with planning applications (ENV 2 – Environmental Appraisal). Annex 9.1 in Chapter 9 of the plan provides an EPS checklist covering policies ENV1 – ENV13. An EIA has been undertaken and supporting this is the Sustainability Appraisal; and
- An Independent Sustainability Appraisal is mandatory for large-scale developments (Heading 1.4b, Annex 9.1). BREEAM (Building Research Establishment Environmental Assessment Method) is recommended as an appropriate appraisal method for buildings (Heading 1.4c, Annex 9.1). As CEEQUAL is recognised as the equivalent of BREEAM for civil engineering projects. It has been agreed with the CoW that the CEEQUAL pre-assessment, submitted in support of the draft Order, is a fitting Independent Sustainability appraisal.

5.4.27 These are also addressed throughout the ES.

Victoria Area Planning Brief, Adopted March 2006

5.4.28 The Victoria Area Planning Brief (VAPB) is a non-statutory planning document produced by the CoW. The following principles for all major developments are listed in the Brief and are relevant to this proposal:

i. 'Pedestrian movement around sites and within the transport interchange should be given the highest priority;

ii. Proposed developments must take account of, and as far as possible address, the transport requirements at Victoria;

iii. Proposals must not harm the residential amenity of the Victoria Area, and the integration of developments with the local community should be facilitated;

iv. New buildings in Victoria must be designed and built to the highest quality, and the negative impacts of construction activity should be ameliorated; and

v. *CoW, TfL and the GLA will work together to support and develop the strategic and long term objectives for Victoria'*.

5.4.29 The required provisions in the VAPB include the following which must be included within the VSU scheme:

- scheme to include the upgrade of Victoria Underground Station (Phase 1- 3);
- improvements required to District and Circle ticket hall in accordance with Station Planning Standards and Guidance;
- PRM access to be provided to all platforms; and
- adequate evacuation routes to street and assembly areas at street level required.

5.4.30 In terms of interchange between transport modes, the brief identifies the following:

- adequate provision is required for expected increase in interchange passengers;
- safe interchange should be ensured;
- minimise conflict between pedestrians and between pedestrians and vehicles;
- good visibility of access to other modes required; and
- limit walk distance between modes.

5.4.31 The proposed designs for the VSU scheme address these requirements (see design proposals) and urban design and transport issues are addressed in the relevant sections of the ES, the application for deemed planning consent and the accompanying documents. The proposals are also support the statement in section 7.24 of the VAPB:

'The City Council fully supports the Victoria Station Upgrade and will work with TfL and the GLA to facilitate the consents process and development of the project. When proposals for any other development that could materially affect the VSU Project proposal are being considered the potential impact on the delivery of VSU will be considered'.

5.4.32 Other VAPB themes relevant to the VSU scheme which have been addressed in this ES include:

- Transport (related policies are addressed in the Transport Assessment and traffic and transport appendix (Technical Appendices Volume 1).

- Conservation Areas and Listed Buildings (addressed in the technical appendix for built heritage, (Technical Appendices Volume 3, Appendix E);
- Sustainable and Resource Efficient Buildings (see the Sustainability Appraisal and CEEQUAL Pre-Advisory Report;
- Pollution considered in (Technical Appendices Volume 2, Appendix C and Technical Appendices Volume 3, Appendix I.); and
- Shopping and Services (considered in the technical appendices for socio-economics and community, (Technical Appendices Volume 4, Appendix J and K respectively).

Supplementary Planning Guidance

5.4.33 A series of Supplementary Planning Guidance notes (SPG) have been produced for the CoW. These SPGs develop specific policy areas within the UDP. The following SPGs have been identified in relation to this development:

- Access For All;
- Central Activities Zone;
- Designing Out Crime in Westminster; and
- Design Matters in Westminster.

Access For All, November 2004

5.4.34 This document addresses the need to consider the access for PRM. It has been established that access can be a material consideration in determining planning applications. The SPG acknowledges that creation of an accessible environment should be accepted as a basic principle of good design, as such, it encourages the design of accessible new buildings.

5.4.35 The VSU scheme ensures accessibility through the provision of lifts for PRM, escalators and appropriate signage.

5.4.36 Other measures to enhance access for all are found in legislation, policy and technical guidance. The ultimate aim of inclusive access is that the design and layout of the proposed development at VSU is to enable everybody to be able to enter the Underground, use the transport system and leave safely, independently with ease. The legislation and design guidance documents that are of particular relevance is:

- Disability Discrimination Act (1995);
- Disability Discrimination Act (2005);
- London Supplementary Planning Guidance: ‘Accessible London: achieving an inclusive environment’;

- Department for Transport: Inclusive Mobility (updated July 2005);
- Disabled Persons Transport Advisory Committee: Inclusive Projects (June 2003); and
- Sign Design Guide: A Guide to Inclusive Signage. The Sign Design Society, 2000.

Central Activities Zone, December 2001

5.4.37 This Supplementary Planning Guidance (SPG) has been produced to supplement relevant policies in the Unitary Development Plan (UDP) by providing additional background information on the Central Activities Zone (CAZ) in Westminster. This SPG outlines the character and function of Victoria area, describes the land uses within the area and summarises the existing planning designations relevant to the area. It acknowledges that Victoria Street itself, with the station at one end, is dominated by a mix of office and retail uses. Victoria Street's retail facilities are used by office workers, local residents and visitors to the area.

5.4.38 The VSU scheme supports this, as it ensures accessibility to the CAZ and as the scheme has been designed to ensure that it complements the character and function of the area.

Designing Out Crime in Westminster SPG

5.4.39 This SPG (19/11/2004) explains how crime prevention measures can be incorporated into a scheme from the start of the design process and the benefits of doing so. It sets out the commitment of the City Council to crime prevention and what to consider during the preparation of a scheme. The aim of *'Designing Out Crime'* is to reduce the vulnerability of people and property to crime by removing opportunities which may be unwittingly provided by the built environment. It also aims to reduce fear of crime and in doing so, improve people's quality of life.

5.4.40 It seeks to achieve surveillance and self-policing in designing the orientation of entrances and windows to buildings. It encourages well-defined private and public spaces. In terms of layout, the following issues need to be taken into account: adequate natural surveillance of both people and property, well defined public and private areas, the appearance of the development, integration with surroundings, and convenient footpaths which are attractive, safe and adjacent to vehicular routes. A good mix of land uses is encouraged. All car parks are required to be designed for both vehicle and personal safety. In private parking areas and dual use car parks the hours of access for vehicles and pedestrians should be carefully considered as well as any internal linkages. Provision should also be made for secure cycle storage in accordance with the City Council's UDP policies.

5.4.41 The new entrance to the NTH comprises an open and sweeping corner

feature that allows a high degree of natural surveillance. Measures such as CCTV will also be included to ensure the security of the VSU scheme. This will include CCTV within the passageways and tunnels and help points within the ticket halls to enhance passenger safety.

Design Matters in Westminster SPG, November 2004

5.4.42 This document re-states well-established planning practice and defines CoW's expectations for new buildings as *'positive and enduring additions'* to the urban landscape and amplifies underlying principles in operation at both local and national level. It is intended to elucidate the relevant policies set out in the adopted Westminster UDP and other related guidance and assist in their implementation.

5.4.43 CoW re-emphasises its objectives to protect strategic views and local distinctiveness. The aim is to achieve convincing new architecture of distinction, which has integrity and is entirely complementary to the locality and neighbouring buildings. Good architecture is not only about good design, but also about harmony with the surroundings. Wherever appropriate the CoW seeks to achieve new architecture reflecting its particular townscape role and function. The new station entrances must adhere to this policy guidance by providing structures which are accessible, visible as entrances to the Underground and sensitive to their surroundings.

5.4.44 The VSU scheme has been designed to complement and ensure that the integrity and distinctiveness of the local streetscape is maintained. This will be achieved through high quality architectural design of 'the Beach' and sensitive construction management. The entrance to the NTH will be encompassed by the CSD design and has been assessed separately and therefore is not considered as part of this ES.

5.5 Conclusions

5.5.1 It is concluded that the VSU scheme supports the aims and objectives of the national, regional and local planning policy framework for the Victoria area. The development will bring significant benefits in terms of sustainable development, travel and to the community, and will make an important contribution to ensuring the future vitality of the area.

6 Assessment of Effects

6.1 Introduction

6.1.1 This section of the ES summarises the likely significant environmental effects of the VSU scheme on key sensitive receptors during the construction and operational phases of the development.

6.1.2 The following environmental topics are discussed in this section:

- traffic and transport;
- noise and vibration;
- air quality;
- townscape and visual amenity;
- built heritage;
- archaeology and cultural heritage;
- demolition and excavated materials, and waste;
- contaminated land;
- water resources;
- ecology;
- socio-economics; and
- community.

6.1.3 This ES Main Report provides a synopsis of the detailed assessments that are provided within the specialist technical reports which are provided as appendices to the main report. The individual assessment of each topic is structured as follows:

- Introduction: provides an introduction to each specialist assessment and what the assessment aims to achieve. It makes reference to the scoping report provided in Appendix A, which outlines the methodologies and approaches to each specialism.
- Baseline: summary of the 2007 baseline environment presented in the technical appendices.
- Works Affecting the Baseline: summary of the works that are likely to affect the baseline environment resulting in change and what those effects might be.
- Mitigation and Residual Effects: summary of the mitigation measures recommended within this ES and the significant residual effects that are likely to remain a result of construction and/or operation of the VSU scheme.

6.1.4 The individual specialist technical reports provided in the technical appendices provide a detailed account of the baseline environment, the methodology used for assessment, an assessment of effects, description of necessary mitigation and the significant residual effects. Note that the scoping report (provided in Annex A) provides a detailed account of the scope of each technical assessment and the methodology used to obtain the results documented within this section of the ES.

6.2 Traffic and Transport

Introduction

6.2.1 The principal objective of the VSU scheme is to overcome the current capacity constraints at Victoria Underground Station and the resultant delays to passenger journeys. The scheme will increase the capacity of Victoria Underground Station so that it is capable of handling present and forecast demand. This will significantly improve passenger waiting time, quality of access, interchange, and overall station ambience.

6.2.2 This section identifies the key transport facilities of importance that the construction and permanent operation of the VSU scheme may affect, and outlines measures for avoiding or mitigating these effects where possible.

6.2.3 The key objectives of the assessment are to:

- determine the baseline in terms of the presence of differing transport modes and how they operate in the area;
- identify activities during construction which may have an effect on the baseline traffic and transport scenario;
- assess the significance of any effects of the scheme and outline the incorporated mitigation measures which where necessary, reduce the significance of adverse effects; and
- propose measures for reducing or further mitigating significant residual effects.

Baseline

6.2.4 The temporary worksites and associated temporary traffic management proposals will affect all modes of transport currently operating within the area surrounding Victoria Underground Station. The baseline conditions for each mode are briefly described below.

Bus Operations

6.2.5 The focal point for bus operations is the existing bus station which is located immediately in front of the National Rail station.

6.2.6 Buses accessing the bus station do so from the west, via the signal controlled junction at Buckingham Palace Road. Terminus Place skirts the northern perimeter of the bus station, connecting with Wilton Road at its eastern end. The bus station and Terminus Place, together, act as an eastbound one-way system, with buses accessing the numerous bus stops from designated aisles. All buses exit from the east of the bus station onto Victoria Street.

6.2.7 The very high bus flow exiting onto Wilton Road means that the point at which buses cross the mouth of Wilton Road is very sensitive to changes in traffic flow from Wilton Road; any abnormal delay to exiting buses effectively brings the bus station to a state of gridlock. The bus stops within the bus station are located on a series of parallel islands that run longitudinally east/west. The barriers and shelters located on each island constitute a barrier to north/south pedestrian movement and therefore such crossing movements are confined to the western and eastern extremities of the islands.

6.2.8 Additional on-street bus stops and stands are located on Victoria Street, Wilton Road, Vauxhall Bridge Road, Buckingham Palace Road and Grosvenor Gardens.

6.2.9 A number of bus routes that serve the Victoria Station complex require lay-over facilities. For the bus services that use Terminus Place these lay-over facilities are provided on Vauxhall Bridge Road. Existing bus stops are illustrated in Figure 6.2(1) (all figures are presented in Volume II).

6.2.10 Buses wishing to access the lay-overs from Terminus Place do so by traversing the northern ends of Wilton Road and turning right into Vauxhall Bridge Road. Similarly, buses in Wilton Road that require access to the lay-overs perform a right turn into Vauxhall Bridge Road from the northern end of Wilton Road. The existing lay-over facilities are illustrated in Figure 6.2(2).

Commuter Coaches

6.2.11 Several commuter coach services also operate in the Victoria area**.** These services primarily serve Gillingham and Maidstone in Kent. These commuter coaches operate weekdays only and typically each service has five or less services in the morning peak (07:00 to 09:00) to London, no inter peak service, and a similar number of return trips in the PM peak (16:00 to 18:30). Existing coach stops are illustrated on Figure 6.2(3).

Tour Buses

6.2.12 Two sightseeing tour bus companies operate services through the network in Victoria; the Big Bus Company and The Original Tour. On average these tour buses run approximately every 10-15 minutes with the duration of the tours being about 2 hours. The frequencies of tour buses are slightly lower outside

summer (June to August inclusive). Sightseeing tour bus stop and stands are illustrated in Figure 6.2(4).

Taxi Operations

6.2.13 The primary taxi set-down and pick-up facilities for the National Rail Station are provided immediately in front of the main entrance to the station. A second taxi set-down and pick-up facility is located at the rear of the station on the rail/air deck which primarily serves Gatwick Express passengers.

6.2.14 Access for taxis serving the main facility is via a one-way (westbound) length of carriageway, adjacent to the forecourt, along the southern edge of the bus station. Taxis enter this area from Wilton Road to the east, and are intended to exit left onto Buckingham Palace Road to the west of the National Rail Station. However, observations show that some taxi drivers carry out U-turn manoeuvres within the bus station to take them along Terminus Place and hence enable them to exit onto Wilton Road and Victoria Street or Vauxhall Bridge Road.

6.2.15 A feeder rank is located on the east side of Wilton Road. This extends back round into Neathouse Place (north side), from where it extends south along the centre of the carriageway of Vauxhall Bridge Road. A further extension of the feeder rank is available in Gillingham Street. A TV monitor is mounted on the footway adjacent to the kerb at the head of the feeder rank in Wilton Road which provides the leading taxi driver with information about conditions within the station forecourt. This facility ensures that the feeder rank continuously 'tops up' the main rank at the station entrance.

6.2.16 The rail/air deck is the second formal taxi facility serving the Victoria Station complex. The rail/air deck principally serves Gatwick Express rail services using platforms 13 and 14. The taxi rank on the deck is immediately adjacent to the pedestrian exit and is therefore very convenient in this respect. The rail/air deck itself also accommodates approximately 130 pay and display spaces managed by National Car Parks (NCP), and other. Further operational parking associated with National Rail activities is also provided on the rail/air deck. The existing taxi facilities are illustrated in Figure 6.2(5).

Pedestrians and Persons of Reduced Mobility

6.2.17 Victoria Underground Station is located at the hub of an important transport interchange where connection between mainline trains, buses, and taxis takes place. By its very nature the interchange generates a significant amount of pedestrian activity.

6.2.18 Pedestrian movement in the area surrounding the Victoria Station complex, including Terminus Place, Wilton Road, Vauxhall Bridge Road and Buckingham Palace Road. As a consequence, pedestrian congestion is sometimes experienced, particularly during peak commuting hours.

6.2.19 In the morning peak the main pedestrian desire line is from the Victoria Station complex, eastbound, towards Victoria Street, Bressenden Place and the new development of Cardinal Place (on the east side of Bressenden Place). This route currently involves a minimum of three road crossings to get to Victoria Street (east) all of which are signal controlled. All signalled crossings have facilities for PRM and/or impaired eyesight.

6.2.20 Pedestrian movement during peak periods is such that the pedestrian accumulation areas on the footways adjacent to the signalled crossings become overcrowded, resulting in pedestrians spilling onto the edge of the carriageway, or fanning out along the kerb edge beyond the limits of the formal crossing areas.

6.2.21 Observations and studies (ref ISP, Jan 2007) indicate existing average peak hourly pedestrian flows of up to 7000 persons per hour (i.e. 2 per second) potentially interacting with some 100+ buses per hour (i.e. 2 per minute), on the south side of Victoria Street in the proximity of the Wilton Road junction. Initial assessments have indicated a key component of the overall pedestrian flow comprises a main movement between the Victoria National Rail Station concourse, and the south, and north sides of Victoria Street. Clearly, there is also a substantial movement to, and from, the Underground, Cardinal Place (i.e. North East of Victoria Street/Bressenden Place Junction) and also to and from the Terminus Place bus facilities. However, it is noted that flows in the normal AM and PM peak periods are mainly tidal in one direction to, and from, Victoria Street whilst flows at other times are far more dispersed. Figure 6.2(6) illustrates the main pedestrian movements and existing pedestrian crossing facilities.

Freight and Private Vehicular Traffic

6.2.22 Due to the strategic role of the inner ring road route that lies within the area affected by the construction activities, the proposed works will affect all types of road user. These roads carry significant volumes of traffic and their proximity to the rail, bus and coach stations mean that significant amounts of taxi, bus and coach traffic are contained within the overall traffic flows.

6.2.23 Whilst light vehicles (including taxis) form the majority of traffic flow, heavy goods vehicles form up to 18 per cent of traffic on some links within the local area.

6.2.24 Modelling of the existing highway network has indicated that it is already operating close to capacity with very little scope to accommodate variations in traffic flow during the peak periods. As a consequence, temporary changes to junction geometry or reductions in road widths will arise from the temporary traffic management measures.

Road Safety

6.2.25 The most recent accident data for the area was obtained from TfL for a 36 month period to the end of December 2006.

6.2.26 It is evident that the main cluster of accidents has occurred in the proximity of Terminus Place, along Buckingham Palace Road, along Wilton Road, along Victoria Street and on Vauxhall Bridge Road at the junction with Neathouse Place.

6.2.27 Undoubtedly the high pedestrian flows generated by the transport interchanges, especially during the peak hours, raises the potential for conflict with motorised modes.

6.2.28 The total number of accidents that involved pedestrians was 47, which shows that of all the accidents that took place in the 36 months up to the end of December 2006, 31% involved pedestrians. Of these pedestrian accidents 19% were classified as serious. This figure outlines the importance of Victoria and particularly the direct vicinity of the Victoria Station complex as a pedestrian area.

Provision for Cyclists

6.2.29 At present there are no signed cycling routes along either Wilton Road or Vauxhall Bridge Road, however, both roads are identified by TfL as being suitable for cyclists.

6.2.30 The northern end of Buckingham Palace Road is marked for cyclists as is a section along Grosvenor Gardens.

6.2.31 In addition, the area to the front of Victoria National Rail station is designated as an advisory cycle route linking the pedestrian link through Victoria National Rail Station from Buckingham Palace Road to Wilton Road and/or Vauxhall Bridge Road.

6.2.32 Bressenden Place, Allington Street and Victoria Street do not form part of the London Cycle Network.

Parking and Loading

6.2.33 There are residential and metered parking bays in a number of locations throughout the study area including Allington Street, Bresseden Place, Warwick Row, Bridge Place, Vauxhall Bridge Road, Grosvenor Gardens, Gillingham Street and Hudson's Place.

6.2.34 Provisions for loading and servicing can be found in the following locations: Terminus Place Bressenden Place, Wilton Road, Vauxhall Bridge Road,

Buckingham Palace Road and Allington Street.

Works Affecting the Baseline

6.2.35 This section discusses the aspects of the scheme (as outlined in Section 2) that will affect the baseline discussed in the previous sections. The significance of the works is discussed in the following section and provided in detail in Table 8-1and Table 8-2.

6.2.36 It is the size and shape of the numerous worksites rather that the construction activities themselves that is the key factor in determining the nature and scale of effects of traffic and transport arising from the scheme. The encroachment of these worksites onto areas of public highway on the surface will affect a number of road users, including pedestrians, buses, taxis, cyclists, general traffic, and users of the mainline station. In addition the construction phases will have a bearing on the duration of the effect. The following constraints and their effect on specific road users are of particular significance:

- the significant loss of footway area outside the National Rail station and adjacent to the eastern exit to Terminus Place, and the need to balance the provision of temporary replacement footway with the operational requirements of other, competing, road users such as buses and taxis;
- the loss of carriageway area at the eastern end of Terminus Place and the adjustments to the operation and physical layout of the bus station necessary to maintain bus operations around the worksites, and the consequences of this for both taxis and pedestrians;
- the narrowing of Wilton Road for a significant period of time, and the closure of Wilton Road and parts of Allington Street and the effects such actions have on general traffic, pedestrians, cyclists, buses and taxis;
- the narrowing of Bressenden Place and the effect this has on general traffic capacity as well as the effect on pedestrians arising from amendments to the pedestrian island at the Bressenden Place/Victoria Street junction;
- the temporary restricted access to both pedestrian and vehicular traffic through the main eastern entrance to the mainline station, the latter affecting the servicing of the station; and
- the potential for works within the underground station to restrict access to it, thereby affecting the dynamics of pedestrian movement on the surface.

6.2.37 In addition to the effects of the worksites on the surface, construction activities below ground will affect the operation of the existing Underground station. The key factors that would affect the baseline operation of the Underground station during construction are:

- restricted corridors and concourse areas within the Underground station;
- restricted platform areas within the Underground station;
- temporary diversion of pedestrians within the Underground;
- temporary closures of accesses to the Underground station;
- temporary closures of Underground station; and
- temporary adjustments to customer facilities within the Underground station (including the ticket office).

Mitigation and Residual Effects

Utilities Diversions

6.2.38 The utility works associated with the construction of VSU are extensive and will have an effect on all forms of surface transport, including pedestrians. Worksite layouts and temporary traffic management measures have been prepared, and a preliminary assessment of the transport and traffic effects for the utilities phases has been undertaken. Given that the locations of a number of the utility worksites are similar to the worksites required for the main construction work, and the proposed arrangements to divert general traffic away from the Wilton Road route are the same as for the main construction works, the preliminary assessment shows that the traffic effects and associated mitigation for the utility works will be similar to that for the main works, albeit for much shorter durations.

Construction

6.2.39 The methodology for assessment is explained in detail in the scoping report (Annex A). The traffic and transport assessment used the criteria developed for Crossrail for the assessment of significance of the effects, the application of which is also explained in detail in (Technical Appendices Volume 1). Table 8-1 presents a summary of the assessment results. It shows the unmitigated impact and resultant effect, incorporated mitigation and remaining significant residual environmental effects. Suggest that Rail and underground passengers be considered as a receptor even if you consider that they will not be affected as services will be maintained and therefore they leave services and become pedestrians:

- road safety;
- pedestrians and PRM;
- cyclists;
- bus routeing;
- bus passengers;
- taxis (routeing, pickup/set down and passengers);
- parking and loading; and

- freight and private vehicles.

6.2.40 There are a number of mitigation measures proposed to reduce the effects arising from the construction phases. These include:

- Pedestrians, PRM and Road Safety – provision of temporary footway areas and pedestrian diversions via islands at signal junctions;
- Bus Routeing – provision of contraflow bus lanes, relocation of bus services (C1 and C10 only), and layover relocation;
- Bus Passengers – provision of contraflow bus lanes, relocation of bus stops and bus re-routeing. There will also be the need for passenger diversions;
- Taxi Routeing and Pick Up/Set Down – provision of a substitute taxi rank and secondary pick up point;
- Taxi Passengers – passenger diversions to alternative facilities;
- Parking and Loading – provision of alternative loading bays and increased management of services loads/delivery timings; and
- Freight and Private Vehicles – traffic diversions.

6.2.41 There are a number of significant residual environmental effects predicted for the construction phase of the works. These have been summarised below:

- reduced and insufficient footway width around worksites, at Wilton Road and Vauxhall Bridge Road;
- bus diversions and restricted access resulting in delays to the services and pedestrians;
- bus stop relocation and the consequential increase in the walking distance to bus stops;
- parking and servicing;
- taxi route diversions and relocation of taxi rank; and
- delays to road users due to diversions.

6.2.42 The identification of appropriate mitigation has required discussions with affected stakeholders and where agreement has been reached the mitigation is presented. In some cases the discussions are on-going and where this is the case the mitigation will be confirmed when agreement is reached. The mitigation measures will be wide-ranging, reflecting the many user groups that are affected by the works. The diversion of general traffic away from Wilton Road is a fundamental part of the mitigation but residual effects occur as a consequence. Supplementary mitigation has also been recommended in most cases and includes measures such as:

- additional signing and provision of marshalling;
- potential adjustment to worksite size;

- relocation of bus stands;
- provision of increased taxi waiting area facilities at a substitute rank and increased area for taxi feeder services on the rail/air deck; and
- potential junction improvements at Eccleston Bridge/Buckingham Palace Road to provide capacity for displaced traffic.

Operation

6.2.43 The methodology for assessment is explained in detail in (Technical Appendices Volume 1). The traffic and transport assessment used the criteria developed for Crossrail for the assessment of significance of the effects the application of which is also explained in detail in Annex A. Table 8-2 presents a summary of the assessment results.

6.2.44 The effect of the operational VSU scheme on aspects of the baseline is significantly beneficial.

6.2.45 The project will substantially increase the size of the station, improving conditions for passengers and reducing overcrowding. The provision of additional escalators and new lifts will improve access, particularly for persons of restricted mobility.

6.2.46 The provision of a new ticket hall on the north side of Victoria Street, together with improved access to station platforms will also improve access for passengers and address the current problems associated with overcrowding of the concourse and platforms which requires temporary station closures during peak periods in order to maintain safe operational conditions. Overall the measures will significantly reduce delays to users of the underground.

6.2.47 The provision of a new ticket hall on the north side of Victoria Street will also provide benefits on the surface highway as the new facility will change pedestrian desire lines and reduce pedestrian flows across the top of Vauxhall Bridge Road and Wilton Road. Pedestrian volumes across the 'Little Ben' Island will also be reduced. This will be a significant beneficial effect.

6.2.48 Conversely, it is predicted that pedestrian flows across the island at the Bressenden Road/Victoria Street junction will increase, potentially beyond holding capacity, and mitigation improvements are likely to be required to address this.

6.3 Noise and Vibration

Introduction

6.3.1 This section identifies the key noise sensitive receptors that the temporary construction and permanent operation of the VSU scheme will affect and

outlines measures for avoiding or mitigating these effects where possible.

6.3.2 The key objectives of the assessment are to:

- determine the baseline in terms of background noise levels in the area and key noise and vibration sensitive receptors;
- identify the activities during construction, including demolition, and operation which may have an effect on background noise levels and vibration disturbance;
- assess the significance of any effects of the scheme and outline the incorporated mitigation measures necessary to reduce the significance of adverse effects; and
- propose measures for further mitigation of significant residual effects where appropriate.

Baseline

Overview

6.3.3 Road transportation is the predominant noise source in the locality, namely traffic on Buckingham Palace Road, Victoria Street and Grosvenor Gardens as well as bus traffic in the bus station and the taxi rank in front of the National Rail Station.

6.3.4 Noise from various items of fixed plant (mainly ventilation and extraction systems) exists. Public Address system announcements from the Victoria National Rail Station and noise from stationary buses and slow-speed bus movements at Terminus Place also contribute to the baseline noise environment, especially close to the Thistle Victoria Hotel.

Monitoring Results

6.3.5 Ambient noise levels were monitored during April and May 2006. The monitoring locations were chosen to be representative of the closest noise sensitive receptors to the proposed works. Long-term ambient noise monitoring was undertaken at two sites with short-term monitoring at a further seven sites.

6.3.6 Measured ambient noise levels appropriate to each receptor are given in Table 6-1. The locations of these receptors and monitoring positions are illustrated in Figure 6.3(1).

Table 6-1: Measured Ambient Noise Levels (dB L_{Aeq})		
Relevant Receptor	Monitoring Location (L = Long Term, S = Short Term)	Measured Ambient Noise Levels (dB L_{Aeq})
A	1: 1-14 Evelyn Mansions, Carlisle Place (S)	64-66
B	5: Allington Street, opposite Royal Westminster Hotel (S)	62-63
C	7: Outside Abford House, Vauxhall Bridge Road (S)	75
D	3: Outside The Stage Door PH, opposite VPT side entrance doors	67
E	7: Outside Abford House, Vauxhall Bridge Road (S)	75
F	2a: Outside Duke of York Door, next to theatre main entrance (S)	a) 71-72 (ground level)
G	6: Roof of Victoria Thistle Hotel (L)	67
H	5: Allington Street, opposite Royal Westminster Hotel (S)	62-63
I	4: Adjacent to The Stag PH (S)	66-67
J	2b: On roof of VPT along Bressenden Place (L)	b) 64 (roof)

6.3.7 Results from long term unattended monitoring indicate that daytime noise levels in the area are fairly constant with background L_{A90} levels of 60 – 5 dB and ambient L_{Aeq} levels typically 2-3 dB higher. Noise levels decrease by approximately 5 dB in the early hours of the morning when there is less road traffic.

6.3.8 Noise levels were measured inside and external to the Victoria Palace Theatre (VPT) during both evening and matinee performances. The results showed that noise external to the theatre was not audible inside the auditorium at any time during either the matinee or evening performances. The minimum internal noise level measured during performances in terms of $L_{Amin, Fast, 5 sec}$, was 39 dB. The corresponding external levels during performances were 64-71 dB(A) at street level.

6.3.9 An external noise level of 75 dB(A) was recorded close to the Apollo Theatre.

Sensitive Receptors

6.3.10 The kinds of resources and receptors considered noise-sensitive are:

- residential property and other buildings in residential use including hotels[11];

[11] Staff quarters, if any, are considered noise sensitive at all times, guest rooms are only considered noise sensitive at night but are not classified as dwellings for the purposes of the Noise and Vibration Policy (described later).

- theatres and auditoria;
- studios;
- churches and religious buildings;
- courts, lecture theatres and conference facilities;
- schools and colleges and libraries; and
- hospitals, laboratories and other critical work areas.

6.3.11 Receptors identified in the above categories and considered in the assessment are described below.

6.3.12 In the first category, receptors were considered in the residential areas nearest to the works. These are described in Table 6-17 of the Community section (Section 6.13) of this ES as Residential Areas 1, 2, and 3. They are also illustrated on Figure 6.13 (4) in the Community Section (6.13). Some locations outside these three zones were also identified as being in this category and so were also considered.

6.3.13 There are two theatres in the vicinity of the works i.e. the VPT on Allington Street and the Apollo Theatre on Vauxhall Bridge Road.

6.3.14 The two places of worship identified on Figure 6.13 (2) in the Community Section (6.13) have also been considered, as have the six premises in Table 6-15 in that section listing nurseries, schools, and colleges.

Works Affecting the Baseline

6.3.15 The baseline could potentially be affected by the following aspects of the construction phase of the works:

- airborne noise from worksites;
- groundborne noise and vibration from construction operations; and
- airborne noise from road traffic using the highway.

6.3.16 During the operating phase there is the potential for noise and vibration from new plant and services to affect the baseline.

6.3.17 The construction works are described in Section 2 of this ES and the activities carried out at the worksites listed in Table 2-4 of that section have been assessed using information from the Construction Design Team[12].

6.3.18 Changes in the baseline noise level will also arise as a result of construction

[12] Underpinning designs are being developed in order to determine whether 4 to 7 Victoria Buildings, 22 Terminus Place and 181 to 183 Victoria Street can be retained, but for the purposes of the noise assessment it has been assumed that they will be demolished.

traffic using the highway network and/or non-construction traffic being diverted from the usual routing to accommodate the works.

6.3.19 Baseline flow data and projected flows for construction and non-construction traffic for Phase 1 of the main construction period have been obtained from the Transport Assessors. These data have been used to assess the effects of the changes.

6.3.20 A different approach to the assessment of the operational phase has been adopted. Criteria have been set for this phase for plant and services; compliance with these criteria by appropriate design would avoid significant effects occurring.

Mitigation and Residual Effects

General Construction

6.3.21 The criteria for assessment are set out in Technical Appendices Volume 2, Appendix B).

6.3.22 A draft CoCP has been prepared in consultation with the CoW that sets out the provisions for the management of noise effects arising during the construction phase. It is intended that an application under Section 61 of the Control of Pollution Act (1974)[13] will be submitted for consultation with CoW to manage and control noise and vibration arising from the construction phases of the VSU scheme.

6.3.23 A Noise Policy has also been prepared. Under this policy (which applies to buildings in residential use), provided that specified criteria are met, offers will be made to provide noise insulation and/or further mitigation measures will be investigated. Further mitigation will include consideration of some or all of the following measures, determined on a case-by-case-basis: screening/enclosure of individual items of plant, provision of more elaborate screening of worksites than the standard hoarding e.g. an acoustic canopy, installation of a glazing system having higher sound in insulation performance than the package specified in the Noise Insulation Regulations[14] and adopted as the standard system under this policy; and an offer to temporarily re-house the occupiers.

6.3.24 The assessment has predicted significant effects from airborne noise at the worksites at residential buildings as set out in Table 6-2 and Table 6-3 below.

[13] Section 61 of CoPA sets out procedure whereby a developer or contractor can apply to the local authority in advance of the works for consent to carry out construction activities in accordance with a schedule. The local authority has powers to set conditions regarding the works including working hours, construction methods, and noise/vibration levels.
[14] The Noise Insulation Regulations 1975. SI 1975:1763

Table 6-2: Residual Effects of Airborne Noise from Daytime Construction Activity				
Receptor Type/Location [1]	**Floor Level [2]**	**Estimated number of dwellings**	**Predicted Effect [3]**	**Affected Periods**
Residential Premises (including PHs [4])				
20 Palace St SW (18)	0	**2**	SE	May 10 – Mar 11
20 Palace St SW (18)	1	**5**	SE	Oct 09 – Dec 13
20 Palace St SW (18)	2	**43**	SE	Oct 09 – Dec 13
The Stag PH S (3)	0	0		
The Stag PH S (3)	1	0		
The Stag PH S (3)	2	**1**	FM SE	Oct 09 – Dec 13 Jan 14 – Apr 14
Allington Street Area				
The Kings Arms PH N (4)	0	0		
The Kings Arms PH N (4)	1	**1**	NI	May 10 – Mar 11
The Kings Arms PH N(4)	2	**2**	NI	May 10 – Mar 11
The Cameo Apartments 17 Allington St N (9) – West End	0	**1**	SE	May 10 – Mar 11
The Cameo Apartments 17 Allington St N (9) – West End	1	**2**	SE	May 10 – Mar 11
The Cameo Apartments 17 Allington St N (9) – West End	2	**3**	SE	May 10 – Mar 11
The Cameo Apartments 17 Allington St N (9) – East End	0	**1**	SE	Oct 09 – Dec 13
The Cameo Apartments 17 Allington St N (9) – East End	1	**2**	NI SE	Oct 09 – Mar 11 Apr 11 – Mar 14
The Cameo Apartments 17 Allington St N (9) – East End	2	**3**	SE NI SE	Oct 0 – Apr 10 Jul 10 – Oct 10 Apr 11 – Mar 14
13 Allington St N (7)	0	0		
Part of 1 - 20 Allington Ct	1	**2**	NI SE	Oct 09 – Dec 13 Jan 14 – Mar 14
Part of 1 - 20 Allington Ct	2	**2**	NI SE	Oct 09 – Dec 13 Jan 14 – Mar 14
11 Allington St (Entrance to 1-20 Allington Ct) N (7)	0	0		
Part of 1 - 20 Allington Ct	1	**2**	NI SE	Oct 09 – Dec 13 Jan 14 – Mar 14
Part of 1 - 20 Allington Ct	2	**2**	NI SE	Oct 09 – Dec 12 Jan 14 – Mar 14
9 Allington St E (7)	0	0		

Table 6-2: Residual Effects of Airborne Noise from Daytime Construction Activity				
Receptor Type/Location [1]	**Floor Level [2]**	**Estimated number of dwellings**	**Predicted Effect [3]**	**Affected Periods**
Part of 1 - 20 Allington Ct	1	**2**	NI SE	Oct 09 – Dec 13 Jan 14 – Mar 14
Part of 1 - 20 Allington Ct	2	**2**	NI SE	Oct 09 – Dec 12 Jan 14 – Mar 14
7, 7a Allington St E (7)	0	0		
Part of 1 - 20 Allington Ct	1	**2**	NI SE	Oct 09 – Dec 13 Jan 14 – Mar 14
Part of 1 - 20 Allington Ct	2	**2**	NI SE	Oct 09 – Dec 12 Jan 14 – Mar 14
5a Allington St E (8)	0	0		
Part of 1 - 20 Allington Ct	1	**1**	NI	Oct 09 – Dec 13
Part of 1 - 20 Allington Ct	2	**1**	NI	Oct 09 – Dec 13
4, 5 Allington St N (8)	0	0		
Part of 1 - 20 Allington Ct	1	**1**	NI SE	Oct 09 – Apr 12 May 12 – Dec 13
Part of 1 - 20 Allington Ct	2	**1**	NI	Oct 09 – Dec 13
The Stage Door PH E (4)	0	0		
The Stage Door PH E (4)	1	**1**	NI SE NI SE	Oct 09 – Sep 11 Oct 11 Nov 11 Dec 11 – Dec 14
The Stage Door PH E (4)	2	**2**	NI	Oct 09 – Mar 12 Apr 12 – Dec 13
Duke of York PH W (3-4)	0	0		
Duke of York PH W (3-4)	1	**1**	NI	Nov 09 – Feb 11 Dec 11 – Feb 12
Duke of York PH W (3-4)	2	**2**	NI	Nov 09 – Feb 11 Dec 11 – Feb 12
Duke of York PH S (4)	0	0		
Duke of York PH S (4)	1	**1**		
Duke of York PH S (4)	2	**2**	NI	Nov 09 – Apr 10 Feb 11
Vauxhall Bridge Road				
316-314 Vauxhall Br Rd SW (4)	0	0		
316-314 Vauxhall Br Rd SW (4)	1	**2**	NI	Sep 10 – Jul 11
316-314 Vauxhall Br Rd SW (4)	2	**2**	NI	Sep 10 – Jul 11 Apr 12
Carlisle Place				
1-14 Evelyn Mansions NE (7)	0	**1**	SE	Oct 09 – Dec 13

Table 6-2: Residual Effects of Airborne Noise from Daytime Construction Activity				
Receptor Type/Location [1]	**Floor Level [2]**	**Estimated number of dwellings**	**Predicted Effect [3]**	**Affected Periods**
1-14 Evelyn Mansions NE (7)	1	**2**	NI SE NI SE	Oct 09 – Nov 11 Dec 11 – Sep 12 Oct 12 – Dec 12 Jan 13 – Apr 14
1-14 Evelyn Mansions NE (7)	2	**4**	NI SE	Oct 09 – Apr 13 May13 – Apr 14
15-39 Evelyn Mansions SW (8)	0	**2**	SE	Oct 09 – Dec 13
15-39 Evelyn Mansions SW (8)	1	**4**	SE	Dec 09 – Apr 14
15-39 Evelyn Mansions SW (8)	2	**10**	SE NI SE NI SE	Oct 09 – Apr 10 May 10 – Jul 10 Aug 10 – Feb 11 Mar 11 Apr 12 – Apr 14
Montfort House (Bentley House), Carlisle P NE (5 +S/B)	0	**3**	SE	Oct 09 – Dec 12
Montfort House (Bentley House), Carlisle P NE (5 +S/B)	1	**3**	SE	Oct 09 – Dec 13
Montfort House (Bentley House), Carlisle P NE (5 +S/B)	2	**6**	SE	Oct 09 – Mar 14
St Andrew's Hall W(7)	0	**2**	SE	Oct 09 – Nov 11
St Andrew's Hall W (7)	1	**4**	SE	Oct 09 – Dec 12
St Andrew's Hall W (7)	2	**8**	SE	Oct 09 – Dec 13
Convent, Carlisle Pl NE (3+ S/B)	0	**6**	SE	May 10 – Jul 10
Convent, Carlisle Pl NE (3+ S/B)	1	**3**	SE	May 10 – Jul 10 Mar 11 Dec 12
Convent, Carlisle Pl NE (3+ S/B)	2	**3**	SE	Oct 09 – Mar 12
1 Carlisle Place NE (5+B)	0	**2**	SE	May 10 – Jul 10
1 Carlisle Place NE (5+B)	1	**2**	SE	May 10 – Jul 10 Mar 11
1 Carlisle Place NE (5+B)	2	**2**	SE	May 10 – Jul 10 Mar 11 Dec 12
2 Carlisle Place NE (5+B)	0	**2**	SE	May 10 – Jul 10
2 Carlisle Place NE (5+B)	1	**2**	SE	May 10 – Jul 10 Mar 11
2 Carlisle Place NE (5+B)	2	**2**	SE	May 10 – Jul 10 Mar 11 Dec 12
3 Carlisle Place NE (5+B)	0	**2**		
3 Carlisle Place NE (5+B)	1	**2**	SE	May 10 – Jul 10
3 Carlisle Place NE (5+B)	2	**2**	SE	Oct 09 – Jul 10

Table 6-2: Residual Effects of Airborne Noise from Daytime Construction Activity

Receptor Type/Location [1]	Floor Level [2]	Estimated number of dwellings	Predicted Effect [3]	Affected Periods
				Mar 11
1-5 Carlisle Mansions NE (5+B)	0	**1**		
1-5 Carlisle Mansions NE (5+B)	1	**2**		
1-5 Carlisle Mansions NE (5+B)	2	**2**	SE	May 10 – Jul 10
76-85 Carlisle Place NE (5+B)	0	**3**		
76-85 Carlisle Place NE (5+B)	1	**4**		
76-85 Carlisle Place NE (5+B)	2	**4**	SE	May 10 – Jul 10
Hotels				
Royal Westminster Hotel E (3-13)	0			
Royal Westminster Hotel E (3-13)	1		SE	Oct 09 – Mar 11
Royal Westminster Hotel E (3-13)	2		SE	May 10 – Mar 11
Royal Westminster Hotel S (3-13)	0			
Royal Westminster Hotel S (3-13)	1		SE	Nov 09 – May 10 Jul 10 – Apr 12
Royal Westminster Hotel S (3-13)	2		SE	Oct 09 – May 10 Jul 10 – Apr 12
Grosvenor Hotel N (9)	0			
Grosvenor Hotel N (9)	1		SE	Oct 09 – Mar 10 May11 – May 12
Grosvenor Hotel N (9)	2		SE NI SE SE NI	Oct 09 – Jun 10 Jul 10 – Aug 10 Sep 10 – Apr 11 May 11 – Jul 11 Aug 11 – May 12
Victoria Palace Theatre E	0	Note 5		
Apollo Theatre E	0	Note 6		

Notes		
	1	The receptor description includes the façade orientation (eg N = North) and the estimated number of storeys (in brackets).
	2	0 = Ground floor, 1 = 1st or 2nd floor, 2 = higher floors.
	3	SE = Significant Effect, NI = Noise Insulation, FM = Further Mitigation
	4	NI and FM only apply to dwellings (or buildings used as a dwelling). Where a building has a mixture of uses (e.g. PHs and Hotels) NI and FM are shown based on whether the relevant noise criteria have been met. It does not guarantee that the façade or floor in question constitutes residential accommodation.
	5	Discussions are underway with the operators of the VPT to devise a mechanism to mitigate the potential effects of these external noise levels.
	6	The auditorium is partially underground and it is not expected that these levels of external noise will have a significant effect.

Table 6-3: Residual Effects of Airborne Noise from Night-time Construction Activity

Receptor Type/Location [1]	Floor Level [2]	Estimated number of dwellings	Predicted Effect [3]	Affected Periods
Residential Premises (including PHs [4])				
The Stag PH S (3)	0	0		
The Stag PH S (3)	1	0		
The Stag PH S (3)	2	**1**	SE	Nov 10 – Mar 12
Allington Street Area				
9 Allington St E (7)	0	0		
Part of 1 - 20 Allington Ct	1	**2**	NI	Jul 10 – Jun 13
Part of 1 - 20 Allington Ct	2	**2**	NI	Jul 10 – Jun 13
7, 7a Allington St E (7)	0	0		
Part of 1 - 20 Allington Ct	1	**2**	NI	Jul 10 – Jun 13
Part of 1 - 20 Allington Ct	2	**2**	NI	Jul 10 – Jun 13
Victoria Palace Theatre E	0	Note 5		
Apollo Theatre E	0	Note 6		

Notes		
	1	The receptor description includes the façade orientation (eg N = North) and the estimated number of storeys (in brackets).
	2	0 = Ground floor, 1 = 1st or 2nd floor, 2 = higher floors.
	3	SE = Significant Effect, NI = Noise Insulation, FM = Further Mitigation
	4	NI and FM only apply to dwellings (or buildings used as a dwelling). Where a building has a mixture of uses (e.g. PHs and Hotels) NI and FM are shown based on whether the relevant noise criteria have been met. It does not guarantee that the façade or floor in question constitutes residential accommodation.
	5	Discussions are underway with the operators of the VPT to devise a mechanism to mitigate the potential effects of these external noise levels.
	6	The auditorium is partially underground and it is not expected that these levels of external noise will have a significant effect.

Groundborne Noise from Construction Activity

6.3.25 Underground construction activity, particularly breaking out of existing structures, has the potential to cause groundborne/structure-borne noise in buildings above. When percussive work is required in locations that have structural connections with, or are very close to, the foundations of other buildings and the noise occurs in sensitive locations or at sensitive times, there may be a significant effect. This may occur at times in the case of the Victoria Palace Theatre and other properties near locations where demolition operations will occur (these are considered further, below). As far as tunnel excavation is concerned, and other forms of non-percussive underground working, there is not likely to be a significant effect due to groundborne or structure-borne noise.

6.3.26 Until the work starts and the local structural details are discovered during the demolition, it is not possible to envisage the measures that may be available in specific cases, and the assessment has been made on the assumption that the likely method of working will involve percussive breaking. However, the use of percussive methods will be avoided where practicable. Since the effect of this additional mitigation is not currently known, the unmitigated effects have been presented in Table 6.4 for buildings around locations of demolition activity (listed according the address of the ground floor).

6.3.27 Jet grout underpinning involves drilling through the Duke of York basement and the footings of the PH and the adjoining Victoria Palace Theatre. This operation will cause audible vibration which may be transmitted up through the building. Measurements during the jet grout trials may assist in determining the extent of this.

6.3.28 Since it is assumed that the Duke of York PH will be unoccupied during this activity there will be no significant effects on the occupiers. As regards the VPT, discussions are underway with the operators to devise a mechanism to mitigate the potential effects of the works.

Table 6.4: Locations of Significant Groundborne Noise Effects from Construction (see note 1)

Location	Use[2]	Activity
Victoria Palace Theatre	T	demolition of Elliott House 175 – 179 Victoria Street and jet grout underpinning via basement of Duke of York PH
Elland House	O	demolition of Elliott House
Portland House	O	demolition of Elliott House, 3-11 Bressenden Place, 120-124 Victoria St & Subway
92 – 100 Victoria Street (Cardinal Place)	C	demolition of Elliott House, 3-11 Bressenden Place, 120-124 Victoria St & Subway
The Stag PH	P/R	demolition of Elliott House
1 Warwick Row	O	demolition of Elliott House
9 Allington Street	C/R	demolition of Elliott House
10 - 20 Allington Street	O	demolition of Elliott House
7 Allington Street	C/R	demolition of Elliott House
5 Allington Street	C/R	demolition of Elliott House
3 Allington Street	C/R	demolition of Elliott House
173 Victoria Street	C	demolition of 3-11 Bressenden Place, 120-124 Victoria St & Subway , and 175 – 179 Victoria Street
1-14 Evelyn Mansions	R	demolition of 3-11 Bressenden Place, 120-124 Victoria St & Subway
171 Victoria Street	C	demolition of 3-11 Bressenden Place, 120-124 Victoria St & Subway
169 Victoria Street	C	demolition of 3-11 Bressenden Place, 120-124 Victoria St

Table 6.4: Locations of Significant Groundborne Noise Effects from Construction (see note 1)

Location	Use[2]	Activity
		& Subway
Grosvenor Hotel	H	removal of surface vent (from Victoria Station)
Apollo Theatre	T	removal of surface vent (from Victoria Station)
Abford House	O	removal of surface vent (from Victoria Station) and demolition of 175 – 179 Victoria Street
4 – 7 Wilton Rd	C	removal of surface vent (from Victoria Station)
9 -10 Terminus Place	C	removal of surface vent (from Victoria Station)
11 Terminus Place	C	removal of surface vent (from Victoria Station)
12 Terminus Place	C	removal of surface vent (from Victoria Station)
14 Terminus Place	C	removal of surface vent (from Victoria Station)
17 Terminus Place	C	removal of surface vent (from Victoria Station)
19 Terminus Place	C	removal of surface vent (from Victoria Station)
20 Terminus Place	C	removal of surface vent (from Victoria Station) and demolition of 175 – 179 Victoria Street
21 Terminus Place	C	removal of surface vent (from Victoria Station)
22 Terminus Place	C	removal of surface vent (from Victoria Station) and demolition of 175 – 179 Victoria Street
4 - 6 Terminus Place	C	removal of surface vent (from Victoria Station) and demolition of 175 – 179 Victoria Street
7 Terminus Place	C	removal of surface vent (from Victoria Station) and demolition of 175 – 179 Victoria Street
Shakespeare PH	P/R	removal of surface vent (from Victoria Station)
Duke of York PH	P/R	demolition of 175 – 179 Victoria Street
138 – 140 Victoria Street	C	demolition of 175 – 179 Victoria Street
142 Victoria Street	C	demolition of 175 – 179 Victoria Street
144 - 146 Victoria Street	C	demolition of 175 – 179 Victoria Street
148 Victoria Street	C	demolition of 175 – 179 Victoria Street
152 Victoria Street	C	demolition of 175 – 179 Victoria Street
154 Victoria Street	C	demolition of 175 – 179 Victoria Street
156 Victoria Street	C	demolition of 175 – 179 Victoria Street
181 Victoria Street	C	demolition of 175 – 179 Victoria Street
179 Victoria Street	C	demolition of 175 – 179 Victoria Street

Note 1	Until the work starts and the local structural details are discovered during the demolition, it is not possible to envisage the measures that may be available in specific cases, and the assessment has been made on the assumption that the likely method of working will involve percussive breaking. However, the use of percussive methods will be avoided where practicable.	
Note 2	Key to uses	T= Theatre, O = Office, C = Commercial, P/R=PH ground floor, residential above, R – Residential, H - Hotel

Groundborne Vibration from Construction Activity

6.3.29 Table 6-4 and Table 6-5 summarise the residual effects from groundborne vibration during demolition activity on buildings and occupiers respectively in the absence of mitigation. Alternative methods of removing those parts of the structure nearest to affected buildings so as to minimise the effects of vibration will be investigated and implemented, where practicable. Since the detailed working methods are not yet available (see paragraph 6.3.26) the effect of potential additional mitigation is not currently known, and so the unmitigated effects have been presented below.

6.3.30 Significant vibration effects might also arise during jet grout underpinning activity in the basement of the Duke of York PH and the adjoining Victoria Palace Theatre as described above under groundborne noise from construction activity. However it is assumed that the Duke of York will not be occupied during those operations.

Table 6-4: Residual Effects of Groundborne Vibration from Construction Activity (see note 1)

Building			Effect in relation to Buildings
Address	**Use**	**Distance from activity [2]**	
Worksite A	**Oct 09 – May 10**	**Demolition of Elliot House**	
Victoria Palace Theatre	Theatre	2	Exceeds criteria for standard and listed buildings [3]
The Stag PH	PH + Residential	4	Likely to exceed criterion for standard buildings
Worksite C/D	**Jan 09 – Feb 09 (see note 4)**	**Removal of surface vent**	
Victoria Station	Station	0	Expected to exceed criterion for standard buildings
Worksite H	**Nov 09 – Feb 11**	**Demolition of 175-179 Victoria Street**	
181 Victoria Street	Retail/ Commercial	0	Expected to exceed criterion for standard buildings
179 Victoria Street	Retail/ Commercial	To be demolished	
7 Terminus Place	Retail/	0	Expected to exceed criterion for

Table 6-4: Residual Effects of Groundborne Vibration from Construction Activity (see note 1)			
Building			**Effect in relation to Buildings**
Address	**Use**	**Distance from activity [2]**	
	Commercial		standard buildings
4-6 Terminus Place	Retail/ Commercial	6	Likely to exceed criterion for standard buildings
Notes 1	Until the work starts and the local structural details are discovered during the demolition, it is not possible to envisage the measures that may be available in specific cases, and the assessment has been made on the assumption that the likely method of working will involve percussive breaking. However, the use of percussive methods will be avoided where practicable.		
2	At foundation in mm/s		
3	Discussions are underway with the operators of the VPT to devise a mechanism to mitigate the potential effects of the works.		
4	These are enabling works and are programmed to be carried out in advance of the main works.		

Table 6-5: Residual Effects of Groundborne Vibration from Construction Activity (see note 1)			
Building			**Effect in relation to Occupiers**
Address	**Use**	**Distance from activity [2]**	
Worksite A	**Oct 09 – May 10**	**Demolition of Elliot House**	
Victoria Palace Theatre	Theatre	2	Major SE [3]
The Stag PH	PH + Residential	4	Major SE
Worksite C/D	**Jan 09 – Feb 09 (see note 4)**	**Removal of surface vent**	
Victoria Station	Station	0	Note 5
Worksite H	**Nov 09 – Feb 11**	**Demolition of 175-179 Victoria Street**	
181 Victoria Street	Retail/	0	Potential for SE

Table 6-5: Residual Effects of Groundborne Vibration from Construction Activity (see note 1)			
Building			Effect in relation to Occupiers
Address	Use	Distance from activity [2]	
	Commercial		
179 Victoria Street	Retail/ Commercial	To be demolished	
7 Terminus Place	Retail/ Commercial	0	Potential for SE
4-6 Terminus Place	Retail/ Commercial	6	Potential for SE
Notes 1	Until the work starts and the local structural details are discovered during the demolition, it is not possible to envisage the measures that may be available in specific cases, and the assessment has been made on the assumption that the likely method of working will involve percussive breaking. However, the use of percussive methods will be avoided where practicable.		
2	Plan distance in metres		
3	Discussions are underway with the operators of the VPT to devise a mechanism to mitigate the potential effects of the works. Vibration might be noticed by people within the immediate vicinity of the works.		
4	These are enabling works and are programmed to be carried out in advance of the main works.		
5	However, it is assumed that apart from the workforce no one will be nearby for a significant period i.e. people will be passing the location not static there. Consequently, no significant effect has been attributed to this location.		

Road Traffic Effects During Construction

6.3.31 No significant effects are predicted from airborne noise from construction traffic or diverted non-construction traffic using the highway during construction.

Utilities Diversions

6.3.32 It is considered that the effect of these works on road traffic will be in terms of journey times and that the flows assumed for the altered network (i.e. including the road traffic diversions) during the main works will be essentially unchanged.

6.3.33 Since, as is reported above, the effect of the road traffic diversions on noise levels from road traffic does not give rise to any significant effects, the same will be true for traffic effects arising from the utilities works.

6.3.34 The construction activities undertaken for the utilities diversions are scheduled to be completed prior to the main works for the VSU scheme.

6.3.35 Although powers to carry out utilities diversions are being sought in the TWAO, it is intended that, where possible, these works will be carried out in advance of the main VSU works. The utilities diversions works are on a smaller scale than the main works and are of the similar to normal 'street works'. The periods of occupation of each work location vary from about 1 to about 3 months.

6.3.36 If unmitigated, these works have the potential to give rise to significant effects during the daytime or at night, depending on the duration of the noisier elements of the activity. However works will be managed using Best Practicable Means to control noise levels and ensure that the effects on sensitive receptors are minimised.

Operation

6.3.37 The intention is that is that the project design will ensure that noise and vibration from the new plant meets the required criteria. On that basis no significant effects are predicted for the operating phase.

6.4 Air Quality

Introduction

6.4.1 The VSU scheme represents a significant development that will take place in a densely urbanised environment. It is expected that there would be a prolonged period of construction activity with works taking place both on the surface and below ground.

6.4.2 This section summarises the potential for dust nuisance arising from surface construction areas and the potential air quality effects from all activities and phases of the proposed development and suggests mitigation measures where appropriate. The assessment of air quality effects can be summarised in the following steps:

- identify key pollutants and assessment criteria associated with the construction and operational phases;
- determine the study area and baseline air quality;
- assessment of the construction and operational phases of the scheme whereby potential impacts and effects are identified and documented; and
- determination of mitigation measures to reduce the significance of adverse effects and significant residual effects.

Baseline

Overview

6.4.3 Various European Union (EU) Air Quality Directives and UK Air Quality Regulations govern the redevelopment of Victoria Underground station with respect to air quality. The following section also provides a summary of the relevant legal framework.

6.4.4 EU Framework Directive 96/62/EEC on ambient air quality assessment and management came into force in November 1996 and had to be implemented by Member States by May 1998. The Directive aims to protect human health and the environment by avoiding, reducing or preventing harmful concentrations of air pollutants. As a Framework Directive it requires the Commission to propose "Daughter" Directives setting air quality objectives, limit values, alert thresholds, guidance on monitoring, siting and measurement for individual pollutants. The Daughter Directives relevant to this assessment include:

- Directive 1999/30/EEC relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air; and
- Directive 2000/69/EEC relating to limit values for benzene and carbon monoxide in ambient air.

6.4.5 The air quality limit values included in the various EU air quality directives have been implemented in England through the Air Quality Standards Regulations 2007. Taking this into account, for the purposes of this assessment, the Air Quality Standards Regulations 2007 have been used to inform appropriate limit values for relevant pollutants.

6.4.6 The Air Quality Strategy 2007 includes air quality objectives which, in most cases, are numerically synonymous with the limit values. The air quality objectives are for specific use by local authorities in undertaking their local air quality management duties pursuant to Part IV of the Environment Act 1995.

6.4.7 Under the original 1998 Air Quality Standards, local authorities had a duty to review and assess local air quality to determine whether national objectives would be met. This process is continued under the 2007 Air Quality Strategy. The Review & Assessment (R&A) process requires local authorities to undertake a phased assessment to identify any areas likely to experience exceedences of the air quality objectives. Any location likely to exceed the objectives must be declared an Air Quality Management Area (AQMA) and an action plan must be prepared and implemented, with the aim of achieving the objectives in the designated area.

6.4.8 Key air quality objectives and limit values are summarised in Table 6-6.

Table 6-6: Air Quality Assessment Criteria (relating to road traffic)

Pollutant	Averaging Period	Air Quality Objective	Where applicable (a)	Attainment Date
Nitrogen Dioxide (NO_2)	1-hour	(b) 200 µg/m^3	All locations accessible to the public	UK – 31 December 2005 (d) EU – 1 January 2010 (e)
	annual	40 µg/m^3	Locations of permanent residence	UK – 31 December 2005 (d) EU – 1 January 2010 (e)
Particulate Matter (PM_{10})	24-hour	(c) 50 µg/m^3	Locations where the public may be expected to be present for at least 8 hours per day (e.g. residential properties, hospitals, care homes, etc)	UK – 31 December 2004 (d) EU – 1 January 2005 (e)
	annual	40 µg/m^3	locations of permanent residence	UK – 31 December 2004 (d) EU – 1 January 2005 (e)
Particles ($PM_{2.5}$)	annual	(f) 25 µg/m^3	Urban background locations	UK –2020 (d) EU – 2010 (e)

Notes:
(a) Criteria are applicable only at locations where persons may be exposed over the averaging period. For example, the 1-hour criteria are applicable at all public places, the annual mean criteria at locations of residence.
(b) Expressed as the 99.79 percentile for calendar year,
(c) Expressed as the 90.4 percentile for the calendar year;
(d) Air Quality Objective. Source: The Air Quality Strategy 2007;
(e) EU Directive 1999/30/EEC relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air.
(f) The European Directive with proposals for $PM_{2.5}$ concentrations in air is currently subject to negotiation and final adoption.

6.4.9 Where air quality objectives are not expected to be achieved, local authorities are required to designate Air Quality Management Areas (AQMAs) as soon as possible after a problem is identified and to produce and implement Air Quality Action Plans (AQAP) to improve air quality. The statutory status of air quality objectives is that local authorities are required to demonstrate best efforts to achieve air quality that is compliant with the air quality objective rather than strict compliance itself. Upon the formalisation of the action plan, the local authority must then periodically submit progress reports on air

quality within the AQMA particularly when circumstances within the area change (when further assessment is required).

6.4.10 The UK Climate Change Programme published by DEFRA in 2006 sets out a number of national policies for reducing greenhouse gas emissions by 2008 – 2012 to 12.5% below 1990 levels, and for reducing carbon dioxide (CO_2) emissions alone by 2010 to 20% below 1990 levels. Although the UK Government is committed to reducing greenhouse gas emissions, as required by the Kyoto Protocol, there are no statutory requirements for the reduction of greenhouse gases at the sub-national level. The EU Emissions Trading Scheme focuses on industrial installations.

Local Air Quality Management

6.4.11 CoW has completed the first three stages of the first round of R&A in 1998. As a consequence of NO_2 and PM_{10} objectives being largely exceeded, the whole borough was declared an Air Quality Management Area (AQMA) for both pollutants in March 1999. An Air Quality Action Plan (AQAP) was published in 2001, followed by a Stage 4 report including air dispersion modelling results, based on the first London emissions inventory. This report was updated in 2003.

6.4.12 In 2004 an Updating and Screening Assessment was undertaken to examine changes since the original assessment. The latest report, an Air Quality Progress Report (dated April 2006), highlights that although some improvements have been achieved, air quality remains an issue within the borough.

6.4.13 The AQAP contains a number of measures designed to improve air quality within the Westminster area. Such measures include the extra provision of air quality information services (through the internet and SMS services), provision of additional cycle spaces, electric vehicle recharging points and, more recently, proposals to introduce a low emission zone (LEZ) to the City.

Ambient Air Quality Monitoring

Nitrogen Dioxide (NO_2)

6.4.14 Ambient concentrations of nitrogen dioxide (NO_2) arise from a wide range of combustion-related sources, including road traffic, industry and space heating. NO_2 represents approximately 10% of total nitrogen oxide (NO_X) emissions from motor vehicle exhausts (although recent evidence suggests that this could be as high as 20 – 70% depending on the classification of the vehicle (AQEG, 2006)), the remainder as nitrogen monoxide (NO). The NO oxidises in the atmosphere to form NO_2. The rate of oxidation is dependant on a number of factors including the availability of ozone. The relationship between NO_X and NO_2 concentrations is not linear; reducing NO_X emissions will not result in a direct reduction in NO_2 concentrations.

6.4.15 Urban background concentrations of NO_2 are continuously monitored at a site named 'Westminster' located approximately 1.5km from the proposed VSU scheme. The monitored concentrations of NO_2 are provided in Table 6-7.

Table 6-7: Annual Mean NO_2 Monitoring Results – Urban Background (µg/m^3)

Year	Westminster
	NO_2
2001	44
2002	43
2003	47
2004	46
2005	48

Source: April 2006 Air Quality Progress Report (CoW, 2006)

6.4.16 In addition, diffusion tube monitoring is carried out at various background and intermediate locations within the Borough. Relevant data for these monitoring locations are presented in Table 6-8.

Table 6-8: Diffusion Tube Annual Mean NO_2 Monitoring Results – Urban Background (µg/m^3)

Location/Year	2003	2004	2005
Palace Street	51	54	41
Belgrave Gardens	36	44	43
Hyde Park	31	26	40
North Wharf Road	45	47	52
Lanark Road	37	40	44
Queen's Park Library	41	45	40
St John's Wood Terrace	33	37	40
Shirland Road	37	37	-
Hyde Park Partisol	30	35	30
Horseferry Road	42	42	45
Covent Garden	42	44	51

Note: these results are uncorrected. They are presented as reported in the Air Quality Progress Report as an indication of spatial variation of air pollution.

6.4.17 As concluded in the Air Quality Progress Report 2006 the above tables show that concentrations of NO_2 (annual mean) exceeded the air quality standard

in most locations throughout the Borough despite the actions taken so far.

Particulate Matter (PM_{10})

6.4.18 Atmospheric particles are composed of a number of organic and inorganic materials emitted from a variety of sources. The size of airborne particles is typically less than 20-30 microns in diameter. Smaller particles have a greater health impact which is why the UK Air Quality Objective specifically refers to PM_{10} (particles with a mean aerodynamic diameter of less than 10µm). Primary sources of PM_{10} include road traffic, non-combustion activities including construction/demolition, and combustion processes.

6.4.19 PM_{10} has been measured in Westminster in several places. Table 6-9 shows annual mean PM_{10} concentrations for the urban background measurement location in Hyde Park (Gravimetric method).

Table 6-9: Annual Mean PM_{10} Monitoring Results – Urban Background (µg.m-^{3})

Year	Hyde Park
2001	23 (16)
2002	23 (7)
2003	36 (24)
2004	20 (9)
2005	15 (3)

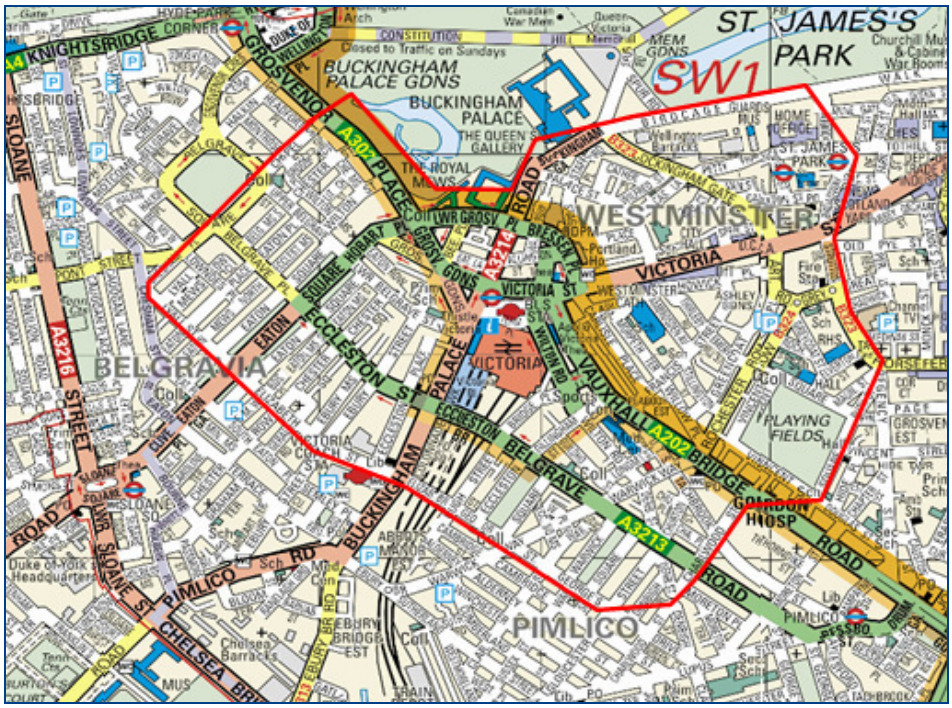
Note: Number of exceedences of the PM_{10} daily mean limit value of 50 µg.m-^{3} in brackets.

Study Area

6.4.20 Potential effects from construction activities that generate dust are generally limited to within 150-200m of the construction site boundary, depending on the extent of mitigation, prevailing wind, rainfall and the presence of natural screening by, for example, vegetation or existing physical screening such as boundary walls on a site. Receptors closer to construction sites are likely to experience significantly greater exposure and nuisance as a result of dust emissions.

6.4.21 The effects of traffic on air quality are limited to 200m from the centre of the road (Plate 6.2); beyond this distance, the influence of a given link to air quality is negligible. The effect of changes in traffic flows during the construction phase will therefore be considered for receptors within this boundary, particularly if there are any sensitive receptors.

Plate 6.2: Extent of Study Area



Note: map represents the extent of the area considered by the traffic model for the construction phase, delimited by the red line.

Sensitive Receptors

6.4.22 VSU is located in the City of Westminster. The area is highly developed and characterised by a mixture of retail, office and residential uses. It is a busy area with a high number of pedestrians resulting in a high number of receptors being near to the roads, particularly those arriving and departing from both the National Rail and Underground stations.

6.4.23 A number of sensitive areas have been identified within the study area. These include:

- Westminster City School and Sixth Form;
- St Vincent De Paul RC School;
- Burdett Coutts CE Primary School;
- St Peter's Eaton Square CE School;
- Victoria NHS Walk In Centre;
- dentist, north end of Buckingham Palace Road;
- dentist, Buckingham Gate opposite Allington Street; and
- dentist, Wilton Road.

6.4.24 A number of residential areas have been identified in the study area which may experience some deterioration in air quality as well as potential dust nuisance (Figure 6.4(1)). These areas include the:

- Allington Street Zone;
- Vauxhall Bridge Road to Ambrosden Avenue Zone;
- Buckingham Palace Road Zone;
- Palace Street Zone;
- Ambrosden Avenue to Howick Place Zone; and
- Southern Periphery Zone.

6.4.25 These residential areas are predominantly blocks of flats and apartments that line various roads throughout the study area. This means that there is a high density of residential receptors who could potentially expect some changes in air quality throughout the duration of the construction works.

6.4.26 In addition there are a number of properties in the study area which have large glass façades which may be susceptible to dust nuisance. These are particularly prominent near to the construction area along Victoria Street and Bressenden Place.

6.4.27 Air pollutants such as the oxides of nitrogen (NO_X) and dust can also impact upon vegetation. Elevated concentrations of these pollutants in the ambient air can lead to damage to plant tissues or can suppress growth depending both on the pollutant and the species of plant. The UK has a non-statutory objective of 30 $\mu g/m^3$ for ambient NO_X concentrations but typically this should only apply where areas are not influenced by major roads unless there are protected sensitive areas present. There are four sites of local ecological importance in the CoW, however these sites lie outside the zone of influence of the scheme and it is not considered that these will be affected by the upgrade works.

Works Affecting the Baseline

6.4.28 Construction activities which specifically include those during demolition, earthworks and tunnelling have the potential to give rise to dust and adverse effects on local air quality. The operation of site plant and machinery can also give rise to greenhouse gas emissions. These issues are discussed in further detail below.

Construction Dust

6.4.29 The nature of the Victoria Station Complex as a major transportation hub means there are large numbers of receptors in the area. Such a high density of receptors means that the control of construction dust is a key issue in order to maintain quality of life and reduce nuisance and health impacts as much as possible. The nature of the construction works means that there will be a number of different of activities being undertaken concurrently which have differing dust-raising potential. These include demolition, piling, excavation, tunnelling and jet grouting.

Air Quality and Greenhouse Gases

6.4.30 Air quality effects arise from both the construction work itself (i.e. emissions from onsite plant) and from the traffic relating to this construction work.

6.4.31 The combustion of fossil fuels (for example from diesel engines) leads to emissions of air pollutants which can be detrimental to human health both in the short and long term. In addition, this combustion leads to the direct emission of carbon dioxide and other greenhouse gases which contribute to enhanced global warming. Plant which use electricity as their source of power are primarily associated with emissions of greenhouse gases by virtue of the national 'mix' of electricity. (Note that the majority of electricity generated in the UK is thermal energy which also leads to the emissions of traditional pollutants. The emission of these pollutants have localised effects at the point of generation (not at the point of use), whereas emissions of greenhouse gases are non-localised and therefore still apply at the point of use).

6.4.32 Similarly, movement of construction traffic also leads to the direct emission of air pollutants and greenhouse gases. The emissions that arise from traffic are a product of their engine type, speed and distance travelled. In addition congested traffic can give rise to increased particulate concentrations through brake wear and re-suspension of particles from stop-start traffic patterns.

6.4.33 Emissions from the operational phase of the VSU scheme are primarily related to the relocation of ventilation shafts which serve the new tunnels. Dust and particles can be generated from the general wear and tear of stations, along with that of the trains and rails. This could also contribute to indoor air quality. Any dust that is generated could be released at street level due to ventilation of the platforms.

Mitigation and Residual Effects

Construction Dust

Overview

6.4.34 The construction phase has an approximate duration of six years. The activities in each phase of the construction programme are different and take place in numerous locations which will lead to diverse effects on receptors. While some activities may impact upon a smaller number of receptors over a long period, others may impact upon more people over a shorter time, yet the effects may be the same.

6.4.35 The GLA and Mayor of London's guidance "The Control of Dust and Emissions from Construction and Demolition – Best Practice Guidance" tiers mitigation measures based on the risk of dust nuisance. Dust nuisance risk is

determined by the development size, sensitive receptors and whether it is deemed a 'major development'. The level of mitigation prescribed reflects the risk of dust nuisance from construction activities. Based on these criteria, the VSU would be "high risk", and therefore the overarching mitigation measures to be applied will comply with this classification.

6.4.36 The key activities in mitigating dust nuisance are: firstly, to prevent dust from being released (by using techniques that minimise the production of dust); secondly, to prevent the liberation of this dust as far as practicable through dampening and cleaning techniques; and thirdly, to enclose the construction area or protect sensitive receptors. The incorporated mitigation measures, as outlined in the scheme specific draft CoCP will minimise the amount of dust generated. The section below explains how these measures will be implemented and the above tier system applied, depending on the nature of works.

6.4.37 Construction of the VSU will take place in a number of phases and across several worksites. Each of these worksites will undertake differing activities which may or may not lead to a significant risk of dust nuisance. In certain cases, the full level of mitigation as described in the GLA guidance may not be appropriate. Therefore each of the construction activities and/or sites have been assessed and categorised into one of three tiers based on the activities, receptors and duration of works. Each tier therefore reflects the relative risk of dust nuisance from the site as a whole where progressively more stringent measures will be taken to further reduce residual effects:

- Tier 1 sites and activities are low intensity works where the dust raising potential is relatively low and therefore procedures following the CoCP sufficiently mitigate the potential for dust to cause nuisance;
- Tier 2 sites will adopt the GLA 'high risk' mitigation measures, as these sites are more likely to lead to dust nuisance, or are located near to sensitive receptors. Where numerous Tier 2 activities co-exist, extra mitigation measures will be taken, as discussed below; and
- Tier 3 activities are considered highly likely to cause nuisance even if measures proposed in the draft CoCP are followed. Therefore further precautionary measures will be considered in order to mitigate the potential for dust nuisance and reduce the residual impact.

6.4.38 This assessment highlights that some construction sites will require a higher degree of mitigation from construction dust than others due to the combination of location, nature and duration of the construction activities.

Tier One – General Measures

6.4.39 Tier one sites will comply with the mitigation measures proposed in the draft CoCP. This includes a section on Standard Dust Control Procedures.

6.4.40 As a first measure, frequent visual monitoring of dust should be undertaken.

During certain works undesirable meteorological conditions may lead to the formation of dust clouds – these can be clearly identified by a visual assessment. In this event work could be temporarily called to a halt while these undesirable conditions remain.

6.4.41 The site manager, or other delegate, will liaise with the local community in order to determine whether the mitigation measures employed are sufficient to avoid any construction dust nuisance. By incorporating a grievance mechanism the site manager can be made aware of any issues that may arise involving nuisance and appropriate measures taken to minimise the risk of any future nuisance from occurring.

6.4.42 The nature of the construction works means that there will be a number of different of activities being undertaken concurrently which have differing dust raising potentials. Depending on the nature of the works being undertaken it may be preferable to schedule works with a high dust-raising potential simultaneously in order to reduce the duration of the impacts. This should be considered in consultation with any affected parties.

6.4.43 Standard mitigation practices should be concerned with the suppression of dust and activities to prevent the liberation of the dust. Therefore, standard mitigations to be implemented in accordance with the draft CoCP include (summarised here);

- maintain all dust control equipment in good condition and record maintenance activities;
- not allow dry sweeping of large areas;
- provide and ensure the use of wheel-wash facilities near the site exit wherever there is a potential for carrying dust or mud off the site;
- impose and signpost maximum speed limits of 5mph on un-surfaced haul routes and work areas and 10mph on surfaced haul routes and work areas;
- provide hardstanding for vehicles which can be easily cleaned;
- minimise the amount of excavated material held on site;
- avoid double handling of material wherever practicable;
- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate;
- only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction;
- carry out site inspections regularly to monitor compliance with dust control procedures set out above and record the results of the inspections, including nil returns, in the log book detailed;

- minimisation of the on-site storage of the materials to be used – sheeting of all materials wherever possible to prevent liberation of dust;
- increase the frequency of site inspections when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions; and
- record any exceptional incidents causing dust episodes on or off the site, and the action taken to resolve the situation, in the log book detailed above.

Tier Two – Elevated Risk

6.4.44 Sites classed as Tier Two represent sites where activities are likely to involve an elevated risk of dust nuisance and therefore need further control measures in place. These should include all the measures included in Tier One, as well as the following additional measures, in accordance with the GLA Construction Dust Guidance (summarised here):

- comprehensive site survey to determine the prevailing wind direction (using available meteorological data). A minimum of two permanent PM10 monitoring stations to be installed along the transect of the average wind direction – this should supply data which is readily available to the local authority;
- use of solid barriers encompassing the entire site boundary;
- use of ultra-low sulphur diesel in all site plant;
- strip and wrap buildings to be demolished to reduce the amount of dust which may be liberated; and
- batching of concrete and other materials off-site to reduce the amount of works required on-site.

Tier Three – High Risk

6.4.45 These sites involve activities which may lead to elevated dust generation and/or involve prolonged activities.

6.4.46 As a precaution, dust monitoring should be implemented as standard at tier 3 sites. This would apply to the VSU site. The relevant monitoring methods should include those applicable to Tier Two, but may be supplemented with the following measures:

- hand-held or low-cost permanent monitoring at recognised sensitive receptors such as schools or health centres;
- visual inspection of these sites, as well as liaison with the relevant stakeholders – this should be recorded in a log;
- all vehicles to comply with the future Low Emission Zone (LEZ) as a minimum;

- access to real-time data on-site which can be used to identify periods of activity which lead to elevated dust concentrations at receptors which may be used to temporarily halt works, or modify working practices in order to minimise impacts; and
- set-up a relevant grievance mechanism for the community, including a telephone complaint system.

6.4.47 As a result of the above mitigation methods there will be no significant residual effects from construction dust.

Air Quality and Greenhouse Gases – Construction Activities

6.4.48 The combustion of fossil fuels (for example from diesel engines) leads to emissions of air pollutants which can be detrimental to human health both in the short and long term. In addition, this combustion leads to the direct emission of carbon dioxide and other greenhouse gases which contribute to global warming. Plant which use electricity as their source of power are primarily associated with the emissions of greenhouse gases (by virtue of the national 'mix' of electricity). Note that although the generation of thermal energy also leads to the emissions of traditional energy, these emissions of these pollutants have localised effects, whereas emissions of greenhouse gases are non-localised and therefore still relevant in this context. In order to reduce the emissions of pollutants from site plant, the following measures will be considered:

- efficient planning of construction activities in order to reduce the number of plant, and to maximise the use of plant while at the site – maximising use of plant when in operation;
- to not leave construction plant idling when not in use;
- site plant located away from potential receptors;
- use of mains electricity of battery power where possible (practical for hand tools) rather than diesel in order to reduce emissions; and
- avoid the use of diesel or petrol powered generators.

6.4.49 Similarly, movement of site traffic delivering and removing construction materials also leads to the direct emission of air pollutants and greenhouse gases. The emissions that arise from traffic are a product of their engine type, speed and distance travelled. In addition, congested traffic can give rise to increased particulate concentrations through brake wear and resuspension of particles from stop-start traffic patterns.

- care will be taken in planning the routes that vehicles make to the facility in order to make it as efficient as possible, to minimise both the release of pollutants and the exposure to population and other receptors;

- planning will ensure that vehicles used for operations should be used to their maximum capacity in terms of load, to minimise the number of vehicles and journeys to and from the facility;
- where possible, consideration to non-road methods of material delivery will be given, or for long-distance haulage, partial non-road delivery, for example using trains or barge; and
- note that is also assumed that personnel working on the construction of the scheme are assumed to use public transport to arrive at the site, and therefore no parking provisions will be made at the construction site.

6.4.50 As construction activities lead to the emission of greenhouse gases, in addition to the above, the following may also be considered:

- all work areas, offices and other facilities should include energy efficient equipment wherever possible and include staff awareness initiatives on energy efficiency; and
- the purchase of 'green' energy should be considered in order to minimise the impact of the construction works on climate change.

6.4.51 As a result of the above mitigation methods there will be no significant residual effects for greenhouse gas emissions.

Air Quality – Non-Construction Traffic

6.4.52 Traffic impacts from the construction phase and utilities works could potentially lead to some changes in ambient air quality around the area of Victoria Station. It is important however to stress that the changes identified are temporary and represent a 'worst-case' scenario for the construction traffic flows.

6.4.53 Diversions should be designed to reduce congestion both temporally and spatially as slow moving traffic can lead to increased emissions due to reduced engine efficiency.

6.4.54 There will be no significant residual effects for air quality as a result of traffic movements during the construction and utilities phase of the VSU scheme.

Operational Phase

6.4.55 Emissions from the operational phase of the VSU will result from the relocation of ventilation shafts which serve the new tunnels, energy use of the Underground Station and dust and particles generated from the general wear and tear of the stations, together with that of the trains and rails. Any dust that is generated could be released at street level due to the ventilation of the platforms.

6.4.56 In order to minimise the above effects, the following measures will be considered:

- ventilation shafts will (as far as is reasonably practicable) be sited well away from sensitive receptors in order to reduce the risk of adverse effects on air quality;
- platforms and passageways and other station areas will be regularly cleaned in order to be kept dust-free and minimise the chance of resuspension;
- use of energy efficient equipment and technologies wherever possible;
- changes in traffic and public transport due to modal shift;
- sourcing of energy from renewable or low-carbon technologies wherever feasible, including on-site generation as discussed in the Energy Demand Assessment; and
- training of staff in energy efficiency practices, including dimming of lights during off-peak times reducing the number of escalators in operation. Sensors may be installed to identify when customers require the use of such facilities and to power down when they do not.

6.4.57 With this incorporation of appropriate measures as set out above, there will be no significant residual effects from the operational phase of the scheme on air quality.

6.5 Townscape and Visual Amenity

Introduction

6.5.1 This section summarises the potential effects of the activities and phases of the VSU scheme on the existing townscape and visual amenity of the study area and suggests mitigation measures where appropriate. The approach to undertaking this assessment is presented in Annex A to this report. The study area assessed includes the places where the development could be visible from and/or where it could influence the local townscape character. It includes Victoria National Rail Station, Victoria Street from Westminster Cathedral to the station, Grosvenor Gardens, Bressenden Place, Allington Street, Vauxhall Bridge Road, Carlisle Street and Ashley Place.

The assessment of the potential effects of the development on townscape and visual amenity can be summarised in the following steps:

- identification of the existing townscape character (the distinct and recognisable pattern of elements that make up the character of a particular area);
- identification of the potential visual receptors (the people experiencing the change in view resulting from the development) and evaluation of their sensitivity to changing views;

- assessment of the potential effects of the development on the townscape character of the environs of the construction site;
- assessment of the potential effects of the development on the visual amenity of receptors within the zone of visual influence of the development; and
- the supplementary mitigation measures designed to further reduce the magnitude and significance of the residual effects.

Baseline

Townscape Character

6.5.2 The townscape character of the study area was assessed by analysing the following townscape elements: urban layout, land use, density and scale, appearance, legibility accessibility, public open space and existing trees. (These are fully described in Technical Appendices Volume 3, Appendix D) Three separate character zones in the study area were identified. These are:

- around Victoria National Rail Station - a busy transport hub dominated by constant pedestrian, bus and taxi activity. The buildings around the station are in an eclectic mixture of architectural styles, heights and massing. They have a wide variety of uses including: food outlets, offices and shops. They are mainly 7 storeys or lower. There are no trees around the station but they can be glimpsed in Grosvenor Gardens to the west;
- Victoria Street and Bressenden Place - an area of mainly tall buildings of steel, concrete and glass. There are five London plane trees (*Platanus X hispanica*) growing in Bressenden Place, an area otherwise lacking in tree cover. Cars, buses and lorries dominate the use of the streets and are responsible for the constant traffic noise of the area; and
- Westminster Cathedral, Carlisle Place, and Ashley Place - a quiet area of mainly residential or ecclesiastical properties, many of great cultural or architectural merit. There is on-street parking and little through traffic.

The Zone of Visual Influence and Key Receptors

6.5.3 The Zone of Visual Influence (ZVI) as illustrated on Figure 6.5(2), extends west of Terminus Place to Grosvenor Gardens, south down Wilton Road and Carlisle Place and north along Allington Court and Bressenden Place. It includes the section of Victoria Street that passes through the development area. High sensitivity receptors include residents of Carlisle Place and Evelyn Mansions. Medium sensitivity receptors include office workers in the office blocks within the ZVI, pedestrians and shoppers passing through the ZVI, theatre goers, users of Grosvenor Gardens, shoppers and visitors to the public houses in the ZVI. Lower sensitivity receptors include road users within the ZVI.

6.5.4 With regard to the external appearance of the VSU scheme as relevant to townscape and visual issues, the above ground structures covered by this assessment are:

- Cardinal Walk: Cardinal Place Entrance;
- Victoria Street North: units on the corner of Victoria Street North Entrance and Bressenden Place Services; and
- 'the Beach': Wilton Road entrance and the reinstatement of 'the Beach'.

6.5.5 The location of the above ground structures is shown on Figure 6.5(3) and these are described in detail in Technical Appendices Volume 3, Appendix D.

Works Affecting the Baseline

6.5.6 The general work activities described in Section 2 have been carefully considered to determine the effects of the VSU scheme on the baseline townscape and visual amenity of the area.

6.5.7 Works activities which have the potential to alter the townscape and visual amenity will be the changes brought about by the erection of site hoarding and the movement of heavy plant around the development site. These works are likely to have an effect from the outset of the project and are not limited to a single phase.

6.5.8 The elements of the design that will be apparent at street level occupy prominent locations. 'The Beach' entrance, (otherwise known as the Kent and Sussex Stairs) leads downs to the STH and is located on the corner of Wilton Road and Terminus Place, directly in front of the eastern entrance to Victoria National Rail Station. The Corner Site entrance leads down to the NTH and is located on the corner of Bressenden Place and Victoria Street. The Cardinal Place entrance will also lead down to the NTH and is located on the opposite side of Bressenden Place.

Mitigation and Residual Effects

Construction

6.5.9 The methodology for assessment is explained in detail in Annex A. The townscape and visual amenity assessment considered the combination of magnitude, value and sensitivity of the receptor for the assessment of significance of the effects, the application of which is also explained in detail in Annex A. The predicted significant effects will mostly arise during the temporary construction period as summarised in Section 2. The effects focus on the visual impact of the worksites and the effects on the settings and views. The following incorporated mitigation measures will be applied:

- the erection of timber hoardings (up to 3m high where appropriate) around each site to create an orderly appearance and reduce any negative effect on visual amenity. The hoardings will be painted and maintained in good condition throughout the length of the contract;
- the careful design of site lighting to minimise light intrusion into neighbouring properties; and
- the control and orderly planning of vehicle movements to and from each site.

6.5.10 After mitigation the scheme will result in the following significant residual effects during the construction period:

- deterioration in views for office workers in Portland House, Cardinal Place and Terminus Place, Victoria Palace Theatre goers, users of Victoria Station and pedestrians on Bressenden Place and Wilton Road; and
- adverse effect on townscape character due to the erection of hoardings, the felling of three trees and the temporary removal of Little Ben clock tower.

Operation

6.5.11 The methodology for assessment is explained in detail in Annex A. The townscape and visual amenity assessment gave due regard to the combination of magnitude, value and sensitivity of the receptor for the assessment of significance of the effects during operation the application of which is also explained in detail in Annex A.

6.5.12 The above ground structures will aim to positively enhance the townscape character of the Victoria area. The mitigation measures include:

- the use of high quality materials - glass, metal, concrete and stone - in the design of the structures to reflect the surrounding diversity of both contemporary and traditional materials;
- the arrangement of the structures to complement the surrounding townscape and highlight landmark buildings;
- the improvement of the arrangement of ‘the Beach’ to clarify the design of the area so that it can become an area of open space; and
- the replanting of trees lost during construction to complement the new structures and surrounding townscape.

6.5.13 By employing the above techniques the above-ground structures will become new focal points within the streetscape, appropriate in scale, materials and general arrangement to their location. The scheme will therefore result in the following significant residual beneficial effects:

- the high quality of the design of above-ground structures will enhance the townscape character;
- the re-design of 'the Beach' will improve visual amenity for a number of visual receptors I particularly pedestrians and office workers in the vicinity of Victoria Station; and
- the legibility of the study area will be improved with a reduction in clutter on 'the Beach' and improved signage at the new station entrances.

6.6 Built Heritage

Introduction

6.6.1 The term 'built heritage' is taken to refer to buildings, structures and townscapes that are of historic importance. PPG15 - Planning and the Historic Environment (1994) establishes a presumption against development which would adversely harm the setting or special architectural or historic interest of listed buildings; similarly development which would not preserve or enhance the character or appearance of Conservation Areas.

6.6.2 This section identifies the key built heritage features of importance on which the temporary construction and permanent operation of the VSU scheme are likely to have a significant environmental effect, and outlines measures for avoiding or mitigating these effects where possible. The approach to undertaking this assessment is presented in Section 5 of Annex A.

6.6.3 The key objectives of the assessment are to:

- determine the baseline in terms of the presence of built heritage features and how they contribute to the character of the area;
- identify the activities during construction and which may have an effect on the built heritage features which are of importance;
- assess the significance of any impacts of the scheme and outline the incorporated mitigation measures which where necessary, reduces the significance of adverse effects; and
- propose measures for reducing or further mitigating significant residual effects.

6.6.4 In addition, LU considered it prudent to design a building that could occupy the corner site in such a way that demonstrates successful integration of the above ground elements of VSU in this location, fully respects the setting of the VPT and the locality generally and which conforms to the Victoria area planning brief. This is subject to a separate planning application.

6.6.5 The location of listed buildings and conservation areas together with the

extent of the 1mm and 10mm settlement contours are illustrated in Figure 6.6(1).

Baseline

History

6.6.6 Historic maps show that the area was predominately marshes and fields. It was developed in 1827 to include a reservoir and subsequently a canal and basin. The River Tyburn, that once crossed the site, was culverted to form the King's Scholar's Pond Sewer in the 1890s.

6.6.7 The Victoria National Rail Station was built in the canal basin area to provide rail links to Brighton and the south coast. Opened in 1860, initially there were two separate, adjacent stations but these were brought together as one in 1925. The footprint of the Victoria National Rail Station forecourt and Terminus Place was defined in 1816 when Shaftesbury Terrace was built and took the place of the canal basin and wharf, which formerly occupied the site. The Thistle Victoria Hotel (formerly The Grosvenor Hotel) was built adjacent to the western end of the National Rail station in 1861. The Metropolitan Railway was extended in 1862 and a terminus provided (now the District and Circle line section of the present Underground) in front of the mainline station.

6.6.8 The surrounding land use consisted of streets lined with terraced houses and included the Stag Brewery, immediately to the northeast of the site. The brewery was founded in 1641 and occupied the site just east of Bressenden Place. It closed in 1959 when the site was redeveloped after World War II. Entertainment venues arrived in the area, including the VPT in 1911.

6.6.9 Following the development of rail infrastructure in the area, Victoria Street increasingly became a highly sought after location in the years which followed, with developments occurring along the south side and latterly on the north side of this street. In the early 1960s, part of the area surrounding the Victoria transport complex was redeveloped with additional roads and buildings constructed. There has been ongoing development of the area since the 60s; the most recent development is Cardinal Place (to the north east of the Victoria transport facilities), which was completed in 2005 with apartments, shops and offices.

Listed Buildings

6.6.10 The listed buildings in the vicinity of the proposed works and their grading are:

- Victoria Palace Theatre, Grade II;
- Victoria National Rail Station (Eastern), Grade II;
- Victoria National Rail Station (Western), Grade II;

- Little Ben Clock Tower, Grade II;
- Apollo Theatre, Grade II*; and
- The Victoria Thistle Hotel Grade II* (formerly the Grosvenor Hotel)

6.6.11 The works are not in a conservation area however, the Westminster Cathedral and Grosvenor Gardens Conservation Areas are nearby.

6.6.12 Descriptions of the buildings and conservation areas can be found in Technical Appendices Volume 3, Appendix E.

The Victoria Palace Theatre (Grade II)

6.6.13 The Victoria Palace Theatre (VPT) was designed by Frank Matcham in 1911. It is fourstoreys high and has a symmetrical main frontage which is three-bays wide. The external walls of the Victoria Street facade appear to be of load bearing masonry construction and faced with white faience in a flamboyant Classical style. The ground to second floor is channelled, with a modern cantilevered canopy over the entrances and there is a large central arch. The main entrance consists of wooden double-doors with elaborate glazing. The windows to the first and second floors are paired with square-heads. Above the arch is an open loggia with four Ionic columns with three large windows behind. The loggia is flanked by festooned ox-eye windows. The Victoria Street facade is crowned by an entablature with a central pediment behind which rises a cupola with pedastalised Ionic columns and a dome surmounted with a gilt ballerina-type figure. The later single-storey extension to the right of the main entrance, serves as a bar area and comprises a three arch loggia surmounted by an open balustrade. The exterior is complemented by a similarly ornate interior.

6.6.14 There is a secondary facade containing the stage door and servicing area facing onto to Allington Street. This has plainer red brick lower floors but is colonnaded on the upper levels with ionic columns.

Victoria National Rail Station (Grade II)

6.6.15 The frontage of Victoria National Rail is split into two sections, the South East and Chatham Railway facade (SECR) facade on the eastern side and the London to Brighton Railway (LBSCR) facade to the west, flanked by the Thistle Victoria Hotel, which is also listed.

6.6.16 The existing eastern facade was designed by AW Blomfield in the Baroque style and dates from 1909. It is rendered in Portland stone and abuts an earlier Victorian facade. The building is of three storeys plus an attic with a flat central roof, two pedimented projections to either side of a central segmental entrance arch at ground level.

6.6.17 The western (LBSCR station) facade dates to 1906 and was truncated in

1979 during redevelopment works. The building is of nine floors and is constructed of brick with ashlar detailing. Also rendered in ashlar are projections to the centre and either end - the latter formed of three bays and capped with round headed pedimented and hung-tile mansard roofs. The central section has a broken segmental headed pediment with statues adorning the shoulders and a gabled projection rising above it containing a clock face.

6.6.18 At the front of the station buildings are three broad canopies with a cast iron framework and timber barge boarding. The overall effect is one of an ornate highly detailed facade.

Little Ben (Grade II)

6.6.19 Little Ben is a cast iron miniature clock tower situated in Wilton Road which mimics its larger namesake. It was manufactured by Gillett and Johnston of Croydon and was erected in 1892. In 1964 it was removed from the site and re-erected there in 1981. It is a typically ornate late Victorian structure.

The Thistle Victoria (formerly The Grosvenor) Hotel. (Grade II*)

6.6.20 The Thistle Victoria Hotel (Grade II *) designed by J.T Knowles was built on the west side of Victoria National Rail Station in 1861, in the Baroque style. It was refurbished after being bought by the London, Brighton & South Coast Railway in 1899 and extended in 1907. It is of yellow brick and stone, with a rusticated ground floor and a French pavilion roof. The building is of five floors with two additional floors in the roof. The building is well articulated with sound architectural detailing. It's grand and cohesive appearance justifies Grade II* listing.

The Apollo Theatre (Grade II*)

6.6.21 The Apollo Theatre, Wilton Road, is a particularly prominent building designed in the late 1920's by E. Wainsley Lewis and W.E. Trent. It has a concrete facade, ribbed horizontally and curved in towards the main entrance facade with vertical ribbing. Black octagonal pilasters run up either side of the main facade which rises above the flat roof of the main building. The distinctive style of this theatre and relative rarity as a building are what justifies a Grade II* status.

Conservation Areas

6.6.22 Also of importance to the site is the Westminster Cathedral Conservation Area. This was designated in 1968, extended in 1977 and 1993. The area is dominated by Westminster Cathedral and associated clergy housing. A key open space is the Piazza in front of the cathedral. Properties in neighbouring areas are characterised by red brick Victorian apartment blocks of a uniform scale and appearance, the nearest to the site being in Carlisle Place. The

Conservation Area also includes the south frontage of Victoria Street with its 1970 commercial development.

6.6.23 To the west is the Grosvenor Gardens Conservation Area, an area of Renaissance style 19th century terraces.

Works Affecting the Baseline

6.6.24 Work activities described in Section 2 have been carefully considered to determine the effects of the upgrade scheme on the baseline built heritage value of the area. Construction sites will occupy various sites in the area in a phased programme. The main sites will be in front of the National Rail station in the area known as 'the Beach' and boarded by Wilton Road and Terminus Place; and Bressenden Place and the adjacent area presently occupied by 120 to 124 (even) Victoria Street and 3 to 11 (odd) Bressenden Place.

Mitigation and Residual Effects

Methodology

6.6.25 The methodology for assessment is explained in detail in the scoping report (Annex A). The built heritage assessment gives due regard to the combination of magnitude of impact of the works with any subsequent settlement or movement on the listed structure and value of the receptor, for the assessment of significance of the effects. This assessment uses the broad criteria within PPG15 and PPG16 together with professional judgement to assess value, impact magnitude and to categorise significance. The application of levels of significance is explained in detail in Annex A. Tables 8.1 and 8.2 summarise the assessment for construction (temporary effects) and operation (permanent effects).

Construction Effects

Settlement

6.6.26 Particularly significant (Psig) adverse settlement effects have been identified at the Victoria Palace Theatre and significant (Sig) potential settlement effects at the Apollo Theatre and Victoria National Rail Station (Eastern). Mitigation at the Apollo and National Rail station will be by robust construction methods to limit movements. Mitigation at the Victoria Palace Theatre will be primarily underpinning by ground improvement and additional tunnelling techniques to minimise volume loss such as pipe arches, grouted spiles, limiting advance length and sequential excavation. These actions will reduce ground movements to non-significant. However cautionary protective measures and strengthening works at the Victoria Palace Theatre will remain potentially significant (Sig) pending further development.

Groundworks

6.6.27 Potentially significant adverse effects from ground improvement works and underpinning using jet grouting will be mitigated by pre construction trials, careful sequencing of the work, real time monitoring and the use of experienced contractors to reduce effects to non-significant (NSig).

Groundwater

6.6.28 Potentially significant adverse effects from groundwater build-up have been identified at the Apollo Theatre. If necessary additional pumping facilities will be installed to avoid groundwater build-up and therefore reduce the potential effects to non-significant (NSig).

Setting

6.6.29 Potentially significant adverse (Sig) residual temporary effects have been identified on the settings of Victoria National Rail Station (Eastern) and Victoria National Rail Station (Western) from the work site and temporary structures in the forecourt and bus station in front of it and on the setting of the Apollo Theatre from the work site in Wilton Road.

6.6.30 A potentially significant adverse effect on the setting of the Victoria Palace Theatre has been identified from demolition of numbers 120-124 Victoria Place and 3 to 11 Bressenden Place. The area will be occupied in part by the ventilation housing and the entrance of the North Ticket Hall. These structures will be designed to stand alone architecturally and structurally with no detriment to the setting of the area. Areas of the site not used by the ticket hall will be screened off or hard landscaped. The flank wall of the theatre exposed by demolition will be appropriately clad with an architectural finish. It is considered that with these actions the effect on the setting of the theatre compared to the baseline is non significant (NSig).

6.6.31 The worksite for the North Ticket Hall and Corner Site Development will have an adverse significant residual temporary effect on the Victoria Palace Theatre.

6.6.32 The Little Ben Clock Tower is to be removed prior to the works, stored and replaced on completion of the works. The effects should therefore be non-significant (NSig).

6.6.33 The effects on the adjacent Conservation Areas are considered non-significant (NSig).

Operational Effects

6.6.34 An adverse significant (Sig) residual effect has been identified on the setting

of Victoria National Rail Station (Eastern) from the two new air vents and the new Wilton Road entrance in the area of the forecourt known as 'the Beach' (area bounded by Wilton Road, the Victoria National Rail Station (Eastern) façade and Terminus Place). The same structures are considered to have a significant permanent residual effect on the setting of the Apollo Theatre. Currently the existing structures on the beach can be considered to have a significant negative (Sig) effect on the setting of the National Rail station and the Apollo Theatre. Therefore the net effect of the new structure is considered to be non significant (NSig). Design development is ongoing to ensure that the new structures are as considerate as possible to the setting of these buildings. The effects of the new proposals will be mitigated through ongoing design of the vent structures.

6.6.35 At present, the residual effect from possible strengthening works to the Victoria Palace Theatre (potentially causing building settlement) is regarded as significant adverse (Sig). It is envisaged this will be reduced to non significant with further design development, and discussions and agreement with the relevant parties.

6.6.36 Residual effects on the Victoria National Rail Station (Eastern) have been identified due to the incorporation of the new lift between the Kent and Sussex stairs and possible additional emergency exits. These effects will be mitigated by the use of existing structural openings in the facades and their residual effect will be non-significant (NSig).

6.7 Archaeology and Cultural Heritage

Introduction

6.7.1 This section of the ES assesses the effects of the VSU scheme on archaeology and cultural heritage. It has been compiled in accordance with the standards specified by the Institute of Field Archaeologists (IFA 2001), the Association of Local Government Archaeological Officers, English Heritage, the Greater London Archaeological Advisory Service, and other professional guidance.

6.7.2 This section identifies the key archaeological features of importance that the temporary construction and permanent operation of the VSU scheme will affect and outlines measures for avoiding or mitigating adverse impacts where possible.

6.7.3 The key objectives of the assessment are to:

- establish the baseline in terms of the presence of features of archaeological importance and the potential for previously undiscovered features and/or remains;

- identify the activities during construction which may have an effect on features which are of importance;
- assess the significance of any effects of the scheme and outline the incorporated mitigation measures which where necessary, reduce the significance of adverse effects; and
- propose measures for reducing or further mitigating significant residual effects.

Baseline

Outline

6.7.4 This section provides a summary of the baseline conditions for the VSU scheme site and areas proximal to the works. The full description of the archaeological and cultural heritage baseline is detailed in the scoping report (Annex A).

6.7.5 The VSU scheme does not lie in an Area of Special Archaeological Priority as designated by the CoW. The VSU scheme does not contain any Scheduled Ancient Monuments (SAMs). The VSU scheme itself does not lie in a Conservation Area but lies adjacent to the Westminster Cathedral Conservation Area.

6.7.6 An archaeological investigation has been previously undertaken within the VSU scheme limits. An archaeological and geo-archaeological evaluation by MoLAS in February 2006 (site code VSB06) showed that there was survival of historic archaeological deposits within the east of the VSU scheme site and alluvial clays and sands across the study area at depth probably dating from the mid-Holocene period onward. The location of boreholes investigated within the VSU scheme are illustrated on Figure 6.7(1). Archaeological investigations and find spots within a 500m search area of the VSU scheme are also shown on Figure 6.7(2). Full details of these are discussed in Annex A.

Geology and Topography

6.7.7 London occupies part of the Thames Basin which is formed of chalk with sands and clays. In the City, and in most of London, this later deposit is London Clay. Above the clay lie the fluvial deposits of the River Thames arranged in gravel terraces. The VSU scheme lies within the marshy floodplain of the River Tyburn and the eastern part of the site is crossed by a tributary of this river, known as the Tachbrook. The subsoil comprises deposits of alluvium over Kempton Park Gravels. Alluvium has the potential to preserve not only archaeological remains but also palaeo-environmental remains (evidence of former environments) such as wood, seeds and pollen, this information aids in the understanding of ancient habitats and landscapes. Modern street level over the VSU scheme lies at c 4m–5 mAOD (Above Ordnance Datum).

Prehistoric (480,000BC – AD 43)

6.7.8 During the prehistoric period the study area was wet and marshy as a result of fluvial transgressions and regressions. The transgression phases laid down clays and silts while the regressive phases laid down organic peats. Both silts and peats have been recorded at sites in the area dated to the Mesolithic/Neolithic and Bronze Age periods. The recent archaeological and geoarchaeological investigation at site VSB06 within the VSU scheme limits revealed alluvial clays and sands probably dating from the mid-Holocene period onward. Figure 6.7(1) shows the conjectured land surface of Westminster during the early Holocene period. This surface has been created from resources including analysis of MoLAS and BGS (British Geological Survey) boreholes to create a model of the past land surface at that date. As can be seen from the model the VSU scheme lies in a river valley, most probably that of the Tachbrook, a tributary of the Tyburn River. During the prehistoric periods there would have been many small channels surrounding higher areas forming sandy islands. Areas such as this would have been exploited by prehistoric people for food and building materials. Scattered prehistoric finds in the area have been recorded, including a Palaeolithic scraper in Piccadilly and a Neolithic axe in Francis Street. A Bronze Age palstave was found at Buckingham Palace Road and other prehistoric finds loosely located to 'Westminster' have been reported.

Roman (AD 43 – AD 410)

6.7.9 The history of the area immediately around the VSU scheme in the Roman period is not well known. An early crossing of the Thames at a ford between Lambeth and Westminster has been postulated and a Roman presence at Thorney Island, near Westminster Abbey, has been shown on a number of sites in the vicinity. However, the land to the west of Thorney Island formed part of an extensive marsh during the Roman period, probably including the site. A few stray Roman finds have been found locally including Roman coins found at Buckingham Gate c 500m to the north of the VSU scheme.

Saxon (AD 410 – 1066)

6.7.10 The history of the area immediately around the VSU scheme in the Saxon period is not well known. The main focus of the Early and Middle Saxon settlement was a busy trading port further to the east around Aldwych, the Strand and Covent Garden in an area known in the 8th century as Lundenwic. The Tyburn forms the boundary between the Westminster Abbey estate, gifted by Dunstan in c AD971, and the manor of Eia (later Eybury/Ebury). The majority of the VSU scheme lies within the latter. Greater London Scheduled Monument Register (GLSMR) entries for the vicinity of the VSU scheme are a bridge which is thought to have crossed the river to the north in the vicinity of Buckingham Palace and one of the main roads from Saxon *Lundenwic* referred to as *Akemannestraete.*

Medieval (AD 1066 – 1500)

6.7.11 The Doomsday Survey of 1086 records that the manor of Eia was held by one of William the Conqueror's principal lieutenants, Geoffrey de Mandeville. The VSU scheme site falls within the southern part of this manor. The description of the land in Doomsday provides an indication that the environment was pasture and water meadows which suggests that the area around the VSU scheme was generally uninhabited on marginal land in the medieval period.

Post-Medieval (AD 1500 – present)

6.7.12 Although there is little archaeological evidence from which to determine the nature of the site in the 16th century, 17th century mapping shows that it was undeveloped and set within open fields. Later mapping shows the eastern part of the VSU scheme was crossed by a large ditch or sewer, the King's Scholars' Pond Sewer, running roughly from north to south. An artificial channel may have been dug in the 17th century probably to drain marshland to the south, the sewer was constructed in the 18th century and was probably bricked over early in the 19th century. It is possible that this channel was constructed on the line of a much older ditch.

6.7.13 During the 17th Civil War the construction of major defences took place around London. The line of the defences has not been comprehensively established archaeologically, but it is a possibility that sections of the defences crossed near to or possibly on the VSU scheme. Fortifications are though to have been at the turnpike on Chelsea Road, now the south corner of Royal Mews and to the south-east in Tothill Fields. The conjectured defence line (ditches and banks) between these fortifications would pass through the VSU scheme.

6.7.14 The Stag Brewery, established in the 1640s in the north-east limits of the VSU scheme, was rebuilt in 1797–1807 but was closed in 1959 and subsequently demolished. In 1793 the Chelsea Waterworks Company was founded to the south. In order to create a reservoir for the use of the company some existing streams and creeks were enlarged to form the reservoir, located within the southern part of the VSU scheme. By 1859 the Grosvenor Basin had been largely infilled and the railway line from the River Thames to the new Victoria National Rail Station followed its route. In 1860, the Victoria National Rail Station opened for business.

6.7.15 The area to the east of Buckingham Palace Road remained relatively open, marshy low-lying ground which was used for pasture, osier beds and market gardens until the end of the 18th century when the land was reclaimed for large-scale residential development. Small terraced houses are shown on maps of this period to the south of Brewer Street (present day Allington Street) and gardens, a timber yard and Pimlico Wharf to the south. By 1827, the whole area surrounding the VSU scheme is shown to be built up. The

Metropolitan and District line, constructed in 1868 by cut and cover, runs through the site of the VSU scheme south of Victoria Street. New development continued throughout the 1920s and 1930s as the Victoria area expanded with housing and industry. The area suffered some minor blast damage during World War II. Damage occurred to some of the buildings that lined Victoria Street and minor blast damage occurred to the south of the Stag Brewery. The tunnelled Victoria line was constructed between 1968 and 1971 and runs from north to south on the eastern side of the site.

Summary of Archaeological Potential

6.7.16 The potential for survival of ancient ground surfaces (horizontal archaeological stratification) on the site of the VSU scheme is probably limited to areas under the existing roads, spaces behind buildings or within properties that have not been basemented. However alluvial deposits may well still survive below basements dependant on their depth.

6.7.17 Archaeological survival is likely to be extremely limited in some areas because of the amount of disturbance by the 'cut and cover' nature of the Underground railway system as well as modern building intrusion. However, there are many areas within the limits of the VSU scheme which are likely to be less truncated such as under roads and in yards/open areas, some of which have remained untouched throughout the progressive development of the site. Although modern roads and pavements will have services below their surface many of these do not penetrate to any great depth or are confined to relatively narrow subways and similar features. On the basis of existing evidence it is considered that there is:

- moderate potential for palaeoenvironmental remains on the site of the VSU scheme. The historic landscape model shown on Figure 6.7(1) demonstrates that the VSU scheme lies within the valley of the Tyburn with higher ground rising to the west. There is evidence for 'low spots' within the valley sequences suggesting that there was variation across the floodplain providing a variety of habitats and local conditions for exploitation by prehistoric hunters. The alluvium offers a high potential for palaeoenvironmental information as it may preserve organic material from plants and animals providing an indication of the ancient environment of Westminster;
- low potential for prehistoric remains on the site of the VSU scheme but any remains that are encountered may be of considerable significance given the potential for the survival of organic and palaeoenvironmental material;
- low potential for Roman remains on the site of the VSU scheme;
- low potential for Saxon remains on the site of the VSU scheme;
- low potential for medieval remains on the site of the VSU scheme; and

- high potential for post-medieval remains on the site of the VSU scheme. Ground reduction for the modern development will have removed some of any post-medieval horizontal stratigraphy, however features cut into contemporary ground surface such as the Civil War defences, the Kings Scholars' Pond Sewer, Chelsea Waterwork's reservoir, cellars, wall foundations, drains and pits may survive. The VSU scheme lies over a number of separate older properties dating from at least the 17th century including the Stag Brewery which underwent considerable development until its demolition in the 20th century.

Works Affecting the Baseline

6.7.18 The existing ticket halls, cut and cover tunnels, subways, modern basements, and services on site will have previously removed some archaeological remains. Some areas within the VSU scheme are basemented and some are not; the depths of basements across the site also vary. The Kings Scholars Pond Sewer and the D&C lines run through the site and the underground access from Victoria National Rail Station to the Victoria line Underground Station will have removed localised areas of archaeological material. Although the area has been previously developed, the VSU scheme could disturb potential archaeological remains that may survive on the site.

6.7.19 The potential impacts arising from the VSU scheme are outlined below and are illustrated on Figure 6.7(3):

- demolition of existing buildings prior to construction may partially remove potential archaeological remains;
- excavation for the cut and cover and piled box at the new NTH in Bressenden Place would completely remove potential archaeological remains within its footprint;
- excavation for the cut and cover and piled box for the new service area in Bressenden Place would completely remove potential archaeological remains within its footprint;
- excavation for the cut and cover and piled box at the extension of the STH in Wilton Road/Terminus Place would completely remove potential archaeological remains within its footprint;
- other works to the south of the south ticket hall to widen the staircases require piling and would completely or partially remove potential archaeological remains within the area affected;
- excavation for a fire fighting shaft west of Bressenden Place would completely remove potential archaeological remains within its footprint;
- excavation for the proposed temporary access shafts for tunnelling in Allington Street would completely remove potential archaeological remains within their footprints;

- excavation for a pump shaft in Vauxhall Bridge Road would completely remove potential archaeological remains within its footprint;
- excavation for a PRM lift shaft in Victoria Street would completely remove potential archaeological remains within its footprint;
- excavation for a crane base currently proposed to the west of north ticket hall box that requires piled foundations would partially or completely remove potential archaeological remains within its footprint;
- excavations for structures within construction compounds such as batching facilities and sumps would partially or completely remove potential archaeological remains within the areas affected;
- jet grouting in Allington Street, Wilton Road, Vauxhall Bridge Road and Victoria Street although not removing archaeological remains would have a major effect on archaeological remains as the information value of any archaeological features would be lost by consolidating the deposits to a degree which prevents future access and investigation. Any organic remains could also be affected by grouting depending upon the chemical composition of the material used. Closely spaced injection positions could lead to extensive near surface disturbance (Davis et al 2004); and
- service diversions and new service trenches are likely to partially or completely remove potential archaeological remains.

6.7.20 The above works will have an impact on archaeological remains across the VSU scheme particularly under the existing roads, spaces behind buildings or within properties that have not been basemented. Alluvial deposits may survive below basements or other development, dependant on their depth. Archaeological survival is likely to be extremely limited in some areas of the scheme such as ‘cut and cover’ areas of underground railway construction and modern building intrusions. As yet, the full extent of modern disturbance across the scheme site has not been established. There are areas within the limits of the VSU scheme which are likely to be less truncated, such as under roads and in open areas, some of which have remained as such throughout the progressive development of the study area and it is these areas that will be subject to the greatest impact from VSU works.

Mitigation and Residual Effects

Construction

6.7.21 The methodology for assessment is explained in detail in the scoping report (Annex A). The archaeology and cultural heritage assessment gave due regard to the combination of importance of the features and the magnitude of effect for the assessment of significance the application of which is also explained in detail in Annex A.

6.7.22 A summary of the assessment results has been provided in Table 8-1. The anticipated effects on archaeology will mostly arise during the temporary construction period and will be as a result of:

- demolition of existing structures;
- excavation and piling works;
- jet grouting; and
- service diversions.

6.7.23 No resources of high importance have been identified that might merit permanent *preservation in situ*. The impact of the scheme on buried archaeological resources will be mitigated by a suitable programme of archaeological investigation and where this is not possible a watching brief. This mitigation strategy would be undertaken prior to development and post-determination (as a planning condition attached to the planning permission) to achieve *preservation by record*. It is therefore anticipated that effects on the baseline (identified above) would not result in any significant residual effects within the footprints of the buildings/shafts etc.

6.7.24 However, grouting works that will take place outside these localised areas may remove the information value of potential archaeological features within the affected area by consolidating the deposits to a degree which prevents future access and investigation. Grouting can cause an impact because the organic remains can be affected by the chemical composition of the grout. The residual effect of grouting would be dependent on whether it occurs before or after geo-archaeological and archaeological evaluation takes place as an evaluation could not be implemented after grouting takes place.

6.7.25 Archaeological evaluation of material removed as auger arisings prior to grouting would be necessary to reduce the residual effects and to allow for evaluation of those areas delimited for grouting and other works within the areas of grouting.

6.7.26 It is therefore concluded that there will be no significant residual effects during construction.

Operation

6.7.27 The methodology for assessment is explained in detail in scoping report (Annex A). The archaeology and cultural heritage assessment gave due regard to the combination of importance of the features and the magnitude of effect for the assessment of significance the application of which is also explained in detail in Annex A. A summary of the assessment results has been provided in Table 8-2.

6.7.28 It is possible that the scheme will affect the water table within the site and vicinity of the VSU scheme. Although unlikely, any possible long-term effect

in relation to deterioration via drying out of archaeological remains including organic deposits in the vicinity of the VSU scheme is presently unquantifiable beyond the assumption that some deterioration may occur. As this can be addressed by the incorporation of recording deposits for future comparison it is concluded there are unlikely to be any significant residual effects arising from operation.

6.8 Demolition and Excavated Materials, and Waste

Introduction

6.8.1 This section provides an account of waste in terms of construction (including demolition) waste, and operational waste. It documents the potential effects that construction and permanent operation of the VSU scheme will have on the baseline and also outlines measures for mitigating these effects where possible.

6.8.2 The key objectives of the waste assessment are to:

- determine the baseline in terms of the waste arisings;
- identify the activities during construction which may have an effect on the baseline waste arisings;
- assess the significance of any effects of the scheme and outline the incorporated mitigation measures which where necessary, reduce the significance of adverse effects; and
- propose measures for reducing or further mitigating significant residual effects.

6.8.3 This section will concentrate upon the generation of waste (including its disposal, re-use or recycling) during the construction and operational phases of the VSU scheme.

6.8.4 This section of the ES has been structured with reference to these potential impacts and considers inert, non-hazardous and hazardous wastes for each phase of the development.

Baseline

Legislation Overview

6.8.5 In assessing the significance of the potential environmental effects a wide range of legislation that regulates the control and management of waste has been taken into consideration. The key legislation relevant to VSU scheme includes:

- Pollution Prevention and Control (PPC) (England and Wales) Regulations 2000;

- Environmental Protection Act 1990 (and subsequent Amendments to)
- Council Directive 75/442/EEC (Waste Framework Directive);
- Waste Strategy 2007 (Defra);
- The Waste Management (England and Wales) Regulations 2006; and
- Hazardous Waste (England and Wales) Regulations 2005.

6.8.6 Particular attention has been paid to the hierarchical waste management strategy outlined in the Waste Strategy 2007. The strategy outlines a hierarchy of options for waste management, starting with the most sustainable option (reduction) and ending with the least sustainable option (disposal):

- reduction;
- re-use;
- recovery (i.e. recycling, composting and energy recovery); and
- disposal.

6.8.7 Further detail regarding the waste hierarchy can be found in Paragraph 1.1.3 of Technical Appendix G.

6.8.8 Waste arisings from the VSU scheme will, where possible, be dealt with nearer the top end of the hierarchy i.e. reduction and reuse. Due consideration will also be given to The Mayor of London's Municipal Waste Strategy and The Mayor's Draft Business Waste Management Strategy.

6.8.9 Victoria Underground station is operational and therefore there are no figures on the quantities of construction waste to use a basis for assessment. The operational waste currently being generated at the station is thought to be of the same magnitude as the predicted waste stream under the proposed scheme. Therefore it is construction waste that will have greatest impact on the baseline.

Sensitive Receptors

6.8.10 The principal potential receptors that may experience effects from waste generation and handling would be occupants of residential and commercial properties in the vicinity. The assessment has also identified that the main impacts from waste management operations have been covered under other sections of this ES.

6.8.11 The potential impacts for occupants of residential and commercial properties from above ground effects of waste handling operations such as noise, dust and odour are likely to be mainly during the demolition/construction phase. However, the occupants of properties located within 200m of the development site have been classified as of high sensitivity and the effects of

moderate magnitude during the construction phase.

Works Affecting the Baseline

6.8.12 Waste activities have been carefully considered to determine the effects of the VSU scheme on the baseline. The impacts associated with excavated materials and other waste generation will be confined to the construction phase.

Construction and Demolition

6.8.13 The key activities that would affect the baseline include:

- demolition of buildings; and
- tunnel driving and shaft sinking.

6.8.14 There are several buildings that will need to be demolished to enable construction activities to proceed. The buildings to be demolished are as follows:

- 175 to 179, and 120 to 124 Victoria Street;
- 3 to 11 Bressenden Place;
- Elliot House;
- Subway and public lavatories under Bressenden Place;
- Roof structure for South Ticket Hall (STH);
- Cardinal Place basement structure (part);
- National Rail Basement (part); and
- Electricity Substation in Allington Street.

6.8.15 There are other properties where part of the building will be encroached upon and where partial demolition may be required. This is still the subject of further investigation and discussion with property owners.

6.8.16 The overall volume of excavated material from the tunnels and station boxes during the construction phase will be approximately 171,500m^3.

6.8.17 Construction and demolition wastes are discussed in greater detail in the VSU Scheme Demolition & Excavated Materials, and Wastes Management Plan (Technical Appendices Volume 3, Appendix G).

6.8.18 In addition to the waste generated from the excavations and demolition of the existing site, it can be expected that during the construction the following wastes will be generated:

- general construction waste including maintenance wastes from construction plant and equipment, inert construction materials, packaging materials and empty containers;
- sludge from drainage interceptors used to remove solids and oils and greases from wastewater and site run-off;
- sewage from portable toilets and office facilities; and
- commercial waste from site office, canteen and work facilities, such as food waste, paper, plastics, drinks containers, office consumables, etc.

Operational

6.8.19 Effects associated with the operational phase are considered negligible. The quantities produced under the upgrade scheme are predicted to be similar to those of the baseline.

Mitigation and Residual Effects

Construction

6.8.20 Waste management is a highly legislated and regulated practice. Mitigation measures to reduce the impacts from waste generation and handling include the use of an Environmental Management Strategy incorporating an Environmental Management and Monitoring Plan (EMMP) and a Site Waste Management Plan (SWMP) This will ensure that waste management procedures are put in place and that all legislation is followed and will minimise any environmental risk.

6.8.21 The VSU SWMP will:

- identify individual responsibilities for resource and wastes management;
- identify the types and quantities of waste that will be generated;
- identify resource management options for those wastes;
- identify procedures to ensure the use of appropriately licensed/registered waste management carriers and facilities; and
- incorporate a plan for monitoring and reporting on resource use and quantities of waste generated.

6.8.22 Responsibility for ensuring this is undertaken effectively will be assigned to competent personnel. Waste will be segregated and stored in secure, designated amenities, uplifted by appropriately certified waste contractors and disposed of to licensed waste management facilities. All regulatory waste paperwork will be completed and held on record which will assist in monitoring the types and quantities of waste generated.

6.8.23 The scope for re-use of materials will be fully explored and the use of

demolition materials on site for construction and landscaping purposes will significantly reduce the volume of waste requiring disposal. Opportunities for recycling steel, timber and clean hardcore will be explored, whilst contaminated materials will be removed from site for disposal to a licensed waste management facility.

6.8.24 The waste related effects are highest during the demolition/construction phase which is undertaken over a limited period of time. During construction, most of the waste will be generated within the immediate environs of the construction site.

6.8.25 The potential effects on all receptors from the disturbance and removal of possible contamination within the site during the demolition/construction phase are covered in the section on land contamination (Section 6.9).

6.8.26 With respect to potential receptors, there are occupants of properties in close proximity to the development site and as a result, they are likely to be affected by above-ground effects from waste handling such as noise, dust and odour that will be most prominent during the construction phase. Materials being delivered to site by road may cause minor disruption to the roadway network and local occupants. Nevertheless, any disruption to these occupants would be of limited duration as they will be at their greatest during the demolition and construction phases.

6.8.27 With the implementation of the EMMP and the SWMP, there will be no significant residual effects arising from the demolition and construction phase of the works.

Operation

6.8.28 During operation regular monitoring and reporting to the Environment Agency will provide a high level of control and early identification of potential impacts. This will include mitigation measures to minimise waste impacts during the design and use of construction and operational plant, both fixed and mobile. Environmental Management Strategy procedures will inform the process to be applied in managing waste generated to Best Available Techniques (BAT). Operational procedures will be developed to ensure that all waste is managed according to the Duty of Care requirements contained in the Environmental Protection Act 1990.

6.8.29 It is important that the generation and handling of waste materials from the construction and subsequent operation of the VSU scheme is managed and controlled through the following:

- implementation of the management plans and mitigation measures outlined in this section
- diligent compliance with legislation and 'Duty of Care'; and

- regular monitoring and reporting of waste issues.

6.8.30 The potential effects can be controlled and should not form a barrier to the construction, commissioning and operation of the station. Procedures shall be identified for adoption through the SWMP and the EMMP to ensure that the effects on the surrounding environment is minimised.

6.8.31 The significance of potential impacts is a function of the presence and *sensitivity* of receptors, and *magnitude* (duration, spatial extent, reversibility, likelihood and threshold) of the impact. However, many of the impacts will be covered in more detail under other sections of this ES. These include the dust generated during waste removal operations, odour from biodegradable wastes, the traffic impact from the removal of wastes from site and the noise associated with the handling of such materials.

6.8.32 The magnitude of impacts resulting from waste handling operations has also been considered within other sections of this ES.

6.8.33 There will be no resulting significant residual effects during operation.

6.9 Contaminated Land

Introduction

6.9.1 Contaminated land may be encountered where works involve breaking ground (e.g. through the construction of station boxes or emergency egress and ventilation shafts) or where ground undergoes significant disturbance (e.g. through major ground treatment or tunnelling) or is exposed (e.g. through demolition).

6.9.2 This section provides an account of the state of the land in terms of contamination levels and the potential effects of the temporary construction and permanent operation of the VSU scheme. It also outlines measures for avoiding or mitigating these effects where possible.

6.9.3 The key objectives of the assessment are to:

- determine the current site conditions and areas of potentially contaminated land;
- identify the activities during construction and operation which may lead to:
  - the mobilisation and migration of contaminated soil or groundwater through new pathways such as stations and shaft structures;
  - contamination of groundwater during station and tunnel construction and associated groundworks; and

  - health effects, particularly to construction workers working in close proximity to contaminated material.
- assess the significance of any effects of the scheme and outline the incorporated mitigation measures which where necessary, reduce the significance of adverse effects; and
- propose measures for reducing or further mitigating significant residual effects.

6.9.4 Issues relating to the transport covered in the traffic and transport section under construction traffic and disposal of potentially contaminated material is discussed in the Demolition & Excavated Materials and Waste Management Plan (Technical Appendix G).

Baseline

Current Site Conditions and Site History

6.9.5 The site is currently occupied by various buildings at ground level, including the Underground station to the south of the site, VPT to the northeast of the site, Terminus Place Buildings to the west and various other buildings and roads. The site gently slopes towards the River Thames to the south at around 4mAOD.

6.9.6 A summary of the key historical uses of the site and its surrounding area is provided in Table 6-10.

Table 6-10: Summary of Historic Land Use

Date	Notable Features
1640	Stag Brewery directly northeast of the site has been built
1959	Stag Brewery removed.
1723	Grosvenor Canal constructed
1813	Site no longer greenfield: north of site is terraced housing, south of site is allotments and a timber yard.
1817	Kings Scholar Pond Sewer (carrying flow of the River Tyburn) as an open drain flowing north to south across site. This later becomes culverted at around 1m below ground level (bgl)
1860s	Victoria National Rail Station now present in the south of the site. Grosvenor Canal Basin now infilled and built upon with Victoria National Rail Station.
1868	Circle and District line (originally named the Metropolitan Railway) installed beneath the site using cut and cover method. Installed to depths of 2.5m-4.0m bgl
1991	Construction of Western Deep Sewer (30m bgl)

6.9.7 The remainder of the site surroundings have been given over to housing or commercial development that has been demolished and redeveloped on a number of occasions over time.

Potential Sources of Contamination

On-Site Sources

6.9.8 The following potential sources of contamination have been identified from the desk study:

- made ground: (Source cut and cover spoil from the Circle and District line, Grosvenor Canal basin infilling): The made ground was noted to contain clinker and ash;
- Pyrite has been recorded within the London Clay;
- King's Scholars' Pond Sewer used as a storm drain. Stormwater has the potential to contain elevated concentrations of lead and oils generated from particulate emissions and spills from vehicles;
- timber yard – historically present on the southern section of the site. Contaminants commonly associated with this type of operations include several forms of hydrocarbons: coal tar, volatile organic hydrocarbons and speciated polycyclic aromatic hydrocarbons. Heavy metals could also be used within timber treatment preparations; and
- electrical substations located: directly east of the District line station, north of the VPT and in the southeast of the site (Within the basement of Network Rail premises). Electrical substations contain oils and polychlorinated biphenyls (PCBs).

6.9.9 These potential areas of contamination are shown on Figure 6.9(1).

Off-Site Sources

6.9.10 Potentially contaminating activities located up gradient of the site include:

- the Stag Brewery, located directly east/northeast (up-hydraulic gradient) of the site which was operational until 1959 before it was demolished in 1963 to become an office site. Associated contamination is likely to include gas oil (for heating purposes) and small quantities of oils associated with maintenance and the operation of machinery; and
- made ground generated from the removal of buildings within the site surroundings could give rise to heavy metals and potentially asbestos.

Site Geology and Hydrogeology

6.9.11 The published geological mapping (BGS Sheet 270 for South London, 1:50,000, drift and solid, dated 1981) indicates that the site is underlain by

made ground, followed by a drift of alluvium overlying a solid geology of London Clay.

6.9.12 Norwest Holst Ltd has undertaken a ground investigation of the site (for both contamination and geotechnical purposes), as detailed within a factual report released in draft form in April 2006[15]. This investigation undertaken between 23rd January and 8th March 2006, comprised seven boreholes drilled to depths between 11 and 30m bgl, four of which were extended to 40m bgl.

6.9.13 The locations of the boreholes are shown in Technical Appendix H - Contaminated Land.

6.9.14 The following sequence of strata was encountered during the ground investigation undertaken on site:

- Made Ground: identified beneath the concrete and other hardstanding to depths of between 2.2 and 4.7m in thickness comprising a matrix of either sandy Gravel or gravelly silty Sand followed by sandy gravely Clay. The inclusion of clinker, ash, brick and metal was recorded throughout the made ground matrices;
- Alluvium/Peat: recorded between 2.6 and 4.7m in thickness the Alluvium encountered on site generally comprised slightly sandy clay, although in the north of the site, the Alluvium was mottled clay with an organic odour and in the north-east of the site, the alluvium encountered was wholly comprised of fibrous peat. Occasional sand and organic rich pockets were noted in the alluvium encountered to the southeast of the site;
- River Terrace Gravels: Medium-dense sandy gravel was encountered in all the boreholes with recorded thickness of between 4.8 and 6.6m. On rare occasions, the River Terrace Gravels were recorded as either very dense or loose; and
- London Clay: The interface of the London Clay with the River Terrace Gravels was recorded as comprising stiff, slightly sandy Clay becoming stiff to very stiff thinly laminated fissured clay with occasional burrows of off-white silt with depth. Pyrite nodules were noted at various intervals within all boreholes. London Clay was encountered to the base of each excavation.

6.9.15 A shallow groundwater table is located within the River Terrace Gravels above the London Clay at approximately 4.1m - 9.6m bgl. It is considered that groundwater would naturally flow to the south, towards the River Thames.

6.9.16 The River Terrace Gravels located beneath the Made Ground and Alluvium on site are classified as a minor aquifer with associated soils of a ‘U’ (high

[15] Report on Ground Investigation for Victoria Station Upgrade' Norwest Holst, Report Reference SCC/JW/F14264, August 2006.

permeability) classification. The U classification is often given in urban areas where it has only been possible to gather limited data. The Thanet Sands and Upper Chalk lying beneath the London Clay are classified as a major aquifer. The London Clay formation, with an estimated minimum thickness of 40m bgl is of negligible permeability and is considered an aquiclude.

Chemical Testing Undertaken

6.9.17 During the Norwest Holst Investigation (2006) soil samples were collected from the made ground within all boreholes and selected samples were additionally obtained within the various types of natural strata present on site (including alluvium, river terrace gravels and London Clay). These samples were tested for the following suite of chemical contaminants:

- heavy metals: arsenic, boron, cadmium, copper, chromium, lead, mercury, nickel, selenium and zinc;
- speciated polycyclic aromatic hydrocarbons (PAH) (US EPA 16 speciations);
- speciated total petroleum hydrocarbons (TPH);
- speciated poly chlorinated biphenyls (PCBs) (undertaken only within the vicinity of the electrical substations);
- pH;
- ammonia;
- sulphate as SO4 (2:1 water extract); and
- loss on ignition.

6.9.18 Chemical testing of groundwater was undertaken within four boreholes (BH05/1, BH05/3, BH05/4 and BH05/7) for parameters as specified above (minus any soil-specific analysis). During the soil sampling, chemical testing was undertaken to determine the leachability of nitrate, magnesium and chloride.

Chemical Test Results for Soils on Site

6.9.19 Only lead was detected at an elevated concentration. Made ground in BH05/5 located in the east of the site and BH5/01 directly to the north west of the site contained lead concentrations which exceeded the Contaminated Land Exposure Assessment Soil Guideline Value (CLEA SGV) of 750mg/kg. The maximum concentration detected was 1832.5mg/kg.

Chemical Test Results for Groundwater

6.9.20 Elevated concentrations of chloride and nitrate were identified in leachate samples obtained from made ground when compared to the Surface Water Abstraction Directive (SWAD).

6.9.21 Elevated concentrations of sulphate were identified in leachate samples obtained from made ground and natural strata when compared to SWAD.

Gas Monitoring

6.9.22 The natural decomposition of peat has the potential to generate gases including carbon dioxide (CO_2), carbon monoxide (CO), hydrogen sulphide (H_2S) and methane (CH_4), which can subsequently build up in the ground.

6.9.23 Eleven gas monitoring visits were undertaken over a period of one month (between 22/02/06 to 22/03/06) in borehole BH05/04 and six gas monitoring visits were undertaken between a three week period (03/03/06 and 22/03/06) in BH05/06. All gas visits entailed monitoring of gases including CO_2, CO, H_2S and CH_4, plus monitoring the depletion of oxygen (O_2), atmospheric pressure and flow (l/hr).

6.9.24 Gas concentrations recorded were up to 7.6% CO_2 in BH05/04, and 5.6% in BH05/06. No in-ground concentrations of either CH_4 or H_2S gases were recorded during either investigation.

Works Affecting the Baseline

6.9.25 There is a potential for excavation works to uncover previously unknown contaminated material. These works include excavation for the NTH, STH, fire fighting shaft, access shaft, pump shaft lift shafts etc. During excavation and the main construction works there would be the potential for construction workers through inhalation, ingestion and dermal contact with contaminated soils, and through the volatilisation of contaminants and/or land gases in the absence of mitigation measures.

6.9.26 During the operation phase, in the absence of mitigation measures there could be health effects on future site users from the presence of in ground gases.

Mitigation and Residual Effects

Construction

6.9.27 The methodology for assessment is explained in detail in the scoping report (Annex A). The contaminated land assessment gave due regard to the combination of magnitude and sensitivity of the receptor for the assessment of significance of the effects. The assessment took account of a considerable body of guidance produced by both local authorities and practitioners in conjunction with professional judgement. The determination of significance is also explained in detail in Annex A.

6.9.28 Effects were classified under demolition and excavation. Demolition and excavation both carry a risk to personnel from potentially contaminated soils.

This will be mitigated using measures within the CoCP and Health Service Guidelines (HSG). Excavation can also result in a risk from ingress of land gases.

6.9.29 Disposal of excavated soils can also present contamination risks. Given the site constraints there will be limited opportunities to reuse any of the soil arisings generated from the development on site. All made ground excavated from the proposed development will therefore be disposed of at a suitable licensed landfill facility (chemical test results currently indicate that it will be suitable for a non- hazardous landfill facility).

6.9.30 Providing the incorporated mitigation measures identified above arising from contaminated land are implemented, it is considered that there will not be any significant residual effects during construction. A summary of the assessment process has been provided in Table 8-1.

Operation

6.9.31 Gas protective measures will be undertaken in the proposed ticket halls including ventilation within confined spaces, well constructed ground slab and passive and active venting.

6.9.32 No significant residual potential effects have been identified when the scheme is in operation. A summary of the assessment process has been provided in Table 8-2.

6.10 Water Resources

Introduction

6.10.1 This section provides an account of hydrology and hydrogeology in terms of flood risk and quality. It documents the potential effects that construction and permanent operation of the VSU scheme will have on the baseline and also outlines measures for avoiding or mitigating these impacts where possible.

6.10.2 The key objectives of the assessment are to:

- establish the baseline in terms of the presence and importance of groundwater and surface water features.;
- identify the activities during construction and operation which may lead to the deterioration of the features identified in the baseline;
- assess the significance of any impacts of the scheme and outline the incorporated mitigation measures which are necessary to reduce the significance of adverse effects; and
- propose measures for reducing or further mitigating significant residual effects.

6.10.3 To supplement this Environmental Statement, an assessment of flood risk has been prepared in accordance with Planning Policy Statement 25 (PPS25) and associated Environment Agency guidance and the findings of this assessment are presented in this report.

Baseline

6.10.4 The lowest existing ground levels at the LLAU are at the subway entrances and are between 104.2 and 104.8 mATD.

6.10.5 The area lies within the defended floodplain of the River Thames. Control of flooding is achieved through closure of the Thames Barrier to cut off tidal inflows under surge conditions and flood walls along the river banks to contain the residual risk from fluvial floods (a floodplain map is provided as Figure 6.10(1)). The Thames flood defence walls in the vicinity of the LLAU are designed with a crest level of 105.41 mATD and, in conjunction with the Barrier, are intended to provide protection against the 1:100 year fluvial flood with a 1:1000 year tidal surge.

6.10.6 Data available from the Environment Agency shows that if the Thames Barrier failed to close then a peak water level of 105.2 mATD could be attained in the reach of the river closest to the VSU scheme. If a limited breach or overtopping of the flood defences occurred under these flood conditions some attenuation of peak water levels would occur due to storage effects since the LLAU is at least 900m away from the river. In the absence of any model studies to calculate the attenuation a nominal reduction of 0.10m from the peak river water level has been agreed with the Environment Agency giving the baseline flood level as 105.1 mATD.

6.10.7 Surface water runoff from rain falling on the LLAU drains to the Thames Water combined sewer system. Existing surfaces over the LLAU are effectively 100% impermeable being made up of roofs and areas of hardstanding.

6.10.8 There are no ordinary watercourses, main rivers or surface water abstraction licences within 500 m of the LLAU. The LLAU is crossed by the line of the Tyburn River which is one of London's 'Lost Rivers' having been fully culverted with the construction of the brick lined King's Scholars' Pond Sewer (KSPS) in the late 18th century (it was converted to a closed sewer in the 1840s; a cast iron crossing section was included later when the D&C line was built). Connections to the combined sewer system followed in the 19th century and another deep tunnel connection, the Western Deep Sewer, was built in 1991. Thames Water Utilities Ltd (TWUL) manages the sewer system.

6.10.9 The only surface water feature within 500m of the LLAU is a lake in the grounds of Buckingham Palace. This is 420m to the northwest and has a surface water level higher than the ground within the LLAU. There is no possibility of runoff from the LLAU flowing into the lake.

6.10.10 The ground investigation undertaken by Norwest Holst Ltd as described in Paragraph 6.9.12 (Contaminated Land) reports the geological succession shown in Table 6-11.

Table 6-11: Geological Succession of the Site

	Top Elevation (mATD)		Base Elevation (mATD)		Thickness (m)	
	Min	Max	Min	Max	Min	Max
Made Ground	103.5	104.9	99.2	102.5	2.2	4.7
Alluvium	99.2	102.5	98	100	0.7	2.6 to 3.6
River Terrace Deposits	98	100	92.6	93.7	4.8	6.6
London Clay Formation	92.6	93.7	50.8	48.5	42	45.6

6.10.11 Recent borehole data from Wilton Road proved a 13m thickness of Lambeth Group, 2m of Upnor Formation and 11m of Thanet Sand below the London Clay. The top of the Chalk is thus expected to be below 25 mATD. The water level in the Chalk is around 45 metres bgl (60 mATD).

6.10.12 Potable groundwater exists within the deep aquifer below the LLAU. This comprises the Chalk, Thanet Sands and sand facies at the base of the Lambeth Group. This aquifer has been scoped out since there is a residual thickness of 11 m of London Clay and all of the clay facies of the Lambeth Group between the deep aquifer and the toe depth of the deepest piles. These clay strata restrict downward seepage within the LLAU. Potentially, there are breaks in the continuity of the clay layers in the area where water wells have been constructed in the Chalk. However, recently constructed cooling boreholes are fully grouted and cased through the overlying strata. The location, construction and status of older boreholes, especially those associated with the 17th and 18th century breweries in the area, are less well documented. Natural geological pathways through the London Clay are considered unlikely.

6.10.13 Non potable groundwater exists in all strata above the Thanet Sands but only the Terrace Gravels have sufficient permeability to be considered as a minor aquifer (NRA, 1994[16]). Limited groundwater quality data exists from previous site investigations. The following receptors may abstract shallow groundwater for non-potable purposes within a radius of 500m of the LLAU:

[16] National Rivers Authority (NRA), 1994. Policy and Practice for the Protection of Groundwater. Groundwater Vulnerability of West London. Sheet 39. Cranfield University, Silsoe.

- 2 Nr abstraction licences (39/0116 at Stag Place 125m to the north east and 39/0196c in Buckingham Palace Gardens 320 m to the north (data provided previously to LU));
- basement drainage sumps including the VPT (this site was visited in June 2007 and the rest water level was estimated to be around 100 mATD, i.e. perched above the shallow aquifer) and the Apollo Theatre (this site was visited in October 2007 and an average pumped outflow of 2.7 l/s was measured);
- track drainage along the District and Circle (D&C) line (invert level round 96 mATD, (CIRIA 12917)). The D&C walls may key into the London Clay locally and form a cut off where the line has been lowered to pass under the KSPS. The track drains in the adjacent sections then intercept the natural flow plus any additional flows that may occur around the KSPS if its construction has led to a zone of enhanced permeability; and
- any leakage into the KSPS (invert level around 101.6 mATD; it crosses over the D&C line) would come from groundwater perched above the Terrace Gravels.

6.10.14 The piezometry of the shallow aquifer within the LLAU is dominated by the flows into the D&C line. Total drainage pumping at Victoria is one of the largest on the LU system and the majority of this originates from the D&C line. Data provided to MM by LU shows that outflows to the back drainage sump averaged around 60 l/s in early 2007. Ground investigations report that water levels of 95.8 to 96.6mATD have been measured between 1996 and 2006.

6.10.15 Further information on piezometry and groundwater quality will be added to the groundwater baseline through the planned geotechnical investigations.

Works Affecting the Baseline

6.10.16 Work activities described in Section 2 have been carefully considered to determine the effects of the upgrade scheme on the baseline water resource features in the area. It is anticipated that effects on water resources will be confined to the construction phase and will be as a result of the large-scale underground tunnelling and grouting activities.

Mitigation and Residual Effects

Construction

6.10.17 The methodology for assessment is explained in detail in the scoping report Annex A. The assessment of significant effects of the construction phase on water resources gave due regard to the combination of importance of

[17] CIRIA REPORT 129, A Study of the Impact of Urbanisation on the Thames Gravels Aquifer. 1993.

attribute and scale of potential effect, the application of which is also explained in detail in Annex A. Table 8-1 presents a summary of the assessment results. It shows the impact, effect, incorporated mitigation and remaining significant residual effects.

6.10.18 The assessment classified the impacts of flooding, dewatering, site and ground works. Flooding presents a potential risk to subsurface works. This will be included in the risk register and appropriate design measures will be included to minimise risk and manage the situation should it occur. There is also a risk of the Thames Flood defences failing (however, this is regarded as a risk generic to all local construction projects). Emergency procedures will include the risk of flooding from either catastrophic failure of existing defences or inundation of groundwater. Dewatering may result in localised short term reduction in water levels and groundwater flows but this is not considered significant.

6.10.19 Other potential effects may be caused by contaminated surface runoff and groundwater contamination (especially from loss of grout during pre-treatment of gravels). These effects will be mitigated through the implementation of the CoCP and monitoring of grout operations and impacts during drainage works.

6.10.20 There will be no resulting significant residual effects arising from the operation of VSU.

Operation

6.10.21 The methodology for assessment is explained in detail in Annex A. The assessment of significant effects of the operational phase on water resources gave due regard to the combination of importance of attribute and scale of potential effect, the application of which, is also explained in detail in Annex A. Table 8-2 presents a summary of the assessment process. It shows the impact, effect, incorporated mitigation and remaining significant residual effects. During scheme operation there is a risk of flooding caused by station entry levels located below the Thames flood level. As above, the risk of the Thames Flood defences failing is regarded as a risk generic to all local construction projects. Emergency procedures will include the risk of flooding from either catastrophic failure of existing defences or inundation of groundwater.

6.10.22 Flooding may also be caused by grout curtains and tunnels acting as groundwater cut-off causing changes in groundwater flows and levels. This will be mitigated through the monitoring of groundwater levels and drainage flows. Counter measures may also be taken such as the installation of additional drainage if required.

6.10.23 There will be no significant residual effects.

6.11 Ecology

Introduction

6.11.1 This section describes the ecological features and the potential effects on habitats, and protected and notable species of flora and fauna due to the construction and operation of the VSU scheme. The effect on sites designated for their nature conservation value within and immediately surrounding the VSU scheme are also considered. As previously stated and explained within Section 1.6.2, a technical appendix for this topic has not been prepared.

6.11.2 The key objectives of the assessment are to:

- establish the baseline in terms of the presence and importance of ecological features and the potential presence of protected species;
- identify the activities during construction and operation which may lead to adverse effects on any ecological features identified in the baseline;
- assess the significance of any effects of the scheme and outline the incorporated mitigation measures which where necessary, reducing the significance of adverse effects; and
- propose measures for reducing or further mitigating significant residual effects and enhancing the ecology following scheme completion.

Baseline

6.11.3 Construction and operation of a development can have effects on ecological features beyond the confines of the site itself. Following recommended guidance from the Institute of Ecology and Environmental Management (IEEM, 2006) all ecological features should be investigated which occur within the zone of influence (ZoI), which arises during the whole lifespan of the proposed development. The potential zone of influence is defined as:

- areas directly within the land take for the proposed development and access;
- areas which will be temporarily affected during construction;
- areas likely to be affected by hydrological disruption; and
- areas where there is a risk of pollution and noise disturbance during construction and/or operation.

6.11.4 The ZoI for the development covered in this assessment is a maximum of 2ha, this includes direct land take of less than 1hectare (ha) at Bressenden Place.

6.11.5 The ecological features which have been recorded within and adjacent to the zone of influence for the VSU scheme are described below and their

conservation value summarised in Table 6-12.

Designated Sites

6.11.6 There are no statutory sites designated for nature conservation within 2km of the VSU scheme. There are four non-statutory designated sites (Site of Importance for Nature Conservation, SINCs) within 2km of the VSU scheme (as illustrated on Figure 6.11(1)), these being:

- St James's Park, Green Park and Buckingham Palace Gardens which are Sites of Metropolitan Importance for Nature Conservation. This SINC is approximately 450m north of the VSU scheme and is designated for its local importance in supporting a diversity of bird species and notable plant species;
- Eccleston Square and Warwick Square are Sites of Borough Importance (Grade 1) for Nature Conservation. This SINC is approximately 600m south of the VSU site and is designated for its wildlife-friendly gardening and bird diversity;
- Belgrave Square is a Site of Borough Importance (Grade 2) for Nature Conservation. This site is approximately 1.2km north-west of the VSU scheme and is designated as one of the best open spaces for birds in central London; and
- St George's Square Gardens Site of Local Importance for Nature Conservation. This site is approximately 2km south of the VSU scheme and is designated for its large trees and good floristic diversity.

6.11.7 None of these designated sites lie within the ZoI of the VSU scheme and are therefore not regarded as being relevant to this assessment. They would not be affected by the VSU scheme.

Habitats

6.11.8 A site visit of the area was undertaken by an ecologist in April 2007. During the site visit the only natural vegetation observed was a series of urban trees along Wilton Road and Bressenden Place.

6.11.9 Previous work undertaken identified that five trees would be removed to facilitate the construction of the VSU scheme. These trees were surveyed to determine their ecological value. Four of the trees are London plane (*Platanus x hispanica*) and one is an Italian alder (*Alnus cordata*). Three other London plane trees were also observed on the north-eastern corner of Bressenden Place. These trees have not been previously highlighted for removal but, given their proximity to the ZoI these trees are included in this assessment. None of the trees observed presented habitat suitable for bats or nesting birds and the ecological value of the trees has been assessed as low. No brown-field vegetation or similar habitats occur within the ZoI of the

VSU scheme. Updated survey work has confirmed that only three London Plane trees will now be required to be removed along Bressenden Place.

Protected and Notable Species

6.11.10 Owing to the urban nature of the VSU scheme site and the surrounding areas there are limited natural habitats available to support protected species. Buildings are largely inhospitable for the majority of wildlife, however built structures may provide suitable roost sites for bats and nesting birds.

Bats

6.11.11 All species of bat are fully protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and Schedule 2 of the Conservation (Natural Habitats & c.) Regulations 1994. This level of protection includes their roosts and hibernacula. No bats have been observed within the ZoI of the VSU scheme. Biological records, however, have identified the presence of two pipistrelle species of bat (*Pipistrellus pipistrellus* 45 kHz and *Pipistrellus pipistrellus* 55 kHz) within 300 to 400m of the VSU scheme (this includes a known pipistrelle 45 kHz roost).

6.11.12 It is therefore likely that pipistrelle bats are foraging within the areas around the VSU scheme although it is deemed extremely unlikely that the bats would be affected by the scheme.

Birds

6.11.13 No bird species (other than domestic pigeons) were observed to be nesting within any of the structures on site during the site visit. However, biological records have recorded song thrush (*Turdus philomelos*), starling (*Sturnus vulgaris*) and house sparrow (*Passer domesticus*) within 100 to 200m of the VSU scheme. Starling and house sparrow are abundant in the area and highly likely to be breeding within the ZoI, and both species are Local Biodiversity Action Plan (LBAP) priority species for London. The song thrush is unlikely to be breeding in the area and is probably a record from a nearby park or garden.

6.11.14 Vertical structures have potential to provide suitable nesting sites for black redstart (*Phoenicurus ochrurrs*). Black redstarts are a fully protected priority species under the Wildlife and Countryside Act 1981 (as amended) with Schedule 1 status. However, black redstarts have not been recorded within 2km of the VSU scheme and therefore highly unlikely to be affected by the VSU scheme.

6.11.15 The bats and two of the bird species described above and listed in Table 6-12 could be affected by the VSU scheme, and are therefore deemed as valued ecological resources which occur within the zone of influence.

Table 6-12: Valued Ecological Resource within Zone of Influence			
Ecological Features	**Conservation Value**	**Evaluation Criteria – Legal Protection**	**Evaluation Criteria – Biodiversity Value**
Habitats			
London plane trees *Platanus x hispanica*	Negligible	-	Potential for breeding birds
Italian alder *Alnus cordata*	Negligible	-	Potential for breeding birds
Protected and Notable Species			
Breeding birds	-	All breeding birds protected under the EC Birds Directive and the W&CA (1981).	-
House sparrow *Passer domesticus*	Medium	-	London BAP priority species.
Starling *Sturnus vulgaris*	Medium	-	London BAP priority species.
Pipistrelle *Pipistrellus pipistrellus* 45kHz	High	Full protection under Wildlife & Countryside Act (1981), the EC Habitats Directive (1979) and the Conservation Regs (1994).	UK & London BAP priority species.
Pipistrelle *Pipistrellus pipistrellus* 55kHz	High	Full protection under Wildlife & Countryside Act (1981), the EC Habitats Directive (1979) and the Conservation Regs (1994).	UK & London BAP priority species.

Work Activities Affecting the Baseline

Construction

6.11.16 It is considered that the key activities that would affect the ecological baseline within the zone of influence would be attributable to the construction process. This would include the following:

- demolition of buildings on site;
- noise and vibration effects felt during piling and tunnelling activities;
- removal of three London Plane trees; and
- dust raising activities such as demolition and earthworks.

6.11.17 The potential impacts, effects and incorporated mitigation measures are presented within Table 8-1 together with enhancement measures for the area. The potential adverse effects that will occur as a result of that activities mentioned above include:

- Loss during construction of three London Plane trees which are of negligible conservation value (as illustrated on Figure 6.11(2));
- Loss of potential bird nesting habitat within the structures of the buildings to be demolished (as illustrated on Figure 6.11(2));
- Loss of potential bat roosting habitat within the structures of the buildings to be demolished;
- Disturbance during construction from noise and dust effects to breeding birds, including notable bird species, which could be breeding on or adjacent to the buildings being demolished; and
- Disturbance during construction to pipestrelle bats which could be foraging in the area.

Operational

6.11.18 The effect of the operational VSU scheme on the ecological baseline within the zone of influence is regarded as negligible as the operation of the scheme would not create any effects over and above those already experienced within this urbanised environment.

Mitigation and Residual Effects

Construction

6.11.19 Measures that have been incorporated into the VSU scheme to reduce the significance of the effects identified include:

- demolition and tree removal works to be undertaken outside the bird breeding season;
- where the above may not be possible, bird nest survey prior to any works commencing on site will be undertaken;
- bat roost survey will be undertaken of all structures to assess any requirements for licensing under the Wildlife & Countryside Act 1981, as amended; and
- measures provided to minimise dust and noise & vibration effects presented within the Air Quality (Section 6.4) and Noise & Vibration (Section 6.3) sections of the ES and as part of the VSU scheme CoCP.

6.11.20 The construction process, demolition of buildings and loss of tress within the ZoI could have a negligible to slight negative residual effect, but not significant, effect within the ZoI.

6.11.21 The design of the VSU will include as a minimum the replacement of the three trees which will be removed as part of the works. The potential for further tree planting will be investigated to promote ecological enhancement and allow for potential failure of newly planted trees.

Operation

6.11.22 The assessment concludes that there are unlikely to be any significant residual effects arising from operational processes of the completed scheme.

6.12 Socio - Economics

Introduction

6.12.1 This section of the ES summarises the impacts and resulting effects on socio-economic resources and receptors. It is supported by the detailed assessment found in Technical Appendix J, Volume 3. The key objectives of the assessment are to:

- outline baseline conditions in terms of the demographics of the area and how the area functions to support both society and businesses. It also outlines the presence of sensitive socio-economic receptors;
- identify the activities during construction that will affect sensitive receptors, particularly those businesses which are directly affected by the scheme;
- assess the significance of any effects of the scheme and outline the incorporated mitigation measures which where necessary, reducing the significance of adverse effects; and
- propose measures for reducing or further mitigating significant residual effects.

Baseline

Age Structure

6.12.2 There are five wards in the Victoria Station area: St. Vincent's Sqaure, Warwick, St. James's; Tachbrook and Knightsbridge and Belgravia. Census data from 2001 identifies the total population as 42,709. Table 6-13 indicates the split by age ranges and compares the borough, city and country average. The five wards have a considerably lower proportion of children compared to the city and country average although the reverse is the case for the age 26 – 35 age group.

6.12.3 The composition of the work force in the five wards is younger than the national and London average. Almost 60% are aged between 20 – 39 contrasting with 55% for the London average and 50% for the England average.

Table 6-13: Age Profile of Residents in Assessment Area				
Age Range	**% of Residents in Range**	**Westminster Average**	**London Average**	**England Average**
<16 years	11.3%	13.5%	20.2%	20.2%
16<25	15.8%	15.8%	13.9%	12.1%
26<35	22.7%	24.5%	19.4%	14.8%
36<45	15.1%	14.7%	15.3%	14.6%
46<55	12.7%	11.4%	11.3%	13.1%
56<65	10.2%	8.7%	8.2%	10.3%
>65	12.3%	11.6%	11.7%	15.0%
Total	**42,709**	**181,623**	**7,171,054**	**49,130,783**

Source: Census 2001 data

Ethnicity

6.12.4 The five wards have a greater ethnic mix than the average for England. However, this is not as mixed as the Westminster borough or the London average. The proportions of Asian or Asian British; Black or Black British and Chinese or other Ethnic Group are all approximately half the London average and one third lower than the borough average.

Employment, Labour Force and Skills Base

6.12.5 The National Employers Skills Survey 2004 shows that employers in London are less likely than average to be experiencing hard-to-fill vacancies or any skill shortage vacancies. While London accounts for 18% of total employment in England, only 11% of all skill shortage vacancies were found in the capital. The percentage of economically active residents in the five wards of the study area is 64%, slightly lower than the Westminster, London and England average.

Land Use

6.12.6 In Westminster and the area around the Victoria Station Complex, land is primarily used for business and commercial purposes including various central and local government offices, as well as residential dwellings.

6.12.7 Westminster contains 16,207 office and 8,526 retail premises constituting 8.4 million sq. m of office accommodation and 2.2 million sq. m of retail accommodation. Business Rates collected by the CoW is the way that those who occupy non-domestic property contribute towards the cost of local services. The value of the property may alter if the circumstances of the property have changed. The last valuation came into effect in 2005 and the next will do so in 2010. Commercial property is discussed in more detail

below.

Westminster Business Environment

6.12.8 The CoW makes an important contribution to the nation's wealth and prosperity. It has more businesses than any other local authority and 570,000 people are employed within its boundaries (14 % of London's total). Job density (the number of filled jobs in an area divided by the number of people of working age resident in that area) for 2003, was the highest of five levels at 0.94 and over.

6.12.9 The 2003 Westminster Business City Survey interviewed 500 representative businesses and the overriding perception was that the convenience and central location of Westminster was its main benefit. Westminster is considered convenient for transport, accessing central London, and being close to tourists, clients and other businesses. In particular, 76 % of service sector businesses felt that being close to public transport and the centre of London was a benefit.

6.12.10 TfL 2004 statistics back up this business perception. The statistics indicate that during the three-hour morning peak 34,000 people enter Victoria, London's busiest Underground station, that on average 150,000 people an hour enter the Underground system and Victoria Underground station has 80 million passengers per year.

Local Business Profile

6.12.11 The local economy around Victoria Station Complex is not dependent on either the regional or national economies but rather is a large contributor to, and driver of, those wider economies. The types of businesses in close proximity to the station are given below:

- retail;
- business services;
- tourism/entertainment; and
- food/alcohol.

Public Transport Use

6.12.12 Ward level data shows that of the residents who are local to the area around the Victoria Station Complex, over 45% of all residents (who work away from home) use public transport as their main mode of travel to work. Additionally, approximately 50-60 % of residents do not own a car. The Westminster Economic Development Strategy (2005, p.16) states that:

"In comparison to London as a whole, workers in Westminster are far more reliant on public transport as their mode of travel to work".

6.12.13 Residents in the five wards travel considerably further to work, on average, compared to the London and England average. The proportion working less than 5km from home is far smaller than even the rest of the borough. This could suggest high usage of public transport within Victoria and more specifically Victoria Underground Station.

6.12.14 Pedestrian flow data supplied by Intelligent Space Partnership (and used in the traffic and transport Section (6.2)) shows that the majority of pedestrian movements are north-east from the station in the morning and the reverse in the evening. However, there are also substantial pedestrian movements to the station from all directions in the morning and from the station to surrounding streets in the evening. This could suggest that, although small in comparison to commuters, there is still a reasonable flow of residents that use the station.

Works Affecting the Baseline

6.12.15 All work taking place on the VSU scheme will have some impact on the socio-economic baseline as it will have an effect on the economic vitality of the whole area. For example, construction activity may deter visitors to the area. However, the following works have been identified as they will affect specific parts of the baseline:

- demolition of buildings as identified in the baseline;
- construction of extension to Sussex Stairs;
- work on creation of North Ticket Hall;
- jet grouting in Allington Street and construction of tunnels; and
- construction of Cardinal Place Stairs.

Mitigation and Residual Effects

Construction

6.12.16 A total of approximately 305 jobs will be lost through demolition of existing premises (empty buildings were not included). A further 25 jobs will be lost from stalls on ‘the Beach’ area. This totals 330 direct jobs lost. Using a multiplier of 1.5 to account for indirect jobs lost this brings the total to 495. This is not considered significant as the main sources of employment will be office based and it is considered that there will be a range of job opportunities elsewhere within Westminster. Additionally, employers affected by demolition may be able to relocate to alternative premises in the area. This is supported by the findings of the Health Impact Assessment (HIA) which consider that this loss in the context of the Victoria economy, which is a thriving office, retail and leisure economy totalling over 500,000 jobs. This figure appears negligible when seen as a percentage of local employment (less than 0.001%).

6.12.17 There will be a total of 195 jobs created (full time equivalent) over the six year construction period. This will be beneficial to the local area. There will be also induced and indirect employment benefits. Indirect benefits are created through expenditure on supplies and services and indirect benefits through spending of those employed. Multipliers are a standard concept used to calculate these benefits. Based on a 1.5 multiplier (adopted by the Crossrail ES) there will be a further 97 jobs created. (Further detail on the calculations of jobs losses during the construction period is provided in Technical Appendices Volume 4, Appendix J).

6.12.18 There may be a number of businesses that could experience disruption during the construction period that are located beyond the LLAU. Whilst the extent of this disruption and the knock-on impact to these businesses is difficult to quantify, the scale of impact is not viewed as significant to the operation of the business in light of the prescribed mitigation throughout the traffic, noise and air quality assessments.

Operation

6.12.19 In addition to increased jobs, commuters will experience easier journeys to their places of employment and residents will find it easier to access the station for their journeys to work. This will stimulate economic activity as Victoria becomes a more accessible and attractive place to work and shop. This will be a significant benefit of the project.

6.12.20 The project will bring London wide benefits. The CoW is primarily concerned with meeting the needs of its residents and resident businesses. However, it also recognises the vital role that Victoria has in supporting the economy of London. Major transport infrastructure is key in ensuring that Victoria is able to operate as effectively and efficiently as possible. In discussions with CoW, officials commented that the VSU scheme will benefit central London as a whole. It will help improve the attractiveness of Victoria as a place to do business which will in turn fed into the wider London economy. The VSU scheme is also important in helping to further increase the status of Victoria as a major shopping centre in central London, which will have a significant positive impact for the both the local and the city-wide economy. Discussions have also indicated that the VSU is supported by London business organisation, London First.

6.12.21 Although a number of premises will be demolished as part of the proposed scheme not all the replacement buildings have been confirmed. Therefore, for the purpose of this assessment it has been assumed that (where no further information is available) there will be replacement development that provides employment at a level equal to that currently provided, or where buildings are empty, equal to current potential based on floor area. Therefore, there will be potentially 245 new jobs created. Applying a 1.5 multiplier (as with construction) there will be a potential 122 induced/indirect jobs created. (Further detail on the calculations of jobs losses during the

operational period is provided in Technical Appendices Volume 4, Appendix J).

6.12.22 In addition there may also be new employment opportunities created directly by the construction of the proposed Corner Site Development over the new north ticket hall. Using the information available on floor area, we calculate that 398 jobs may be created. Applying a multiplier indicates that a further 199 jobs will be created. However, this will be the subject of a separate planning application. This has been documented here to explain cumulative effects following the proposed demolition of the existing offices on site.

6.13 Community

Introduction

6.13.1 This section assesses the effects of the VSU scheme on residents, workers and visitors to the area. The effect on sensitive receptors both within and immediately surrounding the proposed development area are considered.

6.13.2 The key objectives of the assessment are to:

- establish the baseline in terms of the sensitive receptors and resources used by the local and wider community;
- identify the activities during construction and operation and which may lead to adverse or beneficial effects on receptors identified in the baseline, more specifically:
  - the general impairment of the amenity or well-being of the community where multiple impacts may cause a significant effect on the same resources or receptors;
  - severance or diversion of a public right of way impeding on the pedestrian accessibility of a community resource/receptor;
  - demolition of, or land take from, a community facility or residential area.
- assess the significance of any effects of the scheme and outline the incorporated mitigation measures which where necessary, reducing the significance of adverse effects; and
- propose measures for reducing or further mitigating significant residual effects.

6.13.3 The assessment also considers benefits to the community such as improved accessibility to facilities. Further information is provided in the technical appendix (Appendix Volume 4 Appendix K).

Baseline

6.13.4 The area surrounding the project site largely comprises office space supported by a significant number of shops, bars and restaurants. Whilst office space is not considered a community resource the supporting services are considered sensitive if there are no replacement facilities within the surrounding area. There are a number of residential areas in the direct vicinity of Victoria Station Complex and also a number of community facilities which serve local residents, the local work force and people from further afield.

6.13.5 The baseline was compiled by undertaking a land use survey and desk based review. Information held by CoW was of particular use. Baseline information was collected in the following areas.

Public Rights of Way and Other Access Routes

6.13.6 The main flow of pedestrians in the area is north east from Victoria National Rail Station to the many offices located along and in the vicinity of Victoria Street. This is explained in more detail in the traffic and transport Section 6.2. This assessment examines the effect on public right of way access routes between Victoria National Rail Station and identified community facilities and between the residential areas and identified community facilities. Pedestrian crossings and subways (pre and post construction) are identified on Figure 6.2(6). Station access points are identified in Figure 6.13(1).

Community Receptors

6.13.7 The groups of users presented in Table 6-14 below are considered as sensitive receptors in this community impact assessment.

Table 6-14: Community Receptors

User Group	Issues to Consider
Residents[18]	• Access routes between residential areas and Victoria Interchange • Access routes between residential areas and community facilities
Incoming Workforce	• Access to/from Victoria Interchange and place of work • Access to community facilities used by local workforce
Incoming other Community Facility Users	• Access routes to/from Victoria Interchange and other community facilities e.g. schools

[18] Main residential receptors are identified later in this section.

Table 6-14: Community Receptors	
User Group	**Issues to Consider**
People with additional mobility requirements[19] (disabled, elderly, parents of young children using buggies).	• All of the above access issues as severance will have a more significant impact on any of these particular groups

Spatial Scope: Boundary of Assessment Area

6.13.8 The assessment area lies predominantly to the north, north-east and east of Victoria National Rail Station. It is the area bounded by Buckingham Palace Road north from Victoria National Rail Station – Buckingham Gate – Artillery Row – Howick Place – Frances Street – Vauxhall Bridge Road – Gillingham Street – Belgrave Road – Eccleston Bridge Road – Buckingham Palace Road – Lower Belgrave Street – Beeston Place – Lower Grovesnor Place – Buckingham Palace Road. The boundary has been defined by a qualitative assessment of the community facilities in the area that will be affected by the project overall. Consideration has also been given to the extent of catchment of those facilities. The area of influence defined in the earlier sections on traffic and transport (Section 6.2) effects, air quality (Section 6.4), noise (Section 6.3) and effects on the townscape (Section 6.5) has also been taken into account. The location of other public transport facilities has also helped define the area. For example, the location of St. James's Park Underground station to the north east of Victoria National Rail Station is an obvious access point for many facilities nearby which can then be excluded from this assessment.

Demolished Buildings

6.13.9 The following buildings are to be demolished as part of this project:

- Numbers 3 - 11 Bressenden Place;
- Numbers 120 – 124 and 175 - 179 Victoria Street;
- Elliott House; and
- Numbers 4 – 7 Terminus Place.

6.13.10 The current usage of these buildings has been considered for any community effects.

Community Resources

6.13.11 The community impact assessment classifies community resources as follows:

[19] Members of this group will also be in one of the groups above but are considered here additionally due to their level of accessibility need.

- principal community facilities – Important community facilities used by local residents, workers and others from further a field. Often, there is no other appropriate alternative in the vicinity;
- other community facilities – Resources used by local residents / workers or others from outside the area where there are appropriate alternatives in the vicinity; and
- residential areas.

Principal Community Facilities

6.13.12 The principal community resources and receptors identified within this area are identified in Figure 6.13(2). They are also listed in Table 6-15 below.

Table 6-15: Principal Community Facilities

Principal Community Facilities	Facility (where more than one exists they are listed in order of proximity to Victoria Underground Station)
Nurseries, Schools and Colleges	1 St Vincent de Paul Primary School, Morpeth Terrace; 2 Pre School Nursery, King's Scholar's Passage 3 Westminster Cathedral Choir School, Morpeth 4 Terrace; Westminster City School, Palace Street; 5 Westminster Kingsway College, Castle Lane Campus 6 St. Peter's Eaton Square Primary, Ebury Street
Medical Facilities	1 Medi Centre walk-in Medical Centre, Victoria National Rail Station 2 Dentist, North end of Buckingham Palace Road 3 Dentist, Buckingham Gate opposite Allington Street 4 Dentist*, Wilton Road
Places of Worship	1 Westminster Cathedral, Cathedral Piazza 2 Westminster Chapel, Castle Lane
Sports and Recreation Facilities	1 Theatre, Victoria Street 2 LA Fitness Gym, Bressenden Place 3 Fitness First Gym, Victoria Street 4 Theatre, Wilton Road 5 Fitness First Gym, Back of Cardinal Place 6 Queen Mother Sports Centre*, Vauxhall Bridge Road
Other Key Community Facilities	1 Convent of St Vincent de Paul – day centre, Carlisle Place 2 Westminster City Hall, Library and Advice Centre, Victoria Street 3 Open Space, Grovesnor Gardens 4 Passport Office, Bridge Place

*These facilities are located just outside the boundary but have been included due to their importance as attractors to pedestrians exiting the Victoria Station complex.

Other Community Facilities

6.13.13 The following table lists the areas where there are community facilities that are likely to be affected by the VSU scheme. These community facilities are non-essential - i.e. suitable alternatives exist in the immediate vicinity. Due to the high number of these facilities around the Victoria Station complex they are not listed individually but by area. The areas are listed within Table 6-16 in order of proximity to the works and are illustrated on Figure 6.13(3).

Table 6-16: Other Community Facilities

Location	Type of Facilities
Area of Victoria St – Buckingham Palace Rd – Bressenden Place	Smaller local shops, cafes, bars and restaurants
Victoria National Rail Station	High Street retailers, catering outlets and bars
Cardinal Place	High Street retailers, bars and restaurants
Victoria Street	High Street retailers, banks and catering outlets

Residential Areas

6.13.14 The main residential areas likely to be affected by the VSU scheme and covered by this assessment are located as follows in Table 6-17 and on Figure 6.13(4), in order of proximity to the works.

Table 6-17: Key Residential Areas

Area	Description
Allington Street Zone:	Mansion block apartments located in Allington Street and to the north in Lake View Court are the closest to the works.
Vauxhall Bridge Road to Ambrosden Avenue Zone:	Mansion block apartments, located predominantly along Carlisle Place and Morpeth Terrace. Area bounded by Vauxhall Bridge Road – Frances Street – Ambrosden Avenue and Victoria Street.
Buckingham Palace Road Zone:	Flats located above retail units along the road to the north west of the project site.
Palace Street Zone:	New build apartments located on the western side of Palace Street along with Victorian houses and Victorian conversion flats located on the eastern side of Palace Street and the roads running off towards Buckingham Gate.
Ambrosden Avenue to Howick Place Zone:	Mansion block apartments in the area bounded by Ambrosden Avenue – Frances Street – Howick Place – Wilcox Place and Victoria Street.

Table 6-17: Key Residential Areas	
Area	**Description**
Southern Periphery Zone:	Mixture of housing styles located on the outer edges of the assessment area along Frances Street and Gillingham Street.

Works Affecting the Baseline

6.13.15 The following works have been identified as they will have effects on specific parts of the baseline:

- work on creation of NTH, resulting in closure of eastern leg of Allington Street – closure of public right of way. This will particularly affect residents in Allington Street;
- jet grouting in Allington Street and construction of tunnels – effect on residents in Allington Street;
- construction of shafts, tunnels etc under the clock island area – effect on community facilities located close by. These include Fitness First Gym; and
- worksite on Vauxhall Bridge Road – Potential to affect use of the dentist surgery at the top of Vauxhall Bridge Road.

6.13.16 These are covered in more detail in Table 10 of the Community Assessment technical appendix which details proposed mitigation of these activities to lessen any effects on the community.

Mitigation and Residual Effects

Construction Effects

6.13.17 There is not anticipated to be any temporary displacement of residents or temporary closure or disruption of community facilities. There will be a number of impacts on accessibility. The closure of the eastern leg of Allington Street will be mitigated by the provision of an alternative pedestrian route via Warwick Row. The diversion is less than 500m so the effect is not considered to be significant. The pedestrian subway at the junction of Bressenden Place and Victoria Street is scheduled for closure. However, it has been determined that this will not have any significant effect on the community as the street level crossing facilities will remain in place and functional.

6.13.18 There will be no closure of any footways and management measures will be introduced to enable congestion reduction and a relatively clear pathway for users.

6.13.19 There are a number of indirect effects as identified in the traffic and transport,

air quality, noise and townscape chapters. Considering these in combination, there are some residual negative effects on the community. However, mitigation is proposed for each of these in the relevant specialist sections of this report and is summarised in Table 10 of the Technical Appendices Volume 4, Appendix K. A number of locations are anticipated to experience increased noise and vibration. However, only one site, the Stage Door Public House on Allington Street is recommended for further mitigation. Any effect on this site will not have a significant effect on the local community. Therefore, overall, these residual negative effects are not considered significant for the community.

Operational Effects

6.13.20 There will be no permanent loss of residential or community facilities. The buildings proposed for demolition are not community facilities, they are mainly office and retail based. Offices are not considered a community facility and replacements for retail uses are adequately represented in the immediate area.

6.13.21 The operational scheme will result in the closure of the pedestrian subway at the south end of Bressenden Place at its junction with Victoria Street. However, this closure of a public right of way will not result in any significant negative impacts for the community as the street level pedestrian crossing will be retained. Additionally, the original subway did not provide step free access so was not suitable for all community receptors, for example PRM.

6.13.22 However, the opening of the new North Ticket Hall will result in a reduction in pedestrian congestion along Victoria Street and around street level of the Victoria National Rail station. This will result in an overall improvement in accessibility to the Victoria area. This is a significant positive direct effect on the community.

6.13.23 There are a number of indirect positive effects of the operation of the VSU. The enhanced accessibility of the area, along with improvements to the amenity result in positive residual indirect effects on the community. However, these are not considered significant.

7 Cumulative Effects

7.1 Introduction

7.1.1 The Transport and Works (Applications and Objections Procedure) Rules 2006 require that the ES should contain a description of likely significant cumulative effects (Schedule 1, Paragraph 4). In accordance with this requirement, this section provides an assessment of the cumulative effects of the proposed VSU scheme.

7.1.2 In terms of the VSU scheme, the significant cumulative effects will be addressed under the following sub-headings:

- combined effects embedded within the VSU scheme upon sensitive receptors (Type 1 Effects); and
- cumulative effects from the station upgrade scheme in relation to other relevant developments, upon sensitive receptors (Type 2 Effects).

7.1.3 Combined effects of those individual effects arising from the development on sensitive receptors have been assessed using the detailed assessments made in the technical appendices which support this ES.

7.1.4 In terms of assessing the potential cumulative effects in relation to other relevant developments, the guidance provided by the document *'Environmental Impact Assessment: A guide to the procedures refers to the need to assess the potential cumulative effects on "other existing or proposed development'* (DTLR, 2000). The recent DCLG consultation paper Environmental Impact Assessment: A guide to good practice and procedures" provides further information by describing other developments as those that are *"already begun or constructed or those that have not been commenced but have a valid planning permission."* (DCLG, 2006).

7.1.5 It should be noted that the approach for assessing both combined and cumulative effects is complementary to that used to assess the equivalent interactions for the Victoria Transport Interchange[20]. By adopting this approach and indeed, considering the same receptors will facilitate a robust cumulative assessment that can be cross-referenced to ensure the significance of effects are fully realised and where practicable, appropriately managed.

7.2 Assessment of Combined Effects (Type 1 Effects)

7.2.1 The assessment of the combined effects of the VSU scheme on sensitive receptors has included the demolition and construction phases and the operational phase of the completed scheme.

[20] The Environmental Impact Assessment for the Victoria Transport Interchange is being undertaken by Waterman Environmental, part of the Waterman Group.

7.2.2 The individual effects on resources and receptors have been assessed and outlined in the subsections of Section 6. This section looks at combined effects. For the purposes of this assessment this has been defined as 'multiple residual effects which will cause a significant effect on the same resources and receptors resulting in a significant adverse combined effect. This section describes the significant residual effects that will remain post incorporated mitigation.

7.2.3 For the purpose of this assessment the definition provided by the community impact assessment has been used to identify resources and receptors. This is based on the premise that it is the local community that will generally experience combined effects. The assessment has focused on those disciplines that have identified significant residual effects within their individual assessments and where these effects are likely, in combination with other identified effects, to cause a significant combined effect on the local area.

7.2.4 The practicality of defining specific 'communities' in such a densely developed area as Central London is difficult. The community assessment highlighted residential areas and identified community resources and receptors within a defined study area around the works. Although specific communities cannot be identified, it can be assumed that there are community links between these residential areas and the various community resources facilities within the study area. These links may not define a 'community' but help to define the network within which the local population functions.

7.2.5 The assessment of combined effects collated direct significant residual effects likely to directly affect the community. Effects were excluded where they would not have the potential to interact with other effects (i.e. vibration, groundborne noise, archaeology, waste, water, ecology and contamination). The effects were tabulated and are presented on Figures 7.1 (construction) and 7.2 (operation). Professional judgement was used to assess where there would be a significant residual combined effect on the local community.

Combined Effects during Construction (Years 2009 – 2015)

7.2.6 Table 7-1 presents a summary of the combined residual effects (including Figure 7.1 reference points) of the VSU scheme associated with the construction process (years 2009 – 2015).

Table 7-1: Summary of Combined Residual Effects during Construction			
Ref	**Impact**	**Significant Residual Effects**	**Supplementary Mitigation**
1	**Traffic**: Phases 1,2,3,4, and 5 Construction worksites located within Terminus Place, Station forecourt and 'the Beach'.	During Phases 1,2, 4 and 5 there is still insufficient footway width despite temporary footways around perimeter of worksite C.	Additional signing and marshalling of pedestrians during peak periods.
2	**Traffic**: Phase 2 - Construction worksite in Wilton Road requiring full closure of Wilton Road and its encroachment onto 'the Beach'.	With eastern arch entrance to mainline station closed during Phase 2 there is insufficient footway width (including that in Wilton Road), despite temporary footway around site, to accommodate pedestrian demand.	Additional signing and marshalling of pedestrians during peak periods. Determine whether more footway could be made available in Wilton Road during Phase 2.
3	**Traffic:** Phases 3, 4 and 5 Encroachment of worksite onto eastern footway of Vauxhall Bridge Road (VBR).	This route is congested and pedestrian facility may be difficult to provide for return crossing.	Investigate potential for Reducing size of worksite on east side to ease local 'pinch point' on footway.
4	**Traffic:** Phases 1,2 and 3 Closure of eastern leg of Allington Street to all vehicular traffic.	Diversion which are likely to be in place for a long period of the works (18 months approx).	None
5	**Traffic:** Phase 2 – Closure of Wilton Road to all vehicular Traffic.	Allowing all traffic to use VBR northbound would cause severe problems for buses and pedestrians at the Victoria Bridge Road/Wilton Road/Victoria Street junction. Use of contraflow bus only lane minimises effect.	Relocation of existing bus stand from VBR to accommodate proposed changes.
6	**Traffic:** Phases 1, 2, 4, 5, 5a, 5b, 5c, 5d and 5e – Worksite encroachment onto Bus Station and Terminus Place.	Relocation of bus services C1 and C10 would result in longer walk to relocated bus stop for passengers of these services.	None
7	**Traffic:** Phases 1,2,3,4, 5, 5a, 5b, 5c and 5d, 5e. Worksites on Bressenden Place.	Potential for disruption or delay to the affected bus services.	None

Table 7-1: Summary of Combined Residual Effects during Construction			
Ref	**Impact**	**Significant Residual Effects**	**Supplementary Mitigation**
8	**Traffic:** Phase 2 – Closure of Wilton Road to all vehicular traffic.	Longer walk for passengers due to relocated stops.	None
9	**Traffic:** All phases - Worksite encroachment onto Bus Station and Terminus Place.	Longer walk for passengers due to relocated stops.	None
10	**Traffic**: All phases - Worksite encroachment onto Bus Station and Terminus Place.	Diversion of taxis from normal route.	The provision of increased waiting areas for passengers at rail/air deck.
11	**Traffic:** All phases - Worksite encroachment onto Wilton Road.	Relocation of taxi feeder rank from current location requiring longer walk for passengers.	The provision of increased area for taxi feeder rank on Rail/air deck.
12	**Traffic:** All phases - Worksite encroachment onto Bus Station and Terminus Place.	Relocation of taxi rank from current location requiring a longer walk for passengers.	None
13	**Traffic**: All phases – Encroachment of worksite onto carriageway of Bressenden Place.	Additional delays to road users.	None
14	**Traffic:** All phases – Encroachment of worksite onto carriageway of Wilton Road.	Additional delays to road users.	Proposed improvements to the Eccleston Bridge/Buckingham Palace Road junction (to provide increased capacity to handle displace traffic from Wilton Road) under investigation.
15	**Townscape**: Felling of three trees in Bressenden Place.	Slight adverse until the trees are sufficiently established to contribute to the local townscape character.	Regular maintenance of the new trees until they are fully established.

Table 7-1: Summary of Combined Residual Effects during Construction			
Ref	**Impact**	**Significant Residual Effects**	**Supplementary Mitigation**
16	**Townscape:** Removal of clock.	Removal of Little Ben clock tower during works.	None
17	**Townscape:** Area around worksites.	Loss of open space – moderate adverse due to already congested space.	None
18	**Visual Amenity:** Office workers in Portland House will have deterioration in views.	Moderate adverse due to adverse effects caused by demolition and erection of construction compounds.	Hoardings could offer opportunities for a temporary public art project for the duration of construction to enhance townscape character.
19	**Visual Amenity:** Office workers in Cardinal Place will have deterioration in views.	Moderate adverse due to adverse effects caused by demolition and erection of construction compounds.	Hoardings could offer opportunities for a temporary public art project for the duration of construction to enhance townscape character.
20	**Visual Amenity:** Office workers in buildings around Terminus Place will have deterioration in views.	Moderate adverse due to adverse effects caused by demolition and erection of construction compounds.	Hoardings could offer opportunities for a temporary public art project for the duration of construction to enhance townscape character.
21	**Visual Amenity:** Victoria Palace Theatre goers will experience deterioration in views.	Moderate adverse due to adverse effects caused by demolition and erection of construction compounds.	Hoardings could offer opportunities for a temporary public art project for the duration of construction to enhance townscape character.
22	**Visual Amenity:** Users of Victoria Station will experience deterioration in views.	Moderate adverse due to adverse effects caused by demolition and erection of construction compounds.	Hoardings could offer opportunities for a temporary public art project for the duration of construction to enhance townscape character.
23	**Visual Amenity:** Pedestrians in Bressenden Place will experience deterioration in views.	Moderate adverse due to adverse effects caused by demolition and erection of construction compounds.	Hoardings could offer opportunities for a temporary public art project for the duration of construction to enhance townscape character.

Table 7-1: Summary of Combined Residual Effects during Construction			
Ref	**Impact**	**Significant Residual Effects**	**Supplementary Mitigation**
24	**Visual Amenity:** Pedestrians on Wilton Road will experience deterioration in views.	Moderate adverse due to adverse effects caused by demolition and erection of construction compounds.	Hoardings could offer opportunities for a temporary public art project for the duration of construction to enhance townscape character.
25	**Built Heritage:** Construction of NTH and paid area link.	Potential settlement on VPT. Currently significant adverse although may be reduced to non significant through further scheme design.	None
26	**Built Heritage:** Change to setting of VPT.	Currently significant adverse although they may be reduced to non significant through further scheme design	None
27	**Built Heritage:** National Rail Station (Eastern).	Currently significant adverse although they may be reduced to non significant through further scheme design	None
28	**Built Heritage:** National Rail Station (Western).	Currently significant adverse although they may be reduced to non significant through further scheme design	None
29	**Built Heritage:** Apollo Theatre.	Currently significant adverse although they may be reduced to non significant through further scheme design	None
30	**Noise:** 20 Palace St (SW)	Significant Effect Oct 09 – Dec 13 (shorter duration at ground floor).	None
31	**Noise:** The Stag PH (Upper floor only)	Noise Policy triggered (Further Mitigation).	None

Table 7-1: Summary of Combined Residual Effects during Construction			
Ref	**Impact**	**Significant Residual Effects**	**Supplementary Mitigation**
32	**Noise:** The Stag PH (Upper floor only)	Significant residual effects Nov 10 – March 12 (would be removed by application of FM to address daytime effects – see above).	None
33	**Noise:** The Cameo Apartments, 17 Allington Street N West End	Significant effect May 10 – March 11.	None
34	**Noise:** The Cameo Apartments, 17 Allington St N East End	Gound Floor – Significant Residual Effect Oct 09- Dec 13.	None
35	**Noise:** 1-14 Evelyn Mansions (NE)	Ground floor significant effect within period Oct 09 – Dec 13 (no Noise Insulation).	None
36	**Noise:** 15-39 Evelyn Mansions (SW)	Noise Insulation at upper floors so no significant residual effects. Ground floor and floors 1 and 2: significant effect within period Oct 09 – Apr 14 (no Noise Insulation).	None
37	**Noise:** Montfort House Carlisle Place NE	Significant effect Oct 09 – March 14 (shorter period at lower floors).	None
38	**Noise:** St Andrew's Hall (W)	Significant effect Oct 09 – Dec 13 (shorter period at lower floors).	None
39	**Noise:** Convent, Carlisle Pl (NE)	Significant Effect within period Oct 09 – March 12 (shorter duration at ground floor).	None

Table 7-1: Summary of Combined Residual Effects during Construction			
Ref	**Impact**	**Significant Residual Effects**	**Supplementary Mitigation**
40	**Noise:** 1 Carlisle Mansions (W)	Potential Significant Effect May 09 – Dec 12 (shorter duration at lower floors).	None
41	**Noise:** 2 Carlisle Mansions (W)	Potential Significant Effect May 09 – Dec 12 (shorter duration at lower floors).	None
42	**Noise:** 3 Carlisle Mansions (W)	Potential Significant Effect Oct 09 – March 11 (shorter duration at lower floors – no significant effect at ground floor).	None
43	**Noise:** 76-85 Carlisle Place (NE)	Significant Effect within period May 10 – Jul 10 (Not ground or first floors).	None
44	**Noise:** Royal Westminster Hotel (E)	Significant Effect within period Oct 09 – Apr 12 (shorter duration at lower floors, no SE at ground floor).	None
45	**Noise:** Royal Westminster Hotel (S)	Significant Effect within period Oct 09 – Apr 12 (shorter duration at lower floors and no significant effect at ground floor).	None
46	**Noise:** Grosvenor Hotel (N)	Lower floors significant effect from Oct 09 – May 12 not at ground floor.	None

Conclusion (Construction)

7.2.7 The assessment examined the above effects (presented in Table 7.1) in conjunction with the areas identified by the community assessment. Figure 7.1 clearly shows that there may be a combined significant residual effect at three key locations:

- Bressenden Place and its junction with Victoria Street;
- the 'Little Ben' traffic island and immediate vicinity; and
- Terminus Place and Wilton Road (north end).

7.2.8 These combined effects are likely to adversely effect the residential areas 1 and 2 (north part) as identified by the community impact assessment. They may also effect the 'other' community facilities' at Victoria Street, Buckingham Palace Road, Bressenden Place and Victoria National Rail Station as also identified by the community assessment. There may be a number of significant effects at other locations but they are predominantly noise and have therefore been considered as part of the noise assessment.

Combined Effects during Operation (Year 2015)

7.2.9 The completed scheme will not only provide improvements to journeys, above and below ground, but also through considerate design will lead to an overall improvement to access for persons of restricted mobility, pedestrian management, townscape, streetscape and visual appearance of the area. This will be especially prevalent around 'the Beach' area.

7.2.10 There will be also significant residual positive effects of the VSU scheme in the operational period. These are derived principally due to the congestion relief and improvements in passenger movement throughout the Victoria Station complex. These effects are likely to be further realised and potentially amplified as the other major projects within the area materialise.

7.2.11 Table 7-2 presents a summary of the combined residual effects of the VSU scheme associated with its operation.

Table 7-2: Summary of Combined Residual Effects during Operation

Ref	Impact	Significant Residual Effects	Supplementary Mitigation
1	**Traffic:** New North Ticket Hall.	Change in pedestrian desire lines results in a reduction in pedestrian flows on Little Ben Island and along the south side of Victoria Street resulting in significant beneficial effects.	None
2	**Traffic:** Increased number of entrances to the Underground.	Significant improvement for access and reduced delays.	None
3	**Townscape:** Beneficial effect on townscape character in Bressenden Place and Victoria Street east of Vauxhall Bridge Road.	Beneficial effect on the townscape character: clearer urban layout, improved legibility, greater accessibility.	Explore possibility of further planting

Table 7-2: Summary of Combined Residual Effects during Operation			
Ref	**Impact**	**Significant Residual Effects**	**Supplementary Mitigation**
4	**Visual Amenity:** Office workers in Portland House.	Beneficial: effect on views from ground level and upper storeys towards Cardinal Place, distance views towards 'the Beach' from top storeys.	None
5	**Visual Amenity:** Office workers in Victoria House.	Beneficial: near views of 'the Beach' where new features will be an attractive addition to the street scene.	None
6	**Visual Amenity:** Office workers Cardinal Place.	Beneficial: direct close views of attractive new entrance structure on Cardinal Walk.	None
7	**Visual Amenity:** Office workers in buildings around Terminus Place.	Beneficial: direct, oblique views of attractive new structures on the 'Beach'.	None
8	**Visual Amenity:** Users of Victoria Station.	Beneficial: removal of existing street furniture and installation of new structures on 'the Beach' will enhance travellers vies as they leave or enter the station.	None
9	**Visual Amenity:** Pedestrians on Bressenden Place.	Beneficial: close views of new landmark entrance in Cardinal Place.	None
10	**Visual Amenity:** Pedestrians on Wilton Road.	Beneficial: direct close views of attractive structures on 'the Beach'.	None
11	**Visual Amenity:** Visitors to the VPT.	Good design to ensure visual cohesion and uniformity of the space.	None
12	**Community:** Opening of new North Ticket Hall.	Significant positive residual effects. Easier access to places of employment, shops and services as a result of less congestion.	None

Table 7-2: Summary of Combined Residual Effects during Operation			
Ref	**Impact**	**Significant Residual Effects**	**Supplementary Mitigation**
13	**Built Heritage:** VPT	Permanent strengthening works cause an effect on the fabric of the building, this may be reduced with further design works.	None
14	**Socio-Economics:** General	Reduced congestion in Victoria area and increased access: significant beneficial.	None
15	**Socio-Economics:** General	Increased economic attractiveness of Victoria as a place to work: significant beneficial.	None

Conclusion (Operation)

7.2.12 There will be a significant beneficial combined effect on the local community in the immediate environs of Victoria National Rail and Underground stations. There are isolated adverse effects but when considered together they do not produce a significant combined effect.

7.3 Assessment of Cumulative Effects (Type 2 Effects)

7.3.1 The area around the Victoria Station complex will be subject to a number of developments that are likely to progress at the same time as the construction period of the VSU scheme. The project used the following criteria to determine which schemes should be considered:

- schemes surrounding site that have been granted planning permission where there is a net change in floorspace above 10,000 m^2 and which are considered likely to have the potential to result in some cumulative effect;
- schemes in close proximity to the site which have been granted planning permission, but fall below the floorspace threshold stated above. These schemes have been considered where proximity to the site is such that potential for cumulative effects cannot be ruled out; and

- other reasonably foreseeable but unconsented schemes in the area including a consideration of future proposals which would respond to planning briefs relevant to the site and its surrounds. It should be noted that in some cases professional judgement was used where there was a lack of detailed design information.

7.3.2 Based on an initial review the following schemes were identified in the Scope and Methodology report (Annex A):

- Wilton Piazza (mixed use development);
- Howick Place (mixed use development);
- Victoria National Rail Station Upgrade;
- Victoria Coach Station;
- Expansion of Victoria Palace Theatre;
- Refurbishment of Chelsea Barracks;
- Parliament Square Improvement Project;
- Corner Site Development; and
- Victoria Transport Interchange (VTI).

7.3.3 The planning team undertook a comprehensive review of the above schemes. Table 7-3 summarises the planning review and explains which schemes have actually been assessed with reasoned justification. It should be noted that based on the review the District and Circle line Upgrade was itemised as a separate entity and not part of the VTI project and Victoria Coach Station was deleted as there are currently no planned works. The review also added Abford House, Pimlico School redevelopment and the planning brief for Victoria Street, Buckingham Gate and Palace Street.

7.3.4 Figure 2.2 shows the location of each scheme.

Table 7-3: Planning Review of Projects for the Cumulative Assessment					
Scheme Name	**Applicant**	**Agent**	**Status**	**Details**	**Is the scheme considered in the Cumulative Assessment?**
Wilton Piazza 18-36 Gillingham Street, 1-6 Gillingham Mews And 119-128 Wilton Road London SW1V 1LL	LS Wilton Plaza Limited	Jones Lang Lasalle Limited	Application granted by CoW 15/03/07. Planning Application Ref: 06/08704/FULL	Redevelopment project which involves the erection of new buildings comprising ground and nine upper floors fronting Wilton Road and ground and eight upper floors to Gillingham Street and projecting rearward into the site, for use as retail (Class A1) and restaurant/cafe (Class A3) at ground level. The proposals also include 112 residential units at first to ninth floor levels (including 27 affordable units), student accommodation comprising 157 student bed spaces and facilities at first to eighth floor level, 64 car parking spaces, cycle parking and servicing area at ground floor level. A total of 17, 864m^2 gross external area. The plant at roof level includes solar thermal panels and the proposals also include public art, soft and hard landscaping (including a children's play area) and creation of new vehicular access from Gillingham Street.	This scheme is currently due to be completed before the start of VSU works – it has been assumed it would not contribute to cumulative effects

Table 7-3: Planning Review of Projects for the Cumulative Assessment					
Scheme Name	**Applicant**	**Agent**	**Status**	**Details**	**Is the scheme considered in the Cumulative Assessment?**
Howick Place	Fabriche Cermiche Investments Sarl	The London Planning Practice	Application granted by CoW 27/08/06. Ref: 06/02089/FULL	Modifications to existing building including erection of additional glazed storey, installation of roof flights over internal light well and between corner and main building, addition of plant to roof and alterations to fenestration in connection with use of building as a Creative Design and Arts Centre (minimum 6003m^2) (Sui Generis), offices (maximum 3168m^2) (Class B1), a retail and/or retail showroom (492m^2) (Class A1/Sui Generis), Royal Mail Public Collection Office (328m^2) (Sui Generis), nine (5x1-bed and 4x3-bed) self-contained residential flats (3168m^2) (Class C3) and a community safety office (56m^2) (Sui Generis) with 10 car parking spaces at ground floor level. A total of 13,215m^2 gross external area.	This scheme is currently due to be completed before the start of VSU works – it has been assumed it would not contribute to cumulative effects.
Victoria National Rail Station Upgrade	N/A	N/A	N/A	Station refurbishment.	There is currently no indication as to the extent of works or when these are due to commence therefore they have not been considered in this assessment.

Table 7-3: Planning Review of Projects for the Cumulative Assessment					
Scheme Name	**Applicant**	**Agent**	**Status**	**Details**	**Is the scheme considered in the Cumulative Assessment?**
Expansion of Victoria Palace Theatre	N/A	N/A	N/A	Under VTI scheme, there will be a 6m northerly extension of the theatre to make the stage deeper (horizontally). The proposals include a corresponding extension to the basement to make it deeper.	There is currently no programme for this work and no listed building consent has been submitted. The works are assumed to be minor in nature and it is presumed they will not generate sufficient impacts to contribute to a cumulative effect. They have therefore been excluded from the assessment.
Refurbishment of Chelsea Barracks	DTZ Pieda Consulting	MoD	An application made on 6 Jan 03 for a screening opinion for a redevelopment of site for smaller military use and residential units. 21 Feb '03 CoW stated EIA not required. Planning application never made site now due	Chelsea Barracks is a 5.18ha site, occupying a significant length of the City's boundary with the Royal Borough of Kensington and Chelsea. The MoD proposes to dispose of the site in 200/8 and relocate to Woolwich. The planning brief outlines a comprehensive development for the site combining major residential development with substantial affordable housing, and associated community uses, and in particular, an area of open space.	No development proposals have been made for the site. There is therefore no information on programme, phasing and extent of works. This has not been considered as part of the assessment.

Table 7-3: Planning Review of Projects for the Cumulative Assessment					
Scheme Name	**Applicant**	**Agent**	**Status**	**Details**	**Is the scheme considered in the Cumulative Assessment?**
			to sale in and CoW have adopted a planning brief for the site.		
Parliament Square Improvement Project	N/A	N/A	N/A	Aims to create a high-quality urban space at Parliament Square to include enhanced and expanded public space by closing the south side of the square.	It was assumed that due to the nature and scale of this project and its distance from the proposed scheme (approx 1km) it would be unlikely to contribute to cumulative effects.
Corner Site Development	LU	TfL Group Properties and Facilities	Application for full planning permission received by CoW 22/08/07. Planning Application Ref: 07/07416/FULL	Erection of new 8/9-storey building (plus basement) to be built in association with a new entrance to an enlarged Victoria Underground station and comprising 7,665m^2 of office (Class B1) space, 335m^2 of Class A uses and ancillary accommodation. (Site includes 120-124 Victoria Street and 3-11 Bressenden Place). The scheme is known locally as the Corner Site Development (CSD).	This scheme could not be built until after the completion of the VSU works, accordingly it is not included in the assessment of cumulative effects.

Table 7-3: Planning Review of Projects for the Cumulative Assessment					
Scheme Name	**Applicant**	**Agent**	**Status**	**Details**	**Is the scheme considered in the Cumulative Assessment?**
Victoria Transport Interchange	Land Securities	Moseley & Webb	Application for full planning permission received by CoW 17/08/07. Planning Application Ref: 07/07296/FULL	Demolition of the existing buildings on site with the exception of the Victoria Palace Theatre, Duke of York pub and the Little Ben Clock and the comprehensive redevelopment of the site for transport works above and below ground, new public spaces and pedestrian routes and a mixed use development comprising of offices (Class B1/A1-A5), art gallery/cinema space (Class D1/D2), retained Victoria Palace Theatre (Sui Generis) and residential development (Class C3) and associated highways, utilities and other ancillary works. Little Ben Clock is temporarily relocated and replaced in its current position.	This scheme is programmed to commence in 2010 and finish in 2019. It has therefore been considered in the assessment of cumulative effects.
Abford House Abford House & 333 Vauxhall Bridge Road London SW1V 2SD	Co-operative Insurance Society Ltd	Gerald Eve	Application granted by CoW 10/01/07. Planning Application Ref: 04/08391/FULL	Redevelopment to provide (Class B1) offices on basement, part lower ground, part ground and nine upper floors with (Class A1) retail and/or (Class A2) financial and professional services and/or (Class A3) restaurant accommodation on part ground and part lower ground floors and related works. Total of 12,460m^2 gross external area.	This scheme is currently due to be completed before the start of VSU works – it has been assumed it would not contribute to cumulative effects.

Table 7-3: Planning Review of Projects for the Cumulative Assessment					
Scheme Name	**Applicant**	**Agent**	**Status**	**Details**	**Is the scheme considered in the Cumulative Assessment?**
District and Circle Line Upgrade	N/TS	N/A	N/A	Basic station modernisation currently at the planning stage.	The works will not be carried out at the same time as the VSU and so have not been included in this assessment.
Pimlico School Development	Bouges UK	Bouges UK	Application submitted 12/9/07 number 000000016646	Complete redevelopment of secondary school on Lupus Street. New school buildings, library and adult education centre – start date 2008 completion by 2010.	The works are programmed to finish in 2010 and VSU will start in 2009. Due to the limited overlap of the works and the distance between the two schemes (approximately 1km) the school project has not been included in the assessment.
Victoria Street, Buckingham Gate and Palace Street	N/A	N/A	Consultation carried out early 2007.	Identifies seven potential development parcels and sets out the planning framework and other material considerations for major development proposals.	No development proposals have yet been made for the sites. This has therefore been excluded from the assessment.

7.3.5 The review conducted by the planning team (and presented in Table 7-3) set the remit for the cumulative effects assessment. The assessment has focused on the interaction between the VSU and the VTI projects. The other projects are considered to either be in the early planning stages or are programmed for completion before the commencement of the VSU works.

7.3.6 It has been assumed for those projects in the early planning stages that if consent is required they will carry out the appropriate level of environmental work. The predicted effects of the VSU should be considered as part of a cumulative impact assessment and the proposed management of works on site planned accordingly. This would also be the case for any development proposed under the planning briefs. Once schemes have actually been designed and programmes prepared under these briefs the developers would need to consider the VSU as part of their consent submissions.

7.3.7 The VSU is proposed for construction from 2009 to 2015 and the VTI from 2010 to 2019. They are both major construction projects within a similar area. The VTI focuses on above ground works and the VSU on below ground works. The results of the cumulative assessment are presented in Table 7-4 (construction) and Table 7-5(operation).

7.3.8 The key areas of potential cumulative effects are traffic and transport, air quality and visual amenity. The VSU project team are committed to ensuring best environmental practice on-site through comprehensive CoCP and Environmental Management Plans. Every effort will be made for close and continued liaison between the two schemes and CoW throughout the construction process to ensure that all potential effects on sensitive receptors are mitigation as far as is reasonably practicable.

Table 7-4: Assessment of Significant Residual Cumulative Effects During Demolition and Construction			
Receiving Baseline	**Scheme Significant Residual Effects**		
	VSU	**VTI (information taken directly from VTI ES)**	**Cumulative Significant Residual Effects**
Traffic and Transport	Passenger footway issues around the perimeter of worksite C and on Wilton Road (due to closure of eastern arch entrance); Bus diversions for lengthy periods/delays to services/ relocation of bus stops causing longer walks and potential congestion due to all traffic using north bound VBR; relocation and diversion of taxis; some delays to road users. ***Conclusion: a number of significant residual effects***	The implementation of a site specific EMP would minimise any temporary disruptions to the road network surround the site. Any additional demolition and construction generated road traffic would be insignificant in relation to the existing traffic volumes: ***Conclusion: negligible***	The VTI have not identified any significant residual effects. However, the schemes are likely to have a cumulative adverse effect on traffic and transport resources. The VSU project team would work closely with the VTI project team and CoW to ensure that the disruption to the transport system is a low as is reasonably practicable.

Table 7-4: Assessment of Significant Residual Cumulative Effects During Demolition and Construction			
Receiving Baseline	**Scheme Significant Residual Effects**		
	VSU	**VTI (information taken directly from VTI ES)**	**Cumulative Significant Residual Effects**
Noise and Vibration	Significant noise effects identified on residential properties and other sensitive uses surrounding worksites. Vibration and groundborne noise effects identified on receptors. ***Conclusion: significant residual effects for groundborne and airborne noise and vibration***	**Vibration:** through the implementation of a site specific EMP vibration monitoring against specified limits will ensure that all vibration would be within acceptable limits. ***Conclusion: negligible*** **Traffic:** the generation of construction traffic would be insignificant in the context of the existing traffic flows – there would be no significant traffic noise. ***Conclusion: no significant residual effects*** **Noise:** although the implementation of a site specific EMP would minimise noise the scale and nature of the development, together with the proximity of a number of sensitive receptors will give rise to a number of noise effects. ***Conclusion: negligible to moderate adverse***	There will be a significant cumulative effect.

Table 7-4: Assessment of Significant Residual Cumulative Effects During Demolition and Construction			
Receiving Baseline	**Scheme Significant Residual Effects**		
	VSU	**VTI (information taken directly from VTI ES)**	**Cumulative Significant Residual Effects**
Air Quality	***Conclusion: No significant residual effects due to the implementation of the CoCP and Environmental Management Strategy.***	Road traffic emissions: the effects of construction plant operating on the site and construction vehicles leaving the site would be negligible within the context of local background concentrations and existing adjacent road traffic emissions. ***Conclusion: negligible*** Dust: a site specific EMP with standard dust control and management measures would minimise any dust emissions, however, during extreme periods of dry and windy weather there would be a potential for temporary short term effects. ***Conclusion: minor adverse***	The VSU will follow a comprehensive CoCP and the VTI will follow a comprehensive EMP. There will be no significant cumulative effects.
Townscape and Visual Amenity	Significant residual effects identified on townscape surrounding worksites, from removal of mature trees and temporary removal of 'Little Ben' clock tower. Effects on views from some office buildings and for pedestrians in key streets. ***Conclusion: there will be***	The demolition and construction would involve the use of a range of plant and equipment which are likely to give rise to temporary adverse effects. ***Conclusion: adverse***	The VSU works are significant, the combination of two major areas of works will have an adverse cumulative effect on the visual amenity and local townscape.

Table 7-4: Assessment of Significant Residual Cumulative Effects During Demolition and Construction			
Receiving Baseline	**Scheme Significant Residual Effects**		
	VSU	**VTI (information taken directly from VTI ES)**	**Cumulative Significant Residual Effects**
	significant townscape and visual amenity effects.		
Built Heritage	There will be the potential for a significant adverse effect on the VPT caused by possible strengthening works. The setting of some listed buildings will also be temporarily affected. ***Conclusion: significant residual effect (due to strengthening works)***	***Conclusion: Negligible significant effects***	There will be no cumulative effects.
Archaeology and Cultural Heritage	The only effect identified is the potential that organic remains could be affected by the chemical composition of jet grouting. ***Conclusion: significant adverse (due to jet grouting)***	Targeted geo-archaeological sampling, localised excavation and/or archaeological watching brief following demolition of buildings to determine presence of any remains. Any finds would be recorded and/or preserved as appropriate. ***Conclusion: negligible significant effects***	There will be no cumulative effects.
Contaminated Land	Use of CoCP, EMP and Waste Management Strategy. ***Conclusion: no significant effects***	The disposal of any contaminated land would be subject to legislative and regulatory control. Any contaminated land would be treated prior to disposal. A site specific EMP would manage contamination on	There will be no cumulative effects.

Table 7-4: Assessment of Significant Residual Cumulative Effects During Demolition and Construction			
Receiving Baseline	**Scheme Significant Residual Effects**		
	VSU	**VTI (information taken directly from VTI ES)**	**Cumulative Significant Residual Effects**
		site. The risk of water and groundwater contamination would be minimised through the undertaking of a Foundations Works Risk Assessment. ***Conclusion: negligible significant effects***	
Water Resources	Use of CoCP, EMP and Waste Management Strategy ***Conclusion: no significant effects***	Measures to protect ground and surface water resources will be included with a site specific EMP. All drainage flow routes and connections would be maintained. All basement areas would be constructed using standard sealed construction techniques. ***Conclusion: negligible significant effects***	There will be no cumulative effects.
Ecology	All designated sites are remote from the site and will not be affected by construction works. Terrestrial habitats are of low value. CoCP and EMP include pre-demolition checks for nesting birds and works scheduled outside breeding season where practicable. ***Conclusion: no significant effects***	All designated sites are remote from the site and will not be affected by construction works. Terrestrial habitats are of low value. Site specific EMP will include pre-demolition checks for nesting birds and works scheduled outside breeding season where practicable. ***Conclusion: negligible significant effects***	There will be no cumulative effects.

Table 7-4: Assessment of Significant Residual Cumulative Effects During Demolition and Construction			
Receiving Baseline	**Scheme Significant Residual Effects**		
	VSU	**VTI (information taken directly from VTI ES)**	**Cumulative Significant Residual Effects**
Socio-Economics	Creation of 195 full time equivalent (FTE) jobs and 97 indirect jobs. Loss of 457 jobs due to demolition and site clearance. ***Conclusions: not significant (as a proportion of local employment)***	Creation of 1,106 FTE jobs and 553 indirect jobs Generate additional expenditure of £0.8million trough workforce spending. Job losses through demolition not identified. ***Conclusion: moderate beneficial***	There will be no cumulative effects.
Community	***Conclusion: no significant effects***	Not undertaken	There will be no cumulative effects.

Table 7-5: Assessment of Significant Residual Cumulative Effects During Operation			
Receiving Baseline	**Scheme Significant Residual Effects**		
	VSU	**VTI (information taken directly from VTI ES)**	**Cumulative Significant Residual Effects**
Traffic and Transport	Changes in pedestrian desire lines resulting in a reduction of pedestrian flows on Little Ben Island and along the south side of Victoria Street. Significant improvements to passenger journeys through station improvements. ***Conclusion: significant beneficial effect***	**Pedestrian:** new open spaces and planned network of pedestrian routes increasing accessibility. Relocation of bus stops increasing efficiency and capacity. ***Conclusion: substantial beneficial*** **Highway:** improve operational efficiency of highway network, removal of servicing from active streets. ***Conclusion: moderate beneficial*** **Parking:** minimum parking provision to encourage use of public transport ***Conclusion: minor beneficial*** **Buses:** provision of new on-street bus stops would increase walking distance. ***Conclusion: minor adverse*** **Bus Stops:** relocation of bus stops and infrastructure to the surrounding streets will increase walking times for passengers	There would be a cumulative beneficial effect.

Table 7-5: Assessment of Significant Residual Cumulative Effects During Operation			
Receiving Baseline	**Scheme Significant Residual Effects**		
	VSU	**VTI (information taken directly from VTI ES)**	**Cumulative Significant Residual Effects**
		interchanging with other modes. ***Conclusion: moderate adverse***	
Noise and Vibration	No significant residual effects.	**Traffic:** the re-routing of traffic and relocation of bus stops would cause increases and decreases in traffic flows around the site. The impact would vary depending on location. ***Conclusion: minor beneficial to negligible to minor adverse.*** **Equipment:** operational building plant and services would be designed to meet operational noise requirements of CoW. ***Conclusion: negligible***	There will be no cumulative effects.
Air Quality	Some emissions of greenhouse gases without 100% energy from renewable sources but this would not be significant. ***Conclusion: no significant residual effects***	**Vehicular:** reduction in vehicular emissions due to relocation of bus stops and re-routing of traffic. ***Conclusion: negligible to minor beneficial*** **Plant:** designed in line with building regulations all flues at roof level away from receptors ***Conclusion: negligible***	There will be no cumulative effects.

Table 7-5: Assessment of Significant Residual Cumulative Effects During Operation			
Receiving Baseline	**Scheme Significant Residual Effects**		
	VSU	**VTI (information taken directly from VTI ES)**	**Cumulative Significant Residual Effects**
Townscape and Visual Amenity	Beneficial effects on the public realm at 'the Beach' area. ***Conclusion: beneficial significant residual effect***	Combination of some beneficial and some adverse impacts on views. ***Conclusion: moderate beneficial to moderate adverse***	There will be no cumulative effects.
Built Heritage	Strengthening works (as reported in construction). ***Conclusion: significant adverse effect***	Not reported	There will be no cumulative effects.
Archaeology and Cultural Heritage	***Conclusion: No significant residual effects.***	***Conclusion: negligible (no ground disturbance)***	There will be no cumulative effects.
Contaminated Land	***Conclusion: No significant residual effects.***	***Conclusion: negligible***	There will be no cumulative effects.
Water Resources	Counter flooding measures such as installation of additional drainage. ***Conclusion: no significant residual effects***	Flood defences of the Thames and location of development mean site adequately protected from tidal and fluvial flooding, on and off-site groundwater flooding would be minimised through waterproofing of basements and appropriate mitigation informed by groundwater monitoring. ***Conclusion: negligible***	There will be no cumulative effects.

Table 7-5: Assessment of Significant Residual Cumulative Effects During Operation			
Receiving Baseline	**Scheme Significant Residual Effects**		
	VSU	**VTI (information taken directly from VTI ES)**	**Cumulative Significant Residual Effects**
Ecology	***Conclusion: no significant residual effects***	Significant areas of landscaping with ecological benefits. ***Conclusion: moderate beneficial***	There will be no cumulative effects.
Socio Economics	245 jobs created. ***Conclusion: not significant as a proportion of local employment***	4034 direct and 403 indirect jobs and productivity benefits of £2.393 billion over the life time of the project. ***Conclusion: substantial beneficial*** Increased provision of residential units generating £8million a year locally and £15.2million regionally with £2.9million generated by future employees. ***Conclusion: moderate beneficial*** High quality environment in which to live and work. ***Conclusion: minor beneficial***	There will be no cumulative effects.
Community	Easier access to places of employment, shops and services. ***Conclusion: significant beneficial residual effect***	Not assessed.	Not Applicable

8 Summary of Key Environmental Effects and Mitigation Measures

8.1 Introduction

8.1.1 The ES has presented the baseline data for each environmental receptor identified during the scoping phase of the EIA process. The results of the assessment process are documented within Section 6 which is supported by detailed technical appendices. Table 8-1 and Table 8-2 present a summary of the impacts, effects, incorporated mitigation measures, significant residual effects, supplementary mitigation and enhancement measures that have been developed for the scheme and presented throughout Section 6. The tables are presented in the context of construction effects and operational effects in Section 8.2 and 8.3 respectively.

8.2 Construction

8.2.1 Table 8-1 presents a summary of the effects of the VSU scheme associated with the construction process.

Table 8-1: Summary of Construction Effects

Ref	Impact	Effect	Incorporated mitigation adopted to address effect	Significant residual effect	Supplementary mitigation	Enhancements
Construction						
Traffic and Transport						
Road Safety						
C1	Phases 1,2,3,4, and 5 - Construction worksites located within Terminus Place, Station forecourt and 'the Beach'.	Increased risk of conflict between pedestrians and moving traffic due to crowded footways.	Provide temporary footway areas around perimeter of worksite and encourage use of alternative routes.	During Phases 1,2, 4 and 5 there is still insufficient footway width despite temporary footways around perimeter of worksite C.	Additional signing and marshalling of pedestrians during peak periods. Provide additional pedestrian routes from the mainline concourse	None
Pedestrians and PRM						
C2	Phase 2 - Construction worksite in Wilton Road requiring full closure of Wilton Road and its encroachment onto 'the Beach'.	Severe restriction on pedestrian capacity due to reduced footway areas along key pedestrian route and the closure of the eastern-most entrance to the mainline station.	Provide temporary footway areas around perimeter of worksite and encourage use of alternative routes.	With eastern arch entrance to mainline station closed during Phase 2 there is insufficient footway width (including that in Wilton Road), despite temporary footway around site, to accommodate	Additional signing and marshalling of pedestrians during peak periods. Determine whether more footway could be made available in Wilton Road during Phase 2. Provide additional pedestrian routes	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
				pedestrian demand.	from the mainline concourse.	
C3	Phases 3, 4 and 5 Encroachment of worksite onto eastern footway of Vauxhall Bridge Road.	Severe restriction on pedestrian capacity due to reduced width of footway.	Provide diversion via pedestrian islands at signalled junction and west-side footway but this route is congested and pedestrian facility may be difficult to provide for return crossing.	This route is congested and pedestrian facility may be difficult to provide for return crossing.	Investigate potential for reducing size of worksite on east side to ease local 'pinch point' on footway.	None
Bus Routing						
C4	Phases 1,2 and 3 – Closure of eastern leg of Allington Street to all vehicular traffic.	Several bus services unable to use Allington Street as part of their normal route between Terminus Place and Victoria Street (east).	Affected buses diverted via identified routes. Contra-flow bus lane provided in Victoria Street, between Wilton Road and Bressenden Place.	Diversion which are likely to be in place for the longer of the works (18 months approx).	None	None
C5	Phase 2 – Closure of Wilton Road to all vehicular traffic.	Several bus services unable to use Wilton Road.	Provide contra-flow bus lane in Vauxhall Bridge	Allowing all traffic to use VBR northbound would cause severe problems for buses and pedestrians at	Relocation of existing bus stand from VBR to accommodate proposed changes.	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
				the Victoria Bridge Road/Wilton Road/Victoria Street junction. Use of contraflow bus only lane minimises effect.		
C6	Phases 1, 2, 4, 5, 5a, 5b, 5c, 5d and 5e – Worksite encroachment onto Bus Station and Terminus Place.	Operation of buses affected by reduced areas in which to manoeuvre and stop.	Relocation of some services (C1 and C10) away from the bus station area and reconfiguration of the bus stop islands.	Relocation of bus services C1 and C10 would result in longer walk to relocated bus stop for passengers of these services.	None	None
C7	Phases 1,2,3,4, 5, 5a, 5b, 5c and 5d, 5e. Worksites on Bressenden Place.	Lay-over for long distance buses affected by worksite.	Relocation of lay-over subject to agreement with third parties.	Potential for disruption or delay to the affected services.	None	None
Bus Passengers						
C8	Phase 2 – Closure of Wilton Road to all vehicular traffic.	Bus stops in Wilton Road are temporarily suspended.	Provide contra-flow bus lane in Vauxhall Bridge Road with bus stops relocated to VBR and re-route some affected buses via Eccleston Bridge	Longer walk for passengers due to relocated stops.	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			and Buckingham Palace Road.			
C9	All Phases Worksite encroachment onto Bus Station and Terminus Place.	Pedestrian route on eastern end of bus islands is unavailable.	Divert pedestrians to crossing at western end of bus islands.	Longer walk for passengers due to relocated stops.	None	None
Taxis – Routing and Pick Up/Set Down						
C10	All Phases Worksite encroachment onto Bus Station and Terminus Place.	Direct impact on main taxi rank at front of mainline station.	Use of Rail/air deck at rear of station as substitute main taxi rank. Supplemented by provision of secondary pick up point at Wilton Road/Hudson's Place.	Diversion of taxis from normal route.	The provision of increased waiting areas for passengers at rail/air deck.	None
C11	All Phases Worksite encroachment onto Wilton Road.	Direct impact on main taxi feeder rank located on the off-side lane of Wilton Road.	Use of Rail/air deck at rear of station as substitute main taxi rank. Supplemented by provision of secondary pick up point at Wilton Road/Hudson's Place, with provision	Relocation of taxi feeder rank from current location therefore longer walk for taxi users.	The provision of increased area for taxi feeder rank on rail/air deck.	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			for new feeder rank(s) at these locations.			
Taxi Passengers						
C12	All Phases - Worksite encroachment onto Bus Station and Terminus Place.	Direct impact on main taxi rank necessitating its relocation to rail/air deck and Hudson's Place.	Signed diversion of taxi passengers to the alternative facilities but distance is significant.	Relocation of taxi feeder rank from current location therefore longer walk for taxi users.	None	None
Parking and Loading						
C13	Phases 1 2, 3, 4, 5, 5a, 5b, 5c, 5d and 5e - Worksite encroachment onto Wilton Road.	Direct impact on existing on-street loading bays within Wilton Road.	Provision of alternative on-street loading bay within southern end of Wilton Road.	None	Not Applicable	None
C14	All Phases - Worksite encroachment onto Bressenden Place.	Direct impact on existing on-street loading bay on west side of Bressenden Place.	Properties adjacent to loading bay subsumed within worksite area therefore demand for loading removed.	None	Not Applicable	None
C15	All Phases - Worksites in Wilton Road, Station Forecourt, and 'the Beach'.	Direct impact on servicing and access of National Rail station.	Potential increased use of Airdeck and Buckingham Palace Road with increased	None.	Not Applicable	None

Table 8-1: Summary of Construction Effects

Ref	Impact	Effect	Incorporated mitigation adopted to address effect	Significant residual effect	Supplementary mitigation	Enhancements
Construction						
			management of servicing loads and times. To be progressed in liaison with Network Rail.			
Freight and Private Vehicular Traffic						
C16	All Phases – Encroachment of worksite onto carriageway of Bressenden Place.	Reduced width of carriageway, resulting in a reduction in capacity at the Bressenden Place/Victoria Street signals.	None	Additional delays to road users.	None	None
C17	All Phases – Encroachment of worksite onto carriageway of Wilton Road.	Reduced width of carriageway and need to remove all through traffic except buses and cyclists.	Diversion of affected traffic via Eccleston Bridge and Buckingham Palace Road.	Additional delays to road users.	Proposed improvements to the Eccleston Bridge/Buckingham Palace Road junction (to provide increased capacity to handle displace traffic from Wilton Road) under investigation.	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
Noise and Vibration						
Façade direction in brackets where relevant. Note 1: Where a property qualifies for NI but there is an earlier period for which a SE is predicted, it has been assumed that the NI will be offered and installed before the first SE period occurs thereby removing those SEs. Note that No SRNE = No Significant Residual Noise Effects. Note 2: Until the work starts and the local structural details are discovered during the demolition, it is not possible to envisage the measures that may be available in specific cases, and the assessment of groundborne noise and vibration has been made on the assumption that the likely method of working will involve percussive breaking. However, the use of percussive methods will be avoided where practicable.						
C18	20 Palace St (SW) 18 storeys	Airborne noise from daytime working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	Significant Effect Oct 09 – Dec 13 (shorter duration at ground floor)	None	None
C19	The Stag PH (Upper floor only)	Airborne noise from daytime working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has	**No SRNE** Noise Policy triggered (Further Mitigation)	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.			
C20	The Stag PH (Upper floor only)	Airborne noise from night-time working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	Significant Residual Noise Effects Nov10 – Mar12 (NB Would be removed by application of FM under the Noise Policy to address daytime effects)	None	None
C21	*The Kings Arms PH* (Upper floors only)	Airborne noise from daytime working at worksites	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and	**No SRNE** Noise Policy triggered (Noise Insulation	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			Further Mitigation Policy to address residential occupiers.			
C22	The Cameo Apartments, 17 Allington St N (9) West End	Airborne noise from daytime working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	Significant Effect May 10 – Mar 11	None	None
C23	The Cameo Apartments, 17 Allington St N (9) East End	Airborne noise from daytime working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address	Noise Insulation Applied to upper floors so **No SRNE** Ground floor - Significant Effect only within period Oct 09 – Dec13 (no insulation)	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			residential occupiers.			
C24	*1 to 20 Allington Court N (7)* (Not ground floor)	Airborne noise from worksites from daytime working	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	Noise Insulation so **No SRNE**	None	None
C25	*1 to 20 Allington Court N (7)* (Not ground floor)	Airborne noise from night-time working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	Noise Insulation so **No SRNE** (part of façade)	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
C26	The Stage Door PH (3 Allington St) SE (4) (Not ground floor)	Airborne noise from worksites from daytime working	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	Noise Insulation so **No SRNE**	None	None
C27	Duke of York PH W (3 – 4) (Not ground floor)	Airborne noise from daytime working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	Noise Insulation so **No SRNE**	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
C28	Duke of York PH S (4) (Not ground floor)	Airborne noise from daytime working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	Noise Insulation at upper floors so **No SRNE**	None	None
C29	316-314 Vauxhall Br Rd SW (4) (Not ground floor)	Airborne noise from daytime working at worksites.	Best practicC32able means applied Tc33o minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	Noise Insulation at upper floors so **No SRNE** Ground floor no noise insulation or significant effects	None	None
C30	1-14 Evelyn Mansions Carlisle Place NE (7)	Airborne noise from daytime working at	Best practicable means applied to	Noise Insulation at upper floors so **No**	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
		worksites.	minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	**SRNE** Ground floor significant effect within period Oct 09 – Dec 13 (no Noise Insulation)		
C31	15-39 Evelyn Mansions, Carlisle Place SW (5)	Airborne noise from daytime working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	Noise Insulation at upper floors so **No SRNE** Ground floor and 1st/2nd floors Significant Effect within period Oct 09 – Apr 14 (no Noise Insulation)	None	None
C32	*Montfort House, Carlisle Place NE (5 + S/B)*	Airborne noise from daytime working at worksites.	Best practicable means applied to minimise noise/vibration	Significant Effect within similar period Oct 09 – Mar 14 (shorter period at	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	lower floors)		
C33	*St Andrew's Hall, Carlisle Place W (7)*	Airborne noise from daytime working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	Significant Effect within similar period Oct 09 – Dec 13 (shorter period at lower floors)	None	None
C34	Convent, Carlisle Place NE (3+ S/B)	Airborne noise from daytime working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61	Significant Effect within period Oct 09 – Mar 12 (shorter duration at lower floors)	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.			
C35	*1 Carlisle Mansions W (5+B)*	Airborne noise from daytime working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	Significant Effect within period May 09 – Dec 12 (shorter duration at lower floors)	None	None
C36	*2 Carlisle Mansions W (5+B)*	Airborne noise from daytime working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise	Significant Effect within period May 09 – Dec 12 (shorter duration at lower floors)	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			Insulation and Further Mitigation Policy to address residential occupiers.			
C37	*3 Carlisle Mansions W (5+B)*	Airborne noise from daytime working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	Significant Effect within period Oct 09 – Mar 11 (shorter duration at lower floors, no SE at ground floor)	None	None
C38	76-85 Carlisle Mansions NE (5+B)	Airborne noise from daytime working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation	Significant Effect within period May 10 – Jul 10 (Not ground or first floors)	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			Policy to address residential occupiers.			
C39	Royal Westminster Hotel E (3 – 13))	Airborne noise from daytime working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	Significant Effect within period Oct 09 – Apr 12 (shorter duration at lower floors, no SE at ground floor)	None	None
C40	Royal Westminster Hotel S (3-13)	Airborne noise from daytime working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	Significant Effect within period Oct 09 – Apr 12 (shorter duration at lower floors, no SE at ground floor)	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
C41	Grosvenor Hotel (N) 9 storeys	Airborne noise from daytime working at worksites.	Best practicable means applied to minimise noise/vibration emissions, together with COCP and S61 process. Project has adopted Noise Insulation and Further Mitigation Policy to address residential occupiers.	Significant Effect within period Oct 09 – Apr 12 (Not at ground floor)	None	None
C42	154 Victoria Street when percussive work is required in a location that has structural connections with, or is very close to, the foundations of other buildings and the noise occurs in sensitive locations or at sensitive times	Groundborne Noise from construction activity including demolition of 175 – 179 Victoria Street	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Alternative methods of removing those parts of the structure nearest to affected buildings so as to minimise the effects of vibration will be	Likely Significant Effect (see note 1)	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			investigated and implemented, where practicable. Since the effect of this additional mitigation is not currently known, the unmitigated effects have been presented.			
C43	156 Victoria Street when percussive work is required in a location that has structural connections with, or is very close to, the foundations of other buildings and the noise occurs in sensitive locations or at sensitive times	Groundborne Noise from construction activity including demolition of 175 – 179 Victoria Street	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Alternative methods of removing those parts of the structure nearest to affected buildings so as to minimise the effects of vibration will be investigated and implemented, where	Likely Significant Effect (see note 1)	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			practicable. Since the effect of this additional mitigation is not currently known, the unmitigated effects have been presented.			
C44	181 Victoria Street when percussive work is required in a location that has structural connections with, or is very close to, the foundations of other buildings and the noise occurs in sensitive locations or at sensitive times	Groundborne Noise from construction activity including demolition of 175 – 179 Victoria Street	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Alternative methods of removing those parts of the structure nearest to affected buildings so as to minimise the effects of vibration will be investigated and implemented, where practicable. Since the effect of this	Likely Significant Effect (see note 1)	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			additional mitigation is not currently known, the unmitigated effects have been presented.			
C45	179 Victoria Street when percussive work is required in a location that has structural connections with, or is very close to, the foundations of other buildings and the noise occurs in sensitive locations or at sensitive times	Groundborne Noise from construction activity including demolition of 175 – 179 Victoria Street	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Alternative methods of removing those parts of the structure nearest to affected buildings so as to minimise the effects of vibration will be investigated and implemented, where practicable. Since the effect of this additional mitigation is not currently	Likely Significant Effect (see note 1)	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			known, the unmitigated effects have been presented.			
C46	Victoria Palace Theatre	Groundborne Vibration during demolition of Elliott House	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process. Alternative methods of removing those parts of the structure nearest to affected buildings so as to minimise the effects of vibration will be investigated and implemented, where practicable. Since the effect of this additional mitigation is not currently known, the	Exceeds criteria for standard and listed buildings. Potential Major Significant Effect for occupiers	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			unmitigated effects have been presented. Agreement being negotiated to devise acceptable working arrangements for Theatre and VSU works.			
C47	The Stag PH	Groundborne Vibration during demolition of Elliott House	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process Alternative methods of removing those parts of the structure nearest to affected buildings so as to minimise the effects of vibration will be investigated and	Likely to exceed criterion for standard buildings Potential Major Significant Effect for occupiers	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			implemented, where practicable. Since the effect of this additional mitigation is not currently known, the unmitigated effects have been presented.			
C48	Victoria Station (near air vent). (property owned by LU)	Groundborne Vibration during removal of surface vent	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process Alternative methods of removing those parts of the structure nearest to affected buildings so as to minimise the effects of vibration will be investigated and implemented, where	Expected to exceed criterion for standard buildings	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			practicable. Since the effect of this additional mitigation is not currently known, the unmitigated effects have been presented.			
C49	181 Victoria Street (property owned by LU)	Groundborne Vibration during demolition of 175 – 179 Victoria Street	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process Alternative methods of removing those parts of the structure nearest to affected buildings so as to minimise the effects of vibration will be investigated and implemented, where practicable. Since	Expected to exceed criterion for standard buildings Potential Significant Effect for occupiers	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			the effect of this additional mitigation is not currently known, the unmitigated effects have been presented.			
C50	7 Terminus Place (property owned by LU)	Groundborne Vibration during demolition of 175 – 179 Victoria Street	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process Alternative methods of removing those parts of the structure nearest to affected buildings so as to minimise the effects of vibration will be investigated and implemented, where practicable. Since the effect of this	Expected to exceed criterion for standard buildings Potential Significant Effect for occupiers	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			additional mitigation is not currently known, the unmitigated effects have been presented.			
C51	4-6 Terminus Place (property owned by LU)	Groundborne Vibration during demolition of 175 – 179 Victoria Street	Best practicable means applied to minimise noise/vibration emissions, together with CoCP and S61 process Alternative methods of removing those parts of the structure nearest to affected buildings so as to minimise the effects of vibration will be investigated and implemented, where practicable. Since the effect of this additional mitigation	Expected to exceed criterion for standard buildings Potential Significant Effect for occupiers	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			is not currently known, the unmitigated effects have been presented.			
C52	Addition of construction traffic and diversion of normal traffic from usual routes.	Changes in airborne noise levels arising from changes in flows, but no significant effects.	None required	None	None required.	None
C53	Utilities works	Airborne noise and groundborne vibration from worksite activity. Changes to traffic flow.	Not yet evaluated for this activity.	Effects from Worksite activity not known at this stage. No significant noise effects from traffic changes.	Not known at this stage.	None
Air Quality						
C54	Demolition Activities, Piling, Excavation, Jet grouting, Infilling and Fitting.	Raising of dust from construction activities leading to nuisance.	Measures included in the project CoCP. Tier 2 and 3 sites identified are recommended to include increased mitigations in order to reduce risk.	None	Not Applicable	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
C55	Emissions from the construction phase (vehicle and plant emissions).	Contributes to greenhouse gases.	Measures included in the project CoCP. Efficient planning of activities to minimise vehicle and plant use. Energy efficiency wherever possible.	None	Not Applicable	None
C56	Increase in traffic due to construction activities.	Deterioration in local air quality.	Careful planning to minimise congestion, and to cause minimal disruption to 'normal' traffic flows. Consider non-road delivery methods.	None	Not Applicable	None
C57	Increased congestion due to road closures/diversions.	Deterioration in local air quality.	Careful planning to minimise congestion, and to cause minimal disruption to 'normal' traffic flows. Use of all available road capacity.	None	Not Applicable	None
C58	Utilities Works	Contributes to greenhouse gases.	Works undertaken in accordance with the	None	Not Applicable	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			project CoCP as standard.			
Townscape and Visual Amenity						
C59	Creation of construction compounds, erection of hoardings.	Adverse effect on townscape character through reduction in active open space, loss in legibility.	Maintain hoardings so that they are in good repair and graffiti free at all times.	Moderate adverse due to reduction of already congested public space.	Hoardings could offer opportunities for a temporary public art project for the duration of construction to enhance townscape character.	None.
C60	Felling of three trees in Bressenden Place.	Loss of trees will have an adverse effect on townscape character.	Three replacement trees will be planted when construction is complete.	Adverse until the trees are sufficiently established to contribute to the local townscape character.	Maintenance of the new trees until they are fully established.	None
C61	Removal of Little Ben Clock Tower for the duration of works.	Adverse effect on local landmark.	Careful storage of the clock tower for re-erection after construction is complete.	Adverse due to loss of local landmark however, this is temporary.	None	None
C62	Visual impact of demolition and construction.	Office workers in Portland House will have deterioration in	Maintain hoardings so that they are in good repair and	Moderate adverse due to adverse effects caused by	Hoardings could offer opportunities for a temporary	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
		views.	graffiti free at all times.	demolition and erection of construction compounds.	public art project for the duration of construction to enhance townscape character.	
C63	Visual impact of demolition and construction.	Office workers in Cardinal Place will have deterioration in views	Maintain hoardings so that they are in good repair and graffiti free at all times.	Moderate adverse due to adverse effects caused by demolition and erection of construction compounds.	Hoardings could offer opportunities for a temporary public art project for the duration of construction to enhance townscape character.	None
C64	Visual impact of demolition and construction.	Office workers in buildings around Terminus Place will have deterioration in views.	Maintain hoardings so that they are in good repair and graffiti free at all times.	Moderate adverse due to adverse effects caused by demolition and erection of construction compounds.	Hoardings could offer opportunities for a temporary public art project for the duration of construction to enhance townscape character.	None
C65	Visual impact of demolition and	Victoria Palace Theatre goers will	Maintain hoardings so that they are in	Moderate adverse due to adverse	Hoardings could offer opportunities	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
	construction.	experience deterioration in views.	good repair and graffiti free at all times.	effects caused by demolition and erection of construction compounds.	for a temporary public art project for the duration of construction to enhance townscape character.	
C66	Visual impact of demolition and construction.	Users of Victoria Station will experience deterioration in views.	Maintain hoardings so that they are in good repair and graffiti free at all times.	Moderate adverse due to adverse effects caused by demolition and erection of construction compounds.	Hoardings could offer opportunities for a temporary public art project for the duration of construction to enhance townscape character.	None
C67	Visual impact of demolition and construction.	Pedestrians in Bressenden Place will experience deterioration in views.	Maintain hoardings so that they are in good repair and graffiti free at all times.	Moderate adverse due to adverse effects caused by demolition and erection of construction compounds.	Hoardings could offer opportunities for a temporary public art project for the duration of construction to enhance townscape character.	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
C68	Visual impact of demolition and construction.	Pedestrians on Wilton Road will experience deterioration in views.	Maintain hoardings so that they are in good repair and graffiti free at all times.	Moderate adverse due to adverse effects caused by demolition and erection of construction compounds.	Hoardings could offer opportunities for a temporary public art project for the duration of construction to enhance townscape character.	None
Built Heritage						
Victoria Palace Theatre						
C69	Demolition of adjacent buildings.	Thermal, acoustic and weather proofing provided by party wall reduced.	Installation of suitable durable cladding.	None	Not Applicable	None
		Stability of shared foundations, party wall and KDPS culvert impaired.	Analysis and propping if necessary.	None	Not Applicable	None
C70	Construction of North Ticket Hall and Paid Area Link.	Settlement of the building.	The primary mitigation will be in the form of underpinning by ground improvement	In recognition of the importance of this building and the fact that some detailed work remains to fully	Not Applicable	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			and special construction techniques to minimise settlement effects.	define the protective and strengthening works, the present effect is judged as significant adverse (Sig). However, it is envisaged that this will be reduced to non significant (NSig) status through further development and discussions and agreement with the relevant parties.		
C71	Ground improvement by Jet Grouting.	Heave, settlement, grout ingress, collapse of underground structures.	Full scale trials, real time monitoring; desk studies, intrusive surveys, specialist contractor, detailed method statements.	None	Not Applicable	None
C72	Worksite of the North Ticket Hall and the Corner site Development	Changes to setting.	Installation of site hoardings	Significant changes to setting.	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
Victoria Mainline Station (Eastern)						
C73	Construction of the extended Victoria line ticket hall (STH).	Settlement of the building.	Settlement analysis to define/modify construction methods and protective measures.	None	Not Applicable	None
C74	Physical changes	Works to the basement, possibility of additional access openings at ground level.	Access openings to be located at existing openings or retail sites to limit effect on the architecture.	None	Not Applicable	None
C75	Temporary plant rooms in Terminus Place, Temporary ticket office and queuing, construction site at 'the Beach' for the STH.	Changes to setting.	None	Significant changes to setting however could be reduced to non significant through further scheme design.	None	None
Victoria Mainline Station (Western)						
C76	Temporary plant rooms in Terminus Place, Temporary ticket office and queuing.	Changes to setting.	None	Significant changes to setting however could be reduced to non significant through further scheme design.	None	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
Apollo Theatre						
C77	Construction of the extended STH.	Settlement of the building	Settlement analysis to define/modify construction methods and protective measures.	None	Not Applicable	None
C78	Groundwater changes	Potential build of ground water above basement level.	If necessary permanent additional pumping facilities will be installed prior to construction.	None	Not Applicable	None
C79	Construction site at 'the Beach' for the STH.	Changes to setting.	None	Significant changes to setting however could be reduced to non significant through further scheme design.	None	None
Archaeology and Cultural Heritage						
C80	Demolition of existing buildings prior to construction.	Remove potential archaeological remains.	Archaeological evaluation, possible further mitigation through preservation by record.	None	Dissemination of results to enhance public appreciation through publication or similar.	None
C81	Excavation for North Ticket Hall.	Completely remove potential archaeological	Archaeological evaluation, possible further mitigation	None	Dissemination of results to enhance public appreciation	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
		remains within its footprints.	through preservation by record.		through publication or similar.	
C82	Excavation for new service area in Bressenden Place.	Completely remove potential archaeological remains within its footprints.	Archaeological evaluation, possible further mitigation through preservation by record.	None	Dissemination of results to enhance public appreciation through publication or similar.	None
C83	Excavation for South Ticket Hall.	Completely remove potential archaeological remains within its footprints.	Archaeological evaluation, possible further mitigation through preservation by record.	None	Dissemination of results to enhance public appreciation through publication or similar.	None
C84	Other works to the south of the South Ticket Hall to widen the staircases require piling.	Completely or partially remove potential archaeological remains within the area affected.	Archaeological evaluation, possible further mitigation through preservation by record.	None	Dissemination of results to enhance public appreciation through publication or similar.	None
C86	Excavation for fire fighting shaft west of Bressenden Place.	Completely remove potential archaeological remains within its footprint.	Archaeological evaluation, possible further mitigation through preservation by record.	None	Dissemination of results to enhance public appreciation through publication or similar.	None
C87	Excavation for proposed temporary access shafts for	Completely remove potential archaeological	Archaeological evaluation, possible further mitigation	None	Dissemination of results to enhance public appreciation	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
	tunnelling in Allington Street.	remains within their footprints.	through preservation by record.		through publication or similar.	
C88	Excavation for a pump shaft in Vauxhall Bridge Road.	Completely remove potential archaeological remains within its footprint.	Archaeological evaluation, possible further mitigation through preservation by record.	None	Dissemination of results to enhance public appreciation through publication or similar.	None
C89	Excavation for a PRM lift shaft in Victoria Street.	Completely remove potential archaeological remains within its footprint.	Archaeological evaluation, possible further mitigation through preservation by record.	None	Dissemination of results to enhance public appreciation through publication or similar.	None
C90	Excavation for a crane base currently proposed to the west of North Ticket Hall box that requires piled foundations.	Partially or completely remove potential archaeological remains within its footprint.	Archaeological evaluation, possible further mitigation through preservation by record.	None	Dissemination of results to enhance public appreciation through publication or similar.	None
C91	Excavations for structures within construction compounds such as batching facilities and sumps.	Partially or completely remove potential archaeological remains within the areas affected.	Archaeological evaluation, possible further mitigation through preservation by record.	None	Dissemination of results to enhance public appreciation through publication or similar.	None
C92	Jet grouting in Allington Street, Wilton	Major effect on archaeological by	Archaeological evaluation, possible	Any organic remains could be affected by	Archaeological evaluation prior to	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
	Road, Vauxhall Bridge Road and Victoria Street.	consolidating the deposits to a degree which prevents investigation. Closely spaced injection positions could lead to extensive near surface disturbance (Davis et al 2004, 54).	further mitigation through preservation by record.	chemical composition of the grout.	grouting. Dissemination of results to enhance public appreciation through publication or similar.	
C93	Service diversions and new service trenches.	Likely to partially or completely remove potential archaeological remains.	Archaeological evaluation, possible further mitigation through preservation by record.	None	Dissemination of results to enhance public appreciation through publication or similar.	None
Demolition and Excavated Materials, and Waste						
C94	Demolition of buildings and tunnel driving and shank sinking.	Generation of construction and demolition wastes.	Implementation of the Environmental Management Strategy incorporating an Environmental Management and Monitoring Plan (EMMP) and a Site Waste Management	None	Not Applicable	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			Plan (SWMP).			
Contaminated Land						
C95	Demolition activities	Exposure of staff and visitors to contaminated soils and dust.	PPE provided to staff working in close proximity to contaminated soils and measures within the Code of Construction.	None	Not Applicable	None
C96	Excavation of ticket halls, shafts and tunnels.	Exposure of staff and visitors to contaminated soils and dust.	PPE provided to staff working in close proximity to contaminated soils and measures within the Code of Construction.	None	Not Applicable	None
		Ingress of land gases in to Underground structures.	Gas protection measures to be included within building design.	None	Not Applicable	None
		Contaminated soils requiring specialist disposal.	Disposal to appropriately licensed facilities.	None	Not Applicable	None
Water Resources						
C97	Loss of grout during pre-treatment of	Contaminated surface runoff and	Implementation of the CoCP and	None	Not Applicable	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
	gravels.	groundwater contamination.	monitoring of grout operations and impacts during drainage works.			
C98	General construction activities.	Contaminated surface runoff.	Implementation of the CoCP.	None	Not Applicable	None
C99	Dewatering activities.	Localised short term reduction in water levels and groundwater flows.	Not Applicable.	None	Not Applicable	None
C100	Groundwater flooding	Flooding of works and any linked underground works.	Include in emergency procedures required by the CoCP.	None	None	None
C101	Site below Thames Flood Level	Flood risk if Thames flood defences fail.	Inclusion in risk register, appropriate design and construction methodology.	None	Inclusion in emergency procedures required by the CoCP.	None
Ecology						
C102	Demolition of structures within the zone of influence.	Loss of potential bird nesting habitat within structures.	Demolition work to be undertaken outside the bird breeding season. Where the above cannot be undertaken bird nest	None	Not Applicable	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
			surveys will be undertaken by a suitably qualified ecologist.			
		Loss of potential bat roost habitat.	Bat roost survey will be undertaken prior to any works on site and at a time suitable to the species and which will allow for any licensing requirements to be addressed.	None	Not Applicable	None
		Loss of three London Plane Trees.	Bird nest survey outside breeding season to ensure no offences under the Wildlife & Countryside Act 1981, as amended.	None	Not Applicable	None
			Replacement of the trees as discussed within the Townscape and Visual Amenity Assessment.			Provision of six trees to compensate for the loss of trees.

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
		Dust emanating form demolition activities, and also generally throughout construction may affect urban bird and bat populations.	Incorporated mitigation as addressed within the Air Quality Section (6.4) of the ES and VSU scheme CoCP.	None	Not Applicable	None
C103	Piling and tunnelling and general construction activities.	Noise and vibration effects on local urban bird and foraging bat populations.	Incorporated mitigation as addressed within the Noise & Vibration Section (6.3) of the ES and VSU CoCP.	None	Not Applicable	None
Socio-Economics						
C104	Demolition of buildings as covered in baseline section.	Direct loss of employment as a result of closure. It is calculated that a total of 305 jobs will be lost directly due to demolition (and a further 152 indirectly). This is not considered significant as the local economy is	Businesses affected will receive compensation. Ongoing discussions with TfL.	This is not considered significant as the local economy is strong and can withstand such a change.	Not Applicable	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
		strong and can withstand such a change. Additionally, employers affected by demolition may be able to move to alternative premises in Victoria.				
C105	Construction work in front of Main Station.	Loss of jobs due to removal of stalls. It is calculated that 25 jobs will be lost (and a further 13 indirectly). This is not considered significant as the local economy is strong and can withstand such a change.	N/A	This is not considered significant as the local economy is strong and can withstand such a change.	Not Applicable	None
C106	All construction work.	Creation of jobs. It is calculated that the work will create 195 full time equivalent positions. And 97 indirect/induced jobs.	Not Applicable	Not considered significant in relation to overall Westminster employment market (i.e. less than	Not Applicable	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
		This is not considered significant in relation to the overall Westminster economy of approximately 500,000 jobs.		0.001%).		
C107	General construction activity.	Disruption to businesses outside the LLAU.	Incorporated mitigation as defined by traffic, noise and air.	None	Not Applicable	None
Community						
C108	Closure of Eastern leg of Allington Street (Phase 1, 2, and 3).	Closure of public right of way.	Alternative access provided via Warwick Row.	None	Not Applicable	None
C109	General Construction Activity.	Negative effect on quality of life.	As per each of the specialist technical sections.	Residual negative indirect effects as identified through the assessment of the traffic and transport (Section 6.2), noise (Section 6.3), air quality (Section 6.4) and townscape (Section	Not Applicable	None

Table 8-1: Summary of Construction Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Construction						
				6.5) sections.		
C110	Further proposed noise mitigation for Stage Door Public House in Allington Street.	Possible temporary loss of residential accommodation (not confirmed).	As per each of the specialist technical sections	None – the proposed further mitigation has not been defined. This may result in the temporary loss of accommodation or greater mitigation. However, it is the only site and not anticipated to have a significant effect on the local community.	Not Applicable	None

8.3 Operation

8.3.1 Table 8-2 presents a summary of the effects of the VSU scheme associated with its operation.

Table 8-2: Summary of Operation Effects

Ref	Impact	Effect	Incorporated mitigation adopted to address effect	Significant residual effect	Supplementary mitigation	Enhancements
Operation						
Traffic and Transport						
O1	New North Ticket Hall	Increased usage of pedestrian island at Bressenden Place/Victoria Street junction due to change in desire lines.	Enlarge the existing island.	None	None	None
O2	New North Ticket Hall	Decreased usage of 'southern' pedestrian route between Victoria Street and interchange, and reduced pedestrian flows on the Little Ben island.	None	Change in pedestrian desire lines results in a reduction in pedestrian flows on Little Ben Island and along the south side of Victoria Street resulting in significant beneficial effects.	None	None

Table 8-2: Summary of Operation Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Operation						
O3	New North Ticket Hall	Significant improvement for passenger access and reduced delays.	Not applicable.	Significant beneficial	Not applicable	Not applicable
Noise and Vibration						
O2	Additional plant and services installed.	New sources of noise and vibration.	Design and install to meet relevant criteria to ensure no significant effects.	None	Not Applicable	None
Air Quality						
O3	Installation/Relocation of ventilation shafts.	Increase in emissions of particles from below street level.	Locate vent exits away from sensitive receptors. Possible use of filtration and activated carbon.	None	Not Applicable	None
O4	Indoor air quality of refurbished station and platforms.	Increase in emissions of particles from train and rail use.	Strict cleaning regime of platforms and rails. Maintenance of all infrastructure in including trains. Forced mechanical ventilation to remove	None	Not Applicable	None

Table 8-2: Summary of Operation Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Operation						
			liberated particles.			
O5	Energy use associated with station in operation.	Energy demand of the station leads to a contribution to greenhouse gas emissions.	Adopt energy efficient practices and equipment wherever possible. Source energy from renewable sources wherever possible.	None	Not Applicable	None
O6	Changes in traffic and public transport due to modal shift.	Contributes to greenhouse gases and local air quality.	Potential positive impacts on both local air quality and greenhouse gas emissions.	None	Not Applicable	None
Townscape and Visual Amenity						
O7	Increased number of entrances to the Underground.	Beneficial effect on townscape character in Bressenden Place and Victoria Street east of Vauxhall Bridge Road.	Clearer urban layout, improved legibility, greater accessibility.	Moderate beneficial	Explore the possibility of further tree planting.	None
O8	New structures and entrance on ‘the Beach’.	Office workers in buildings around Terminus Place will experience an	Good design to improve visual cohesion and uniformity of the	Moderate beneficial	Not applicable	Not applicable

Table 8-2: Summary of Operation Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Operation						
		improvement in visual amenity.	space at the entrance to Victoria National Rail Station ('the Beach'). Area will appear more attractive in views.			
O9	New structures and entrance on 'the Beach'.	Office workers in Portland House will experience an improvement in visual amenity.	Good design to improve visual cohesion and uniformity of the space at the entrance to Victoria National Rail Station ('the Beach'). Area will appear more attractive in views.	Moderate beneficial	Not applicable	Not applicable
O10	New structures and entrance on 'the Beach'.	Office workers in buildings in Cardinal Place will experience an improvement in visual amenity.	Good design to improve visual cohesion and uniformity of the space at the entrance to Victoria National Rail Station ('the Beach'). Area will appear more	Moderate beneficial	Not applicable	Not applicable

Table 8-2: Summary of Operation Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Operation						
			attractive in views.			
O11	New structures and entrance on 'the Beach'.	Users of Victoria Station will experience an improvement in visual amenity.	Good design to improve visual cohesion and uniformity of the space at the entrance to Victoria National Rail Station ('the Beach'). Area will appear more attractive in views.	Moderate beneficial	Not applicable	Not applicable
O12	New structures and entrance on 'the Beach'.	Visitors to Victoria Palace Theatre will experience an improvement in visual amenity.	Good design to improve visual cohesion and uniformity of the space at the entrance to Victoria National Rail Station ('the Beach'). Area will appear more attractive in views.	Moderate beneficial	Not applicable	Not applicable
O13	New structures and entrance on 'the Beach'.	Pedestrians on Bressenden Place will experience an improvement in	Good design to improve visual cohesion and uniformity of the	Moderate beneficial	Not applicable	Not applicable

Table 8-2: Summary of Operation Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Operation						
		visual amenity.	space at the entrance to Victoria National Rail Station ('the Beach'). Area will appear more attractive in views.			
O14	New structures and entrance on 'the Beach'.	Pedestrians on Wilton Road will experience an improvement in visual amenity.	Good design to improve visual cohesion and uniformity of the space at the entrance to Victoria National Rail Station ('the Beach'). Area will appear more attractive in views.	Moderate beneficial	Not applicable	Not applicable
Built Heritage						
Victoria Palace Theatre						
O15	Construction of North Ticket Hall and Paid Area Link.	Settlement of the building.	Permanent strengthening works.	At present, the residual effect from possible strengthening works to the Victoria Palace Theatre is	Not Applicable	None

Table 8-2: Summary of Operation Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Operation						
				regarded as significant adverse (Sig). It is envisaged this will be reduced to non significant with further design developments, and discussions and agreement with the relevant parties.		
Victoria National Rail Station (Eastern)						
O16	New vent shafts and Wilton Road entrance on 'the Beach'.	Changes to setting	None	Significant adverse (Sig) effect from new vent shafts and Wilton Road entrance on 'the Beach'. However the present structures on 'the Beach' also have an adverse significant (Sig) effect on the setting of this building hence the overall residual	Further design development	To be defined

Table 8-2: Summary of Operation Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Operation						
				effect is considered non-significant (NSig).		
Apollo Theatre						
O17	New vent shafts and Wilton Road entrance on 'the Beach'.	Changes to setting	None	Significant adverse (Sig) effect from new vent shafts and Wilton Road entrance on 'the Beach'. However the current structures on 'the Beach' also have an adverse significant (Sig) effect on the setting of this building hence the overall residual effect is considered non-significant (NSig).	Further design development	To be defined

Table 8-2: Summary of Operation Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Operation						
Archaeology and Cultural Heritage						
O18	Possible alterations to groundwater flow resulting from cumulative effect of grouting new basements and proposed VTI basements.	May affect preservation of organic remains, especially downstream of the large basement areas.	Recording of deposits at VSU will provide an important sample for future comparison to quantify any possible effects.	None	Not Applicable	None
Demolition and Excavated Materials, and Waste						
O19	Generation and Storage of Waste Material.	Odour from biodegradable wastes.	Waste management, storage and handling procedures within the Environmental Management Strategy (Construction).	None	Not Applicable	None
Contaminated Land						
O20	Natural accumulation of gases.	Release of gas to confined public areas.	Gas protective measures undertaken including ventilation within confined spaces. Well constructed	None	Not Applicable	None

Table 8-2: Summary of Operation Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Operation						
			ground slab and passive and active venting.			
Water Resources						
O21	Changes in Groundwater	Potential flooding of basements.	Desk study of effects; Monitored during construction; Counter measures taken such as installation of additional drainage if required.	None	Not Applicable	None
O22	Site below Thames Flood Level	Flood risk if Thames flood defences fail.	Inclusion in emergency operational procedures.	None	Not Applicable	None
Ecology						
No operational impacts or effects have been identified.						

Table 8-2: Summary of Operation Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Operation						
Socio-Economics						
O23	Reduction in pedestrian congestion at Victoria as a result of VSU project.	Access to places of employment improved. Economic activity stimulated.	Not Applicable	Beneficial	Not Applicable	Not Applicable
O24	Economic attractiveness of Victoria improved as a result of VSU scheme.	Knock-on effect on the rest of the London economy.	Not Applicable	Beneficial	Not Applicable	Not Applicable
O25	Potential new development replacing buildings demolished during the construction process	Creation of new employment opportunities. Using a like for like comparison, 245 jobs could be created. There is also the potential for further job creation on the proposed CSD site. Cumulatively, this would total 643 new direct jobs, along with 321 indirect jobs.	Not Applicable	This is not considered a significant residual effect when considered in relation to the overall Westminster employment market of over 500,000 jobs.	Not Applicable	None

Table 8-2: Summary of Operation Effects						
Ref	**Impact**	**Effect**	**Incorporated mitigation adopted to address effect**	**Significant residual effect**	**Supplementary mitigation**	**Enhancements**
Operation						
Community						
O26	Opening of new North Ticket Hall.	Reduction in pedestrian congestion along Victoria Street. Reduction in pedestrian congestion in Victoria main line station at street level. Overall improvement to accessibility of the Victoria area.	Not Applicable	Significant beneficial residual effects. Easier access to places of employment, shops and services as a result of less congestion.	Not Applicable	Not Applicable
O27	Closure of pedestrian subway at junction of Bressenden Place and Victoria Street.	Removal of public right of way.	Pedestrian crossing at street level remains. Subway does not have step free access.	None	Not Applicable	None

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