

NORTHERN LINE EXTENSION TO BATTERSEA

UPDATED ROUTE OPTION ASSESSMENT



Summary Report

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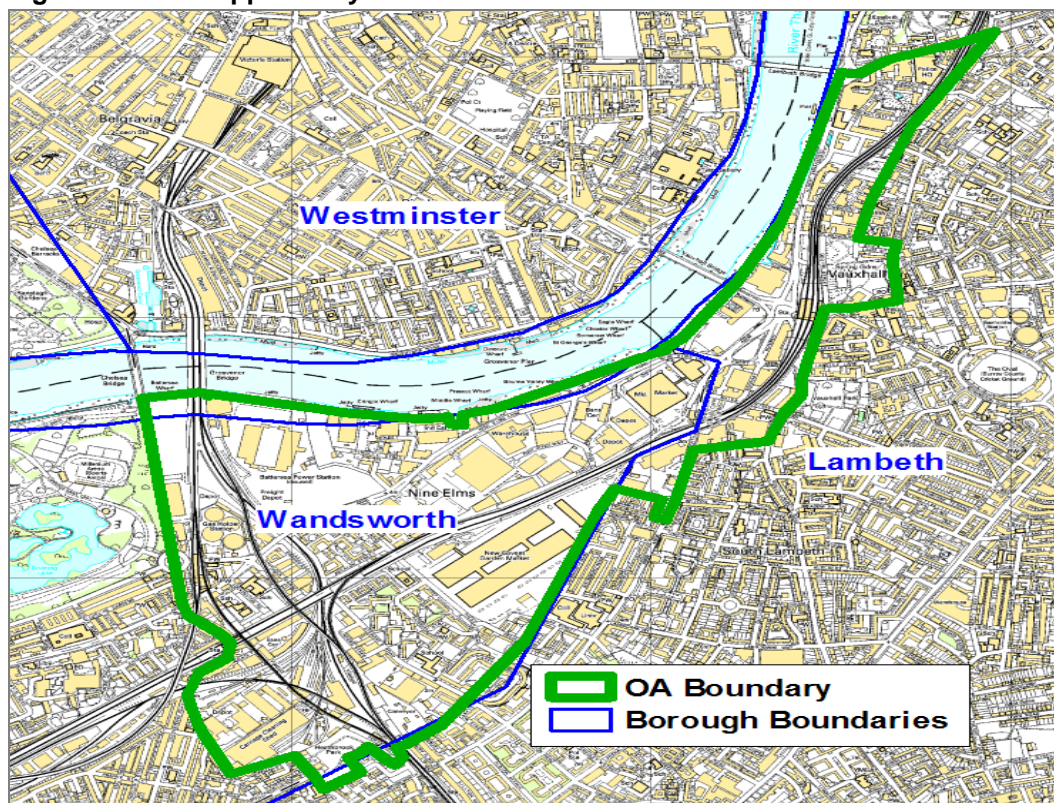
I. Introduction



The Greater London Authority (GLA) has prepared an Opportunity Area Planning Framework (OAPF)ⁱ for the Vauxhall Nine Elms Battersea (VNEB) Opportunity Area (OA) in partnership with Transport for London (TfL), the London Boroughs of Lambeth (LBL) and Wandsworth (LBW), the London Development Agency (LDA) and English Heritage. The GLA also worked with key landowners in the OA through a stakeholder consultation process to help prepare the framework. The Transport Studyⁱⁱ prepared to support the OAPF identified an extension of the Charing Cross branch of the Northern Line (NLE) as key to delivering the preferred level of development in the Opportunity Area.

Governance for the development of the OA is mainly via the VNEB Strategy Boardⁱⁱⁱ, which has representatives from the Mayor of London, Transport for London, Wandsworth Council and Lambeth Council, and the various landowners. A transport working group commissioned by the Board have also met to discuss aspects of the proposal, including the various routes and funding options for the proposed extension.

Figure 1: VNEB Opportunity Area



Subsequent to the publication of the draft OAPF, the owner of the Battersea Power Station site (BPS), one of the largest sites in the OA was granted planning permission. The delivery of the NLE is a condition of the permission; without this no more than the initial phases of development can occur.

This draft report provides a reassessment of the four route options for the NLE. It follows on from previous studies including the VNEB OAPF the accompanying Transport Study and the initial draft 'Northern Line Extension Multi-criteria assessment of Route Options'^{iv} as prepared on behalf of Treasury Holdings (the development managers of BPS) in August 2010^v.

This piece of work is intended as a 'sense check' to the previous assessments and has involved updated transport modelling for each of the four route options using TfL's latest sub-regional models (LTS and (sub)Regional Railplan) as well as a refreshed policy appraisal against the Mayors Transport Priorities using TfL's Strategic Assessment Framework (SAF). It also includes the results of the public consultation held in summer 2011.

Both SAF and WebTag/NATA appraisals were carried out on the four potential route options (the former, Strategic Assessment Framework, is TfL's assessment tool for major schemes; the latter is the Government's recommended approach). As a result the objectives for TfL and the Mayor as set out in the MTS are used in the evaluation, as well as national policy objectives.

This work is intended to provide supporting evidence to any future Transport & Works Act Order (TWAO) Application for the NLE.

Northern Line Extension Options

As part of the OAPF transport study three NLE options were considered (Route options 1 – 3) with Route 2 via an intermediate stop in the Nine Elms area being preferred. The subsequent 'Northern Line Extension Multi-criteria assessment of Route Options' considered the same three station options, but also assessed an additional series of 'Route 4' options, with an alternative station location in the Nine Elms area. Again Route 2 emerged as the best performing option.

This assessment again considers the original three route options as well as a single Route 4 option. These four options are consistent with those that were consulted upon in the summer 2011 public consultation, which was run jointly by the Mayor, TfL and Treasury Holdings.

The details of the four NLE route options considered are as follows:

- Route 1 - Extension from Kennington (Charing Cross branch) to a new station at Battersea Power Station;
- Route 2 - Extension from Kennington (Charing Cross branch) to a new station at Battersea Power Station via an intermediate station within the Nine Elms area south of the railway arches;
- Route 3 - Extension from Kennington (Charing Cross branch) to a new station at Battersea Power Station via a connection at Vauxhall; and
- Route 4 – Extension from Kennington (Charing Cross Branch) to a new station at Battersea Power Station via an intermediate station within the Nine Elms area north of the railway arches.

Figures 2 to 5 show the route options considered in this assessment.

Figure 2: Route 1

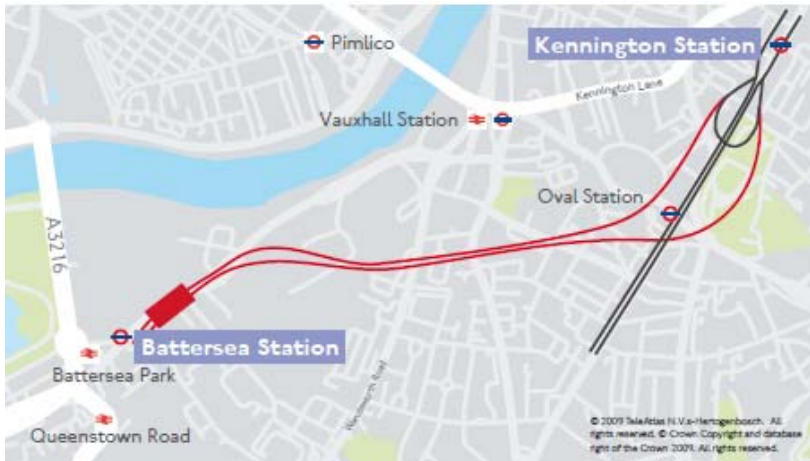


Figure 3: Route 2



Figure 4: Route 3



Figure 5: Route 4



Objectives of this Report

This report builds on the Preliminary Business Case^{vi} and Engineering Feasibility Study^{vii} as well as the VNEB OAPF Transport Study and the initial 'Northern Line Extension Multi-criteria assessment of Route Options' document. It presents an updated multi-criteria framework assessment of the four route options. The assessment has four main aspects:

- Public consultation responses from the summer 2011 consultation
- Mayor's Transport Strategy priorities. The Transport Strategy (2010) sets out the Mayor's objectives and priorities for transport over the next 20 years.
- Vauxhall, Nine Elms and Battersea Opportunity Area objectives as set out in the VNEB OAPF.
- NATA criteria and sub-criteria. The New Approach to Appraisal (NATA) is the Government's appraisal criteria for transport, and assesses transport schemes against 5 core objectives – environment, safety, economy, accessibility and integration.

This assessment concentrates on the comparative performance of the route options for the purposes of recommending an option to be taken forward for more detailed scheme development.

Summary Conclusion

On the basis of the assessment undertaken it is recommended that Option 2 (Northern Line Extension to Battersea Power Station via an intermediate station in Nine Elms, south of the railway arches) is still the best option to take forward for further scheme development.

The remainder of this document is structured as follows:

- Chapter 2 provides a summary of the Public Consultation findings
- Chapter 3 provides an assessment of each route option against the Mayor's transport priorities.
- Chapter 4 provides an assessment of each route option against OAPF objectives
- Chapter 5 provides the comparative multi-criteria assessment of each route option against NATA criteria and sub-criteria.
- Chapter 6 provides conclusions

2. Public consultation



Public Consultation

A formal public consultation^{viii} on the four route options was carried out in May-August 2011. This was carried out jointly by TfL and Treasury Holdings. This consultation followed an initial consultation carried out by Treasury Holdings in May-June 2010.

Three main phases of consultation were conducted each year as follows:

- Around 40,000 leaflets, with a questionnaire, were distributed to local residents in Wandsworth, Lambeth and Southwark asking them to respond identifying their preferred extension route option;
- A further 300 leaflets were sent to individual local organisations and community groups; and
- A copy of the leaflet and questionnaire were sent to all Wandsworth and Lambeth councillors as well as all relevant councillors in the other London Boroughs that the Northern Line passes through.

In addition to the general public, local residents and business owners in the area, there was consultation with individual stakeholders. Stakeholders have included local interest groups, including the Battersea Society, the Heart of Kennington Association, the Kennington Oval and Vauxhall Forum, Lambeth Community Forum and a range of other affected parties, local business owners, charities and statutory consultees. Feedback has also been received from a number of local landowners including Ballymore, the Berkeley Group, New Covent Garden Market, National Grid, Banham Security and Sainsbury's.

During the 2011 public consultation a consultation road-show was held, visiting places across the affected area including The Oval, Nine Elms Sainsbury's, Battersea Park Road and Battersea Park Station. Meetings were also held in response to requests: evening presentations have been given to a number of groups including local businesses, the Battersea Power Station Community forum and the Battersea Society as well as a range of residents associations in and around the Kennington, Oval and Vauxhall area.

Regular meetings were also held with landowners in the Nine Elms area as well as with Thames Water, Network Rail and the Environment Agency.

The results of the public consultation in terms of route preferences to both consultations are shown in Figure 6. 61% of respondents preferred Route 2 in both consultations in response to the question ‘which route option do you prefer for the proposed extension to the Northern Line?’

Figure 6: Results of Public Consultation on Route Options

Route	2010 Consultation (%)	2011 Consultation (%)
Route 1	7	4
Route 2	61	61
Route 3	25	24
Route 4	7	5
Other / None	-	6

This is further reflected by the fact that route 2 received the lowest number of negative comments and the highest number of positive comments of the four routes.

Route 1, along with Route 4, were by far the least popular options among local residents. Many respondents viewed Route 1 as being too direct – cutting straight through the whole of the Nine Elms opportunity area and only serving Battersea Power Station. Many comments suggested that Route 1 would be a missed opportunity to assist in the redevelopment of the wider Nine Elms area if only one station was built as part of the extension and that it would not be good value. Conversely, a minority of respondents favoured Route 1 because of its comparatively low cost.

Route 4’s low level of support in the consultation may in part be due to its cost. The slightly higher cost of the option is not viewed by respondents as worthwhile as the route is viewed to be too similar to Route 2.

Route 2 received the most support from respondents. This reflects the recognition that the route enhances accessibility in both the parts of the area which are earmarked for development as well as the existing communities. As would be expected, the primary concern with regard to the route proposal was the potential impact on surrounding areas during construction. A small proportion, 18%, of respondents to Route 2 recommended the line instead serve the existing Vauxhall station rather than Nine Elms.

Route 3 was the second most popular route for local residents (24% of respondents). As for Route 2, there is a group of the consultation respondents who would favour an extension that interchanges with the Victoria line and National Rail services at Vauxhall. However, overall there were more negative comments in regards to this route option than were positive, and a significant number of those respondents

voiced concern about Vauxhall station's ability to accommodate the additional trips. This is similar to TfL's own concern about the extent to which further demand could be comfortably accommodated on the Victoria line given the high levels of crowding that already exists.

Few local residents were in favour of Route 4. Respondents stated that if the mid-station was placed at the location suggested in the Route 4 option, it would focus the regeneration around the US Embassy, overlooking existing communities who could benefit from improved transport access. A few respondents also thought that this option would be too expensive.

A number of residents supplied written comments to support their answers. Some quotes in favour of route 2 are given below.

"Best route with station to help poorer area" Nine Elms Resident

"My preferred option. Offers residents and businesses far better access to public transport, and will really help the regeneration of the area. Will help lift congestion at Vauxhall" Nine Elms Resident

"Best option. Good location on Wandsworth Road" Nine Elms Resident

"This route has clearly the wider community benefit to an area that is not currently served by good underground connections" Roehampton Resident

Conclusion

The majority of local residents, land owners and other stakeholders favoured Route 2 as their preferred route choice in both 2010 and 2011.

There were a number of reasons why Route 2 was the most popular. It offers two new stations for the VNEB OA, the new stations have a good distance in between them, and most importantly, the Route 2 mid-station was viewed as being the best positioned in terms of serving the large already established community towards the eastern end of the Nine Elms area. The route is also perceived as providing better value than the others.

4. Assessment against the Mayor's Transport Objectives



This Chapter presents an assessment of each of the NLE route options against the Mayor's Strategic Transport Priorities as set out in the Mayor's Transport Strategy.

The Mayor's Transport Strategy

The Mayor's Transport Strategy (MTS) was published in May 2010 following extensive public and stakeholder consultation. The strategy set out a vision for transport:

'London's transport system should excel among those of global cities, providing access to opportunities for all its people and enterprises, achieving the highest environmental standards and leading the world in its approach to tackling urban transport challenges of the 21st century'.

In support of this vision, the strategy sets out six goals that should be pursued, the outcomes that the achievement of these goals would deliver, and the key challenges that need to be addressed to assist in delivering these.

In order to ensure that projects undertaken by TfL help to meet these goals, challenges and outcomes, a Strategic Assessment Framework (SAF) has been developed (and is now viewed as best practice in the assessment of transport projects in London) that enables options to be compared against one another from the perspective of how well they are expected to aid in the delivery of the MTS.

The MTS also sets out the Mayor's support for a privately-funded extension of the Northern line to Battersea (Proposal 122).

VNEB Opportunity Area – Role in Supporting MTS

The MTS sets out strategic objectives for Transport for London as a whole. In the context of the OAPF, the strategy has, along with others such as the London Plan, been referenced to ensure that broad principles in the OAPF support the VNEB OA. A Northern line extension has been identified as a means of ensuring the OA can develop in a manner that maintains effective delivery of the MTS and London Plan.

At the more detailed level, to ensure that the NLE maximises this positive impact, the SAF has been used to compare all four route options. This enables identification of which option performs best as well as whether there are aspects of route options design that could be improved going forward.

Strategic Assessment Framework Results

The outcome of the assessment against SAF is shown in Figure 7. The figure shows performance against the MTS Challenges, though the actual assessment is based on their disaggregation into the MTS Outcomes.

The assessment indicates that Route 2 performs at least as well as all other options on all challenges. In some areas, the route also exceeds the level of fit that all three other options achieve.

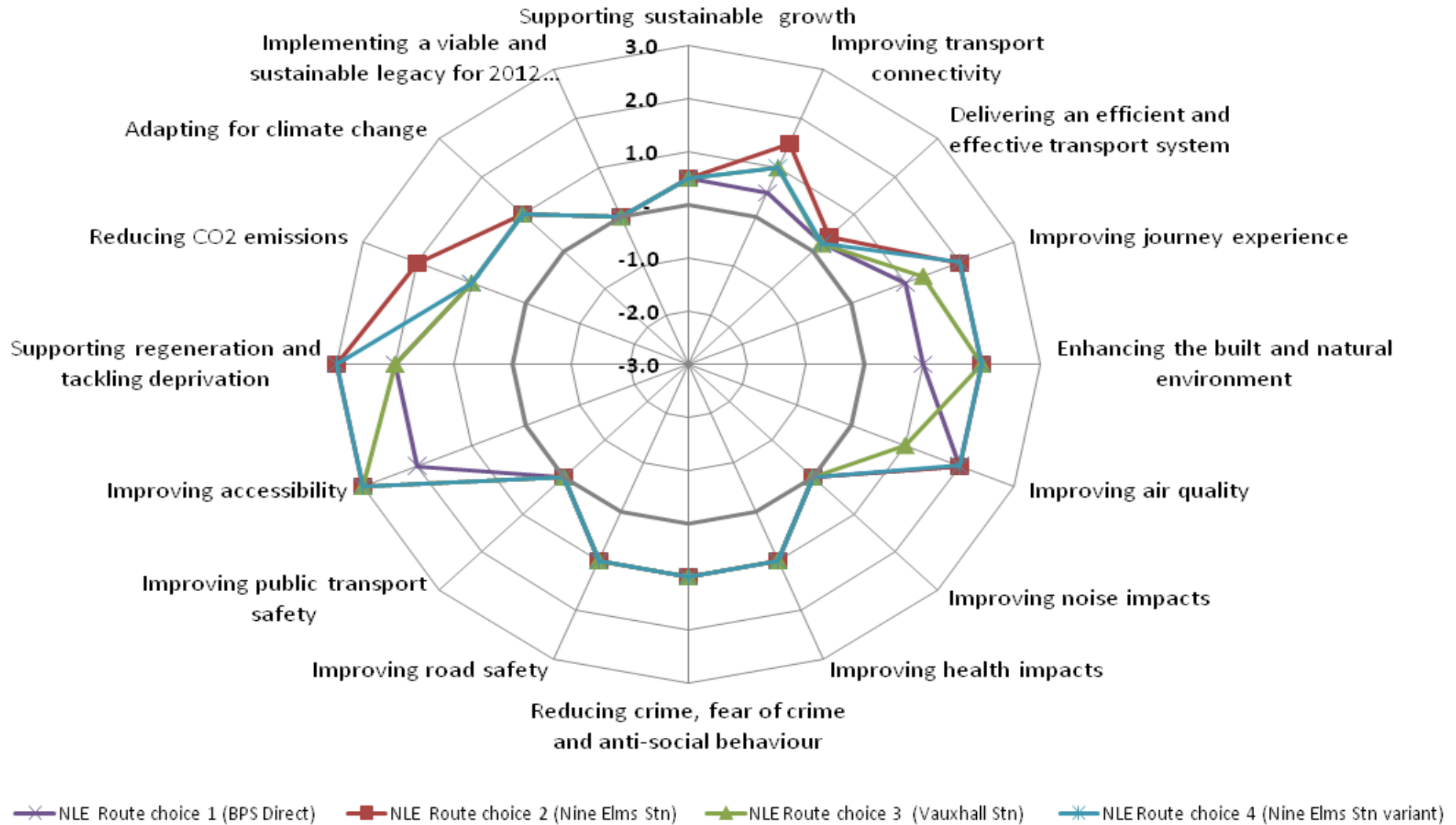
The areas of strong performance for Route 2 and the reasons for this are as follows:

- **Support wider regeneration:** The primary aim of the NLE is to support the regeneration of the OA. As such all four route options score highly. Routes 2 and 4 score highest on this aspect on the basis that the addition of two new stations in the Battersea and Nine Elms area provide the greatest enhancement to the existing transport network by improving accessibility to the most people and helping to ensure that development across the whole OA is supported.
- **Improving access to services:** The extension will provide access to the large range of new services that will be provided in the Opportunity Area, whilst also supporting improved access to existing services across London for new residents. Route 2, given that it provides the largest step change in the size of the area and number of people that would benefit from improved access to public transport, performs best in this respect, with Route 4 a close second.
- **Improving the physical accessibility of the transport system:** Although all new Underground stations would be required by law to be step-free from street to train, Routes 2 and 4, which provide two *additional* Tube stations in London with step-free access, would have the greatest impact on the number of people able to benefit in this respect. Vauxhall Underground station already has step-free access schemes planned for delivery and so Route 3 would not provide as high an increase in the numbers of people benefitting from new step-free facilities. Route 1 limits the improvement to the Battersea Power Station area.
- **Reduce public transport crowding:** Route 2 offers the best integration with the other planned improvements in the OA. The route will attract more passengers onto the NLE than any other option and consequently free-up the most space on alternative public transport modes such as buses.

The areas that Route 2 outperforms all other options on are:

- **Improving transport connectivity:** The option provides the widest geographical spread of access improvements due to both stations on the route being entirely new stations, well-located to serve both current and planned communities and development.
- **Smoothing traffic flow (managing delay, improving journey time reliability and resilience):** Route 2 yields the greatest reduction in car trips as it provides the best integration with the other planned improvements to the transport network in the Opportunity Area. Its configuration extends transport accessibility to the greatest number of people, who can experience its benefits in terms of reduced journey times. This makes public transport more attractive, removes more cars from the road and means that existing road users would experience better journey time reliability and shorter delays.
- **Reducing Greenhouse Gas (GHG) emissions, including CO₂:** The optimal reduction in car trips highlighted above results in the greatest reduction in GHG emissions of the four options.

Figure 7 – NLE Route options performance against SAF challenges



5. Assessment against the OAPF Objectives



In developing the OAPF, TfL and GLA agreed the key objectives against which the various transport and land-use scenarios should be assessed. These are:

- To mitigate adverse impacts caused by development traffic, especially increases in congestion and adverse impacts on the environment
- To ensure that the area's economic potential is realised by improving accessibility to the development sites by walking, cycling, public transport, taxis and goods vehicles

Mitigate Adverse Impacts

Because the NLE is underground, all route options have a low intrusive effect on the local environment compared to alternative public transport schemes.

Without the NLE, trips generated by development would be more reliant upon motorised private modes of transport. Several key arterial road routes as well as one of London's most important bus interchanges are located within the VNEB OA. The quality of these services would deteriorate as highway congestion would increase.

All schemes will result in an increased share of new trips in the VNEB OA by public transport. Route 2 has the highest increase in demand for public transport and so will have the greatest impact in minimising highways congestion and the negative externalities this creates, such as noise and air pollutant emissions.

Despite being similar to Route 2, Route 4 provides a Nine Elms station that fails to provide the best access to as wide an area as possible and has worse integration with the bus corridor along Wandsworth Road. As a result, it attracts fewer trips and would leave more people using motorised modes.

Route 1 is limited in the geographical scope of the improvement in public transport it creates – being limited to the Battersea end of the OA only. Route 3 has the potential to cause substantially higher negative impacts during the construction phases due to the scale of the works that would be required to construct a new interchange station underneath one of London's busiest road junctions.

Improving Accessibility

Improving accessibility within the OA is important to enable new and existing communities and businesses to better access labour markets, employment opportunities and services. This will help them prosper and ensure that the development capacity of the VNEB OA is fully realised. Access to public transport is also used to determine what density of development can be accommodated; planners consider the current and potential PTALs (Public Transport Accessibility Levels) in setting out the development framework. To unlock the potential of the area, high levels of public transport access are required to ensure that the travel demand generated by dense development can be met by sustainable modes.

All four routes support the development of the VNEB Opportunity Area by improving access to the large and high-quality London Underground network.

Routes 2 and 4 provide two completely new stations, whereas Routes 1 and 3 provide only one completely new station. As a result the latter two routes have a more limited effect on improving accessibility in the OA. Route 1 in particular is relatively limited by only providing an improvement in accessibility to the western end of the VNEB OA, particularly the Battersea Power Station site. Although the Power Station site is one of the largest in the OA, there are still very large quantities of redevelopment throughout the Nine Elms area, in particularly along Nine Elms Lane and Wandsworth Road, as well as at Vauxhall, which would benefit from options other than Route 1.

The comparative performance of the routes against the OAPF objectives is summarised in Figure 8.

Figure 8 – NLE route options performance against OAPF objectives

Objective	Route 1	Route 2	Route 3	Route 4
To mitigate adverse impacts caused by additional traffic associated with increased development, especially increases in congestion and adverse impacts on the environment	Provides excellent quick route by PT to the least accessible (western) part of the OA. Lack of intermediate station limits Tube options available for rest of Opportunity Area, and so private transport use would be higher.	Provides very good access by PT to whole of main development area in VNEB OA. Improvements to PTALs enables lower levels of car parking and private transport use.	Provides very good access to the least accessible part of the OA and improves interchange opportunities at Vauxhall. However effect on increasing access to PT to major development in Nine Elms is more limited and likely to cause higher private transport use. Also likely to add to congestion at Vauxhall LUL station.	Provides very good access by PT to whole of main development area in VNEB OA. Improvements to PTALs enables lower levels of car parking and private transport use. Slightly worse integration in Nine Elms with bus network potentially reducing extension usage.
To ensure that the area's economic potential is realised by improving accessibility to the development sites by walking, cycling, public transport, taxi and goods vehicles	Lack of intermediate station limits PTAL increases in OA.	Widespread improvements in accessibility, with Battersea and Nine Elms benefitting. Good integration with bus network at the stations further improves multi-modal accessibility.	Provides further interchange opportunities at Vauxhall, but access to the area is only marginally improved given already excellent range of Tube, Rail and Bus services and only limited accessibility benefits are provided to the Nine Elms area.	Widespread improvements in accessibility, with Battersea and Nine Elms benefitting. Integration with bus network sub-optimal due to station distance from main bus corridors.

6. NATA assessment


 A photograph of a white rectangular sign with a red border and a red circle in the background. The word "UNDERGROUND" is written in white capital letters on a dark blue rectangular background in the center of the sign.

The New Approach to Appraisal (NATA) uses the Government's appraisal criteria for transport, and assesses transport schemes against 5 core objectives – environment, safety, economy, accessibility and integration.

A full NATA appraisal must be undertaken for major transport schemes that are seeking central Government funding, in order to demonstrate the benefits and impacts of proposals against a range of objective criteria and sub-criteria. For the purpose of this comparative exercise for options that lack detailed development, the assessment has attempted to address as many of the sub-objectives as possible, though it must be recognised that some aspects, such as Water and Weider Economic Benefits lack quantitative evidence. Nonetheless, the detail of the assessment for the four route options is sufficient for clear conclusions to be made.

Basis for NATA Assessment

The assessment of route options has been informed by:

- Demand and benefit forecasting of the NLE options, using TfL's (Sub) Regional Railplan model – London's strategic public transport model.
- Cost and feasibility work.
- Stakeholder input.

The basis for the assessment compares the NLE Option against a 'Do Minimum' option that includes the option 5R^{ix} level of development, committed transport network improvements and the full range of OAPF transport improvements *excluding* the NLE. The assessment therefore considers the incremental impact of the NLE options against a consistent base. This is consistent with the modelling approach adopted and with standard NATA appraisal practice, however it is also recognised that this presents a 'very worst case' assessment as the level of development assumed in the 'do minimum' could not actually be delivered without the NLE.

Car Transfer Demand

A number of impacts within NATA are related to the degree to which each option results in a reduction in car trips and car kilometres. Although no detailed highway modelling has yet been undertaken specifically for this NATA assessment, the LTS and RailPlan modelling undertaken can provide an estimate of both overall passenger usage on the NLE extension and on the public transport network as a whole.

An initial analysis of car transfer from the NLE has been undertaken. This indicates that Route 2 would result in a greater reduction in car kilometres than the other routes. This is logical given the fact that the forecast public transport demand for Route 2 is higher than for the other options, and hence assuming a given proportion of car transfer across all options, the absolute reduction in car trips and km will be greater for Route 2.

Demand levels for NLE Options

The approximate anticipated levels of demand on the extension route options is shown in figure 9. Route 2 has, in total, the highest patronage levels forecast, followed by Route 3. As would be expected with a single stop option, Route 1 has the lowest forecast patronage. This has been generated on a consistent basis using TfL's (Sub) Regional Railplan model.

Figure 9 – NLE Route Options Demand Levels

		Route 1	Route 2	Route 3	Route 4
Battersea Power Station	Boarders	4,100	4,000	4,100	4,100
	Alighters	5,400	4,800	5,200	5,100
Nine Elms	Boarders	N/A	3,600	N/A	1,200
	Alighters	N/A	1,800	N/A	800
Vauxhall	Boarders	N/A	N/A	1,400	N/A
	Alighters	N/A	N/A	1,500	N/A
Total	Boarders	4,100	7,600	5,400	5,300
	Alighters	5,400	6,500	6,800	5,900

The sum of boards and alighters, as per Figure 9, in descending order, is 14,100 (Route 2), 12,200 (Route 3), 11,200 (Route 4) and 9,500 (Route 1).

Environment

Noise

There are three key noise related effects to consider.

1- Operational Noise and Vibration

The following operational activities have the potential to cause noise and vibration:

- The passage of trains in tunnels
- Fan and air flow noise from vent shafts.
- PA system noise from the station exits and entrances.

The operation of trains in the Underground line may cause vibration which in turn has the potential to cause reradiated noise in the properties above the line. To

address this potential issue computer modelling is used to predict the properties which may be affected. Where necessary measures will be applied to mitigate the transmission of vibration and reduce reradiated noise in properties to acceptable levels. Vent shaft noise will again be predicted using computer modelling which will allow potential impacts to be determined allowing noise mitigation to be included in the vent shaft design. The PA system has the potential to generate noise, but can be controlled using directional loud speakers set at an appropriate volume to mitigate potential noise impact.

In general, the station operational noise impacts for each of the routes can be summarised as follows:

- *Route 1* - Station noise impacts will be minimised due to lone terminus station integrated into a single development site.
- *Route 2* - Intermediate station will be located on a busy main road near to a popular supermarket and amenities.
- *Route 3* - Construction of Vauxhall interchange would require extensive and intrusive works at one of London's busiest highway junctions and a bus interchange. Noise impacts would be substantial and impact wider area.
- *Route 4* - Intermediate station location amongst residential area so operational noise likely to have greater impact and be more difficult to mitigate.

2 - Construction Noise and Vibration

Noise from construction impacts cannot be overlooked given the scale of the project and the length of the construction period. In this respect, it is the secondary effects of Route 3 that have the most potential to cause a significant negative impact on the Vauxhall area due to the resulting highways disruption associated with the construction of new subsurface links in Vauxhall station below the busy gyratory. To a lesser extent, the need to have an additional vent shaft for Route 4 would increase noise impacts compared to other options.

3 - Reduction in general ambient noise due to a decrease in road traffic levels

It is likely that the NLE could reduce noise levels associated with road traffic by attracting trips that would otherwise be made by car. This is especially important given the high levels of population and employment development envisaged for the OA. The demand modelling undertaken (in the LTS model) suggests that car transfer is likely to be equivalent to more than 2m vehicle trips per annum for all routes, with Route 2 achieving the highest rate of transfer. The differential car transfer rates between routes are unlikely, however, to be significant enough to result in a change in the noise threshold – the measure by which 'significance' is measured.

Local Air Quality

The NLE would reduce the negative impact on local air quality of the regeneration of the VNEB OA and the travel demand it would generate. By reducing levels of road traffic compared to the 'without NLE' scenario, the scheme will help to reduce the levels of pollutants such as nitrogen oxides, particulate matter and carbon monoxide, released at street level experienced by pedestrians, workers and residents within 200m of a road. In general, there would be a net improvement in local air quality as NLE trains would be underground and are powered by electricity sourced from the national grid.

The impact is proportional to the reduction in road traffic and therefore Route 2/4 via a new intermediate station, which is expected to remove more vehicle kilometres than Routes 1 and 3 in the morning peak period, would consequently yield the greatest improvements in local air quality.

Preliminary Environmental Assessment^x work suggests that during construction there may be an impact on local residents, workers and pedestrians from airborne dust nuisance from excavations, materials handling and concrete batching. There will also be a temporary increase in emissions from the construction plant and traffic. These impacts will, however, be localised and temporary, and all construction will be managed according to construction management best practice to mitigate any potential negative impact.

The same work suggests that local air quality may be affected around the ventilation shafts, however it is not expected that these emissions will significantly increase pollutant concentrations at nearby residents or in the areas surrounding these shafts.

As with noise, it is reasonable to expect that Route 3 and the scale of the works at Vauxhall that the route would entail, would have a significantly greater impact on local air quality during construction than any other option.

Greenhouse Gases

The Mayor's Climate Change Action Plan gives average CO₂ emitted for car journeys as 110 grams per passenger kilometre, which is greater than the equivalent figure for Tube journeys of 72 grams per passenger kilometre (TfL 2011 Health, Safety and Environment Report)

The NLE is predicted to encourage mode shift away from private car use to the Underground. Although it may increase bus journeys by people accessing the Underground system, there is also a substantial net reduction in bus travel due to mode shift from bus to Tube for other journeys. There is therefore a shift from less carbon efficient forms of transport to more efficient modes.

Route 2 attracts the most demand to NLE and consequently performs best in minimising the number of motorised mode trips that are taken. Route 1, by comparison, is limited in the geographic scope of the benefits to journey time that the NLE yields and therefore would perform worst in reducing trips on motorised modes that result in a higher output of greenhouse gases.

Landscape

The area is, in general, lacking in notable landscape features. However the extension is an important enabler for the regeneration of the area and furthermore, that the extension will be designed and integrated into the new communities and landscape that are created, including the Linear Park. With this in mind, it is expected that the general impact of the extension will be, at worst, neutral to slightly positive.

Although the four options have some significant differences, in respect of landscape there is little scope for one option to have a substantially different impact from another.

Townscape

Townscape refers to the physical and social characteristics of the urban environment. The design and character of the urban environment can influence how it is used and perceived. The NLE supports extensive redevelopment of the OA. The OA development would provide an opportunity to integrate the urban environment and the new transport infrastructure.

The type of transport provision within the OA can also significantly influence the character of the area. By providing an effective, high-capacity and high-visibility public transport option, the NLE could help to make the area less car-oriented, especially if it is part of an overall design approach which puts in place welcoming public spaces for pedestrians, in which stations are well-integrated.

In the absence of detailed designs for the stations, the impact on townscape remains an opportunity. Given this, and the potential benefits outlined above, all route options with two new stations will toad more benefit in creating a public transport 'culture' than those with only one new station.

For Route 3, the scale of the works required at Vauxhall to construct a new set of subsurface platforms for the Northern line with interchange links to the Victoria line platforms and also to the existing ticket hall would likely require substantial landtake in the Vauxhall area. This incurs not only the risk of buildings that may be considered

assets to the townscape being required for land, but also the consequential deterioration in the townscape during these works.

Heritage

The area served by the extension contains some major landmarks and locations of historical interest, such as Battersea Power Station and New Covent Garden Market (NCGM). The extension itself is fundamental to enabling the redevelopment of the Power Station site and, with it, the renovation of the Power Station which will reduce the risk of it having to be demolished on grounds of safety. All options would allow the full planned redevelopment of the Power Station site to occur.

Any difference between the options in this respect is therefore determined by the extent to which they help preserve and enhance the heritage of the surrounding area. From this perspective, Route 2 has the highest additional positive impact, providing a station location that will act as a public transport gateway for accessing the planned redevelopment of the New Covent Garden Market, helping it to continue as one of the country's leading wholesale destinations for fresh food and flowers. As part of the wider regeneration of VNEB, the Market Authority is proposing to add a new public market, cafes and restaurants to the existing facilities. The likelihood of this being successful, and the consequent benefits to Londoners and beyond, would be substantially enhanced by the provision of a direct Tube connection, analogous to the access provided to Borough Market by London Bridge station.

Biodiversity / Water

There is not expected to be any ongoing impact on ecology during day to day operation of the NLE. However, the Preliminary Environmental Assessment work undertaken by URS suggests that during construction there may be risks of contamination to local ground water and surface water. Possible mitigations will be put forward in future documents such as the Environmental Impact Assessment work.

Physical Fitness

The impact of the NLE directly on physical fitness would be small compared to the impact of improved pedestrian and cycling facilities that are also proposed for the area. As each option encourages a mode shift from car use, some increase in walking would be expected in order to access and egress stations.

As well as new Tube stations, it is planned to extend the Barclays Cycle Hire scheme, with new docking stations put in place at points within the OA. Together

these will enhance the opportunities for end-to-end journeys by sustainable modes, especially if the docking stations are suitably integrated with the stations. Although, there is little scope for meaningful variation in impact between the route options in this respect, those options with two stations would provide some additional benefit through providing additional linkages to the wider transport network.

NATA appraisal guidance also requires that practitioners consider aspects that could cause impacts such as stress and anxiety given that these can manifest as deteriorations in physical fitness. In this context, it is reasonable to state that those route options that will be particularly disruptive to build are likely to have a significant impact on local stress and anxiety. Increased intervention / ventilation shafts and options requiring more land take would likely cause most concern. As such, Route options 3 and 4 in particular risk higher levels of negative externalities during construction and subsequent operation.

Journey Ambience

All of the proposed NLE routes, with the exception of Route 3, would provide crowding relief on the Victoria Line from Vauxhall and on parts of the existing Northern line south of Kennington. National Rail services and local bus services would also benefit from crowding relief, improving the ambience of many public transport journeys. Over the morning peak 3 hour period, modelling suggests the extension will reduce the number of crowded hours on London Buses.

Comparing options, Route 2 (via a new intermediate station) achieves greater modal shift from bus and rail and consequently reduces the number of crowded hours experienced by all users by a significant extent. Route 1 (direct to Battersea Power Station) and Route 3 both reduce total crowded hours by a lower level.

The Route 3 additional demand is expected to exacerbate existing congestion issues at Vauxhall Underground station and on the Victoria Line, causing deterioration in journey ambience for users of the line.

Route 2 via a new intermediate station, as it encourages more modal shift from car and provides more access points to the public transport network, would have a greater positive impact than the Route 3 via Vauxhall or Route 1 direct to Battersea Power Station.

The high level impact on crowding of each route option (in terms of reduced crowded hours) as represented from the (Sub) Regional Railplan model is outlined in Figure 10 below.

Figure 10 – Comparative performance of route options for reduced crowded hours

Annualised reduction in PT crowded hours (am peak)	Route 1	Route 2	Route 3	Route 4
Hours saved	431,000	649,000	535,000	484,000

Environment Objective Summary

Figure 11 summarises the comparison of route sensitivity between the routes for the Environment sub-objectives. Highest means the route option would have the highest positive impact out of the four options..

Figure 11 – Comparative performance of route options for Environment objective

Environment Sub-objective	Route 1	Route 2	Route 3	Route 4
Noise	Highest	Intermediate	Lowest	Intermediate
Local Air Quality	Intermediate	Highest	Lowest	Intermediate
Green House Gases	Lowest	Highest	Intermediate	Intermediate
Landscape	Intermediate (Joint)	Highest (Joint)	Intermediate (Joint)	Highest (Joint)
Townscape	Intermediate	Highest	Lowest	Intermediate
Heritage	Intermediate (Joint)	Highest (Joint)	Intermediate (Joint)	Highest (Joint)
Biodiversity	Equal	Equal	Equal	Equal
Water	Not assessed	Not assessed	Not assessed	Not assessed
Physical Fitness	Highest	Intermediate	Lowest (Joint)	Lowest (Joint)
Journey Ambience	Intermediate	Highest	Lowest	Intermediate

Safety

Accidents

The number and severity of road accidents depends on many factors such as road class, road speed and design and the type, volume, time of day and routing of traffic travelling on the road. Without a full traffic impact assessment it is not possible to anticipate or quantify the impact of the NLE, however the number of vehicle kilometres removed from the road can be taken as a proxy.

All four route options of the NLE should achieve substantial modal shift. It is expected that Route 2 (via a new intermediate station) will remove significantly more vehicle kilometres than the other three options, and so are likely to have a positive impact on accidents.

Security

The NLE itself would be built to modern secure design standards, including CCTV, emergency call points and lighting. As the Underground system is closed and supervised at all times of operation, it is a relatively secure mode. There is no comparative difference between the route options in this respect.

The extension will bring with it greater levels of formal and informal surveillance in areas, both through the systems own CCTV watching at-surface premises and boundaries, and also through the informal surveillance brought by passengers travelling to and from stations. The stations will also introduce additional active frontages where they provide for retail concessions in the station buildings.

As a result it is judged that all options will have a slightly positive effect on security in the opportunity area, with those providing a greater number of stations in entirely new locations likely having the largest positive effect.

Safety Objective Summary

Figure 12 summarises the comparison of route sensitivity between the routes for the Safety sub-objectives. Highest means the route option would have the highest positive impact out of the four options.

Figure 12 - Comparative performance of route options for Safety objective

Safety Sub-Objective	Route 1	Route 2	Route 3	Route 4
Accidents	Lowest	Highest	Intermediate	Intermediate
Security	Intermediate (Joint)	Highest (Joint)	Intermediate (Joint)	Highest (Joint)

Economy

Public Accounts

In order to gauge the impact of each route option on the public accounts, the investment and operating costs, grant and subsidy and changes in indirect tax and other revenues all need to be taken into account. As part of any benefit cost appraisal, the impact on public accounts arising from capital expenditure for implementation of the scheme, future renewals, day to day operating and

maintenance costs, and new revenue accruing to public transport operators would also need to be captured.

It is important to bear in mind that the scheme being promoted is primarily to act as an enabler of regeneration and densification in the VNEB OA. Furthermore, the development and support of the scheme by the Mayor of London with partners has been on the clear basis that the scheme must be funded at no net cost to the public purse. As such, the impact on public accounts should be far smaller than a traditional business case would indicate.

Impact on tax revenues associated with for example, vehicle excise duty, has not been explored at this stage of the assessment.

It should be noted that this assessment also excludes wider economic impacts (see section below for details of separate work on this). This is a critical exclusion. The NLE scheme is fundamentally a vehicle for enabling the regeneration of the VNEB OA. The scheme is not primarily about improving journey time per se but rather providing transport capacity that supports densification of brownfield sites by high trip generating mixed use development. The scheme is also required to ensure that levels of access to public transport are high enough to avoid over-reliance on private transport modes.

From a public accounts perspective, if the scheme is funded at no cost to government such that the capital cost is covered by parties other than government or through a scheme such as Tax Incremental Funding (TIF), the Benefit-Cost Ratio (BCR) for the scheme would be overwhelmingly positive. With regard to operational costs, more detailed revenue and operating and maintenance expenditure forecasting would be required to discern the overall effect on public accounts.

Transport Economic Efficiency

Route option 2 performs strongest in transport benefit terms. On cost terms Route 1 is best performing. As a result, the economic efficiency of each of the two options would be relatively similar. The weakest options are route 4, demonstrating the sub-optimal location and poor interchange with the bus network that would be achieved by locating the station further away from Wandsworth Road, and route 3 due to its high construction cost.

The current exclusion of wider economic impacts limits the performance of the options in transport economic efficiency terms. The expectation is that with their eventual inclusion, all the options will demonstrate better value for money, although there are likely to be differences in scale between them.

Reliability

All NLE options would be inherently reliable as a high frequency segregated mode.

The NLE would also help to provide reliability improvements indirectly as a result of modal shift from car to public transport. By relieving congestion on the highway network, queues of traffic will be rarer and journey times more predictable. This will be beneficial for bus users as well as car users.

Route 3 presents most risk to the reliability of the transport network on the basis that it is likely to cause additional crowding on the Victoria line. The line is forecast to operate with high levels of crowding in 2031. A marginal increase in train loadings as they pass through the busy section between Victoria and King's Cross St Pancras risks causing extended dwell times and a consequential degrading of achievable train service headways, effectively reducing the achieved throughput of trains on the line.

Wider Economic Impacts

As already indicated, this appraisal does not include any estimation of wider economic benefits (WEBs) which has the potential to add additional economic benefits to the case. Wider economic benefits are benefits that have not been considered by 'conventional' transport appraisal but were identified by 'The Eddington Report' as areas where transport delivered additional productivity gains. Analysis of WEBs has underpinned the business case for Crossrail (among other schemes).

The key benefits for the NLE are likely to arise from agglomerations benefits (clustering of high value economic activities) and labour supply benefits (increasing effective labour markets). The uplift in land value created by the extension, a phenomenon well documented in respect of the Jubilee line, would also be an impact that could be captured through mechanisms such as Tax Incremental Financing.

Overall, the inclusion of WEBs would add substantially to the scheme benefits, particularly for a scheme such as the NLE which is tailored towards improving access and capacity to support regeneration and densification of a strategic Central London location. These benefits are being examined independently of this report.

The additional benefit from WEBs would improve the economic performance of all Options, although this would be less pronounced for Route 1 as it has only one station, which reduces the reach of its transport benefits.

Economy Objective Summary

Figure 13 summarises the comparison of route sensitivity between the routes for the Economy sub-objectives. Highest means the route option would have the highest positive impact out of the four options.

Figure 13 - Comparative performance of route options for Economy objective

Economy Sub-Objective	Route 1	Route 2	Route 3	Route 4
Public accounts	Highest (Joint)	Highest (Joint)	Lowest	Intermediate
Transport Economic Efficiency	Highest (Joint)	Highest (Joint)	Lowest	Intermediate
Reliability	Intermediate	Highest	Lowest	Intermediate
Wider Economic Impacts	Lowest	Highest	Intermediate	Intermediate

Accessibility

Option Values

Option values refer to the value placed on transport services by those who do not expect to use them regularly, but who derive a benefit from having the option to use it at some point. As such, the presence and scale of the impact is correlated with the impact on 'accessibility'.

The crucial element that the NLE brings is access to the wider London Underground network. This will provide a large number of journey opportunities to destinations in addition to a passenger's regular commuting and leisure trips. This applies both to residents and workers based in the Opportunity Area and to people who may wish to work in the Opportunity Area in the future or who may wish to visit for retail, leisure or recreation purposes.

It follows that route options with two new stations will provide greater benefit to residents, and that the additional accessibility benefit delivered by Route 2/4 would result in this option having the greater Option Value benefit.

Severance

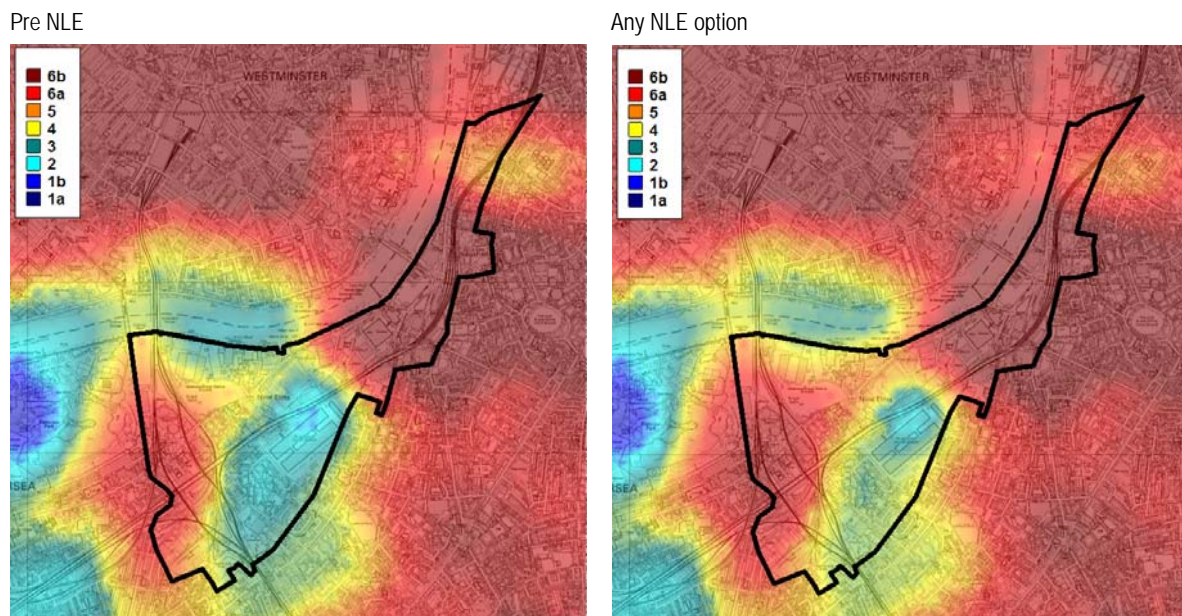
The scheme would provide a public transport service without introducing any additional barriers to on-street pedestrian movement. The impact of the scheme will be similar for each route option.

Despite this, Route option 2, which provides two stations either side of the Waterloo mainline viaduct in the two core local centres (Nine Elms and Battersea), could be expected to reduce the extent of severance caused by the railway viaduct and the buildings that will occupy the area.

Access to the Transport System

The Vauxhall, Nine Elms and Battersea Opportunity Area, and the Nine Elms area in particular, are currently poorly served by public transport. Figure 14 shows Public Transport Accessibility Levels for the area in 2008 and, with future committed schemes, in 2031. These are calculated from the distance to the nearest public transport stop and the frequency of the service from that stop.

Figure 14 – PTAL levels current and post-NLE (2031)



PTAL measures do not reflect the quality of the service offered from those stops (treating bus, Underground and national rail stops as equivalent) or the range of destinations accessible from those stops. Access to the London Underground

network provides significant benefit; the range of destinations easily accessible from the OA will increase significantly with the NLE in place.

The Route 4 option would serve slightly fewer new residents/jobs than Route 2 but slightly more than Route 3.

Although the PTAL charts do not show a substantial advantage from locating an intermediate station at Nine Elms (Route 2) over current or future bus services, this route is judged to be significantly better in terms of providing access when the quality advantage of providing access to the Underground network is taken into account. Route 2/4 provides two new underground stations and brings over 70% more people and jobs within 500m of the Underground network than the other options. However, all options, by bringing Underground services to Battersea provide a very significant improvement in access to high-quality public transport.

Accessibility Objective Summary

Figure 15 summarises the comparison of route sensitivity between the routes for the Accessibility sub-objectives. Highest means the route option would have the highest positive impact out of the four options.

Figure 15 - Comparative performance of route options for Accessibility objective

Accessibility Sub-Objective	Route 1	Route 2	Route 3	Route 4
Option Values	Lowest	Highest (Joint)	Intermediate	Highest (Joint)
Severance	Intermediate	Highest	Intermediate	Intermediate
Access to the transport system	Lowest	Highest	Intermediate	Intermediate

Integration

Transport Interchange

This NATA sub-objective is concerned with the quality of the interchange itself, and not the provision of additional or enhanced interchange opportunities, which is accounted for in the significant travel time benefits detailed under the Transport Economic Efficiency sub-objective.

The new stations could provide an opportunity for developing high quality interchanges between the Underground and bus network, and with walking and

cycling facilities. A quality bus interchange at Vauxhall station has already been provided.

Route 3 would provide an interchange between the Northern Line and the Victoria Line at Vauxhall. However as already noted in earlier work, the engineering constraints associated with the Vauxhall site present a considerable challenge, and the impacts of constructing such an interchange could adversely affect the operation of the existing bus and rail interchange.

Battersea Station would provide excellent interchange with the two existing bus services using Battersea Park Road and good interchange with buses using Queenstown Road, and with Battersea and Queenstown Road (Battersea) railway stations. Nine Elms station would provide interchange with buses using Wandsworth Road.

Land-use Policy

The NLE proposals are being investigated as a means to support the highest levels of development in the Vauxhall, Nine Elms and Battersea (VNEB) Opportunity Area. The OA Transport Study has shown that, in order to support the highest levels of development, the NLE is the only feasible means of providing sufficient capacity.

The NLE will help London to realise two of the six key objectives outlined in the London Plan, specifically:

- the NLE seeks “to improve public transport capacity and accessibility where it is needed, for areas designated for development and regeneration, including the Opportunity Areas” (Policy 3C.1)
- the NLE supports growth in the VNEB Opportunity Area (Policy 3C.3)

The NLE will also help to achieve the key goals of Wandsworth’s current UDP. Wandsworth will soon be bringing forward a Local Development Framework to replace their existing UDP. Under this framework a high density development at Battersea Power Station is explicitly sought. All four NLE options will help to deliver this objective as well as the delivery of new homes and jobs along the river. All four options will support the forthcoming policy in the Wandsworth LDF.

Therefore the NLE provides a very high level of integration with local land-use policy.

None of the land-use policy documents distinguish between the route options and all four options would provide sufficient capacity to support the highest levels of development. However, given the differing locations of stations on the line and the need to integrate and support the surrounding redevelopment, Route 2 has been

identified as having the best fit. The route supports both the Nine Elms and Battersea areas of the OA. Route 1 is limited to Battersea only, and while Route 3 supports the Vauxhall area (in addition to Battersea), this area arguably does not require any further transport access improvements beyond those planned (e.g. Line upgrade and station upgrade).

Route 4's station location lies on the axis of the Linear Park that is being designed to provide a green space that facilitates movements across the OA. The station location in Nine Elms for Route 4 could pose some conflict with the Park, and result in land take away from the planned green space needed to support the new communities.

Integration Objective Summary

Figure 16 summarises the comparison of route sensitivity between the routes for the Integration sub-objectives. Highest means the route option would have the highest positive impact out of the four options.

Figure 16 - Comparative performance of route options for Integration objective

Accessibility Sub-Objective	Route 1	Route 2	Route 3	Route 4
Transport Interchange	Lowest	Intermediate	Highest	Intermediate
Land-use policy	Intermediate	Highest	Intermediate	Intermediate

Summary

Figure 17 presents a summary of the NATA assessment.

Figure 17 – NATA Appraisal Summary

Objective	Sub-Objective	Route 1	Route 2	Route 3	Route 4
Environment	Noise	Noise impacts minimised due to lone terminus station integrated into a single development site.	Intermediate station will be located on a busy main road with common active frontages and adjacent to a popular supermarket, thus minimising noise impacts having a tangible adverse effect in the area.	Construction of Vauxhall interchange would require extensive intrusive works at one of London's busiest highway junction and Bus station. Noise impacts would be substantial and impact wider area.	Additional vent shaft compared to route 2 will increase spread of construction and operational noise. Intermediate station location amongst residential redevelopments so noise likely to have more adverse impact on local quality of life.
	Local Air Quality	Lack of intermediate station reduces extent of PT usage, resulting in higher use of more polluting modes. (i.e. private vehicles) and its associated impact on air quality	Highest reductions in private transport usage compared to other routes – reducing car emissions.	As with noise, air quality impacts of disruption during construction would be substantial. Intermediate station serves area already well served by PT, so impact on reducing car trips will be lower.	Good reductions in private transport usage though sub-optimal Nine Elms station will limit usage and ability to reduce car emissions compared to route 2.

Objective	Sub-Objective	Route 1	Route 2	Route 3	Route 4
	Greenhouse Gases (GHG)	Lack of intermediate station reduces GHG output from energy consumption relative to other option. However, it also will reduce extent of PT use over car use.	Highest reductions in private transport usage compared to other routes, helping to reduce GHGs from private transport.	Impacts of disruption in Vauxhall area would be extensive, leading to elevated GHGs from transport in the area during construction period. Post construction, route will reduce need for car travel and so help minimise GHGs.	Good reductions in private transport usage though sub-optimal Nine Elms station will limit usage and ability to reduce car GHG emissions compared to route 2.
	Landscape	The area is lacking in notable landscape features, however the extension will be design to complement the Battersea Power Station site.	The area is lacking in notable landscape features. The extension will however be designed to ensure good access to the future landscape that will be provided by the regeneration area such as the Linear Park.	The area is lacking in notable landscape features, however the extension will be design to complement the Battersea Power Station site. No impact is anticipated at Vauxhall.	The area is lacking in notable landscape features. The extension will however be designed to ensure good access to the future landscape that will be provided by the regeneration area such as the Linear Park.

Objective	Sub-Objective	Route 1	Route 2	Route 3	Route 4
	Townscape	The extension will benefit the townscape in Battersea, with the station helping to restore the sense of place and importance to the site.	The extension will benefit the townscape in Battersea, with the station helping to restore the sense of place and importance to the site. The Nine Elms station will provide opportunity to further enhance the townscape in the Nine Elms area, by complimenting the redevelopment site it will lie next to.	The extension will benefit the townscape in Battersea, with the station helping to restore the sense of place and importance to the site. At Vauxhall, the townscape may suffer from land take associated with works for the new interchange.	The extension will benefit the townscape In Battersea, with the station helping to restore the sense of place and importance to the site.
	Heritage of Historic Resources	Battersea Power Station is a nationally significant landmark. The recovery of the building is contingent upon its redevelopment. The redevelopment is contingent upon the extension. The extension has a significant impact on this NATA aspect.	Battersea Power Station is a nationally significant landmark. The recovery of the building is contingent upon its redevelopment. The redevelopment is contingent upon the extension. The extension has a significant impact on this NATA aspect. The Nine Elms station location will support the continued success of the NCGM, ensuring the market with its historic origins can continue to be a success.	Battersea Power Station is a nationally significant landmark. The recovery of the building is contingent upon its redevelopment. The redevelopment is contingent upon the extension. The extension has a significant impact on this NATA aspect.	Battersea Power Station is a nationally significant landmark. The recovery of the building is contingent upon its redevelopment. The redevelopment is contingent upon the extension. The extension has a significant impact on this NATA aspect. The Nine Elms station location will support the continued success of NCGM, ensuring the market with its historic origins can continue to be a success

Objective	Sub-Objective	Route 1	Route 2	Route 3	Route 4
	Biodiversity	No sites with notable biodiversity requiring protection have been identified.	No sites with notable biodiversity requiring protection have been identified. Further analysis required on preferred scheme.	No sites with notable biodiversity requiring protection have been identified.	No sites with notable biodiversity requiring protection have been identified.
	Water Environment	Unable to assess at current time	Unable to assess at current time	Unable to assess at current time	Unable to assess at current time
	Physical Fitness	The route is limited to the western end of the OA, reducing access to the wider OA and restricting access to public transport. The lack of an intermediate station does reduce disruption and impact on local land owners, avoiding the consequential stress.	The route maximises extension patronage and provides the greatest step change in access to the broad area, with the consequential improvements on physical fitness.	The negative impacts of the disruption in the Vauxhall area during station construction would impact negatively on health, due to stress and anxiety over matters such as land-take and the highways decongestion that would occur.	The route has good levels of extension patronage and provides good improvements in access to the broad area, with the consequential improvements on physical fitness. Additional shaft site will increase the geographical scope of the numbers of people affected negatively during construction and operation.

Objective	Sub-Objective	Route 1	Route 2	Route 3	Route 4
	Journey Ambience	The single station on the extension limits the mode shift from private to public transport, reducing the positive contribution the line has on surface transport journey quality. However, the lower levels of line usage will reduce the negative impact felt from increased crowding levels by existing line users.	Greatest estimated reduction in private car trips, helping to minimise highway congestion and so improve quality of journey.	Interchange to Victoria line may add to Victoria line crowding and deterioration in the quality of journeys on the line.	Good estimated reduction in private car trips, helping to minimise highway congestion and so improve quality of journey.
Safety	Accidents	Significant improvement in road safety due to reduction in car trips, but lowest of options due to lone station causing relatively low levels of demand.	Greatest improvement in road safety due to reduction in car trips.	Significant improvement in road safety due to reduction in car trips.	Significant improvement in road safety due to reduction in car trips.
	Security	Neutral effect anticipated. Although Tube is a terrorist target, the enhancement to townscape provided by new stations and the provision of active frontages will help improve local security.	Neutral effect anticipated. Although Tube is a terrorist target, the enhancement to townscape provided by new stations and the provision of active frontages will help improve local security.	Neutral effect anticipated. Although Tube is a terrorist target, the enhancement to townscape provided by new stations and the provision of active frontages will help improve local security.	Proximity of the Nine Elms station to the American Embassy could increase the risk to security at the station. Some mitigation measures could be necessary in station design. Effect still considered to be neutral.

Objective	Sub-Objective	Route 1	Route 2	Route 3	Route 4
Economy	Public Accounts	The funding proposal for the Northern Line extension is to see it substantially funded by proceeds from development of sites that would benefit from the extension There are potentially a number of mechanisms by which this funding can be secured and TfL and GLA continue to work with the Government on these.			
	Transport Economic Efficiency	Route 2 demonstrates strongest performance in benefit terms, with overall economic efficiency close to Route 1 due to the latter's lower cost. Routes 3 and 4 demonstrably inferior to route 2, supporting wider NATA conclusions.			
	Reliability	The route will take place on an upgraded railway with good levels of reliability. It will provide an alternative to less reliable surface modes. The distribution of this improvement will be limited by the lone station for accessing the line.	The route will take place on an upgraded railway with good levels of reliability. It will provide an alternative to less reliable surface modes. The distribution of this improvement will be highest for this route as it will minimise the increase in surface transport usage.	The route will take place on an upgraded railway with good levels of reliability. It will provide an alternative to less reliable surface modes. However the interchange to the Victoria line could cause increased crowding on the line and deterioration in the reliability of that service.	The route will take place on an upgraded railway with good levels of reliability. It will provide an alternative to less reliable surface modes. The distribution of this improvement will be strong for this route as it will minimise the increase in surface transport usage.
	Wider Economic Impacts	Unknown. WEI Assessment will be conducted upon the preferred option. In general, given the extensions requirement to facilitate a regeneration area, the WEIs are expected to be positive and should supplement the value for money case for the extension.			
Accessibility	Option Values	Strong beneficial impact. Route is likely to have lowest option value as the lack of intermediate station reduces the size of the community that would be able to easily take advantage of the extension.	Strong beneficial impact. Route is likely to have greatest option value as size of communities within extension catchment area will be highest.	Strong beneficial impact.	Strong beneficial impact.

Objective	Sub-Objective	Route 1	Route 2	Route 3	Route 4
	Severance	The option does not resolve any particular severance issues in the local area, nor will the scheme worsen severance in anyway.	The route reduces severance caused by the South West Trains line in Waterloo, by providing a high frequency service to what will be the two main local centres either side of the lines.	The option does not resolve any particular severance issues in the local area, nor will the scheme worsen severance in anyway.	The option does not resolve any particular severance issues in the local area, nor will the scheme worsen severance in anyway.
	Access to the Transport System	The extension would generate a positive impact, given the strategic locations the Northern line serves e.g. West End, Bank, international gateways.	As route 1, but impact greater due to spread of stations maximising the number of people benefitting from increased access to opportunities and services.	Option has a highly beneficial impact, with the interchange to the Victoria line generating a wider choice of routes on the Tube network, bringing a large number of services within short journey times.	Similar scale of impact as route 2, but marginally less due to reduced catchment area of Nine Elms station location.
Integration	Transport Interchange	Good integration with bus services on Nine Elms Lane but lack of intermediate station restricts interchange to other key bus corridors through VNEB OA.	Good integration with bus services on Nine Elms Lane and also on Wandsworth Road.	Strongest option, with interchange at Vauxhall station providing access to wide variety of sub regional bus routes, as well as maximising journey routes across Tube network.	Similar to option 2, but Nine Elms station location is more isolated from bus routes, meaning a lack of seamless interchange between Tube and Bus on Wandsworth Road.

Objective	Sub-Objective	Route 1	Route 2	Route 3	Route 4
	Land-Use Policy	Option supports policy in the Battersea Power Station area, but lack of intermediate station leaves dense commercial and residential developments and existing communities in Nine Elms area not served by Tube.	Option supports policy in the Battersea Power Station area. Nine Elms station location designed into Sainsbury's site redevelopment and supportive of improving access to the existing Nine Elms communities on the eastern side of Wandsworth Road.	Option supports policy in the Battersea Power Station area. Station location at Vauxhall supports development in VNEB OA to north of Vauxhall Station, but is considered unnecessary given quality of transport already there. Does not support the regeneration in the Nine Elms area e.g. NCGM, Embassy etc.	Option supports policy in the Battersea Power Station area. Nine Elms station location risks infringement on Linear Park route and interferes with redevelopment plans for the Embassy and Embassy Gardens developments.
	Other Government Policies	Scheme is broadly supportive of range of other policies.			

7. Conclusions



This appraisal demonstrates that the NLE fits well as a policy in principle: all four route options perform well against the MTS, OAPF and NATA objectives.

Despite this broad positive performance, there are comparative strengths and weaknesses of each route option which are identified in the appraisal. The appraisal demonstrates that Route 2 remains the best option to take forward. It is the highest-scoring in terms of customer benefits (journey time and crowding) and policy compliance, and has been the most popular option in public consultation, both in 2010 and in 2011.

The results of the modelling validate the conclusions reached in the initial assessment of 2010, with Route 2 having the highest customer benefit, followed by Route 3 (via Vauxhall) and Route 4 (via an intermediate station north of the railway viaduct). Route 4 suffers from having a less accessible location for the Nine Elms station, resulting in lower journey time savings than Route 2. Route 2 would also maximise passenger use of the extension, yielding 2,500-3,000 more boardings than other routes, equivalent to approximately 3 million additional passengers per annum.

By carrying out both SAF and WebTag/NATA appraisals, both the objectives for TfL and the Mayor as set out in the MTS and the national policy objectives have been considered in this evaluation. In both of these assessments Route 2 had the highest score due to the additional benefits that accrue from the second station's location close to an existing residential area, increased interchange with buses, higher passenger numbers and the results from the recent public consultation. Route 3 was the only option to provide alternative benefits, due to the provision of a new interchange at Vauxhall. However this was outweighed by lower accessibility benefits and potential negative impacts to the Victoria line.

Further work will be done to develop a detailed business case for Route 2; this will include more work on the impacts at Kennington station, for example, as well as an appraisal of the Wider Economic Benefits (WEBs) of the scheme.

Notes and references

Documents referred to below can be downloaded from:

<http://www.northernlineextension.com/downloads.aspx>

<http://www.london.gov.uk/who-runs-london/mayor/publications/planning/vauxhall-nine-elms-battersea-opportunity-area-planning-framework>

ⁱ The draft OAPF was published for consultation in November 2009 and is expected to be confirmed by the Mayor in early 2012. /www.london.gov.uk/who-runs-london/mayor/publications/planning/vauxhall-nine-elms-battersea-opportunity-area-planning-framework

ⁱⁱ Sinclair Knight Merz, / TfL VNEB Opportunity Area Transport Study, 2009

<http://www.london.gov.uk/who-runs-london/mayor/publications/planning/vauxhall-nine-elms-battersea-opportunity-area-planning-framework>

ⁱⁱⁱ www.wandsworth.gov.uk/downloads/200168/nine_elms_and_battersea

^{iv} Steer Davies Gleave, August 2010

^v On 12 December 2011 the holding company for the site were placed into administration. It would be expected that whoever buys the site picks up the same responsibility with regard to the NLE; in any case, this development has no effect on this appraisal.

^{vi} Steer Davies Gleave, June 2009

^{vii} Parsons Brinckerhoff, December 2008

^{viii} This section summarises the consultation process and results; a detailed account can be found in TfL's report on the consultation and SDG's Analysis of Consultation Results (both 2011)

^{ix} 'Revised Scenario 5' ; the preferred option set out in the VNEB OAPF, which sets out a high-density mix of retail, commercial and residential development, with up to 25,000 jobs and 16,000 new homes

^x URS, December 2008