SILVERTOWN TUNNEL

Preliminary Environmental Information Report: Appendix 3.A

Options Summary Table

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Summary Tables extracted from Silvertown Tunnel Options Study, Transport for London (Dec 2013)

Table 3.A-1 Options Comparison (Bored and Immersed Tube 'Base' options)

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
Air Quality	Receptors likely to be affected include commercial and residential developments located on the Greenwich Peninsula and at the western boundary of the Royal Victoria Dock. During the construction of the scheme works will include the removal and storage of excavated materials which has the	Construction dust can be mitigated in accordance with best practice with the measures documented in a Construction Environmental Management Plan (CEMP). There are limited mitigation	Environmental risks and associated mitigation measures are considered to be the similar to the bored 'Base' option as air quality will be affected by the same level of traffic flow with both options.	Same as bored 'Base' option.	The environmental risks will be the same for bored 'Base' option and immersed tube 'Base' option due to similar design and capacity of both tunnel options hence same level of traffic flows during construction and

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
	potential lead to the generation of dust. In addition dust can be liberated through the movement of material by vehicles and site plant. During operation of the Scheme a new road layout will be required at Greenwich Peninsula and Silvertown to allow access to the new Silvertown tunnel crossing. Given that this is likely to result in increases in road traffic there is the potential for deterioration in local air quality within the AQMAs designated by	measures to control emissions from vehicles as a result of the Scheme; however the attractiveness of the Scheme could be influenced by tolling charges. Ventilation of the tunnel can be designed in order to mitigate any significant impacts on receptors (for example			operation. The same number of receptors will be affected with each option.

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
	the London Borough of Newham and Greenwich. There are likely to be both improvements in air quality and deterioration in air quality at receptors as a result of the change in traffic flows.	increased stack height would aid dispersion).			
Community and Private Assets	At present the land uses in the immediate vicinity of the proposed options mainly comprise derelict land and industrial premises. Permanent land take related to the option will be minimal and confined to small areas of currently safeguarded land on	No mitigation measures required.	The immersed tunnel option, when compared with the bored tunnel, requires a greater area of land to be constructed (work sites, casting basin, etc.). Although the environmental risks associated with landtake are anticipated	No mitigation measures required.	Given that the land uses in the vicinity of the proposed options do not suggest the demolition of any residential properties or important community facilities it is

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
	both sides of the Thames. Environmental risks associated with landtake and subsequently land use are not anticipated to be significant.		to be greater than the bored tunnel, they will be of temporary character.		considered that once operational the overall environmental risks will be the similar for both 'Base' options.
Cultural Heritage	The proposed bored tunnelling works are anticipated to be at sufficient depths to avoid impacting on archaeological remains however the tunnel portals are likely to result in the removal of any archaeological remains situated within the portal footprints.	No mitigation measures required.	Given that the immersed tunnel option, when compared with the bored tunnel, requires a greater area of land to be constructed, there is greater potential to disturb archaeological remains within the areas of archaeological potential as designated by the London	Consultation with English Heritage and further archaeological work will be required to assess the potential impacts the option will have on archaeological	Given that the construction methodology of the immersed tube tunnel is likely to affect more heritage assets (including in the River Thames) it is considered that the environmental risks associated

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
	The archaeological potential at this stage is unknown; therefore further archaeological assessment work may be required at a later stage to confirm impacts.		Boroughs of Greenwich and Newham. The immersed tunnel will also require a channel to be dredged in the River Thames. This is likely to remove any archaeological resources located within the Archaeological Priority Area designated by the London Borough of Newham which extends to the centre of the River Thames.	resources prior to the commencement of construction. Mitigation measures such as archaeological watching briefs to be undertaken during the construction of the scheme.	with the Immersed Tube 'Base' option are higher.
Ecology and Nature Conservation	Terrestrial Ecology Whilst the tunnel portals will be constructed in areas of land that are	Terrestrial Ecology Retain as much as possible of	Terrestrial Ecology The environmental risks will be similar to the bored 'Base' option,	Terrestrial Ecology There would be a greater	Higher environmental risks are found with the immersed tube

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
	largely urban and are not particularly regarded as ecologically sensitive, the loss of the areas of scrub/ grassland and woodland habitat could be significant in a borough context given the shortage of such habitat locally. The area required for the construction of the southern end of the Scheme includes an area of derelict land that appears to be heavily overgrown with a mixture of small trees and scrub. This is one of the only patches of such	the scrub/woodland habitat within the Scheme. In the case that the scrub/woodland habitat cannot be retained, consideration should be given to incorporating similar habitat types within the design of the completed Scheme.	although there may be additional risks associated with the casting basin, the location of which is unknown. Marine Ecology The construction of an immersed tube tunnel will have an impact on the River Thames and Tidal Tributaries SINC which supports some habitats of conservation importance (e.g. intertidal mudflats) and ecological important biota (e.g. birds and fish). The potential	temporary loss of habitat on the foreshores and compensation measures (e.g. creation of habitat) may be required. Marine Ecology Measures will need to be incorporated into the CEMP to ensure that there would be no significant impacts on aquatic habitats	'Base' option due to dredging operations during construction and the vertical alignment of the immersed tube tunnel. In addition, the immersed tube 'Base' option will require more additional survey work and consultation with non-statutory consultees to confirm the presence of protected species and identify

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	**Mitigation Measures**	**Environmental Risks**	**Mitigation Measures**	
	habitat on the Greenwich Peninsula, and has been identified on Natural England's website as 'deciduous woodland', a BAP habitat. All other areas of green space within this option appear to comprise landscape planting of limited nature conservation value. Marine Ecology The bored 'Base' option will involve tunnelling beneath the River Thames which is designated as the River Thames & Tidal	Marine Ecology No mitigation measures required.	environmental risks of this will include: Temporary loss of intertidal mudflat habitat and associated benthos from the construction of the immersed tunnel Temporary disturbance to intertidal mudflat and associated benthos resulting in temporary disturbance to bird communities caused through installation of the cofferdams Temporary reduction in water quality as a result of an increase in suspended solids and	associated with sedimentation or pollution. The mitigation measures associated with potential risks associated with dredging are: Spill control and hence controlling turbidity during agitation dredging of alluvium, bulk dredging and maintenance dredging	appropriate mitigation. More complex mitigation measures are likely to be required as more habitats are likely to be affected by the immersed tube tunnel. The effect on the river dynamics due to the foreshore cofferdams and the dredged trench will require numerical modelling to

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
	Tributaries SINC. Given that the River Thames will not be directly affected by the tunnelling, the Scheme is likely only to result in indirect effects on ecology within the River Thames from, for example, elevated noise levels or the risk of accidental spillages during construction.		release of contaminant bound sediments causing temporary effects in fish and other biota during the dredging operations Temporary increase in aquatic noise levels during the installation of the immersed tunnel which could have adverse effects on marine mammals and fish. The construction of an immersed tunnel has the potential to significantly affect marine ecology from	Dredging during winter season to avoid fish migrations Licensed disposal of contaminated materials and non-contaminated materials. Dredging work will need to be licensed and comply with criteria for turbidity and oxygen levels.	accurately predict the effect on current flows and determine the extent of erosion and deposition within the river.

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
			dredging operations. Dredging may prevent adult fish from migrating upstream to possible spawning grounds and result in mortality in younger fish. In addition, mobilisation of contaminated sediments has the potential to cause some direct toxicological effects leading to impairment of physiological functions in fish. Combined effects of dredging, outfalls and development are likely to occur during the summer months of June		

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
			to August when dissolved oxygen levels are at their lowest. The need to undertake construction works and dredging within the river to construct an immersed tunnel could result in the deterioration of water quality, elevated suspended sediments in the river and the loss of intertidal mudflats during construction and during operation if permanent structures are needed in the river.		
Effects on All	The key receptors will	Mitigation	The environmental risks	In addition to	On the whole the

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
Travellers	be non-motorised users such as pedestrians and cyclists and vehicle drivers for the view from the road and driver stress assessments. The construction of the bored tunnel is likely to result in the followings environmental risks: Reduced amenity for the users of the cycle routes and footpaths in the vicinity of the tunnel portal Changes in the pedestrian crossings that currently exist on both sides of the river Increased severance on	measures include: The construction of a new footbridge near Boord Street Ensuring the Scheme design makes appropriate provision for pedestrian crossings when designing the new highway arrangements at each of the tunnel portals Minimising	associated with the immersed tube 'Base' option are similar to those identified with the bored 'Base' option. The key receptors will additionally include the river users. Navigation issues are anticipated on the River Thames during construction works. The immersion of tunnel elements will require short term closure of the river. Depending on the exact location of the cofferdam basin, cycle	the mitigation measures proposed for the bored 'Base' option, the immersion of the tunnel elements will require the advanced coordination with Port of London Authority (PLA) to reduce the environmental risks associated with the temporary closure of the	environmental risks of the two tunnel options are considered to be similar. More receptors are likely to be affected during construction of the immersed tube tunnel hence additional mitigation measures may need to be implemented to reduce the environmental risks with regards to navigation.

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	**Mitigation Measures**	**Environmental Risks**	**Mitigation Measures**	
	certain roads depending upon the traffic changes Reduced drivers stress as a result of reduced congestion and enhanced road layout Improvements to public transport connections	footpath and cycle route diversions both during construction and also those that may be needed permanently during Scheme operation Ensuring clear signage for non-motorised users Ensuring the design of the Scheme reflects public transport needs.	and pedestrian routes on the both sides of the river are likely to be affected.	river.	
Geology and	Environmental risks	Potential	The immersed tube	Same as for	Although the

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
Soils	associated with the bored 'Base' option include: Disturbance of potentially contaminated land and areas of Made Ground Mobilising contaminants in the soil that would otherwise be immobile Creation of new pollutant pathways for contamination to reach groundwater and surface water resources Creation of contaminated run-off that could affect surface	mitigation measures will include: Treatment of contaminated land based on the information obtained from the site investigation Completion of Risk Assessments and a Remediation Strategy (if required) and adherence to them throughout	tunnel will be relatively shallow and may therefore pose a higher risk to disturb the underlying contaminated soils. This could result in the contamination of controlled waters such as groundwater within the Secondary aquifer and the River Thames. Contamination could migrate horizontally and vertically along newly created preferential pathways such as drainage runs, piles and site investigation boreholes.	bored 'Base' option.	environmental risks and associated mitigation measure are considered to be essentially the same for both options, it is anticipated that the excavation and disposal of the shallow (potentially contaminated) soil layers in close proximity to the river Thames with the immersed tube 'Base' option will

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	**Mitigation Measures**	**Environmental Risks**	**Mitigation Measures**	
	and groundwater resources Effects of the tunnel construction on ground stability The cut and cover sections are generally deeper for the bored tunnel option than for the immersed tube option therefore the excavated material from the deeper ground is less likely to be contaminated (apart from the ground break point to place the TBM at Silvertown end).	the construction works Adherence to the Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Defra, 2009) Adherence to Environment Agency Pollution Prevention Guidelines Use of a CEMP.	The casting basin requirements of this option will result in a greater amount of excavation work near the River Thames hence higher risk to create pollutant pathways.		pose more risk of mobilising contaminants and creation of new pathways.

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
Materials	The following environmental risks are identified: Waste generated as a result of excavation works Increased pressure on waste management and disposal facilities Energy consumption through plant use and transportation of materials and waste Release of contaminants to air, land or water through the sourcing, use, storage, transportation and	Optimise the design of the Scheme to reduce need for materials import and minimise waste (including proactive engagement with the design team to encourage the selection of materials taking account of their potential environmental effects A CEMP documenting	The immersed tube tunnel will generate around 40% more waste materials due to earthworks excavations of the casting basin and excavation of the open cut and cover passages at the entrance and exits from the tunnel. Waste material will also arise from the dredged channel in which the immersed tunnel will be constructed within the River Thames. For an immersed tunnel there are large volumes of material arising and large volumes required for backfilling. The	Where re-use is not possible there will be a requirement to dispose of excavated material by licensed carriers to licensed landfill sites and handled in accordance with the Waste Management Regulations.	The immersed tube tunnel generates approximately 40% more waste material. The earthworks excavations on land for the immersed tube 'Base' option include lengthy cut and cover tunnels at each approach and the casting basin on-site will yield significant quantities of River Terrace deposits

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
	disposal of materials and waste that could result in pollution Flooding as a result of inappropriate materials and/or waste storage The excavated material from tunnelling activity will predominately be removed from the site at which the TBM enters the ground and from the area of the cut and cover and open cut portals located and the northern and southern ends of the tunnel at Silvertown and the Greenwich Peninsula	control measures for the use, storage and transportation of materials as well as the storage and transportation of wastes A Site Waste Management Plan that will outline the types and quantities of wastes that would be generated and how they would be reduced, re-used, managed	dredged cohesive material will not be suitable for re-use as backfill to the tunnel elements and will need to be disposed of. Terrace gravels may be re-usable but the volumes are small and the cost of storage on site and re-handling to place the material as backfill may be prohibitive. It is therefore unlikely these materials will be re-used.		and London Clay. Limited mitigation options are available much of the waste material may not be suitable to re-use.

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
	respectively.	and disposed of Examine the potential re-use and disposal options for excavated material and in particular re-use options for London Clay.			
Noise and Vibration	The construction and operation of new tunnel crossing has the potential to cause increase in traffic noise on an existing road by altering the traffic flow and composition. In the case of the bored tunnel	Thin/low-noise surfacing can reduce noise levels by up to 3.5dB (A) where the average speed of the traffic is above 75 mph. Below	Same as bored 'Base' option.	Same as bored 'Base' option.	The environmental risks and mitigation measures associated with noise will be the same for both options due to the

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
	a completely new noise source would be created which could have a significant effect upon the existing noise climate. The majority of residential receptors within the anticipated noise study area are located on the northern side of the Scheme in Canning Town. Road traffic noise on the southern side from the A102 and on the northern side from the A1011 and A13 would be the most likely sources of road traffic	this speed there is a reduced benefit from a thin/low-noise surface due to vehicle engine noise contributing more to the overall noise level The use of noise barriers can reduce the noise level at dwellings by reducing sound propagation. To be most effective,			same number and location of receptors and same levels of traffic flow.

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
	noise.	barriers are required to be either very close to the source (the road) or the receptor (the dwellings) A reduction in the average speed of vehicles can result in a reduction in traffic noise.			
Townscape and Visual	Given the surrounding townscape and that the majority of the crossing infrastructure would be below the ground, it is	Achieving finishes to engineering structures that are appropriate	This option has a potential for greater visual impact during construction due to larger construction area	Location of the casting basin off-site.	The construction of the immersed tube tunnel is likely to result in significant

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	**Mitigation Measures**	**Environmental Risks**	**Mitigation Measures**	
	not anticipated any significant impacts to occur outside the areas of the portals.	to townscape context and visual amenity Appropriate landscaping Ensuring an appropriate lighting design.	located on-site. Receptors include users of the Emirates Airline Cable Car and residents on both sides of the river.		temporary deterioration of the existing views. There will be no significant difference between the 'Base' options once the tunnel is operational.
Water Environment	Given the nature of the works it less likely that the bored tunnel option will directly affect any surface watercourses as no works are proposed within the River Thames or the River Lea. Potential environmental	Where works are undertaken in close proximity to the flood defences along the banks of either the River Thames or the River Lea consent from the	Construction of the immersed tunnel will require the localised demolition of the river flood defence walls to allow the connection with the landside structures. Temporary cofferdams will need to be constructed to	In addition to the mitigation measures proposed for the bored tunnel option and based on the experience on the Emirates Airline Cable	When compared with the bored 'Base' option, the proposed immersed tunnel option has the potential to result in significant adverse effects that require

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
	risks include increased flood risk as a result of works in close proximity to, or the crossing of, existing flood defences, the introduction of impermeable surfaces and loss of floodplain storage where the linking highway network is constructed. In addition, there is also potential for detriment to the water quality of groundwater waterbodies associated with heavily silted, or otherwise contaminated, runoff from construction sites. Existing river walls are primarily formed	Environment Agency for works affecting watercourses and/or flood defences will be required prior to undertaking the works. Given the nature of the work and the size of the site it is anticipated that a formal flood risk assessment will be undertaken and approved by the Environment	maintain flood defences during the works. In addition, there is also potential for detriment to the water quality of groundwater and surface waterbodies associated with heavily silted, or otherwise contaminated, runoff from construction sites. Given the need for dredging and the construction methods of the immersed tunnel within the River Thames, it is anticipated that environmental risks are likely to occur with regards to changes to	Car project, it is anticipated that a scouring assessment will also be required to assess the impact of the Scheme on water flow and sediment transport, particularly around Bugsby's Reach which, according to the EA, is susceptible to severe erosion (Mott	mitigation measures and the approval of both the Environment Agency and the Port of London Authority (PLA) prior to commencing works. The hydrodynamic modelling is important because it will indicate whether any additional inter-tidal habitat loss is expected as a result of erosion. The results of the

Environmental topic	Bored 'Base' option		Immersed Tube 'Base' option		Options Comparison Comments
	Environmental Risks	Mitigation Measures	Environmental Risks	Mitigation Measures	
	from steel sheet piling and there is a risk of encountering these during bored tunnelling works.	Agency.	water level, flow paths and dynamics and the movement of sediment within the River.	MacDonald, 2012).	modelling should also confirm that erosion will not adversely affect the integrity of the flood defences if the bed level is reduced due to scouring. Where bed levels are lowered this can reduce the stability of the tidal defence retaining walls.

Table 3.A-2 Options Comparison ('Base' options vs 'Shortened' options)

Environmental topic	'Base' (long) options		'Shortened' options		Options Comparison Comments
	Environmental risks	**Mitigation measures**	**Environmental risks**	**Mitigation measures**	
Air Quality	The options have the potential to result in increase of traffic flows and hence change emissions on the local road network. There are likely to be both improvements in air quality and deterioration in air quality at receptors as a result of the change in traffic flows.	The mitigation measures will be the same as those listed in Table 3.A-1.	The environmental risks are considered to be similar as the 'Base' options as air quality will be affected by the same levels of traffic flow with all of the proposed options. As the location of the tunnel portals will be moved closer to the River the concentration of exhaust fumes in the areas immediately adjacent to the tunnel portals is likely to affect users of the commercial buildings located nearby.	The mitigation measures will be the same as those listed in Table 3.A-1.	There is no significant difference between the two sets of options. The location of sensitive receptors with the 'shortened' options will be closer to the river Thames but it is not considered that this will affect more receptors than those affected if the any of the 'Base' Options is taken forward.

Environmental topic	'Base' (long) options		'Shortened' options		Options Comparison Comments
	Environmental risks	**Mitigation measures**	**Environmental risks**	**Mitigation measures**	
Community and Private Assets	Permanent land take related to the options will be confined to areas of currently safeguarded land on both sides of the Thames. Impacts on land take and subsequently land use are anticipated to be with regards to worksites and casting basin (for immersed tube option) and temporary land-take for the cut and cover sections on both sides of the River with both 'Base' options.	No mitigation measures required.	More landtake will be required with the 'Shortened' options as the exit road on the south side of the River runs above ground rather than in a cut-and-cover tunnel. In addition, environmental risks associated with noise pollution are likely to occur in the open road section on the south side of the River affecting receptors in the residential development immediately adjacent to Millennium Way road.	No mitigation measures required.	More receptors are likely to be affected by the open road section on the south side of the river. Although it is unlikely that any compensation measures will be required with regards to landtake at this design stage of the Scheme, consideration should be given to the fact that more permanent landtake will be required with the

Environmental topic	'Base' (long) options		'Shortened' options		Options Comparison Comments
	Environmental risks	**Mitigation measures**	**Environmental risks**	**Mitigation measures**	
					'Shortened' options.
Cultural Heritage	The environmental risks and associated mitigation measures of options B and C ('Shortened') are unlikely to be significantly different from those of the 'Base 'options described in Table 3.A-1.				No significant difference.
Ecology and Nature Conservation	The environmental risks and associated mitigation measures of options B and C ('Shortened') are unlikely to be significantly different from those of the 'Base' options described in Table 3.A-1.				No significant difference.
Effects on All Travellers	The construction of the long tunnel options is likely to result in the following environmental risks: Changes in the multiple pedestrian crossings that currently exist on both	The mitigation measures will be the same as those listed in Table 3.A-1.	In addition to the environmental risks identified with the 'Base' options, increased severance is likely to occur in the northern part of the Greenwich Peninsula for west-east	Severance of east-west movements on the south side of the river will be slightly alleviated with a new pedestrian bridge in the	Although the construction of new pedestrian bridge at Edmund Halley Way will alleviate the severance issues on the south side of the River, the

Environmental topic	'Base' (long) options		'Shortened' options		Options Comparison Comments
	Environmental risks	**Mitigation measures**	**Environmental risks**	**Mitigation measures**	
	sides of the river Increased severance on certain roads depending upon the traffic changes. Reduced drivers stress as a result of reduced congestion and enhanced road layout Reduced amenity for the users of the cycle routes and footpaths in the vicinity of the tunnel portal.		movements. Options B and C will allow more open views from the road as the cut and cover section on the south side of the river will be reduced.	area of Edmund Halley Way (see Drawing MMD-298348-C-DR-00-ZZ-1060_P1).	overall severance in the area will be worse as the open cut road will be a barrier to movement for non-motorised users in the northern part of the peninsula.
Geology and Soils	The environmental risks and associated mitigation measures of options B and C ('Shortened') are unlikely to be significantly different from those of the 'Base' options described in Table 3.A-1.				No significant difference.
Materials	The environmental risks and associated mitigation measures of options B and C				No significant

Environmental topic	'Base' (long) options		'Shortened' options		Options Comparison Comments
	Environmental risks	**Mitigation measures**	**Environmental risks**	**Mitigation measures**	
	('Shortened') are unlikely to be significantly different from those of the 'Base' options described in Table 3.A-1.				difference.
Noise and Vibration	The 'Base' options have the potential to cause an increase in traffic noise on an existing road by altering the traffic flow and composition.	Measures to minimise environmental risks will be required (e.g. thin/low-noise surfacing, noise barriers, reduction in the average speed of vehicles, etc.)	Environmental risks will be associated with increased traffic noise from the open road on the approach to the tunnel in the south section of the Scheme. The Greenwich Peninsula Masterplan envisages residential development northeast of Millennium Way Road which currently is anticipated to comprises of 18 residential buildings (Class 2 and/or 3). In addition, key sensitive receptors likely	Measures to minimise environmental risks will be required (e.g. thin/low-noise surfacing, noise barriers, reduction in the average speed of vehicles, etc.)	More receptors are likely to be affected with the 'Shortened' B and C options including some key sensitive receptors located to the east of the Scheme. Mitigation measures will be essentially the same, but noise barriers will be located in slightly different areas (closer to the key sensitive

Environmental topic	'Base' (long) options		'Shortened' options		Options Comparison Comments
	Environmental risks	**Mitigation measures**	**Environmental risks**	**Mitigation measures**	
			to be affected by the increased traffic noise levels are identified 0.5miles south of the proposed tunnel approach road at Millennium Primary School (see Drawing 6-2 – UA005651- UE31D)		receptors).
Townscape and Visual	The construction of the immersed tube tunnel is likely to result in significant temporary deterioration of the existing views. There will be no significant visual impact once the tunnel is operational.	Potential mitigation measures during construction of the immersed tube tunnel will be locating the casting basin off-site.	The raised level of the open road on the south side of the River Thames has the potential to permanently deteriorate the existing views affecting a number of receptors. The cut and cover section will be reduced and the approach road to the	Potential mitigation measures include: Achieving finishes to engineering structures that are appropriate to townscape	The 'Shortened' options B and C are likely to negatively affect a wider variety of receptors particularly on the south side of the River Thames. More complex mitigation

Environmental topic	'Base' (long) options		'Shortened' options		Options Comparison Comments
	Environmental risks	**Mitigation measures**	**Environmental risks**	**Mitigation measures**	
			tunnel as well as associated infrastructure will be visible to users of the Emirates Airline Cable Car, visitors of the commercials buildings and leisure facilities and residents on both sides of the new road.	context and visual amenity Appropriate landscaping	measures will be required to address some permanent visual impacts related to the 'Shortened' tunnel options.
Water Environment	The environmental risks and associated mitigation measures of options B and C ('Shortened') are unlikely to be significantly different from those of the 'Base' options described in Table 3.A-1. Flood/drainage issues associated with reducing the level of Millennium Way Road with the 'Shortened' and C options are anticipated, but these can be mitigated through careful design.				On the whole there is no significant difference between the two sets of tunnel options.