Crossrail

Technical Report

Assessment of Noise and Vibration Impacts

Volume 7 of 8

South Eastern Route Section

Final Report

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CONTENTS

1. INTRODUCTION 2

2. ENVIRONMENTAL BASELINE AND ASSESSMENT OF IMPACTS – BLACKWALL WAY AND LIMMO PENINSULAR TO EBBSFLEET STATION 5

Appendix A - Construction Impact Summary Tables, Route Windows SE1 to SE8
1. INTRODUCTION

1.1 This report provides the specialist noise and vibration assessment for route windows SE1 to SE8 and auxiliary route window SE6a.

OVERVIEW OF CROSSRAIL WORKS IN SOUTH EASTERN ROUTE SECTION

Orientation Diagram of the Route Section

Permanent Works

1.2 For part of the south eastern route section, Crossrail will use existing main line railway alignment. Crossrail will operate in tunnel to the west of Victoria Dock portal and will serve a reconstructed surface station at Custom House. The route will then follow the existing alignment currently used by Network Rail’s North London Line (NLL) through a refurbished Connaught Tunnel to Silvertown. Crossrail will then descend a ramp to the North Woolwich portal where a new twin-bore tunnel will be constructed that will surface at Plumstead portal, located between the existing Plumstead and Abbey Wood stations. Abbey Wood station will be reconstructed to allow twelve Crossrail trains per hour to terminate.

1.3 It is assumed that the NLL, south of Stratford, will be terminated as a result of the DLR extension from Canning Town to Stratford International. This will include closure of Silvertown and North Woolwich stations and the withdrawal of services through the Connaught Tunnel.

1.4 However, powers are being sought by Crossrail through the Bill for the closure of the NLL south of Stratford to cover the eventuality of the proposed DLR extension not going ahead. In this situation, the current NLL service would be withdrawn from south of Stratford. This currently calls at West Ham, Canning Town, Custom House, Silvertown and North Woolwich.
1.5 When the NLL service is removed, a number of services can be used as alternatives (assuming Crossrail’s 2016 baseline, with the exception of DLR Stratford International to Canning Town services). Alternatives services which can be used are the Jubilee line between Stratford, West Ham and Canning Town; the DLR between Canning Town and Custom House and the DLR between Canning Town, London City Airport and King George V stations. In particular, following the opening of the London City Airport DLR branch in 2005, it is expected that use of Silvertown and North Woolwich is likely to be very small, and would be likely to drop further following the completion of the route to Woolwich Arsenal. The main direct local link broken by closure of the NLL would be between Silvertown / North Woolwich areas and Custom House area, a journey that could be made on the DLR by changing at Canning Town or by bus. Other current direct NLL journeys could still be made with a maximum of two changes all using high frequency services, rather than the current low frequency NLL.

Construction Works

1.6 Construction methods for each of the works are described in their route window. Methods for constructing Over Head Line Electrification (OHLE) are, however, much the same wherever they are undertaken. OHLE will be installed for the whole route section, as far as the east end of the Crossrail sidings at Abbey Wood. Along surface sections, portal masts will be erected approximately every 50 m, although between Plumstead portal and Abbey Wood only the Crossrail tracks will be wired. Construction of OHLE will require foundations on either side of the railway to be installed by excavating a hole, generally using rail-mounted machinery or, if necessary, by hand. Steelwork and masts (which will have a bolted base), and electrical equipment will be installed generally from the rail. Materials will be delivered by rail or road as appropriate.

1.7 Plant and equipment required for construction of OHLE will include a mini digger, piling rigs, diesel locomotives and wagons, a vibrating poker, generators and road/rail cranes and plant.

1.8 Construction methods for each of the works are described in their route window; for example with respect to construction of station buildings, stabling facilities and grade separated crossings. The construction works, where they take place on or near to the railway, may need to be undertaken during ‘possessions’, when the railway is closed to normal passenger and freight services. These possessions generally take place at night, at weekends or over bank holidays. Where time periods for the works are given in this chapter, they may be subject to alteration to accommodate possession planning requirements (ie times to be negotiated with the train companies and Network Rail, when the works can be undertaken during temporary closure of the railway) and final commissioning, which may need to be completed for the corridor as a whole.

1.9 Enabling works will be required prior to the main construction works. These may take up to 12 months at each site, although at locations where only minor enabling works are required the durations of these works could be much shorter.
THE ROUTE WINDOWS

1.10 The scale of the works along the route varies. Table 1.1 summarises the main works (excluding enabling works) that will take place in the south eastern section. Those route windows containing the more substantial works are highlighted with shading.

1.11 The level of detail that is reported in subsequent sections for Route Windows SE1 to SE8 is commensurate with the extent of works that is proposed in each of these route windows.

**TABLE 1.1 MAIN ELEMENTS OF THE SCHEME WITHIN THE SOUTH EASTERN ROUTE SECTION (ROUTE WINDOWS WITH MAJOR WORKS ARE HIGHLIGHTED)**

<table>
<thead>
<tr>
<th>Route Window</th>
<th>Major Project Works</th>
<th>Local Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE1 Blackwall Way &amp; Limmo Peninsula shafts Blackwall Way to Tarling Road.</td>
<td>Blackwall Way shaft Limmo Peninsula shaft</td>
<td>LB Tower Hamlets LB Newham</td>
</tr>
<tr>
<td>SE2 Custom House Station Tarling Road to Prince Regent Footbridge.</td>
<td>Victoria Dock portal Construction of a new station at Custom House; modifications to DLR platform Realignment of DLR tracks OHLE New station entrance and footbridge</td>
<td>LB Newham</td>
</tr>
<tr>
<td>SE3 Connaught Tunnel Prince Regent Footbridge to Lord Street.</td>
<td>Refurbishment of Connaught Tunnel Demolition of Silvertown station OHLE</td>
<td>LB Newham</td>
</tr>
<tr>
<td>SE4 North Woolwich Portal &amp; Thames Tunnel Lord Street to 80 Beresford Street.</td>
<td>North Woolwich portal New twin-bore tunnel (Thames Tunnel) Warren Lane shaft OHLE</td>
<td>LB Newham LB Greenwich</td>
</tr>
<tr>
<td>SE5 Arsenal Way Shaft 80 Beresford Street to Ann Street bridge.</td>
<td>New twin-bore tunnel (Thames Tunnel) Arsenal Way shaft</td>
<td>LB Greenwich</td>
</tr>
<tr>
<td>SE6 Plumstead Portal Ann Street bridge to Marmadon Road</td>
<td>Plumstead portal Replacement of White Hart Road bridge Two new tracks and track realignment OHLE</td>
<td>LB Greenwich</td>
</tr>
<tr>
<td>SE6A Manor Wharf</td>
<td>Refurbishment of Manor Wharf Dredging</td>
<td>LB Bexley</td>
</tr>
<tr>
<td>SE7 Church Manorway Bridge Marmadon Road to De Lucy Street.</td>
<td>Two new tracks and track realignment Replacement of footbridges on Church Manorway and Bostall Manorway Works to Eynsham Drive bridge OHLE</td>
<td>LB Greenwich</td>
</tr>
<tr>
<td>SE8 Abbey Wood Station De Lucy Street to Tunstock Way</td>
<td>New Abbey Wood sidings Two new tracks and track realignment Two new platforms and new elevated station OHLE</td>
<td>LB Greenwich LB Bexley</td>
</tr>
</tbody>
</table>
2. ENVIRONMENTAL BASELINE AND ASSESSMENT OF IMPACTS – BLACKWALL WAY AND LIMMO PENINSULAR TO EBBSFLEET STATION

ROUTE WINDOW SE1 – BLACKWALL WAY AND LIMMO PENINSULAR SHAFTS

Overview of Route Window SE1

2.1 Within this route window the main Crossrail works will involve construction of the Blackwall Way shaft, the construction of the Limmo Peninsula shaft and the construction of twin-bore tunnels. The route window lies within LB Newham and LB Tower Hamlets. The proposed Blackwall Way shaft site is located along Blackwall Way, adjacent to commercial and residential development.

2.2 The Limmo Peninsula shaft site lies within a large area of land currently being used as a construction site for the DLR extension to London City Airport. It is bounded by the River Lea to the west and south, and to the east by the DLR and Jubilee lines. The elevated Lower Lea Crossing dual carriageway skirts the southern boundary of the site. The site is located toward the southwest point of the triangle. The site has a high background noise level from the nearby roads.

Baseline

2.3 This window includes the proposed Blackwall Way intervention shaft and the Limmo Peninsula vent shaft and associated worksites. There are no noise-sensitive receptors near to the Limmo Peninsula shaft. The baseline noise survey location and duration is listed in the following table and identified on Drawing No. 1E0415-E2E00-E01-F-00001:

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1 week)</th>
<th>Medium term (24-hours)</th>
<th>Short-Term (3-hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH36</td>
<td>John Smith Mews</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
2.4 The Blackwall Way Shaft will be located along Blackwall Way, adjacent to the Reuter’s Building car park and Virginia Quay Developments. The temporary worksite will comprise of an area of undeveloped land bounded by Blackwall Way, the boundary fence of Toynbee Housing Association and the proposed Blackwall Yard Development. Construction is scheduled for duration of approximately four and a half years. Once completed the intervention shaft will be completely surrounded by residential developments.

2.5 The Limmo Shaft will be located on the Limmo Peninsular, which is currently being used as a construction site for the DLR extension.

2.6 John Smith Mews (TH36) is situated near the Blackwall Way intervention shaft site. The daytime $L_{Aeq,3hr}$ level was 68 dB, with the $L_{Amax}$ ranging between 72 and 85 dB. The noise climate at this location was dominated by road traffic noise.

**Impact Assessment – Temporary Impacts**

**Impacts during Construction**

2.7 Temporary impacts from construction activities are illustrated on Drawing No.1E0315-E2E00-E01-F-00001.

**Noise from Surface Activity**

2.8 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

**Construction Sites and Works including Onsite Traffic**

**Limmo Worksite**

2.9 There are no noise-sensitive receptors near to the Limmo Worksite, thus no noise impacts are expected within the vicinity of this proposed worksite.

**Blackwall Way Worksite**

2.10 The closest noise sensitive receptors to the Blackwall Way Worksite comprise of 1 to 14 John Smith Mews. These residential properties may experience significant day, evening and night-time noise impacts. No non-residential receptors are expected to be impacted.

**Offsite Road Traffic**

2.11 Construction vehicles will only use the highway during the daytime (07:00 - 19:00). At façades overlooking roads used by construction traffic, the existing hourly $L_{A10}$ during the daytime is predicted to increase by < 1 dB.
Vibration from Surface Activity

2.12 The plant likely to be required to demolish the existing buildings or structures and construct the Blackwall Way Shaft and the Limmo Peninsula Shaft has been reviewed to identify sources, which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings, or cause damage to buildings.

2.13 The construction information provided by Crossrail indicates that oscillatory bored piling will be required during construction of the Blackwall Way Shaft and that a gantry crane will be required during works at the Limmo Peninsula Shaft.

2.14 Vibration levels due to oscillatory bored piling are not expected to be significant. Vibration levels at adjacent buildings or structures, during operation of a gantry crane, are unlikely to be significant and levels can be reduced at source by either having no joints in the rails or by minimising joint separation. The former option is preferred.

2.15 Vibration levels are not expected to exceed the threshold of significance for building damage at any receptor during any of the proposed works.

2.16 The construction activities required at this site are likely to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.17 No listed buildings, or receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to these worksites.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.18 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds will be exceeded while the temporary railway is running.

Tunnel Boring Machines

2.19 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.
Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not likely to be a total absence of adverse comment.

Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic

Limmo Worksite

2.21 No mitigation required.

Blackwall Way Worksite

2.22 In this route window, an estimated 11 residential properties, comprising of 1 to 14 John Smith Mews, are eligible for noise insulation due to construction noise. No properties are eligible for temporary re-housing.

Offsite Road Traffic

2.23 There are no significant residual impacts.

Vibration from Surface Activity

2.24 No impacts occur during these activities in this route window, and thus there is no need of specific mitigation.

Vibration and Groundborne Noise from Underground Activity

2.25 There are no significant residual impacts.

Construction Trains

2.26 For the construction railway, mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

Tunnel Boring Machines

2.27 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.
Impact Assessment – Permanent Impacts

Impacts during Operation

Noise from the Surface Railway

2.28 Not applicable to this route window.

Vibration from the Surface Railway

2.29 Not applicable to this route window.

Noise from Road Traffic

2.30 With regard to operational traffic no changes in baseline traffic flows in the route window as a result of Crossrail, therefore not applicable.

Noise from Ventilation Shafts

2.31 No residential properties are significantly close to the proposed Limmo Peninsula ventilation shaft to be subject to significant noise impacts when the ventilation fan is in operation.

Vibration and Groundborne Noise from the Underground Railway

2.32 With standard trackform the design aim for groundborne noise is achieved for buildings of standard noise-sensitivity (40 dB \( L_{A_{max,s}} \)) without deep or piled foundations in all locations.

2.33 There is residential development in Victoria Dock Road, foundation details of which are unknown.

2.34 If, following detailed study of the building foundations, 40 dB \( L_{A_{max,s}} \) is likely to be exceeded, there will be protection by the use of special trackform.

2.35 Groundborne noise levels are shown on Drawing No: 1E315-E2E00-E03-F-00001.

Mitigation and Residual Impacts during Operation

Noise from the Surface Railway

2.36 Not applicable to this route window.

Vibration from the Surface Railway

2.37 Not applicable to this route window.

Noise from Road Traffic

2.38 There are no residual effects.

Noise from Ventilation Shafts
2.39 There are no impacts, and thus no need for additional mitigation.

Vibration and Groundborne Noise from the Underground Railway

2.40 Appropriate mitigation will be provided, such that no residual impacts occur.

**Impacts for Sites Granted Planning Permission**

2.41 Two planning applications, incorporating noise sensitive usage, have been identified in the Tower Hamlets SE1 route window. They include amended planning permission for The Switch House and Elektron Buildings, on Aspen Way; and a redevelopment for mixed use comprising 50 flats, 41 live/work units and 792 m2 of commercial ground and 1st floor B1 space. The locations of the proposed planning permissions are located at a significant distance from the worksites, therefore indicating that the residential and noise sensitive aspects of the developments should not experience noise impacts due to Crossrail construction works.
2.42 **LIMMO EXCAVATED MATERIAL DISPOSAL SCENARIO**

**Impact Assessment – Temporary Impacts**

**Impacts during Construction**

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic

2.43 The impacts would be the same as for the Crossrail base case.

Offsite Road Traffic

2.44 The impacts would be the same as for the Crossrail base case.

**Vibration from Surface Activity**

2.45 The impacts would be the same as for the Crossrail base case.

**Mitigation and Residual Impacts during Construction**

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic

2.46 No residual impacts, as for the Crossrail base case for Limmo peninsula shaft.

Offsite Road Traffic

2.47 No residual impacts, as for the Crossrail base case for Limmo peninsula shaft.

**Vibration from Surface Activity**

2.48 No residual impacts, as for the Crossrail base case for Limmo peninsula shaft.

**Impact Assessment – Permanent Impacts**

2.49 There would be no permanent effects as the worksite is only required during the construction phase.
## Route Window SE 1: Blackwall Way & Limmo Peninsula Shafts – Temporary Impacts

<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limmo Worksite</td>
<td>Daytime noise impacts at 0 residential properties. Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
<td>Not significant</td>
<td>Conventional on-site mitigation consisting of 2.4 m high hoardings, use of low noise, well maintained plant. Mitigation = Tier 1</td>
<td>It is estimated that 0 residential properties would be eligible for noise insulation. It is estimated that 0 properties would be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 0 residential properties. Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
</tr>
<tr>
<td>Works</td>
<td>Potential Impact</td>
<td>Significance</td>
<td>Assumed Mitigation</td>
<td>Residual Impact</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>-------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Construction of Limmo Peninsular &amp; Blackwall Way vent shafts.</td>
<td>No significant change in operational railway noise at any noise sensitive receptors – no significant noise impacts.</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
<tr>
<td>Construction of tunnels. Operation of railway</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Significance: Not significant
ROUTE WINDOW SE2 – CUSTOM HOUSE STATION

Overview of Route Window SE2

2.50 Proposed works within the route window comprise the construction of the Victoria Dock portal, a new station at Custom House station, the installation of overhead line electrification equipment, and the construction of twin-bore tunnels. The route window lies within LB Newham.

Baseline

2.52 This route window includes the proposed Victoria Dock Portal and Custom House Crossrail Station and associated worksites. The baseline noise survey locations and durations are listed in the following table and identified on Drawing No. 1E0415-E2E00-E01-F-00002:

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1 week)</th>
<th>Medium term (24-hours)</th>
<th>Short-Term (3-hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE01</td>
<td>246 Victoria Dock Road</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NE02</td>
<td>The Flying Angel</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.53 The portal is to be located between the Royal Victoria and Custom House DLR Stations. An associated worksite will be located in the Excel car park to the south of the rail corridor. Custom House Station is located south of the Victoria Dock Road near its junction with Freemasons Road. The Excel exhibition centre is located to the south with the Royal Victoria Dock beyond. Works include, new Crossrail platforms to replace the existing Silverlink/NLL tracks, new Crossrail station, new ticket hall and modifications to the DLR platform.

2.54 Two 7-day measurements were carried out in this area at 246 Victoria Dock Road (NE01), close to Royal Victoria Station and at the Flying Angel (NE02), opposite Custom House Station. Daytime baseline $L_{Aeq,12hr}$ levels were 73 dB and 69 dB respectively. Night-time $L_{Aeq,8hr}$ levels were 67 dB and 62 dB, with $L_{Amax}$ levels up to 102 and 97 dB. Noise levels were generally dominated by road traffic noise, with the additional influence of railway noise and aircraft noise from London City Airport.

Impact Assessment – Temporary Impacts

Impacts during Construction

2.55 Temporary impacts from construction activities are illustrated on Drawing No.1E0315-E2E00-E01-F-00002.

Noise from Surface Activity

2.56 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

Construction Sites and Works including Onsite Traffic

2.57 The construction programme activities that are likely to cause significant impacts include site establishment, track works and station construction works.

2.58 In the vicinity of the Victoria Dock Portal, there will be a significant number of properties that are affected by construction noise. In particular, properties in Chaunterle Close, Victoria Dock Road, Freemasons Road, Bridgeland Road, The Flying Angel, Excel and May Wynne House are expected to experience significant daytime, night-time and evening noise impacts. A hotel on Victoria Dock Road may experience exterior façade noise levels in excess of 85 dB(A).

Royal Docks Surface Water Sewer Diversion Worksites

2.59 For the purposes of this utilities assessment the five worksites associated with the construction of permanent and temporary access shafts, relating to the diversion of the Royal Docks surface water sewer at Victoria Dock Portal, have been identified as A to E, where:

- Site A – The location of a permanent access shaft. The worksite will be located to the west of the Royal Victoria Station, to the south of the existing tracks.
- Site B – The location of an intermediate access shaft. The worksite will be located to the south of the existing tracks, in an area opposite the Bridgeland Road junction.

- Site C – The location of an intermediate access shaft. The worksite will be located to the south of the existing tracks, in an area opposite 251 to 264 Royal Victoria Road.

- Site D – The location of an intermediate access shaft. The worksite will be located to the south of the existing tracks, in an area opposite Freemans Road junction.

- Site E – The location of a permanent access shaft. The worksite will be located to the east of the Custom House Station, to the south of the existing tracks, opposite the Excel Building.

2.60 A permanent access shaft will be constructed at Site A, to the west of Royal Victoria Station, from which the TBM would drive, or could be recovered if driving was from the eastern end, (Site E). Works here, including driving the new tunnel, would take about 9 months. There will be 24-hour working during the driving of the tunnel but excavated material will only be removed from site during normal working hours.

2.61 At Sites B, C, and D, intermediate access shafts, will be constructed off-line. Works at each of these sites would last 5 months. Construction work is confined to normal hours but pumps will be run continuously to dewater the excavations.

2.62 A permanent access shaft will be constructed at Site E, to the east of Custom House Station, from which the TBM would drive, or could be recovered, if driving was from the western end (Site A). Works here, including driving the new tunnel, would take about 9 months. There will be 24-hour working during the driving of the tunnel but excavated material will only be removed from site during normal working hours.

2.63 The distances from the sites within which significant impacts could occur are shown in the table below. These distances are on the basis of no on-site mitigation, since it is assumed that standard hoardings at 2.4 m high do not cut the line of sight for 4 m high receptors. Baseline noise levels obtained from monitoring and the distances to the nearest dwellings are also shown.

<table>
<thead>
<tr>
<th>Site AW/001 9-1</th>
<th>Use</th>
<th>Baseline Location</th>
<th>Day</th>
<th>Eve</th>
<th>Night</th>
<th>Nearest houses (m) Approx</th>
<th>Potential Impact Zone^1(m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Day</td>
<td>Night</td>
</tr>
<tr>
<td>A – west</td>
<td>TBM drive or receptor shaft</td>
<td>NE01</td>
<td>72.7</td>
<td>70.7</td>
<td>67.0</td>
<td>62</td>
<td>64^2</td>
</tr>
<tr>
<td></td>
<td>Criteria</td>
<td>78</td>
<td>76</td>
<td>72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Access shaft</td>
<td>NE01</td>
<td>72.7</td>
<td>70.7</td>
<td>67.0</td>
<td>78</td>
<td>36</td>
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<tr>
<td></td>
<td>Criteria</td>
<td>78</td>
<td>76</td>
<td>72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Access shaft</td>
<td>NE02</td>
<td>69.3</td>
<td>67.3</td>
<td>62.3</td>
<td>70</td>
<td>57</td>
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<td></td>
<td>Criteria</td>
<td>74</td>
<td>72</td>
<td>67</td>
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<td></td>
</tr>
<tr>
<td>D</td>
<td>Access shaft</td>
<td>NE02</td>
<td>69.3</td>
<td>67.3</td>
<td>62.3</td>
<td>70</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>Criteria</td>
<td>74</td>
<td>72</td>
<td>67</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E - east</td>
<td>TBM drive or receptor shaft</td>
<td>NE02</td>
<td>69.3</td>
<td>67.3</td>
<td>62.3</td>
<td>47</td>
<td>84</td>
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<tr>
<td></td>
<td>Criteria</td>
<td>74</td>
<td>72</td>
<td>67</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes 1 Façade level above criterion for any duration assuming mitigation of 0 dB on–site and unobstructed view of site

Notes 2 For activities lasting more than 1 week this range reduces to 42 m
Offsite Road Traffic

2.64 Construction vehicles will only use the highway during the daytime (07:00 - 19:00). At façades overlooking roads used by construction traffic, the existing hourly $L_{A10}$ during the daytime is predicted to increase by $< 1$ dB.

Royal Docks Surface Water Sewer Diversion Worksites

2.65 The effects of off-site construction traffic for these utilities works have been taken into account in the assessment of this topic for the main works in this route window.

Vibration from Surface Activity

Victoria Dock Portal

2.66 The plant likely to be required to demolish the existing buildings or structures and construct the Crossrail elements of the Victoria Dock Portal has been reviewed to identify sources, which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings, or cause damage to buildings.

2.67 The construction information provided by Crossrail indicates that breakers are required during the set-up of the construction site; and that a vibrating roller is required during construction of the cut and cover sections and during track-works at Custom House and Royal Victoria.

2.68 No significantly substantial buildings or structures have been identified on the construction worksites that would require significant demolition activities, and therefore it is considered that the plant required to undertake the set-up of the construction worksites will not be sources of significant vibration. Vibration levels are predicted to be in the region of 1 to 2.5 mm/s at the nearest houses on Victoria Dock Road to the works, during use of the vibrating roller.

2.69 Vibration levels are not expected to exceed the threshold of significance for building damage at any receptor during any of the proposed works.

2.70 The construction activities required at this site are likely to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.71 No listed buildings, or receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to these worksites.

Custom House Station

2.72 The plant likely to be required to demolish the existing buildings or structures and construct the Crossrail elements at Custom House Station has been reviewed to identify sources, which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings, or cause damage to buildings.
2.73 The construction information provided by Crossrail indicates that breakers and a wacker plate are required during the set-up of the construction site; that a wacker plate, breakers, a tamper, and oscillatory bored piling is required during station and track-works. The works include demolition of the existing station building and adjacent structures, and ‘The Barge’ public house.

2.74 Vibration levels due to oscillatory bored piling are unlikely to be significant. Vibration levels from the platform and station construction works are unlikely to be significant at the nearest potentially sensitive receptors, assuming that the breakers are not vehicle mounted. Vibration levels are predicted to be less than 0.5 mm/s at the nearest buildings on Victoria Dock Road to the works, during use of the tamper; 1 to 4 mm/s at the nearest buildings on Victoria Dock Road to the works, during demolition of ‘The Barge’ public house and demolition of the station building and northern platforms; and 0.5 to 1.5 mm/s at the Excel building, during demolition of the station building and southern platforms.

2.75 Vibration levels are not expected to exceed the threshold of significance for building damage at any receptor during any of the proposed works.

2.76 The construction activities required at this site are likely to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.77 No listed buildings, or receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to these worksites.

**Royal Docks Surface Water Sewer Diversion Worksites**

2.78 There is no piling at any of the worksites. The nearest noise-sensitive buildings (dwellings) are at least 60 m away and the nearest commercial building to any of the sites is about 18 m away (from shaft D). Consequently, it is considered that there will be no significant vibration impacts from above ground sources for these works.

Vibration and Groundborne Noise from Underground Activity

**Construction Trains**

2.79 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds will be exceeded while the temporary railway is running.

**Tunnel Boring Machines**

2.80 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.
2.81 Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not likely to be a total absence of adverse comment.

Royal Docks Surface Water Sewer Diversion Worksites

2.82 The new tunnel does not pass under any buildings. The nearest noise-sensitive buildings (dwellings) are at least 60 m away and the nearest commercial building to any of the sites is about 18 m away (from shaft D). Consequently, there will be no significant impacts from underground construction activity.

Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic

2.83 Hoardings of a minimum height of 3.6 m would generally be provided along the northern boundary of the railway and working area and around the site compound. This corresponds to Tier 2 mitigation.

2.84 In this route window, an estimated 105 properties are expected to be eligible for noise insulation due to construction noise. Included in this number are residents of approximately 51 properties, which may be eligible for temporary re-housing. With the implementation of these mitigation measures, there would be no dwellings that would experience significant residual noise impacts.

Royal Docks Surface Water Sewer Diversion Worksites

2.85 Construction activity at Sites A, B, C, and D will not cause any significant impacts during either the daytime or night-time periods owing to the distances from the sites to the nearest dwellings which, in each case, are on the north side of the railway. All buildings in the vicinity on the south side of the railway are assumed to be non-noise sensitive (in commercial use).

2.86 For daytime working at Site E, the provision of Tier 2 mitigation (including raising the height of site hoardings to 5m - assumed to provide a noise reduction of 10 dB) would ensure that neither the nearest dwellings, nor the recreation ground in Victoria Road experienced significant daytime impacts. This mitigation would also ensure that night-time working at Site E would not cause any significant impacts, even if the site was used as a TBM drive shaft

2.87 With these measures in place, there would be no residual impacts from the on-site work at these locations.

<table>
<thead>
<tr>
<th>Site Table 1 AW19</th>
<th>Daytime</th>
<th>Night-time</th>
</tr>
</thead>
<tbody>
<tr>
<td>A – west</td>
<td>None required</td>
<td>None required</td>
</tr>
<tr>
<td>B</td>
<td>None required</td>
<td>None required</td>
</tr>
</tbody>
</table>
Offsite Road Traffic

2.88 There are no residual effects.

Vibration from Surface Activity

2.89 No impacts occur during these activities in this route window, and thus there is no need of specific mitigation.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.90 For the construction railway, mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

Tunnel Boring Machines

2.91 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.

Impact Assessment – Permanent Impacts

Impacts during Operation

Noise from the Surface Railway

2.92 In this Route Window there are proposed changes to the railway (permanent way) infrastructure in the vicinity of the existing Custom House Station. The existing North London Line is due to cease operation along this corridor by 2006, with planned increases in the DLR services. The new Crossrail alignment will emerge from the Victoria Dock Portal in retained cutting and run at grade through the re-modelled Custom House Station. A Level 3 (detailed assessment) assessment has been carried out for this area.

2.93 The new Crossrail alignment will run eastwards from the station at grade alongside Victoria Dock Road, following the old NLL alignment into the Connaught Tunnel. The position of the Victoria Dock Portal will require the DLR tracks to be slewed further south of their current position.

2.94 The predicted noise changes attributable to the infrastructure and forecast railway traffic changes in the vicinity of the new railway have been calculated taking account of the new alignments, precise mix of expected rail vehicles and the operating speeds of the various train types. Where appropriate, consideration has been given to the non-railway related noise contribution at any receptor.
2.95 The resulting changes in overall noise levels for residential receptors close to the new railway tracks would be as follows:

<table>
<thead>
<tr>
<th>Time Period</th>
<th>No. of Significant Impacts</th>
<th>Noise Decrease</th>
<th>Noise Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>&gt;3 dB</td>
<td>Slight 3-5 dB</td>
</tr>
<tr>
<td>Day (07:00 to 23:00 hrs)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Night (23:00 to 07:00 hrs)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: Noise changes calculated in terms of the LAeq,16hr for Day and LAeq,8hr for Night

2.96 The above table indicates that the changes to the infrastructure and services will not result in an increase in noise levels. On this basis there will be no significant impacts.

2.97 According to the baseline noise survey results, the noise generated by the non-railway sources such as the road traffic on the Victoria Dock Road dominates the noise climate in this area. The introduction of Crossrail infrastructure does not introduce any significant impacts at nearby receptors primarily due to the relatively slow train speeds associated with stopping services on both DLR and the new Crossrail infrastructure.

2.98 A detailed study of the potential maximum noise levels arising from the operation of trains has not been undertaken, as it is considered unlikely that the $L_{A_{max,F}}$ levels associated with the proposed infrastructure and traffic pattern changes will be any higher than those already experienced at nearby receptors.

Vibration from the Surface Railway

2.99 Vibration impacts from the permanent operation of the surface railway will not occur within this route window.

Noise from Road Traffic

2.100 When the Crossrail scheme is operational, it will cause only small increases in the 18-hour traffic flow on roads in this route window. The change in $L_{A_{10,18
hr}}$ corresponding to this increase in traffic is predicted to be < 1 dB. There are therefore no significant impacts arising from increases in operational traffic as a result of the scheme.

Noise from Ventilation Shafts

2.101 Not applicable to this route window.

Vibration and Groundborne Noise from the Underground Railway

2.102 With standard trackform the design aim for groundborne noise is achieved for buildings of standard noise-sensitivity (40 dB $L_{A_{max,s}}$) without deep or piled foundations in all locations.

2.103 There is residential development in Victoria Dock Road, foundation details of which are unknown, but even with piled foundations, 40 dB $L_{A_{max,s}}$ is unlikely to be exceeded.

2.104 Groundborne noise levels are shown on Drawing No: 1E315-E2E00-E03-F-00002.
Mitigation and Residual Impacts during Operation

Noise from the Surface Railway

2.105 It can be seen from this assessment that no significant noise impacts have been identified and, as such, no further mitigation has been considered.

2.106 A preliminary assessment has been undertaken to identify the number of residential properties which may be eligible for noise insulation under the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996, as a result of operational railway noise from modified or altered works in the vicinity.

2.107 The results of this preliminary eligibility assessment indicate that no properties are expected to be eligible for noise insulation under the Regulations.

Vibration from the Surface Railway

2.108 There are no impacts, and thus no need for additional mitigation.

Noise from Road Traffic

2.109 There are no impacts, and thus no need for additional mitigation.

Noise from Ventilation Shafts

2.110 Not applicable to this route window.

Vibration and Groundborne Noise from the Underground Railway

2.111 Appropriate mitigation will be provided, such that no residual impacts occur.

Impacts for Sites Granted Planning Permission

2.112 Five planning applications incorporating residential or sensitive development have been identified within SE2. The main areas for development are concentrated on the Royal Victoria Dock or Western Gateway area. The applications include four proposed hotels, with associated facilities; the alteration and refurbishment of an existing building to form a nightclub, restaurant and residential space; the construction of 151 serviced residential flats and offices and a revised description of a previous application for the construction of 330 dwellings and 6 retail units.

2.113 The planning permission sites are located at distance from the worksites, therefore indicating that the residential and noise sensitive aspects of the developments should not experience noise impacts due to the construction or operation of Crossrail. This is with the exception of one site, which is located relatively close to the works in the Victoria Dock Portal area where significant construction noise impacts are possible.
<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diversion of Royal Docks Surface Water Sewer at Victoria Dock Portal</td>
<td>Daytime noise impacts at 0 residential properties. Evening noise impacts at 0 residential properties. Weekend noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
<td>Not significant</td>
<td>BPM to reduce noise, 5.0 m high hoarding around the contractors compound, enclosure of static plant associated with night time working. Mitigation = Tier 2</td>
<td>An estimated 0 properties would be eligible for noise insulation, of which 01 properties would be eligible for temporary re-housing. With this mitigation Daytime noise impacts at 0 residential properties. Evening noise impacts at 0 residential properties. Weekend noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------</td>
<td>---------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLR alignment changes, new Crossrail tracks from Victoria Dock Portal to Connaught Tunnel.</td>
<td>No significant change in operational railway noise at any noise sensitive receptors - no significant noise impacts.</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
<tr>
<td>DLR alignment changes, new Crossrail tracks from Victoria Dock Portal to Connaught Tunnel.</td>
<td>No operational railway vibration impacts.</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
</tbody>
</table>
ROUTE WINDOW SE3 – CONNAUGHT TUNNEL

Overview of Route Window SE3

2.114 The proposed works within the route window comprise the alteration and refurbishment of the Connaught Tunnel to OHLE, the demolition of Silvertown station, and the installation of OHLE. The route window lies within LB Newham.

2.115 The Connaught Tunnel passes beneath Connaught Passage with Royal Victoria Dock to the west and Royal Albert Dock to the east. The Excel Centre is located to the west of the tunnel which is flanked by modern hotels and office blocks.

2.116 Silvertown station is located to the south of the Connaught Road (A112) and London City Airport, in front of the Tate & Lyle factory. Residential areas lie to the north of the alignment. In this assessment it is assumed that the station will have closed with the opening of the proposed DLR link to Stratford. Background noise levels around Connaught Tunnel are relatively high and are mainly due to road traffic noise.

Baseline

2.117 This route window includes remedial works to be undertaken on the Connaught Tunnel, located between Prince Regent and Silvertown Stations, on the existing North Kent Line. Works are expected to take 10 months to complete. The existing Silvertown station, also located within SE3, would be demolished. The baseline noise survey locations and durations are listed in the following table and identified on Drawing No. 1E0415-E2E00-E01-F-00003:

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1 week)</th>
<th>Medium term (24-hours)</th>
<th>Short-Term (3-hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE03</td>
<td>14 Royal Connaught Apartments</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>NE04</td>
<td>2A Leonard Street</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>
Two survey locations were selected within this Route Window, they included one long-term survey undertaken at the Royal Connaught Apartments (NE03) and one short-term attended survey at Leonard Street (NE04).

The daytime L_{Aeq,12hr} baseline level at Royal Connaught Apartments (NE03) was 71 dB, with a daytime L_{Amax} of up to 105 dB. The night-time L_{Aeq,8hr} level was 67 dB, with the L_{Amax} level ranging between 78 to 94 dB. Although road and rail traffic was light, it was noted to be the dominant noise source at this location.

A short-term daytime measurement result of 73 dB L_{Aeq,3hr} was obtained at Leonard Street (NE04), with L_{Amax} levels of up to 100 dB; the noise climate was dominated by road traffic noise.

Impact Assessment – Temporary Impacts

Impacts during Construction

Temporary impacts from construction activities are illustrated on Drawing No.1E0315-E2E00-E01-F-00003.

Noise from Surface Activity

Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

Construction Sites and Works including Onsite Traffic

Connaught Tunnel worksite at Custom House

These construction works will be carried out during the daytime only. No residential properties will receive a significant noise impact from construction activities.

No non-residential receptors are expected to be affected.

Connaught Tunnel Silvertown worksite and Silvertown Station Demolition

A small number of properties immediately adjacent to the Silvertown worksite, within the Connaught Road area, may experience significant a daytime noise impact due to construction activities. Predicted impacts may occur at the Royal Connaught Apartments, Lily Nichols House and Camel Road. In addition, properties on Connaught Road directly opposite the existing NLL station building may also experience a significant daytime impact as a result of the demolition of the station.

No night-time or weekend works are scheduled to take place at this work site.

A significant daytime impact has been predicted at St Marks Church, directly neighbouring the western boundary of the Connaught Tunnel worksite in Silvertown. No other non-residential impacts have been identified within the route window.
Offsite Road Traffic

2.128 Construction vehicles will only use the highway during the daytime (07:00 - 19:00). At façades overlooking roads used by construction traffic, the existing hourly $L_{A10}$ during the daytime is predicted to increase by < 1dB.

Vibration from Surface Activity

Connaught Tunnel Worksite

2.129 The plant likely to be required to demolish the existing buildings or structures and construct the Crossrail elements at the Connaught Tunnel Worksite has been reviewed to identify sources, which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings, or cause damage to buildings.

2.130 The construction information provided by Crossrail indicates that a wacker plate is required during the set-up of the construction worksites; and, that oscillatory bored piling and a wacker plate are required during platform works.

2.131 No significantly substantial buildings or structures have been identified on the construction worksites that would require significant demolition activities, and therefore it is considered that the plant required to undertake the set-up of the construction worksites will not be sources of significant vibration. Vibration levels due to oscillatory bored piling are unlikely to be significant.

2.132 Vibration levels are not expected to exceed the threshold of significance for building damage at any receptor during any of the proposed works.

2.133 The construction activities required at this site are likely to give rise to vibration levels that are below those that correspond to a semantic rating of 'a low probability of adverse comment'. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.134 No listed buildings, or receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to these worksites.

Silvertown Station Worksite

2.135 The plant likely to be required to demolish the existing buildings or structures and construct the Crossrail elements at Silvertown Station Worksite has been reviewed to identify sources, which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings, or cause damage to buildings.

2.136 The construction information provided by Crossrail indicates that hydraulic breakers are required for the demolition of Silvertown Station.

2.137 Vibration levels are predicted to be in the region of 1.5 to 6 mm/s at the closest buildings on Albert Road to the site.

2.138 Vibration levels may exceed the threshold of significance for building damage at any receptor during the proposed works.
2.139 The construction activities required at this site are likely to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.140 No listed buildings, or receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to these worksites.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.141 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds will be exceeded while the temporary railway is running.

Tunnel Boring Machines

2.142 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.

2.143 Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not likely to be a total absence of adverse comment.

Mitigation and Residual Impacts during Construction

Noise from Surface Activity

2.144 Hoardings 2.4 m high would be provided around the worksites. This would be required around the station works and along the north side of the works. This corresponds to Tier 1 mitigation. Hoardings 3.6 m high would be provided around the Connaught Tunnel Custom House Worksite, corresponding to Tier 2 mitigation.

2.145 Within this route window, 40 properties are expected to be eligible for noise insulation due to construction noise, and no properties would be eligible for temporary re-housing. With the implementation of these mitigation measures there will 4 residual impacts at residential properties.

Offsite Road Traffic

2.146 There are no residual effects.
Vibration from Surface Activity

2.147 Vibration mitigation will be required during demolition activities at Silvertown Station, to mitigate potential impacts on adjacent buildings. An appropriate continuous vibration-monitoring regime should be adopted during demolition works allow monitoring of levels and cessation of activity should levels exceed relevant limits.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.148 For the construction railway, mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

Tunnel Boring Machines

2.149 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.

Impact Assessment – Permanent Impacts

Impacts during Operation

Noise from the Surface Railway

2.150 In this Route Window there are proposed changes to the railway (permanent way) infrastructure in the vicinity of the existing Connaught Tunnel. The existing North London Line (including Silvertown station) is due to cease operation along this corridor by 2006, and as such there will be no railway noise evident in the baseline year. A Level 3 (detailed assessment) assessment has been carried out for this area.

2.151 The new Crossrail alignment will run eastwards from the portal alongside the A112 Albert Road, following the old NLL alignment into tunnel at the North Woolwich Portal.

2.152 The predicted noise changes attributable to the infrastructure and forecast railway traffic changes in the vicinity of the new alignment have been calculated taking account of the new alignments, precise mix of expected rail vehicles and the operating speeds of the various train types. Where appropriate, consideration has been given to the non-railway related noise contribution at any receptor.

2.153 The resulting changes in overall noise levels for residential receptors close to the new railway tracks would be as follows:
The above table indicates that the changes to the infrastructure and services will not result in a significant increase in noise levels. On this basis there will be no significant impacts. However, due to the absolute noise levels and minor noise changes associated with Crossrail, up to 15 properties may be eligible for noise insulation under the Regulations.

According to the baseline noise survey results, the noise generated by the non-railway sources such as the road traffic on Albert Road dominates the noise climate in this area. This is the primary reason that the introduction of Crossrail infrastructure does not introduce any significant impacts at nearby receptors.

A detailed study of the potential maximum noise levels arising from the operation of trains has not been undertaken, as it is considered unlikely that the $L_{\text{Amax,F}}$ levels associated with the proposed infrastructure and traffic pattern changes will be any higher than those already experienced at nearby receptors.

Vibration from the Surface Railway

Vibration impacts from the permanent operation of the surface railway will not occur within this route window.

Noise from Road Traffic

When the Crossrail scheme is operational, it will cause only small increases in the 18-hour traffic flow on roads in this route window. The change in $L_{A10,18\text{ hr}}$ corresponding to this in traffic is predicted to be $< 1\ \text{dB}$.

Noise from Ventilation Shafts

Not applicable to this route window.

Vibration and Groundborne Noise from the Underground Railway

With standard trackform the design aim for groundborne noise is achieved for buildings of standard noise-sensitivity ($40\ \text{dB} \ L_{\text{Amax,s}}$) without deep or piled foundations in all locations.

There is hotel development in the vicinity of the Connaught tunnel foundation details of which are unknown, but even with piled foundations, $40\ \text{dB} \ L_{\text{Amax,s}}$ is unlikely to be exceeded.

Groundborne noise levels are shown on Drawing No: 1E315-E2E00-E03-F-00003.
Mitigation and Residual Impacts during Operation

Noise from the Surface Railway

2.163 A preliminary assessment has been undertaken to identify the number of residential properties which may be eligible for noise insulation under the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996, as a result of operational railway noise from modified or altered works in the vicinity.

2.164 The results of this preliminary eligibility assessment indicate that up to 15 residential properties may be eligible for noise insulation under the Regulations. However, with the introduction of approximately 500 m of 2 m high reflective barrier on the north side of the railway along Albert Road (some of which extends into SE4), the number of properties that may be eligible for noise insulation reduces to zero.

2.165 On the above basis, with the proposed 2 m reflective barrier in place, there are no significant residual impacts and no properties eligible for noise insulation.

Vibration from the Surface Railway

2.166 There are no impacts, and thus no need for additional mitigation.

Noise from Road Traffic

2.167 There are no residual effects.

Noise from Ventilation Shafts

2.168 Not applicable to this route window.

Vibration and Groundborne Noise from the Underground Railway

2.169 Appropriate mitigation will be provided, such that no residual impacts occur.

Impacts for Sites Granted Planning Permission

2.170 A comprehensive development with mixed use consisting of residential, a hotel and retail has been proposed at Royal Victoria Dock, on the Western Gateway. Planning permission for a second hotel on Royal Victoria Dock has also been identified. The proposed development consists of the construction of a 4-storey 240-bedroom hotel. These appear to lie within a worksite and hence would be adversely impacted by construction works associated with Crossrail.
### Route Window SE 3: Connaught Tunnel – Temporary Impacts

<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
</table>

Not Significant
## Route Window SE3: Connaught Tunnel – Permanent Impacts

<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Crossrail tracks from Connaught Tunnel to North Woolwich Portal.</td>
<td>No significant change in operational railway noise at any noise sensitive receptors – no significant noise impacts. Noise Insulation eligibility at: Public House on Connaught Rd 1 to 8 Connaught Rd 10 to 13 Connaught Rd 2d Leonard Street 1 Holt Road</td>
<td>Not significant</td>
<td>500 m of 2 m high reflective barrier along the north side of the railway adjacent to Albert Road (some in SE4)</td>
<td>With the proposed noise barrier: 0 properties may be eligible for noise insulation</td>
</tr>
<tr>
<td>New Crossrail tracks from Connaught Tunnel to North Woolwich Portal.</td>
<td>No operational railway vibration impacts.</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
</tbody>
</table>
Overview of Route Window SE4

2.171 The proposed works within this route window comprise the construction of the North Woolwich portal, the twin-bore Thames Tunnel, Warren Lane shaft, and the installation of OHLE equipment. The route window lies within LB Newham and LB Greenwich.

2.172 The North Woolwich portal will be located within the existing railway corridor of the NLL between Factory Road and Albert Road. Residential areas lie to the north of the site and industrial buildings to the south, while further south lies the River Thames.

2.173 The Thames Crossing tunnels will run between the North Woolwich and Plumstead portals. The site for the Warren Lane shaft is located on the corner of Warren Lane and Beresford Street within the Royal Arsenal Gardens, in an area proposed for redevelopment. Part of the land is currently occupied by a warehouse building at the entrance to Royal Arsenal Gardens. Background noise levels in the area are high, mainly due to road traffic.

Baseline

2.174 This route window includes the proposed North Woolwich Portal, Thames Crossing Tunnel, Warren Lane Shaft and associated worksites. The baseline noise survey location and duration is listed in the following table and identified on Drawing No. 1E0415-E2E00-E01-F-00004:

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1 week)</th>
<th>Medium term (24-hours)</th>
<th>Short-Term (3-hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE05</td>
<td>North Woolwich Railway Museum</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Warren Lane Shaft is located on the corner of Warren Lane and Beresford Street in the London borough of Greenwich. The site is currently occupied by a disused building. The shaft is to provide intervention, emergency intervention and ventilation to the running tunnels.

The daytime $L_{Aeq,12hr}$ baseline level measured at the North Woolwich Railway Museum (NE05), close to the proposed tunnel portal location, was 63 dB, falling to a night-time $L_{Aeq,8hr}$ level of 57 dB. Daytime $L_{Amax}$ levels of up to 95 dB were recorded, with a night-time $L_{Amax}$ of 83 dB. The survey position was installed on the roof of the building, which is located at the end of the North London Line; road traffic was the dominant noise source influencing the measured noise levels.

Impact Assessment – Temporary Impacts

Impacts during Construction

Temporary impacts from construction activities are illustrated on Drawing No.1E0315-E2E00-E01-F-00004.

Noise from Surface Activity

Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

Construction Sites and Works including Onsite Traffic

North Woolwich Worksite

Close to the North Woolwich Worksite, a relatively small number of properties are predicted to receive a significant noise impact from construction activities. Residential properties which may experience significant noise impacts during both the daytime and evening periods include, a Public House on Tate Road, a Public House on Fernhill Street, and residential dwellings on Albert Street and Fernhill Street. Due to the potential for live-in accommodation, public houses have been assessed as sensitive receptors.

Work will only be carried out during the daytime and evening periods; no night-time or weekend work will be undertaken.

No non-residential receptors are predicted to be affected.

Warren Lane Worksite

Close to the Warren Lane Worksite, no properties are predicted to receive a significant noise impact from construction activities.

Some work will be carried out during evening and night-time periods but the noise levels will not be sufficient to cause significant noise impact.

There are no significant weekend construction activities planned at this location.
2.185 No non-residential, noise-sensitive receptors are expected to be affected.

Reconstruction of Sewer at Albert Road, North Woolwich

2.186 This is an open cut construction 5 m deep, about 50 m long, which extends approximately 15 m outside the main worksite to the north and south. It has been assumed that there is only daytime working, apart from possible short-term 24-hr working during connections. It is assumed that the trench would need support and that sheet piles might provide this. The works would take approximately 6 months.

2.187 From a review of the noise monitoring carried out in the vicinity, the daytime criterion has been determined as 71 dB. The nearest noise-sensitive buildings are in Roebourne Way (north of Albert Road).

2.188 The main noise source is likely to be from the removal of excavated material, and (for a free-field $L_{eq}$ at 10 m of 85 dB) there could be significant noise impacts up to about 110 m from the site (assuming no on-site mitigation or obstruction).

Diversion of Sewer at Factory Road, North Woolwich

2.189 The works consist of the construction of 3 shafts and 2 sections of tunnel each 150m long. It is assumed that central shaft is for the TBM drive in two directions, and the end shafts are for recovery of the TBM. The work will take 12 months.

2.190 The Western shaft is opposite Winifred Street, approximately 25 m from housing. It is assumed that only daytime working will take place here apart from overnight pumping to dewater.

2.191 The Eastern shaft is opposite Dockland Street approximately 55 m from housing (in Roebourne Way). It is assumed that only daytime working will take place here apart from overnight pumping to dewater.

2.192 The Central shaft is located in an industrial/commercial area, approximately 80 m from the nearest dwelling (assumed to be present over the Public House on the corner of Fernhill Street and Albert Road). It is assumed that daytime and night-time working would be undertaken during tunnelling, but that excavated material would be stockpiled on-site overnight for daytime removal.

2.193 From a review of the noise monitoring carried out in the vicinity, the daytime criterion has been determined as 71 dB and 64 dB at night. The distances to the nearest noise-sensitive buildings to each shaft are noted above.

2.194 For the Western and Eastern Shafts, the range at which significant impacts could arise are about 110 m (daytime) and 60 m (night) assuming no on-site mitigation.

2.195 For the Central shaft, these ranges for the same conditions are about 120 m (for both day and night).
**Diversion of Sewer at Albert Road, North Woolwich**

2.196 This is an open cut construction 5 m deep, about 100 m long, which extends approx 7 m to the north of the main worksite. It has been assumed that there is only daytime working, apart from possible short-term 24-hr working during connections. It is assumed that the trench would need support and that sheet piles might provide this. The work will take 4 months.

2.197 From a review of the noise monitoring carried out in the vicinity, the daytime criterion has been determined as 71 dB. The nearest noise-sensitive building is the public house (PH) in Albert Road. (It has been assumed that this PH has residential accommodation above the ground floor).

2.198 Assuming no on-site mitigation, the range within which significant noise impacts might occur is about 110 m (daytime).

**Offsite Road Traffic**

2.199 Construction vehicles will only use the highway during the daytime (07:00 - 19:00). At façades overlooking roads used by construction traffic, the existing hourly LA_{10} during the daytime is predicted to increase by < 1 dB.

**Reconstruction of Sewer at Albert Road, North Woolwich**

2.200 The effects of off-site construction traffic for these utilities works have been taken into account in the assessment of this topic for the main works in this route window.

**Diversion of Sewer at Factory Road, North Woolwich**

2.201 The effects of off-site construction traffic for these utilities works have been taken into account in the assessment of this topic for the main works in this route window.

**Diversion of Sewer at Albert Road, North Woolwich**

2.202 The effects of off-site construction traffic for these utilities works have been taken into account in the assessment of this topic for the main works in this route window.

**Vibration from Surface Activity**

**North Woolwich Worksite**

2.203 The plant likely to be required to demolish the existing buildings or structures and construct the Crossrail elements at the North Woolwich Worksite has been reviewed to identify sources, which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings, or cause damage to buildings.

2.204 The construction information provided by Crossrail indicates that hydraulic breakers are required for the demolition of North Woolwich Station buildings and platforms; and that a vibratory piling rig and vibrating roller are required for the construction of the cut and cover tunnel approach.
2.205 Vibration levels are predicted to be in the region of 1 to 4 mm/s at the railway museum, which is a Grade II listed building, during demolition of North Woolwich Station; 1.5 to 6 mm/s, and 1 to 3 mm/s, at 171 – 208 Albert Road, during demolition of North Woolwich Station and diaphragm wall piling, and use of the vibratory roller, respectively.

2.206 Vibration levels may exceed the threshold of significance for building damage at the railway museum during demolition of North Woolwich Station; and at 171 – 208 Albert Road, during demolition of North Woolwich Station and diaphragm wall piling.

2.207 The majority of construction activities required at this site are likely to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’. Levels may occur at 171 – 208 Albert Road that correspond to ‘adverse comment possible’ for a limited period during diaphragm wall piling. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.208 No receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to these worksites.

Thames Tunnel
2.209 Potential surface vibration sources associated with the Thames Tunnel construction site, such as demolition, have been addressed in the North Woolwich Worksite (SE4) and Plumstead Portal (SE6).

Warren Lane Worksite
2.210 The plant likely to be required to demolish the existing buildings or structures and construct the Crossrail elements of the Warren Lane Shaft has been reviewed to identify sources, which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings, or cause damage to buildings.

2.211 The construction information provided by Crossrail indicates that hydraulic breakers are required for the demolition of an existing building on the site; and that oscillatory bored piling is required during shaft construction. Vibration levels due to oscillatory bored piling are unlikely to be significant.

2.212 Vibration levels are predicted to be in the region of 1 to 4 mm/s at the closest building to the works, 9 Warren Lane, during demolition works.

2.213 Vibration levels are not expected to exceed the threshold of significance for building damage at any receptor during any of the proposed works.

2.214 The construction activities required at this site are likely to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.215 No listed buildings, or receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to these worksites.
Reconstruction of Sewer at Albert Road, North Woolwich

2.216 Using vibratory piling to install sheet piles to support the excavation would not give rise to levels at Roebourne Way (distance approximately 30 m) above the building damage criteria adopted in the Crossrail Noise and Vibration Policy.

2.217 The levels might correspond to a semantic rating of ‘low probability of adverse comment’. Owing to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.218 Where there may be significant impacts on building occupants, appropriate mitigation should be accompanied by good public relations. Occupants and owners of potentially affected buildings should be forewarned of the anticipated timing, duration, and magnitude, of the vibration impact, and how it relates to the potential for building damage at their location.

Diversion of Sewer at Factory Road, North Woolwich

2.219 There is no piling at any of the sites and consequently no significant impacts are expected.

Diversion of Sewer at Albert Road, North Woolwich

2.220 If vibratory piling is used to install sheet piles to support the excavation this would not give rise to levels at the PH on the corner of Fernhill Road and Albert Road (distance approximately 20 m from the line of the sewer) above the building damage criteria adopted in the Crossrail Noise and Vibration Policy. The levels might correspond to a semantic rating of ‘adverse comment possible’.

2.221 Owing to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.222 Where there may be significant impacts on building occupants, appropriate mitigation should be accompanied by good public relations. Occupants and owners of potentially affected buildings should be forewarned of the anticipated timing, duration, and magnitude, of the vibration impact, and how it relates to the potential for building damage at their location.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.223 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds will be exceeded while the temporary railway is running.
Tunnel Boring Machines

2.224 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.

2.225 Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not likely to be a total absence of adverse comment.

Reconstruction of Sewer at Albert Road, North Woolwich

2.226 No TBM or construction railway or other plant in this category will be used. Consequently, there will be no significant impacts in this category.

Diversion of Sewer at Factory Road, North Woolwich

2.227 The new tunnel does not pass under any residential premises; the nearest housing is 25 m from one of the end shafts. None of the commercial premises under which the tunnel passes are believed to be especially sensitive to vibration.

Tunnel Boring Machines

2.228 Groundborne noise and vibration from the passage of the tunnel boring machines may be perceptible. However, this will be a transient effect lasting only a few days and will not be significant.

Construction Trains

2.229 In almost all cases, adherence to the measures discussed in Volume 1 of this Technical Report will ensure that no significant adverse effects will occur due to operation of the temporary construction railway in the tunnel. However, in locations occupied by buildings with piled foundations, deep basements or those sensitive to vibration, including theatres and studios, additional mitigation measures will be applied to ensure that no significant impacts arise. Such measures will include reducing discontinuities in rail joints and providing resilient pads between the temporary sleepers and the tunnel invert.

Diversion of Sewer at Albert Road, North Woolwich

2.230 No TBM or construction railway or other plant in this category will be used. Consequently, there will be no significant impacts in this category.

Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic

2.231 Hoardings 2.4 m high would be provided around part of the work sites. This corresponds to Tier 1 mitigation.
2.232 Within this route window, 18 properties are expected to be eligible for noise insulation due to construction noise, with no properties eligible for temporary re-housing. With the implementation of these mitigation measures there will be no residual impacts.

Reconstruction of Sewer at Albert Road, North Woolwich

2.233 Applying 10 dB of on-site mitigation (Tier 2 including 5m site hoardings) would reduce the impact zone to 27 m from the site (for unobstructed buildings). There are no façades of noise-sensitive buildings within this range, and so there would be no residual impacts with this level of mitigation.

<table>
<thead>
<tr>
<th>Site</th>
<th>Daytime</th>
<th>Night-time</th>
</tr>
</thead>
<tbody>
<tr>
<td>AW41</td>
<td>Tier 2 (10 dB)</td>
<td>No additional beyond daytime</td>
</tr>
</tbody>
</table>

Diversion of Sewer at Factory Road, North Woolwich

2.234 With the application of 10 dB of mitigation for the Eastern and Central shaft sites, and 13 dB at the Western site, (eg Tier 2 mitigation including 5m hoarding) there will be no significant impacts.

<table>
<thead>
<tr>
<th>Site</th>
<th>Daytime</th>
<th>Night-time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western shaft</td>
<td>Tier 2 (13 dB)</td>
<td>No additional beyond daytime</td>
</tr>
<tr>
<td>Central Shaft</td>
<td>Tier 2 (10 dB)</td>
<td>No additional beyond daytime</td>
</tr>
<tr>
<td>Eastern shaft</td>
<td>Tier 2 (10 dB)</td>
<td>No additional beyond daytime</td>
</tr>
</tbody>
</table>

Diversion of Sewer at Albert Road, North Woolwich

2.235 If Tier 2 mitigation (including use of 5m high hoarding) is employed, significant noise impacts will be limited to:

- PH (The Henley Arms) at 206 Albert Road, corner of Fernhill Street, (assuming residential accommodation on upper floors)
- Dunedin House, Manwood Street
- St John’s Church, and
- St John’s Church Centre

2.236 Residential accommodation in the PH and at Dunedin House may be eligible for NI. The PH is also likely to be eligible for TRH.

<table>
<thead>
<tr>
<th>Site</th>
<th>Daytime</th>
<th>Night-time</th>
</tr>
</thead>
<tbody>
<tr>
<td>AW43</td>
<td>Tier 2 (10 dB)</td>
<td>No additional beyond daytime</td>
</tr>
<tr>
<td></td>
<td>NI at: The Henley Arms, 206 Albert</td>
<td></td>
</tr>
</tbody>
</table>
2.237 With the above mitigation, there would be residual impacts at St John’s Church and St John’s Church Centre.

**Offsite Road Traffic**

2.238 There are no residual effects.

**Vibration from Surface Activity**

2.239 Vibration mitigation will be required during demolition and piling activities at the North Woolwich Portal, to mitigate potential impacts on adjacent buildings. An appropriate continuous vibration-monitoring regime should be adopted during demolition works allowing monitoring of levels and cessation of activity should levels exceed relevant limits.

**Vibration and Groundborne Noise from Underground Activity**

**Construction Trains**

2.240 For the construction railway, mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

**Tunnel Boring Machines**

2.241 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.

**Impact Assessment – Permanent Impacts**

**Impacts during Operation**

**Noise from the Surface Railway**

2.242 In this Route Window there are proposed changes to the railway (permanent way) infrastructure in the vicinity of the existing Connaught Tunnel. The existing North London Line (including Silvertown station) is due to cease operation along this corridor by 2006, and as such there will be no railway noise evident in the baseline year. A Level 3 (detailed assessment) assessment has been carried out for this area.

2.243 The new Crossrail alignment will run eastwards from the portal alongside the A112 Albert Road, following the old NLL alignment into tunnel at the North Woolwich Portal.
2.244 The predicted noise changes attributable to the infrastructure and forecast railway traffic changes in the vicinity of the new alignment have been calculated taking account of the new alignments, precise mix of expected rail vehicles and the operating speeds of the various train types. Where appropriate, consideration has been given to the non-railway related noise contribution at any receptor.

2.245 The resulting changes in overall noise levels for residential receptors close to the new railway tracks would be as follows:

<table>
<thead>
<tr>
<th>Time Period</th>
<th>No. of Significant Impacts</th>
<th>Noise Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Slight</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Substantial</td>
</tr>
<tr>
<td>Day (07:00 to 23:00 hrs)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Night (23:00 to 07:00 hrs)</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: Noise changes calculated in terms of the LA_{eq,16hr} for Day and LA_{eq,8hr} for Night

2.246 The above table indicates that the changes to the infrastructure and services will not result in a significant increase in noise levels. On this basis there will be no significant impacts. However, due to the absolute noise levels and minor noise changes associated with Crossrail, approximately 1 property may be eligible for noise insulation, in accordance with the policy outlined in Chapter 5 Volume 1 of the Technical Report.

2.247 According to the baseline noise survey results, the noise generated by the non-railway sources such as the road traffic on Albert Road dominates the noise climate in this area. This is the primary reason that the introduction of Crossrail infrastructure does not introduce any significant impacts at nearby receptors.

2.248 A detailed study of the potential maximum noise levels arising from the operation of trains has not been undertaken, as it is considered unlikely that the L_{A_{max,F}} levels associated with the proposed infrastructure and traffic pattern changes will be any higher than those already experienced at nearby receptors.

Vibration from the Surface Railway

2.249 Vibration impacts from the permanent operation of the surface railway will not occur within this route window.

Noise from Road Traffic

2.250 When the Crossrail scheme is operational, it will cause only small increases in the 18-hour traffic flow on roads in this route window. The change in L_{A_{10,18 hr}} corresponding to this increase in traffic is predicted to be < 1 dB.

Noise from Ventilation Shafts

2.251 No residential properties close to the proposed Warren Lane ventilation shaft are predicted to be subject to significant noise impacts when the ventilation fan is in operation. At the nearest buildings, the Rating Level of the plant in normal operation is predicted to be at least 19 dB below the existing L_{A_{90}} (21:00-01:30 and 05:30-07:00) background noise level (this represents a level 24 dB below the assessment criteria), assessed in accordance with BS 4142:1997.
2.252 It is estimated that the noise levels emitted by a ventilation shaft during maintenance operations would be approximately 20 dB lower than during full flow-rate operation, which are the conditions that the above operational assessment is based. Therefore, no residential properties close to the proposed ventilation shafts are predicted to be subject to significant noise impacts during maintenance operations.

Vibration and Groundborne Noise from the Underground Railway

2.253 With standard trackform the design aim for groundborne noise is achieved for buildings of standard noise-sensitivity (40 dB $L_{A_{max,s}}$) without deep or piled foundations in all locations.

2.254 There is residential development in Albert Road foundation details of which are unknown. If, following detailed study of the building foundations, 40 dB $L_{A_{max,s}}$ is likely to be exceeded, there will be protection by the use of special trackform.

2.255 Groundborne noise levels are shown on Drawing No: 1E315-E2E00-E03-F-00004.

Mitigation and Residual Impacts during Operation

Noise from the Surface Railway

2.256 A preliminary assessment has been undertaken to identify the number of residential properties which may be eligible for noise insulation under the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996, as a result of operational railway noise from modified or altered works in the vicinity.

2.257 The results of this preliminary eligibility assessment indicate that up to 1 residential property may be eligible for noise insulation under the Regulations. However, with the introduction of approximately 500 m of 2 m high reflective barrier on the north side of the railway along Albert Road (some of which extends into SE3), the number of properties that may be eligible for noise insulation reduces to zero.

2.258 On the above basis, with the proposed 2 m reflective barrier in place, there are no significant residual impacts and no properties eligible for noise insulation.

Vibration from the Surface Railway

2.259 There are no impacts, and thus no need for additional mitigation.

Noise from Road Traffic

2.260 There are no residual effects.

Noise from Ventilation Shafts

2.261 No significant impacts occur, and therefore no further mitigation measures are required.

Vibration and Groundborne Noise from the Underground Railway

2.262 Appropriate mitigation will be provided, such that no residual impacts occur.
Impacts on Sites Granted Planning Permission

2.263 No extant planning permissions that might be affected by the scheme have been identified in this route window.
## Route Window SE 4: North Woolwich Portal and Warren Lane Shaft – Temporary Impacts

<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction of the North Woolwich tunnel</td>
<td>Daytime noise impacts at 12 residential properties. Evening noise impacts at 18</td>
<td>Significant</td>
<td>BPM to reduce noise, 2.4 m high hoarding to screen noise, use of low noise well</td>
<td>18 properties would be eligible for noise insulation. 0 properties would be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 0 residential properties. Evening noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Weekend impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
</tr>
<tr>
<td>portal.</td>
<td>residential properties. Evening noise impacts at 18 residential properties.</td>
<td></td>
<td>maintained plant.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Night-time noise impacts at 0 residential properties. Weekend noise impacts at</td>
<td></td>
<td>Mitigation = Tier 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 residential properties. Places of worship: No noise impacts. Educational</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>facilities: No noise impacts. Medical facilities: No noise impacts. Public open</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>spaces: No noise impacts.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Not Significant</td>
<td></td>
</tr>
<tr>
<td>Warren Lane vent shaft</td>
<td>Daytime noise impacts at 0 residential properties. Evening noise impacts at 0</td>
<td>Not significant</td>
<td>Standard 2.4 m hoardings Mitigation = Tier 1</td>
<td>0 properties would be eligible for noise insulation. 0 properties would be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 0 residential properties. Evening noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Weekend impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
</tr>
<tr>
<td></td>
<td>residential properties.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Night-time noise impacts at 0 residential properties. Weekend noise impacts at</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 residential properties. Places of worship: No noise impacts. Educational</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>facilities: No noise impacts. Medical facilities: No noise impacts. Public open</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>spaces: No noise impacts.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Not significant</td>
<td></td>
</tr>
<tr>
<td>Utilities Worksite - Reconstruction of Sewer at Albert Road, North Woolwich</td>
<td>Daytime noise impacts at 0 residential properties. Evening noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Weekend noise impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces</td>
<td>Not significant</td>
<td>BPM to reduce noise, 5.0 m high hoarding around the contractors compound, enclosure of static plant associated with night time working. Mitigation = Tier 2</td>
<td>0 properties would be eligible for noise insulation. 0 properties would be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 0 residential properties. Evening noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Weekend impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
</tr>
<tr>
<td>Utilities Worksite - Diversion of Sewer at Factory Road, North Woolwich</td>
<td>Daytime noise impacts at 0 residential properties. Evening noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Weekend noise impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces</td>
<td>Not significant</td>
<td>BPM to reduce noise, 5.0 m high hoarding around the contractors compound, enclosure of static plant associated with night time working. Mitigation = Tier 2</td>
<td>0 properties would be eligible for noise insulation. 0 properties would be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 0 residential properties. Evening noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Weekend impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
</tr>
<tr>
<td>Utilities Worksite - Diversion of Sewer at Albert Road, North Woolwich</td>
<td>Daytime noise impacts at 2 residential properties. Evening noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Weekend noise impacts at 0 residential properties. Places of worship: 2 daytime noise impacts at St Johns Church and St Johns Church Centre. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces</td>
<td>Not significant</td>
<td>BPM to reduce noise, 5.0 m high hoarding around the contractors compound, enclosure of static plant associated with night time working. Mitigation = Tier 2</td>
<td>2 properties would be eligible for noise insulation. 0 properties would be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 0 residential properties. Evening noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Weekend impacts at 0 residential properties. Places of worship: 2 daytime noise impacts at St Johns Church and St Johns Church Centre. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
</tr>
<tr>
<td>Works</td>
<td>Potential Impact</td>
<td>Significance</td>
<td>Assumed Mitigation</td>
<td>Residual Impact</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-------------------------------------------------------</td>
<td>--------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>New Crossrail tracks from Connaught Tunnel to North Woolwich Portal.</td>
<td>Potential noise impact at 1 residential noise sensitive property.</td>
<td>Not significant</td>
<td>500 m of 2 m high reflective barrier along the north side of the railway adjacent to Albert Road (some in SE3)</td>
<td>With the proposed noise barrier: 0 properties may be eligible for noise insulation</td>
</tr>
</tbody>
</table>
ROUTE WINDOW SE5 – ARSENAL WAY SHAFT

Overview of Route Window SE5

2.264 The proposed works within this route window comprise the construction of the twin-bore Thames Tunnel and Arsenal Way shaft. The route window lies within LB Greenwich.

2.265 Having passed beneath the River Thames, the twin-bored tunnel will follow an alignment along the southern edge of the Royal Arsenal towards Network Rail’s North Kent line (NKL) at Plumstead. The Arsenal Way shaft site lies to the north of Plumstead Road (A206) and is bounded by industrial buildings and offices to the north, and Woolwich town centre to the south. Background noise is high mainly due to road noise.

Baseline

2.266 This route window includes the proposed Arsenal Way Shaft (previously called the ‘Sydney Street Shaft’) and associated temporary worksite. One long-term baseline noise survey location was undertaken within SE5, the location and duration is listed in the following table and identified on Drawing No. 1E0415-E2E00-E01-F-00005:

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1 week)</th>
<th>Medium term (24-hours)</th>
<th>Short-Term (3-hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR01</td>
<td>Gill Court</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.267 This area includes the proposed Arsenal Way Shaft, located to the eastern end of the Woolwich Barracks car park, with industrial buildings to the north and Plumstead Road to the south. A temporary worksite will utilise most of the car park area.
2.268 A 7-day measurement survey was undertaken at Gill Court (GR01). The daytime baseline $L_{A_{eq,12hr}}$ level was 73 dB and the night-time $L_{A_{eq,8hr}}$ level was 68 dB. Maximum $L_{A_{max}}$ levels were recorded as 101 dB during the daytime and 100 dB during the night-time period. This location was dominated by noise from traffic on Plumstead Road. The daytime $L_{A90,16hr}$ background level at Gill Court was measured as 64 dB (25%).

**Impact Assessment – Temporary Impacts**

**Impacts during Construction**

2.269 Temporary impacts from construction activities are illustrated on Drawing No.1E0315-E2E00-E01-F-00005.

**Noise from Surface Activity**

2.270 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

**Construction Sites and Works including Onsite Traffic**

**Arsenal Way Worksite**

2.271 No properties are predicted to receive a significant noise impact from construction activities close to the Arsenal Way Worksite.

2.272 Some work will be carried out during evening and night-time periods but the noise levels will not be sufficient to cause significant noise impact.

2.273 There are no significant weekend construction activities planned at this location.

2.274 No non-residential receptors are expected to be affected.

**Offsite Road Traffic**

2.275 Construction vehicles will only use the highway during the daytime (07:00 - 19:00). At façades overlooking roads used by construction traffic, the existing hourly $L_{A10}$ during the daytime is predicted to increase by < 1 dB.

**Vibration from Surface Activity**

2.276 The plant likely to be required to construct Arsenal Way Shaft has been reviewed to identify sources, which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings, or cause damage to buildings.

2.277 The construction information provided by Crossrail indicates that oscillatory bored piling is required during shaft construction. Vibration levels due to oscillatory bored piling are unlikely to be significant.
2.278 Vibration levels are not expected to exceed the threshold of significance for building damage at any receptor during any of the proposed works.

2.279 The construction activities required at this site are likely to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.280 No listed buildings, or receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to these worksites.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.281 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds will be exceeded while the temporary railway is running.

Tunnel Boring Machines

2.282 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.

2.283 Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not likely to be a total absence of adverse comment.

Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic

2.284 Hoardings 2.4 m high would be provided around the work site. This corresponds to Tier 1 mitigation.

2.285 In this route window, no properties are expected to be eligible for noise insulation due to construction noise. There are no dwellings that will be eligible for temporary re-housing. No properties would be subject to a significant residual construction noise impact.
Offsite Road Traffic
2.286 There are no residual effects.

Vibration from Surface Activity
2.287 No impacts occur during these activities in this route window, and thus there is no need of specific mitigation.

Vibration and Groundborne Noise from Underground Activity

Construction Trains
2.288 For the construction railway, mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

Tunnel Boring Machines
2.289 Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.

Impact Assessment – Permanent Impacts

Impacts during Operation

Noise from the Surface Railway
2.290 Not applicable to this route window.

Vibration from the Surface Railway
2.291 Not applicable to this route window.

Noise from Road Traffic

2.292 When the Crossrail scheme is operational, it will cause only small increases in the 18-hour traffic flow on roads in this route window. The change in $L_{A_{10,18\ hr}}$ corresponding to this increase in traffic is predicted to be < 1 dB.

Noise from Ventilation Shafts
2.293 No residential properties close to the proposed Arsenal Way ventilation shaft are predicted to be subject to significant noise impacts when the ventilation fan is in operation. At the nearest buildings, the Rating Level of the plant in normal operation is predicted to be at least 28 dB below the existing $L_{A_{90}}$ (21:00-01:30 and 05:30-07:00) background noise level (this represents a level 33 dB below the assessment criteria), assessed in accordance with BS 4142:1997.
It is estimated that the noise levels emitted by a ventilation shaft during maintenance operations would be approximately 20 dB lower than during full flow-rate operation, which are the conditions that the above operational assessment is based. Therefore, no residential properties close to the proposed ventilation shafts are predicted to be subject to significant noise impacts during maintenance operations.

Vibration and Groundborne Noise from the Underground Railway

With standard trackform the design aim for groundborne noise is achieved for buildings of standard noise-sensitivity ($40 \text{ dB } L_{\text{Amax,s}}$) without deep or piled foundations in all locations.

There is residential development along the south side of Plumstead Road, and Greenwich Community College. The foundation details of these buildings are unknown. If, following detailed study of the building foundations, $40 \text{ dB } L_{\text{Amax,s}}$ is likely to be exceeded, there will be protection by the use of special trackform.

Groundborne noise levels are shown on Drawing No: 1E315-E2E00-E03-F-00005.

Mitigation and Residual Impacts during Operation

Noise from the Surface Railway

Not applicable to this route window.

Vibration from the Surface Railway

Not applicable to this route window.

Noise from Road Traffic

There are no residual effects.

Noise from Ventilation Shafts

No significant impacts occur, and therefore no further mitigation measures are required.

Vibration and Groundborne Noise from the Underground Railway

Appropriate mitigation will be provided such that no residual impacts occur.

Impacts for Sites Granted Planning Permission

Five individual planning permission applications referring to residential development have been identified within this route window. Extensive development is to take place on land off Plumstead Road. All sites are at a significant distance from worksites, indicating that noise impacts as a result of Crossrail construction works are highly unlikely.
## Route Window SE 5: Arsenal Way Shaft – Temporary Impacts

<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes to platforms and</td>
<td>Daytime noise impacts at 0 residential property.</td>
<td>Not significant</td>
<td>Conventional on-site mitigation consisting of 2.4 m high hoardings, use of low noise,</td>
<td>0 properties would be eligible for noise insulation. 0 of these properties would</td>
</tr>
<tr>
<td>new ticket office.</td>
<td>Evening/weekend noise impacts at 0 residential properties.</td>
<td></td>
<td>well maintained plant.</td>
<td>be eligible for temporary re-housing. With this mitigation:</td>
</tr>
<tr>
<td></td>
<td>Night-time noise impacts at 0 residential properties.</td>
<td></td>
<td>Mitigation = Tier 1</td>
<td>Daytime noise impacts at 0 residential property.</td>
</tr>
<tr>
<td></td>
<td>Places of worship: No noise impacts.</td>
<td></td>
<td></td>
<td>Evening/weekend noise impacts at 0 residential properties.</td>
</tr>
<tr>
<td></td>
<td>Educational facilities: No noise impacts.</td>
<td></td>
<td></td>
<td>Night-time noise impacts at 0 residential properties.</td>
</tr>
<tr>
<td></td>
<td>Medical facilities: No noise impacts.</td>
<td></td>
<td></td>
<td>Places of worship: No noise impacts.</td>
</tr>
<tr>
<td></td>
<td>Public open spaces: No noise impacts.</td>
<td></td>
<td></td>
<td>Educational facilities: Impact at Canon Palmer Catholic School at weekends only.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Medical facilities: No noise impacts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Public open spaces: No noise impacts.</td>
</tr>
</tbody>
</table>

Significance: Not significant
### Route Window SE 5: Arsenal Way Shaft – Permanent Impacts

<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation of railway underground railway</td>
<td>Groundborne noise and vibration impacts.</td>
<td>Not significant</td>
<td>If required, appropriate mitigation will be provided</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not significant</td>
</tr>
</tbody>
</table>
ROUTE WINDOW SE6 – PLUMSTEAD PORTAL

Overview of Route Window SE6

2.304 The proposed works within the route window comprise the construction of the eastern part of the twin-bore Thames Tunnel, Plumstead portal, White Hart Road bridge, track realignment of the existing railway corridor, and the installation of OHLE equipment. The route window lies within LB Greenwich.

2.305 The Plumstead portal site is located on land at Plumstead Goods Yard. The surrounding land uses include commercial and residential areas. Residential areas lie to the south of the surface route alignment, centred along Plumstead High Street (A206). Background noise levels are high, mainly due to the railway.

Baseline

2.306 This route window includes the proposed Plumstead Portal, including White Hart Road Bridge and a temporary main work site at Plumstead Goods Yard, including an area of land adjacent to Nathan Way for excavated material handling. Two long-term baseline noise survey locations were undertaken within the route window, the locations and durations are listed in the following table and identified on Drawing No. 1E0415-E2E00-E01-F-00006:

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1 week)</th>
<th>Medium term (24-hours)</th>
<th>Short-Term (3-hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR02</td>
<td>75 Reidhaven Road</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>GR03</td>
<td>75A Marmadon Road</td>
<td></td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

2.307 The portal structures at Plumstead will provide the transition from the running tunnels under the River Thames to the existing North Kent Line surface railway. The existing North Kent Line tracks will be significantly altered as a result of the proposals.
Two 7-day monitoring sites were selected, to the south of the existing railway line, overlooking the tracks. Daytime $L_{\text{Aeq,12hr}}$ baseline levels at 75 Reidhaven Road (GR02) and 75A Marmadon Road (GR03) were both 74 dB, with night-time $L_{\text{Aeq,8hr}}$ levels of 68 dB. During the night-time period, $L_{\text{Ammax,F}}$ levels of up to 103 and 98 dB were recorded at both locations, respectively. The dominant noise source at both locations was due to train movements. In addition, faint road traffic and aircraft were also audible. With regard to GR03, industrial noise and a faint hum, possibly generated by the industrial area, located on the opposite of the tracks, were also just audible.

Impact Assessment – Temporary Impacts

Impacts during Construction

Temporary impacts from construction activities are illustrated on Drawing No.1E0315-E2E00-E01-F-00006.

Noise from Surface Activity

Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

Construction Sites and Works including Onsite Traffic

The construction programme activities that are likely to cause significant impacts include site establishment, tunnelling works and tunnel crossover works.

In the vicinity of the Plumstead Portal, there will be a significant number of properties that are affected by construction noise. In particular, properties in Reidhaven Road, Marmadon Road, White Hart Road and Richard Neve House are expected to experience significant daytime, night-time, evening and weekend noise impacts.

Offsite Road Traffic

Construction vehicles will only use the highway during the daytime (07:00 - 19:00). At façades overlooking roads used by construction traffic, the existing hourly $L_{\text{A10}}$ during the daytime is predicted to increase by < 1 dB.

Vibration from Surface Activity

The plant likely to be required to construct the Crossrail elements at the Plumstead Portal has been reviewed to identify sources, which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings, or cause damage to buildings.
2.315 The construction information provided by Crossrail indicates that hydraulic breakers are required for the demolition of all buildings and structures within the old Goods Yard; a vibrating roller will be required during construction of the cut and cover tunnel section; and it is assumed that a vibratory piling rig is required during the construction of the diaphragm walls. The majority of demolition will not give rise to significant vibration at the nearest potentially sensitive buildings due to the separation distance. However, the timber yard on White Hart Road is adjacent to residential buildings on White Hart Road and Reidhaven Road.

2.316 Vibration levels are predicted to be in the region of 2.5 to 10 mm/s at 123 Reidhaven Road and 125 White Hart Road during demolition of the timber yard. Vibration levels are predicted to be in the region of 1 to 6 mm/s, and 1 to 2.5 mm/s, at the closest buildings on Marmadon Road to the works during vibratory piling of the diaphragm walls, and use of the vibrating roller, respectively.

2.317 Vibration levels may exceed the threshold of significance for building damage at the closest buildings on Marmadon Road to the works during vibratory piling of the diaphragm walls, and at 123 Reidhaven Road and 125 White Hart Road during demolition of the timber yard.

2.318 The majority construction activities required at this site are likely to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’. Levels may occur at 123 Reidhaven Road and 125 White Hart Road during demolition of the timber yard; and at the closest buildings on Marmadon Road to the works during vibratory piling of the diaphragm walls; that correspond to ‘adverse comment possible’. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.319 No listed buildings, or receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to these worksites.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

2.320 Modelling of the groundborne noise caused by the operation of the temporary construction railway in the Crossrail running tunnels shows that the levels will be similar to those from the operating railway assuming standard trackform. Thus, in the cases where standard trackform causes groundborne noise levels to exceed the significance thresholds for special buildings, including theatres and studios, and buildings with piled foundations or deep basements, the significance thresholds will be exceeded while the temporary railway is running.

Tunnel Boring Machines

2.321 Groundborne noise from the passage of the tunnel boring machines, which will be a transient effect lasting only a few days, will be, in overall noise level terms, similar to the levels predicted for the operating railway. It will, however, be of a character that will attract attention, and for the short times that it occurs may cause some complaints.
Vibration as perceived by the tactile sense (as opposed to groundborne noise perceived by the sense of hearing) will be perceptible, but is not expected to exceed the threshold of significant effects in terms of Vibration Dose Value. This threshold is set, in the absence of appreciable existing levels of vibration, between the BS 6472 categories “low probability of adverse comment” and “adverse comment possible”; i.e. there is not likely to be a total absence of adverse comment.

Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic

Hoardings of a minimum height of 2.4 m would generally be provided along the boundaries of the working areas and around the site compound. This corresponds to Tier 1 mitigation.

In this route window, an estimated 71 properties are expected to be eligible for noise insulation due to construction noise. No properties are expected to be eligible for temporary re-housing. With the implementation of these mitigation measures, there would be no dwellings that would experience significant residual noise impacts. Three properties on White Hart Road are predicted to experience an accumulative impact from worksites located in the route window.

Offsite Road Traffic

There are no residual effects.

Vibration from Surface Activity

No impacts occur during these activities in this route window, and thus there is no need of specific mitigation.

Vibration and Groundborne Noise from Underground Activity

Construction Trains

For the construction railway, mitigation in the form of resilient rail pads inserted between the temporary rails and their sleepers, coupled with controls on the quality of the rail joints, will be capable of meeting the required targets in almost all cases. In a few cases, it may be necessary also to eliminate rail joints and/or to provide resilience between the temporary sleepers and the tunnel invert.

Tunnel Boring Machines

Due to the transitory nature of impacts associated with the passage of the TBMs, and with appropriate public consultation, based on the assumptions made, the assessment concludes that there would be no significant residual impact.
Impact Assessment – Permanent Impacts

Impacts during Operation

Noise from the Surface Railway

2.329 In this Route Window there are proposed changes to the railway (permanent way) infrastructure along the length of the existing North Kent Line. Around the Plumstead Portal area, the NKL will be significantly altered in alignment to enable the new Crossrail tracks to emerge to surface. Between the portal and Abbey Wood station, the corridor will be upgraded to four track, with the new up and down Crossrail lines running in between the re-aligned up and down NKL tracks. A Level 3 (detailed assessment) has been carried out for this area.

2.330 The new twin track Crossrail alignment will run eastwards in retained cutting from the portal emerging at grade to the east of Church Manor Way. The four track arrangement will cease at Abbey Wood station where all Crossrail services are proposed to terminate. Two turnback sidings are proposed to the east of Abbey Wood station to enable terminating trains from the east to be re-set for the return journey westwards.

2.331 The predicted noise changes attributable to the infrastructure and forecast railway traffic changes in the vicinity of the sidings have been calculated taking account of the new alignments, precise mix of expected rail vehicles and the operating speeds of the various train types.

2.332 The resulting changes in overall noise levels for residential receptors close to the new railway tracks would be as follows:

<table>
<thead>
<tr>
<th>Time Period</th>
<th>No. of Significant Impacts</th>
<th>Noise Decrease</th>
<th>Noise Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Slight &gt;3 dB</td>
<td>Moderate 3-5 dB</td>
</tr>
<tr>
<td>Day (07:00 to 23:00 hrs)</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Night (23:00 to 07:00 hrs)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: Noise changes calculated in terms of the $L_{Aeq,16hr}$ for Day and $L_{Aeq,8hr}$ for Night.

2.333 In addition, the following non-residential receptors are predicted to experience daytime noise increases of greater than 3 dB.

- Sports Ground to the west of Church Manor Way.

2.334 A detailed study of the potential maximum noise levels arising from the operation of trains has not been undertaken, as it is predicted that the $L_{A_{max,F}}$ levels associated with the proposed infrastructure (including noise barriers) and traffic pattern changes will be lower than those already experienced at nearby receptors, as a result of the introduction of the permanent noise barriers.
2.335 A preliminary assessment has been undertaken to identify the number of residential properties which may be eligible for noise insulation under the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996, as a result of operational railway noise from modified or altered works in the vicinity.

2.336 The results of this preliminary eligibility assessment indicate that up to 10 properties are expected to be eligible for noise insulation under the Regulations.

Vibration from the Surface Railway

2.337 Vibration impacts from the permanent operation of the surface railway are not predicted to occur within this route window.

Noise from Road Traffic

2.338 When the Crossrail scheme is operational, it will cause only small increases in the 18-hour traffic flow on roads in this route window. The change in $L_{A10,18-hr}$ corresponding to this increase in traffic is predicted to be < 1 dB.

Vibration and Groundborne Noise from the Underground Railway

2.339 With standard trackform the design aim for groundborne noise is achieved for buildings of standard noise-sensitivity ($40 \text{ dB } L_{A\text{max},s}$) without deep or piled foundations in all locations.

2.340 There is mixed development in the Plumstead High Street area, foundation details of which are unknown.

2.341 If, following detailed study of the building foundations, $40 \text{ dB } L_{A\text{max},s}$ is likely to be exceeded, there will be protection by the use of special trackform.

2.342 Groundborne noise levels are shown on Drawing No: 1E315-E2E00-E03-F-00006.

Mitigation and Residual Impacts during Operation

Noise from the Surface Railway

2.343 The proposed mitigation scheme includes lengths of permanent noise barriers between the portal and Abbey Wood station to mitigate noise from both the new Crossrail services and the North Kent Line alterations. The following barrier configurations are proposed:

Southern Side of Corridor

• 2 m high (above rail) reflective noise barrier from Plumstead Portal to end of Route Window (extends into SE7 and SE8) and to the south of the re-aligned NKL.

Northern Side of Corridor

• 2 m high (above rail) absorptive noise barrier from Plumstead Portal to end of route window (extends into SE7) and to the north of the re-aligned NKL.
2.344 The resulting changes in overall noise levels for residential receptors close to the new railway tracks, taking into account the proposed mitigation, would be as follows:

<table>
<thead>
<tr>
<th>Time Period</th>
<th>No. of Significant Impacts</th>
<th>Noise Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Noise Decrease</td>
<td>Slight</td>
</tr>
<tr>
<td></td>
<td>&gt;3 dB</td>
<td>3-5 dB</td>
</tr>
<tr>
<td>Day (07:00 to 23:00 hrs)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Night (23:00 to 07:00 hrs)</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: Noise changes calculated in terms of the LAeq,16hr for Day and LAeq,8hr for Night

2.345 No non-residential properties are predicted to experience noise increases of 3 dB or higher.

2.346 It can be seen that from this assessment that no significant adverse noise impacts have been identified along the section of line and as such no further mitigation has been considered. However, it should be noted that with the proposed mitigation, four properties are subject to significant noise decreases (positive impact) during the night-time period.

2.347 A preliminary assessment has been undertaken to identify the number of residential properties which may be eligible for noise insulation under the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996, as a result of operational railway noise from modified or altered works in the vicinity.

2.348 The results of this preliminary eligibility assessment indicate that 0 properties are expected to be eligible for noise insulation under the Regulations with the permanent noise barriers in place.

Vibration from the Surface Railway
2.349 There are no residual effects.

Noise from Road Traffic
2.350 There are no residual effects.

Noise from Ventilation Shafts
2.351 Not applicable to this route window.

Vibration and Groundborne Noise from the Underground Railway
2.352 Appropriate mitigation will be provided such that no residual impacts occur.
Impacts for Sites Granted Planning Permission

2.353 On Griffin Manor Way planning permission has been received detailing the demolition of existing buildings and the development of a 600 unit Young Offenders Institute. Proposed redevelopment of the site at Pettman Crescent is to include mixed-use trade units, sales showrooms, a restaurant, car wash and hotel. Both sites are at a significant distance from the worksites, indicating that noise impacts as a result of Crossrail construction works are highly unlikely.

PLUMSTEAD PORTAL EXCAVATED MATERIAL DISPOSAL SCENARIO

Impact Assessment – Temporary Impacts

Impacts during Construction
Noise from Surface Activity
Construction Sites and Works including Onsite Traffic

2.354 The impacts would be the same as for the Crossrail base case.

Offsite Road Traffic

2.355 The impacts would be the same as for the Crossrail base case.

Vibration from Surface Activity

2.356 The impacts would be the same as for the Crossrail base case.

Mitigation and Residual Impacts during Construction
Noise from Surface Activity
Construction Sites and Works including Onsite Traffic

2.357 No residual impacts, as for the Crossrail base case for Plumstead Portal.

Offsite Road Traffic

2.358 No residual impacts, as for the Crossrail base case for Plumstead Portal.

Vibration from Surface Activity

2.359 No residual impacts, as for the Crossrail base case for Plumstead Portal.

Impact Assessment – Permanent Impacts

2.360 There would be no permanent effects as the worksite is only required during the construction phase.
## Route Window SE 6: Plumstead Portal – Temporary Impacts

<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Works</td>
<td>Potential Impact</td>
<td>Significance</td>
<td>Assumed Mitigation</td>
<td>Residual Impact</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>------------------</td>
<td>--------------</td>
<td>-------------------</td>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td>NKL alignment changes, new Crossrail tracks from Plumstead Portal to Abbey Wood station. Inclusion of two new turnback sidings to the east of Abbey Wood station. Intensification of railway traffic on NKL.</td>
<td>Significant changes in operational railway noise at noise sensitive receptors – 5 properties in total. Public open spaces: 1 daytime noise impact at Church Manor Way Sports Ground</td>
<td>Significant</td>
<td>Southern Side of corridor 2 m high (above rail) reflective noise barrier from Plumstead Portal to end of route window (extends into SE7 and SE8). Northern Side of Corridor 2 m high (above rail) absorptive noise barrier from Plumstead Portal to end of route window (extends into SE7).</td>
<td>Negative Impacts None Positive Impacts Significant positive impacts at: 155, 157, 159, 161 Marmadon Road</td>
<td></td>
</tr>
<tr>
<td>NKL alignment changes, new Crossrail tracks from Plumstead Portal to Abbey Wood station.</td>
<td>No operational railway vibration impacts.</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not significant</td>
<td></td>
</tr>
</tbody>
</table>
Overview of Route Window SE6A

2.361 The route window lies within LB Bexley, in a primarily industrial area. The proposed works within the route window comprise the refurbishment of Manor Wharf at the site of the former Belvedere power station. This will be required in order to create a barge-loading facility, at which excavated material, removed from Plumstead portal and the intervention shafts at Arsenal Way and Warren Lane, will be loaded onto barges for transport down river to landfill in Rainham, Essex.

2.362 This site will be operational for two and a half years from the start of construction. Works will require the replacement of fendering to the jetty, with works undertaken from boats, and some dredging of the wharf to enable barge access. A conveyor will be constructed to allow excavated material to be loaded onto barges. At peak construction of excavated materials loading of barges may be required 24 hours per day. The conveyor will run from an excavated material handling point on the shore within the former Ford car park (disused), south of the River Thames, north of the wharf where it will connect to the barge loading point. Excavated material from the Plumstead portal works will be delivered by lorry to the material handling point on the shore within the disused Ford car park south of the River Thames. Here a small stockpile will be maintained and conveyor loading facilities and a lorry turning area will be provided.

2.363 Site access for the construction of the conveyor and the refurbishment of the jetty will be via the new private access road to the Iron Mountain storage area. Once the handling site is in operation, excavated material will be brought to the site along Norman Road.

2.364 For a period of 12 months the average lorry numbers accessing the site will be 240 per day. During this time there will be a peak period of approximately three months when up to 260 lorries will be accessing the site. At peak this equates to five or six 1,000 tonne barges moored at any one time.
2.365 Norman Road is an un-adopted public highway which is in a very poor condition. Its current width is too narrow to carry the expected number of lorry movements and therefore temporary widening will be necessary.

2.366 The area is primarily industrial, with Belvedere Industrial Estate situated to the southeast of the route window. The area to the west of Belvedere Substation on Norman Road is designated as Metropolitan Open Space and a Nature Conservation Site.

**Impact Assessment – Temporary Impacts**

**Impacts during Construction**

2.367 Temporary impacts from construction activities are illustrated on Drawing No.1E0315-E2E00-E01-F-000019.

**Noise from Surface Activity**

2.368 Not applicable to this route window.

**Construction Sites and Works including Onsite Traffic**

2.369 There are no noise-sensitive receptors near to the wharf, thus no noise impacts are expected within the vicinity of this proposed worksite.

**Offsite Road Traffic**

2.370 There are no impacts predicted.

**Vibration from Surface Activity**

2.371 No impacts are predicted from the stockpiling and barge loading- activities, based on the assumptions made.

**Mitigation and Residual Impacts during Construction**

**Noise from Surface Activity**

2.372 No residual impacts.

**Construction Sites and Works including Onsite Traffic**

2.373 No residual impacts.

**Offsite Road Traffic**

2.374 No residual impacts.
Impact Assessment – Permanent Impacts

2.375 There would be no permanent effects as the worksite is only required during tunnel construction.

Impacts on Sites Granted Planning Permission

2.376 No extant planning permissions that might be affected by the scheme have been identified in this route window.
2.377 **ROUTE WINDOW SE7 – CHURCH MANOR WAY BRIDGE**

**Overview of Route Window SE7**

2.378 The proposed works within the route window comprise track realignment and the provision of two additional tracks within the existing railway corridor, the construction of new footbridges at Church Manorway and Bostall Manorway, the strengthening of Eynsham Drive Bridge, a 2 m high noise barrier will be erected for the length of the route window on both sides of the railway, and the installation of OHLE equipment. The route window lies within LB Greenwich.

![Route Window SE7 Diagram](image)

2.379 The area adjacent to the route is principally residential, with urban green spaces.

**Baseline**

2.380 This route window includes the Plumstead to Abbey Wood four-tracking construction works. The baseline noise survey locations and durations are listed in the following table and identified on Drawing No. 1E0415-E2E00-E01-F-00007:

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1 week)</th>
<th>Medium term (24-hours)</th>
<th>Short-Term (3-hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR04</td>
<td>47 Mottisford Road</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GR05</td>
<td>168 Mottisford Road</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>GR06</td>
<td>71 Abbey Grove</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.381 To accommodate Crossrail, the current two track North Kent Line will be upgraded to four track. The inner two lines will become Crossrail and the outer two lines will become the North Kent Line. As a result of the track widening a number for bridges and footbridges will require additional works, these include: a new Church Manorway Bridge footbridge, Eynsham Drive Bridge strengthening and new Bostall Manorway Bridge footbridge.
2.382 A 7-day measurement survey was undertaken at 47 Mottisford Road (GR04). The daytime baseline $L_{A_{eq},12hr}$ level was 65 dB, with the night-time $L_{A_{eq},8hr}$ level falling to 58 dB and night-time $L_{A_{max}}$ levels ranging up to 91 dB. Weekend daytime $L_{A_{eq},12hr}$ levels were 3 dB below and night-time $L_{A_{eq},8hr}$ levels were 1 dB below the weekday averages. There were no specific dominant noise sources audible on site; the noise environment consisted of faint aircraft noise, faint road traffic noise, train movements and general noise, such as gardening and DIY, occurring within the vicinity of the survey location.

2.383 Two 24-hour surveys were undertaken at 168 Mottisford Road (GR05) and 71 Abbey Grove (GR06). Daytime $L_{A_{eq},12hr}$ levels were 61 and 57 dB, respectively, with daytime $L_{A_{max}}$ levels of 89 and 90 dB. Night-time $L_{A_{eq},8hr}$ levels were 55 and 50 dB respectively, with night-time $L_{A_{max}}$ levels of up to 88 and 84 dB. At both locations train noise was the dominant noise source, albeit infrequent. Other noise sources, which contributed to the measured noise levels included; road traffic, aircraft, sirens and general neighbourhood noise.

Impact Assessment – Temporary Impacts

Impacts during Construction

Noise from Surface Activity

2.384 Temporary impacts from construction activities are illustrated on Drawing No.1E0315-E2E00-E01-F-00007.

Noise from Surface Activity

2.385 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

Construction Sites and Works including Onsite Traffic

2.386 The construction programme activities that are likely to cause significant impacts include works on Church Manorway, Eynsham Drive and Bostal Manorway Bridges. Properties in Church Manorway and Bracondale Road are among those affected.

2.387 In the vicinity of the Plumstead to Abbey Wood track works, there will be a significant number of properties that are affected by construction noise. In particular, properties in Marmadon Road are expected to experience significant noise impacts, although these would be for daytime only.

Mottisfont Road/Bracondale Road Sewer Reconstruction

2.388 The works involve the replacement of those parts of two existing sewers that would lie beneath the widened railway embankment. It will be carried out in open cut working at three main sites in sequence.
2.389 For the purposes of this utilities assessment the three worksites associated with the Mottisford Road/Bracondale Road sewer reconstruction works, have been identified as Site A to C, where:

- **Site A** – A worksite located to the north of the existing tracks and south of 21 Mottisfont Road, on the 1.5x1.2 m diameter sewer that passes through the car park. The initial phase of the work will be carried out at this site and will last approximately 1 month.

- **Site B** – A worksite located to the south of the existing tracks and adjacent to 59 Bracondale Road, on the 1.5x1.2 m diameter sewer that passes through the car park. The worksite will occupy part of an area used for car parking, but access to the existing garages there will be maintained. The second phase of the work will be carried out at this site and last approximately 1 month.

- **Site C** – A subsidiary working location, situated to the south of the existing tracks, on the 450 mm diameter sewer that passes through the end of the rear garden of 53 Bracondale Road. The majority of the construction work will be undertaken within the railway lands, but a shallow excavation may be required in the rear garden of 53 Bracondale Road to connect into the existing sewer. If works are required in the garden of number 53, it will be limited to a short period of several weeks, during normal working hours.

2.390 Construction work at all these locations is confined to normal hours but pumps might need to be run continuously to dewater the excavations.

2.391 The distances from the sites within which significant impacts could occur are shown in the table below. These distances are on the basis of no on-site mitigation, since it is assumed that standard hoardings at 2.4 m high do not cut the line of sight for 4 m high receptors. Baseline noise levels obtained from monitoring and the distances to the nearest dwellings are also shown.

<table>
<thead>
<tr>
<th>Site</th>
<th>Use</th>
<th>Baseline</th>
<th>Day</th>
<th>Eve</th>
<th>Night</th>
<th>Nearest houses (m)</th>
<th>Potential Impact Zone¹ (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Period Lₐₑq dB façade</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A – north</td>
<td>Open trench</td>
<td>GR04</td>
<td>64.6</td>
<td>62.6</td>
<td>58.2</td>
<td>N – 10 m</td>
<td>72</td>
</tr>
<tr>
<td>B – south</td>
<td>Open trench</td>
<td>GR04</td>
<td>64.6</td>
<td>62.6</td>
<td>58.2</td>
<td>S – 10 m</td>
<td>72</td>
</tr>
<tr>
<td>C – south</td>
<td>Open trench</td>
<td>GR04</td>
<td>64.6</td>
<td>62.6</td>
<td>58.2</td>
<td>S – 10 m</td>
<td>24</td>
</tr>
</tbody>
</table>

Notes
1. Façade level above criterion for any duration assuming mitigation of 0 dB on–site and unobstructed view of site
2. Assuming dewatering is required with a total unscreened Lₐₑq of 75 dB at 10 m (Free-field)
3. The nearest house is approximately 2 m from the site boundary, but about 10 m from the end of the excavation
4. Assuming only mini excavator is used here – not full range of plant as at sites A and B. Total unscreened Lₐₑq 73 dB at 10 m (Free-field)
Offsite Road Traffic

2.392 Construction vehicles will only use the highway during the daytime (07:00 - 19:00). At façades overlooking roads used by construction traffic, the existing hourly $L_{A10}$ during the daytime is predicted to increase by $< 1$ dB.

Mottisfont Road/Bracondale Road Sewer Reconstruction

2.393 The effects of off-site construction traffic for these utilities works have been taken into account in the assessment of this topic for the main works in this route window.

Vibration from Surface Activity

Track-work

2.394 The plant likely to be required to construct the Crossrail elements of track-work within this route window has been reviewed to identify sources, which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings, or cause damage to buildings.

2.395 The construction information provided by Crossrail indicates that a tamper and a vibrating roller are required during track-works; and that oscillatory bored piling rig is required for construction of retaining walls. Vibration levels due to oscillatory bored piling are unlikely to be significant.

2.396 Vibration levels due to use of the tamper and vibrating roller are predicted to be less than 3 mm/s at the closest buildings to the works.

2.397 Vibration levels are not expected to exceed the threshold of significance for building damage at any receptor during any of the proposed works.

2.398 The construction activities required at this site are likely to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.399 No listed buildings, or receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to these worksites.

Church Manorway Footbridge

2.400 The plant likely to be required to construct the Crossrail elements at the Church Manorway Footbridge has been reviewed to identify sources, which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings, or cause damage to buildings.

2.401 The construction information provided by Crossrail indicates that concrete breakers are required during the demolition of the existing footbridge; and that a CFA piling rig and a vibrating roller are required during construction of the new subway. Vibration levels due to CFA piling are not expected to be significant.
2.402 Vibration levels are predicted to be in the region of 2 to 8 mm/s at 88 Church Manorway during demolition of the south side of the existing footbridge; and less than 3 mm/s during use of the vibrating roller.

2.403 Vibration levels may exceed the threshold of significance for building damage at 88 Church Manorway during demolition of the south side of the existing footbridge. Vibration levels are not expected to exceed the threshold of significance for building damage at any receptor during the remainder of the proposed works.

2.404 The majority construction activities required at this site are likely to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’. Levels may occur at 88 Church Manorway during demolition of the south side of the existing footbridge that correspond to ‘adverse comment possible’. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.405 No listed buildings, or receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to these worksites.

Eynsham Drive Worksite North and South

2.406 The plant likely to be required to construct the Crossrail elements at the Eynsham Drive Bridge has been reviewed to identify sources, which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings, or cause damage to buildings.

2.407 The construction information provided by Crossrail indicates that concrete breakers, a wacker plate, and a CFA piling rig are required during the bridge works. Vibration levels due to CFA piling are not expected to be significant. Vibration levels from the bridge works are unlikely to be significant at the nearest potentially sensitive receptors, assuming that the breakers are not vehicle mounted.

2.408 Vibration levels are not expected to exceed the threshold of significance for building damage at any receptor during any of the proposed works.

2.409 The construction activities required at this site are likely to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.410 No listed buildings, or receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

Bostall Manorway Worksite North and South

2.411 The plant likely to be required to construct the Crossrail elements at the Bostall Manorway Footbridge has been reviewed to identify sources, which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings, or cause damage to buildings.
2.412 The construction information provided by Crossrail indicates that concrete breakers are required during the demolition of the existing footbridge; and that a CFA piling rig and a vibrating roller are required during construction of the new subway. Vibration levels due to CFA piling are not expected to be significant.

2.413 Vibration levels are predicted to be in the region of 1 to 3 mm/s at the closest building to the worksite during demolition of the existing footbridge and garages and less than 3 mm/s during use of the vibrating roller.

2.414 Vibration levels are not expected to exceed the threshold of significance for building damage at any receptor during any of the proposed works.

2.415 The construction activities required at this site are likely to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.416 No listed buildings, or receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to this worksite.

Mottisfont Road/Bracondale Road Sewer Reconstruction

2.417 Sections of the existing sewers will be replaced by forming an open cut for which sheet piling will be required to provide a trench support system. The shortest distances from the excavation to the nearby houses are:

- Site A (North of railway) 14 m to No 21 Mottisfont Road, and
- Site B (South of Railway) 10 m to No 57 Bracondale Road

2.418 Vibration levels, assuming sheet vibratory piling, are predicted to be in the region of 1 to 4.5 mm/s at the foundations of the closest building to the northern excavation (21 Mottisfont Road), and 1.5 to 7 mm/s at the foundations of the closest building to the southern excavation (57 Bracondale Road).

2.419 Vibratory sheet piling may result in vibration levels that exceed the threshold of significance for building damage for these buildings. Consequently, the Crossrail Noise and Vibration Policy will be applied. The policy provides for an individual assessment of the building’s sensitivity (both its structure and content) to determine whether, if the vibration levels did exceed the designated limit, impact is likely.

2.420 Where impact is predicted, mitigation measures will be optimised to reduce levels as far as reasonably practicable. Condition surveys will be undertaken at buildings deemed sensitive and vibration monitoring at these buildings will be carried out during periods when the adopted limits may be exceeded.
2.421 Vibratory sheet piling activities may give rise to vibration levels that correspond to a semantic rating of 'adverse comment possible' at the closest buildings to the northern worksite, and 'adverse comment probable' at the closest buildings to the southern worksite. Owing to the temporary nature of such works (1 week at each site), and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.422 Where there may be significant impacts on building occupants, appropriate mitigation should be accompanied by good public relations. Occupants and owners of potentially affected buildings should be forewarned of the anticipated timing, duration, and magnitude, of the vibration impact, and how it relates to the potential for building damage at their location.

Vibration and Groundborne Noise from Underground Activity

2.423 Not applicable to this route window.

*Mottisfont Road/Bracondale Road Sewer Reconstruction*

2.424 No tunnelling operations will be carried out at this site. Consequently, no TBM operations or construction railway will be operated at this location.

2.425 Groundborne noise levels are shown on Drawing No: 1E315-E2E00-E03-F-00007.

Mitigation and Residual Impacts during Construction

Noise from Surface Activity

*Construction Sites and Works including Onsite Traffic*

2.426 Hoardings of a minimum height of 2.4 m would generally be provided along the boundaries of the working areas. This corresponds to Tier 1 mitigation.

2.427 In this route window, an estimated 50 properties are expected to be eligible for noise insulation due to construction noise. No properties are expected to be eligible for temporary re-housing. With the implementation of these mitigation measures, there would be 44 dwellings that would experience significant residual noise impacts.

*Mottisfont Road/Bracondale Road Sewer Reconstruction*

2.428 Significant daytime noise impacts from Site A can be avoided at the nearest properties (21 and 23 Mottisfont Road) by providing on-site mitigation with a total noise reduction of 18 dB.

2.429 Unmitigated daytime activities at Site B would also result in the noise levels above the assessment criterion at the façades of properties within about 60 m of, and having a clear view of, the site. The provision of Tier 2 mitigation (including 5 m high site hoardings would reduce this distance to 23 m (assuming only 10 dB of on-site mitigation).

2.430 This would result in significant impacts at three properties (55, 57, and 59 Bracondale Road).
2.431 Significant daytime noise impacts from Site B can be avoided at the nearest properties (55, 57, and 59 Bracondale Road) by providing on-site mitigation with a total noise reduction of 18 dB. (Note that although no 59 Bracondale Road is only about 2 m from the site boundary, it is approximately 10 m from the end of the excavation where the main noise sources would be located.)

2.432 At Site C, because the works here are only expected to last a week, there would be no significant impacts.

2.433 It is not known at this stage whether the activity at Site C would be concurrent with working at activity at Site B. However, as noted above, the works at Site C are only expected to last a week, and so the combination of activity here with works at Site B would not increase the extent of any significant impacts, even if the number of properties experiencing noise levels above the assessment criterion were to be increased.

2.434 Dewatering overnight might not, in practice, be necessary at any of these sites. They are shallow excavations and any overnight water that does arise could probably be pumped out during normal working hours. However, if overnight dewatering is implemented, significant night-time impacts can be avoided by applying screening/enclosure to the generator/pumps to provide 18 dB of attenuation.

**Offsite Road Traffic**

2.435 There are no residual effects.

**Vibration from Surface Activity**

2.436 Vibration mitigation will be required during some demolition activities at Church Manorway Footbridge, to mitigate potential impacts on adjacent buildings. An appropriate continuous vibration-monitoring regime should be adopted during demolition works allow monitoring of levels and cessation of activity should levels exceed relevant limits.

**Vibration and Groundborne Noise from Underground Activity**

2.437 Not applicable to this route window.

**Impact Assessment – Permanent Impacts**

**Impacts during Operation**

**Noise from the Surface Railway**

<table>
<thead>
<tr>
<th>Site</th>
<th>Daytime</th>
<th>Night-time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 4 AW36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A – north</td>
<td>Tier 2 (18 dB)</td>
<td>No additional beyond daytime</td>
</tr>
<tr>
<td>B – south</td>
<td>Tier 2 (18 dB)</td>
<td>No additional beyond daytime</td>
</tr>
<tr>
<td>C – south</td>
<td>None required</td>
<td>None required</td>
</tr>
</tbody>
</table>
In this Route Window there are proposed changes to the railway (permanent way) infrastructure along the length of the existing North Kent Line. Around the Plumstead Portal area, the NKL will be significantly altered in alignment to enable the new Crossrail tracks to emerge to surface. Between the portal and Abbey Wood station, the corridor will be upgraded to four track, with the new up and down Crossrail lines running in between the re-aligned up and down NKL tracks. A Level 3 (detailed assessment) has been carried out for this area.

The new twin track Crossrail alignment will run eastwards in retained cutting from the portal emerging at grade to the east of Church Manor Way. The four track arrangement will cease at Abbey Wood station where all Crossrail services are proposed to terminate. Two turnback sidings are proposed to the east of Abbey Wood station to enable terminating trains from the east to be re-set for the return journey westwards.

The predicted noise changes attributable to the infrastructure and forecast railway traffic changes in the vicinity of the sidings have been calculated taking account of the new alignments, precise mix of expected rail vehicles and the operating speeds of the various train types.

The resulting changes in overall noise levels for residential receptors close to the new railway tracks would be as follows:

<table>
<thead>
<tr>
<th>Time Period</th>
<th>No. of Significant Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Noise Decrease</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;3 dB</td>
</tr>
<tr>
<td>Day (07:00 to 23:00 hrs)</td>
<td>0</td>
</tr>
<tr>
<td>Night (23:00 to 07:00 hrs)</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: Noise changes calculated in terms of the LAeq,16hr for Day and LAeq,8hr for Night

In addition, no non-residential receptors are predicted to experience day-time noise increases of greater than 3 dB.

A detailed study of the potential maximum noise levels arising from the operation of trains has not been undertaken, as it is predicted that the L_{Amax,F} levels associated with the proposed infrastructure (including noise barriers) and traffic pattern changes will be lower than those already experienced at nearby receptors, as a result of the introduction of the permanent noise barriers.

A preliminary assessment has been undertaken to identify the number of residential properties which may be eligible for noise insulation under the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996, as a result of operational railway noise from modified or altered works in the vicinity.

The results of this preliminary eligibility assessment indicate that up to 52 properties are expected to be eligible for noise insulation under the Regulations.
Vibration from the Surface Railway

2.446 Vibration impacts from the permanent operation of the surface railway are not predicted to occur within this route window.

Noise from Road Traffic

2.447 When the Crossrail scheme is operational, it will cause only small increases in the 18-hour traffic flow on roads in this route window. The change in $L_{A10,18hr}$ corresponding to this increase in traffic is predicted to be $< 1$ dB.

Mitigation and Residual Impacts during Operation

Noise from the Surface Railway

2.448 The proposed mitigation scheme includes lengths of permanent noise barriers between the portal and Abbey Wood Station to mitigate noise from both the new Crossrail services and the North Kent Line alterations. The following barrier configurations are proposed:

**Southern Side of Corridor**
- 2 m high (above rail) reflective noise barrier from start to end of route window (extends from SE6, and into SE8) and to the south of the re-aligned NKL.

**Northern Side of Corridor**
- 2 m high (above rail) absorptive noise barrier from start of route window to the east of Church Manor Way (extends from SE6) and to the north of the re-aligned NKL.
- 2 m high (above rail) reflective noise barrier from east of Church Manor Way to the end of the route window (extends into SE8) and to the north of the re-aligned NKL.

2.449 The resulting changes in overall noise levels for residential receptors close to the new railway tracks, taking into account the proposed mitigation, would be as follows:

<table>
<thead>
<tr>
<th>Time Period</th>
<th>No. of Significant Impacts</th>
<th>Noise Decrease</th>
<th>Noise Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Slight</td>
<td>Moderate</td>
</tr>
<tr>
<td>Day (07:00 to 23:00 hrs)</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Night (23:00 to 07:00 hrs)</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: Noise changes calculated in terms of the $L_{Aeq,16hr}$ for Day and $L_{Aeq,8hr}$ for Night

2.450 No non-residential properties are predicted to experience noise increases of 3 dB or higher.

2.451 It can be seen that from this assessment that no significant noise impacts have been identified along the section of line, and as such no further mitigation has been considered. However, it should be noted that with the proposed mitigation, four properties are subject to significant noise decreases (positive impact).
2.452 A preliminary assessment has been undertaken to identify the number of residential properties which may be eligible for noise insulation under the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996, as a result of operational railway noise from modified or altered works in the vicinity.

2.453 The results of this preliminary eligibility assessment indicate that up to 2 properties are expected to be eligible for noise insulation under the Regulations with the permanent noise barriers in place.

Vibration from the Surface Railway

2.454 There are no significant impacts, and thus no need for additional mitigation.

Noise from Road Traffic

2.455 There are no residual effects.

Impacts on Sites Granted Planning Permission

2.456 No extant planning permissions that might be affected by the scheme have been identified in this route window.
# Route Window SE 7: Plumstead to Abbey Wood – Temporary Impacts

<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconstruction of Sewer at Mottisfont Road/Bracondale Road</td>
<td>Daytime noise impacts at 0 residential properties. Evening noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Weekend noise impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces</td>
<td>Not significant</td>
<td>BPM to reduce noise, 5.0 m high hoarding around the contractors compound, enclosure of static plant associated with night time working. Mitigation = Tier 2</td>
<td>0 properties would be eligible for noise insulation. 0 properties would be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 0 residential properties. Evening noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Weekend impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
</tr>
<tr>
<td>Works</td>
<td>Potential Impact</td>
<td>Significance</td>
<td>Assumed Mitigation</td>
<td>Residual Impact</td>
</tr>
<tr>
<td>-------</td>
<td>------------------</td>
<td>--------------</td>
<td>--------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>NKL alignment changes, new Crossrail tracks from Plumstead Portal to Abbey Wood station.</td>
<td>Significant changes in operational railway noise at noise sensitive receptors – 228 properties in total.</td>
<td>Significant</td>
<td>Southern Side of corridor 2 m high (above rail) reflective noise barrier from start to end of route window (extends from SE6, and into SE8). Northern Side of Corridor 2 m high (above rail) absorptive noise barrier from start of route window to east of Church Manor Way (extends from SE6). 2 m high (above rail) reflective noise barrier from east of Church Manor Way to end of route window (and extends into SE8).</td>
<td>Negative Impacts None Positive Impacts Significant positive impacts at: 117, 119, 110, 112 Mottisfont Road Eligibility for Noise Insulation 86 &amp; 88 Church Manor Way (2 properties)</td>
</tr>
<tr>
<td>NKL alignment changes, new Crossrail tracks from Plumstead Portal to Abbey Wood station.</td>
<td>No operational railway vibration impacts.</td>
<td>Not significant</td>
<td>Not required</td>
<td>None</td>
</tr>
</tbody>
</table>

Not significant
ROUTE WINDOW SE8 – ABBEY WOOD STATION AND SIDINGS

Overview of Route Window SE8

2.457 The proposed works within the route window comprise the reconstruction of Abbey Wood station, track realignment, the provision of two additional tracks within the existing railway corridor, and the installation of OHLE equipment. The route window lies within LBs Greenwich and Bexley.

2.458 Abbey Wood station lies on the boundary between LB Greenwich to the west and Bexley to the east. The remains of the 12th Century Lesnes Abbey lie to the southeast of Abbey Wood station. The area is almost entirely residential, punctuated by urban green spaces. A small industrial estate lies to the north of the station, and a single commercial building belonging to British Telecom overlooks the southern side of the station. High background noise levels are mainly attributed to the railway.

Baseline

2.459 This route window also includes the Plumstead to Abbey Wood four-tracking construction works and Abbey Wood Station improvements. The baseline noise survey locations and durations are listed in the following table and identified on Drawing No. 1E0415-E2E00-E01-F-00008:

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Long-term (1 week)</th>
<th>Medium term (24-hours)</th>
<th>Short-Term (3-hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR07</td>
<td>19 Abbey Terrace</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BX01</td>
<td>Wilton Road (West End Styles)</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BX02</td>
<td>14 Sedgmere Road</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>BX03</td>
<td>85 Fendyke Road</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>BX04</td>
<td>Dallberg Way</td>
<td></td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>
2.460 Abbey Wood Station lies on the boundary between the London Boroughs of Greenwich to the west and Bexley to the east. To accommodate Crossrail, the current two track North Kent Line will be upgraded to four track. The inner two lines will become Crossrail and the outer two lines will become the North Kent Line. With the addition of two new tracks, two new platforms are also proposed. The proposed station concourse will span the tracks forming a fully integrated rail, bus, and tram interchange.

2.461 Harrow Manorway Road bridge is located immediately to the east of Abbey Wood Station. The existing bridge is a multi-span flyover that currently carries the A2041. Proposals involve the need to demolish and relocate supporting spans and strengthen works to the bridge to accommodate the track widening.

2.462 Two long-term surveys were conducted at GR07 and BX01, with two medium-term surveys conducted at BX02 and BX03 and an additional short-term undertaken at BX04. Due to access difficulties only an attended short-term survey was possible at BX04, which was originally requested as a longer-term installation.

2.463 At 19 Abbey Terrace (GR07) the daytime $L_{Aeq,12hr}$ was 63 dB, falling to $L_{Aeq,8hr}$ 55 dB at night, with a night-time $L_{Amax}$ of 90 dB. The equipment was installed in the rear garden of the property, which runs parallel with Abbey Wood Station Platform. The station platform and tracks are located almost immediately on the opposite side of the boundary and are just visible through overgrown vegetation. The dominant noise source was train movements. However, in addition, PA announcements, which appear to occur every time a train arrives/leaves the platform, were also clearly audible, as were train doors slamming. Other audible noise sources included: construction noise from the opposite side of the platform, which included workmen regularly shouting, site vehicles, revving of engines, reversing beeps of site vehicles and general banging; planes passing overhead and a continuous hum, possibly generated by a plant room, from the Telephone Exchange Building to the east, however this is unconfirmed.

2.464 The daytime $L_{Aeq,12hr}$ level measured at Wilton Road (West End Styles) was 66 dB, falling to a night-time $L_{Aeq,8hr}$ level of 59 dB, with $L_{Amax}$ levels of up to 92 dB. The dominant noise source was a combination of train movements and road traffic noise. Road traffic noise was a major source, from both the elevated A2041 and from Wilton Road.

2.465 Two 24-hour measurements were undertaken at Sedgmere Road (BX02) and Fendyke Road (BX03). The daytime $L_{Aeq,12hr}$ levels were 64 and 63 dB, respectively. The night-time $L_{Aeq,8hr}$ levels were 60 and 58 dB, respectively. Daytime $L_{Amax}$ levels reached up to 94 and 87 dB, with night-time levels up to 98 at BX02 and 87 dB at BX01. At BX02 the dominant noise source was road traffic. At BX03 the noise environment was quiet, with very little noise activity, although train movements were audible.

2.466 An additional short-term attended survey was undertaken at Dallberg Way (BX04). The daytime $L_{Aeq,3hr}$ levels was 67 dB, with the $L_{Amax}$ ranging between 84 and 91 dB. Observations noted that the prevailing noise climate was influenced by a number of noise sources, these included: frequent train movements, including occasional freight, frequent bus pass bys, birds tweeting, infrequent aircraft audible overhead and emergency vehicle sirens. Typical road traffic was light.
Impact Assessment – Temporary Impacts

Impacts during Construction

2.467 Temporary impacts from construction activities are illustrated on Drawing No.1E0315-E2E00-E01-F-00008.

Noise from Surface Activity

2.468 Appendix A provides tables for each route window giving the predicted durations of significant impacts for representative receptors. Each listed receptor is representative of one or more dwellings or other noise-sensitive location. Also included in the tables is an estimate of the numbers of dwellings that may be eligible for temporary re-housing and/or noise insulation. Appendix A should be read in conjunction with both the text below and the Construction Noise Assessment Plans provided in Volume 8 of this Technical Report.

Construction Sites and Works including Onsite Traffic

Abbey Wood Station and Turnback Sidings

2.469 A number of properties are predicted to receive a significant noise impact from the construction activities at the Abbey Wood Station and Turnback Sidings. Residential properties which may experience significant noise levels during the day, night and weekend periods include properties located in Fendyke Road, Rushdene, Sydney Road, Buckwheat Court off Allsike Road, Hatfield Drive and Coptefield Road to the immediate south of the tracks, Abbey Grove, Abbey Terrace, Wilton Road, Abbey Wood Road, Glover Close, Florence Road, Sedgemere Road and Mottisfont Road. In addition, properties in the recently built residential re-development of the Hermitage Close Industrial Estate are predicted to receive significant noise impacts from the construction activities.

2.470 No work will be carried out during evening periods. However, there will be some night-time work of significant duration concentrated around the station area. A number of properties are predicted to experience significant night-time noise impacts. Affected areas will specifically include properties in Fendyke Road, Rushdene, Hermitage Close, Abbey Terrace, Wilton Road, small areas of Rushdene and Sedgemere Road.

2.471 A number of properties will also experience significant noise impacts from weekend working, although to a lesser extent than daytime impacts.

2.472 Only one non-residential property is predicted to experience significant construction noise impacts, St Benet’s Roman Catholic Church, located off Abbey Road. These impacts would occur during the daytime period only. No other non-residential impacts have been identified.

Abbey Wood Station Sewer Division Worksite

2.473 The works consist of a cut and cover trench about 75 m long carried out within the main worksite and at the same time. Daytime only working has been assumed, apart from possible short-term 24-hr working during connections. It is also assumed that the trench would need support and that sheet piles might provide this. The timescale for the works is 5 months.
2.474 The nearest baseline monitoring locations are BX1 and BX2 from which daytime and night-time criteria of 70 dB and 65 dB (façade, period $L_{Aeq}$ values) have been derived. The nearest noise-sensitive buildings in the vicinity are in Wilton Road.

2.475 With no on-site mitigation, noise-sensitive buildings within about 80 m of the worksite could experience noise levels above the threshold for significant noise impacts (during the daytime).

**Offsite Road Traffic**

2.476 Construction vehicles will only use the highway during the daytime (07:00 - 19:00). At façades overlooking roads used by construction traffic, the existing hourly $L_{A10}$ during the daytime is predicted to increase by < 1 dB.

**Abbey Wood Station Sewer Diversion Worksite**

2.477 The effects of off-site construction traffic for these utilities works have been taken into account in the assessment of this topic for the main works in this route window.

**Vibration from Surface Activity**

**Abbey Wood Station and Turnback Sidings**

2.478 The plant likely to be required to construct the Crossrail elements at Abbey Wood Station and Turnback Sidings has been reviewed to identify sources, which may produce levels of vibration sufficient to cause adverse comment from the occupants of buildings, or cause damage to buildings.

2.479 The construction information provided by Crossrail indicates that concrete breakers are required during demolition of the existing station building, structures and platforms, and a house at 19 Abbey Terrace; a CFA piling rig is required during the construction of new platforms; and an oscillatory bored piling rig and vibrating roller is required during track-works. Vibration levels due to CFA piling and oscillatory bored piling are not expected to be significant.

2.480 Vibration levels are predicted to be in the region of 1.5 to 6 mm/s at 18 Abbey Terrace and the new development to the north of the site, the closest buildings to the works, during demolition of the platforms; and 0.5 to 2 mm/s at the Telephone Exchange. Vibration levels are predicted to be in the region of 1.5 to 6 mm/s at the Abbey Arms public house, the closest building to the works, during demolition of the station building. Mapping indicates that 19 Abbey Terrace is attached or contiguous to 18 Abbey Terrace. Vibration levels of concern could occur due to the structural continuity between buildings.

2.481 The threshold of significance for building damage could be exceeded at 18 Abbey Terrace during the demolition of 19 Abbey Terrace, and at the closest buildings to the worksite during station and platform demolition, although the threshold of significance is unlikely to be exceeded at any other of the surrounding buildings during the remainder of the works.
2.482 With the exception of the demolition of 18 Abbey Terrace, the construction activities required at this site are likely to give rise to vibration levels that are below those that correspond to a semantic rating of ‘a low probability of adverse comment’. Levels may occur at 19 Abbey Terrace that correspond to ‘adverse comment possible’ for a limited period during demolition of 18 Abbey Terrace. Due to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.483 No listed buildings, or receptors that are potentially more sensitive to vibration than residential uses, such as precision laboratories and operating theatres, have been identified that are significantly close to these worksites.

**Abbey Wood Station Sewer Diversion Worksite**

2.484 If vibratory piling is used to install sheet piles to support the excavation, vibration levels, are predicted to be in the region of 1 to 4 mm/s at the foundations of the closest building to the trench (14 m in Wilton Road, north of the works). These levels exceed the threshold of significance (based on the potential for cosmetic potential building damage) in accordance with he assumed policy in Chapter 5 Volume 1 of the Technical Report. However, they are below the corresponding levels for standard buildings.

2.485 As noted in Volume 1 an individual assessment of the building’s sensitivity (both its structure and content) would be undertaken to determine whether, the vibration levels did exceed the threshold of significance, an impact is likely.

2.486 Should an impact be considered likely, mitigation measures will be optimised to reduce levels as far as reasonably practicable. Condition surveys will be undertaken at buildings deemed sensitive and vibration monitoring at these buildings will be carried out during periods when the adopted limits may be exceeded.

2.487 If a vibratory piling method is used then it may give rise to vibration levels that correspond to a semantic rating of ‘adverse comment possible’ in the buildings nearest to the excavation. Owing to the temporary nature of such works, and with appropriate mitigation, the impact to occupants of the buildings is not likely to be significant.

2.488 Where there may be significant impacts on building occupants, appropriate mitigation should be accompanied by good public relations. Occupants and owners of potentially affected buildings should be forewarned of the anticipated timing, duration, and magnitude, of the vibration impact, and how it relates to the potential for building damage at their location.

**Vibration and Groundborne Noise from Underground Construction Activity**

**Abbey Wood Sewer Diversion Worksite**

2.489 No TBM or construction railway or other plant in this category will be used. Consequently, there will be no significant impacts in this category.
Mitigation and Residual Impacts during Construction

Noise from Surface Activity

Construction Sites and Works including Onsite Traffic

2.490 Hoardings 3.6 m high would be provided around the main compound worksites, including to the south of the station platforms. Hoardings 2.4 m high would be provided around the track works including to the north of the station platforms. Additional 2.0 m high barriers will also be erected to the extreme east and west of the site along the tracks. These are the barriers proposed to mitigate operational railway noise, and it is assumed these can be erected at an early stage of the construction programme. This corresponds to Tier 2 mitigation.

2.491 In this route window, an estimated 400 residential properties may be impacted, of these approximately 163 properties are expected to be eligible for noise insulation due to construction noise. The residents of approximately 34 dwellings may be eligible for temporary re-housing for a period. Properties that may be eligible for temporary re-housing include, 19 Abbey Road, 28 Wilton Road and parts of the Hermitage Close development. With the implementation of these mitigation measures, approximately 237 residential properties would be subject to a significant residual construction noise impact.

Abbey Wood Station Sewer Diversion Worksite

2.492 Depending on timescale of this work, houses south of the utilities worksite in Wilton Road would experience significant impacts. With the provision of Tier 2 on-site mitigation (minimum 12 dB reduction, including 5 m high hoardings) this is limited to approximately 10 residential dwellings, all of which will be eligible for NI under the assumed criteria.

2.493 At the time of assessment new buildings were under construction in Wilton Road, to the north of the worksite. These buildings may also be eligible for NI if they are residential in nature and fulfil the appropriate criteria.

2.494 The zone over which significant impacts would occur for these utility works is relatively small. The main works at this location includes substantial structures and it is therefore considered probable that any impact or mitigation associated with the utility works would already be included in that identified above.

Offsite Road Traffic

2.495 There are no residual effects.
2.496 Vibration mitigation will be required during demolition works at Harrow Manorway Bridge and Abbey Wood Station to mitigate potential impacts on adjacent buildings. Attached buildings should be unattached, as far as possible using non-vibratory techniques, such as diamond sawing, before demolition commences, and should continue as it progresses. Additionally, detailed assessment should be undertaken prior to commencement of works to inform the selection of specific items of plant and working methods. An appropriate continuous vibration-monitoring regime should be adopted during demolition works allowing monitoring of levels and cessation of activity should levels exceed relevant limits.

Impact Assessment – Permanent Impacts

2.497 In this Route Window there are proposed changes to the railway (permanent way) infrastructure along the length of the existing North Kent Line. Around the Plumstead Portal area, the NKL will be significantly altered in alignment to enable the new Crossrail tracks to emerge to surface. Between the portal and Abbey Wood station, the corridor will be upgraded to four track, with the new up and down Crossrail lines running in between the re-aligned up and down NKL tracks. A Level 3 (detailed assessment) has been carried out for this area.

2.498 The new twin track Crossrail alignment will run eastwards in retained cutting from the portal emerging at grade to the east of Church Manor Way. The four track arrangement will cease at Abbey Wood station where all Crossrail services are proposed to terminate. Two turnback sidings are proposed to the east of Abbey Wood station to enable terminating trains from the east to be re-set for the return journey westwards.

2.499 The predicted noise changes attributable to the infrastructure and forecast railway traffic changes in the vicinity of the sidings have been calculated taking account of the new alignments, precise mix of expected rail vehicles and the operating speeds of the various train types.

2.500 The resulting changes in overall noise levels for residential receptors close to the new railway tracks would be as follows:

<table>
<thead>
<tr>
<th>Time Period</th>
<th>No. of Significant Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Noise Decrease</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Day (07:00 to 23:00 hrs)</td>
<td>0</td>
</tr>
<tr>
<td>Night (23:00 to 07:00 hrs)</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: Noise changes calculated in terms of $L_{Aeq,16hr}$ for Day and $L_{Aeq,8hr}$ for Night

2.501 In addition, the following non-residential receptors are predicted to experience daytime noise increases of greater than 3 dB.
• St Benet’s Church on Abbey Grove.

2.502 A detailed study of the potential maximum noise levels arising from the operation of trains has not been undertaken, as it is predicted that the $L_{A_{max,F}}$ levels associated with the proposed infrastructure (including noise barriers) and traffic pattern changes will be lower than those already experienced at nearby receptors, as a result of the introduction of the permanent noise barriers.

2.503 A preliminary assessment has been undertaken to identify the number of residential properties which may be eligible for noise insulation under the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996, as a result of operational railway noise from modified or altered works in the vicinity.

2.504 The results of this preliminary eligibility assessment indicate that up to 48 properties are expected to be eligible for noise insulation under the Regulations.

Vibration from the Surface Railway

2.505 The realignment of the North Kent Line from a distance of 13m to 4.2m from the near rail to the nearest remaining property in Abbey Terrace following demolition will potentially cause an increase in vibration dose value of 75%, a significant increase, for that one property.

2.506 The increase can be fully mitigated by the installation of a resilient underballast mat below the newly realigned track for a distance of 35m. There would then be no remaining residual impacts.

2.507 The increase can be fully mitigated by the installation of a resilient underballast mat below the newly realigned up track of the North Kent Line for a distance of 35m. There would then be no remaining residual impacts.

2.508 The realignment of the North Kent Line from a distance of 14.8m to 3.8m from the near rail to the nearest property in Hermitage Close will potentially cause an increase in vibration dose value of 40% to 100%, a significant increase, for 8 properties.

2.509 These increases can be fully mitigated by the installation of a resilient underballast mat below the newly realigned down track of the North Kent Line for a distance of 170m. There would then be no remaining residual impacts.

Noise from Road Traffic

2.510 When the Crossrail scheme is operational, it will cause only small increases in the 18-hour traffic flow on roads in this route window. The change in $L_{A_{10,18hr}}$ corresponding to this increase in traffic is predicted to be < 1 dB. There are therefore no significant impacts arising from increases in operational traffic as a result of the scheme.

Mitigation and Residual Impacts during Operation

Noise from the Surface Railway
2.511 The proposed mitigation scheme includes lengths of permanent noise barriers between the portal and Abbey Wood station to mitigate noise from both the new Crossrail services and the North Kent Line alterations. The following barrier configurations are proposed:

**Southern Side of Corridor**
- 2 m high (above rail) reflective noise barrier from start of route window (extends from SE6 and SE7) to Abbey Wood station and to the south of the re-aligned NKL.
- 2.5 m high (above rail) absorptive noise barrier along the length of the platforms and to the south of re-aligned NKL at Abbey Wood station.
- 2 m high (above rail) reflective noise barrier between the re-aligned NKL and properties on Coptefield Drive and Halifield Drive which face onto the railway corridor.

**Northern Side of Corridor**
- 2 m high (above rail) reflective noise barrier from start of the route window (extends from SE7) to Abbey Wood station and to the north of the re-aligned NKL.
- 2.5 m high (above rail) absorptive noise barrier along the length of the platforms and to the north of the re-aligned NKL at Abbey Wood station.

2.512 The resulting changes in overall noise levels for residential receptors close to the new railway tracks, taking into account the proposed mitigation, would be as follows:

<table>
<thead>
<tr>
<th>Time Period</th>
<th>No. of Significant Impacts</th>
<th>Noise Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Slight</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;3 dB</td>
</tr>
<tr>
<td>Day (07:00 to 23:00 hrs)</td>
<td>47</td>
<td>13</td>
</tr>
<tr>
<td>Night (23:00 to 07:00 hrs)</td>
<td>47</td>
<td>13</td>
</tr>
</tbody>
</table>

Note: Noise changes calculated in terms of the $L_{Aeq,16hr}$ for Day and $L_{Aeq,8hr}$ for Night.

2.513 No non-residential properties are predicted to experience noise increases of 3 dB or higher.

2.514 It can be seen that from this assessment that 13 significant noise impacts have been identified along the section of line, 10 of which are located on the 2nd and 3rd floors of the 4 storey residential properties on Hermitage Close to the north of Abbey Wood station. Additional increases in noise barrier height to remove all of these impacts are not considered practicable at this location due to the line of sight onto the railway and, as such, no further mitigation has been considered. However, it should be noted that with the proposed mitigation, 47 properties are subject to significant noise decreases (positive impact).

2.515 A preliminary assessment has been undertaken to identify the number of residential properties which may be eligible for noise insulation under the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996, as a result of operational railway noise from modified or altered works in the vicinity.
2.516 The results of this preliminary eligibility assessment indicate that up to 5 properties are expected to be eligible for noise insulation under the Regulations with the permanent noise barriers in place.

Vibration from the Surface Railway

2.517 With the installation of a resilient underballast mat below the newly realigned down track of the North Kent Line for a length of 170 m, there would then be no remaining residual impacts.

Noise from Road Traffic

2.518 There are no impacts, and thus no need for additional mitigation.

Impacts for Sites Granted Planning Permission

2.519 Adjacent to Abbey Wood Station a Former Chloride Works off Felixstowe Road holds a planning application for a residential development comprising 202 flats. Due to the close proximity of the Abbey Wood Station Worksite, significant noise impacts may arise from Crossrail construction activity. This area has also been identified as being subject to a significant operational noise impact.
<table>
<thead>
<tr>
<th>Works</th>
<th>Potential Impact</th>
<th>Significance</th>
<th>Assumed Mitigation</th>
<th>Residual Impact</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station and track works. Construction of two new turnback sidings to the east of Abbey Wood station. Works to road bridge.</td>
<td>Daytime noise impacts at 400 residential properties. Evening noise impacts at 0 residential properties. Night-time noise impacts at 139 residential properties. Weekend noise impacts at 0 residential properties. Places of worship: Daytime noise impact at St Benet’s Roman Catholic Church. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
<td>Significant</td>
<td>BPM to reduce noise, 2.4 m and 3.6 m high hoarding to screen noise, use of low noise well maintained plant. Also 2.0 m high noise barriers to the extremes of the working areas, either side of the railway. Mitigation = Tier 2</td>
<td>It is estimated that 163 residential properties may be eligible for noise insulation, of which 34 residential properties may be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 237 residential properties. Evening/weekend noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Weekend noise impacts at 0 residential properties. Places of worship: Daytime noise impact at St Benet’s Roman Catholic Church. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
<td>Significant</td>
</tr>
<tr>
<td>Utilities Worksite - Abbey Wood Sewer Diversion</td>
<td>Daytime noise impacts at 10 residential properties. Evening noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Weekend noise impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
<td>Not significant</td>
<td>BPM to reduce noise, 5.0 m high hoarding around the contractors compound, enclosure of static plant associated with night time working. Mitigation = Tier 2</td>
<td>10 properties would be eligible for noise insulation. 0 properties would be eligible for temporary re-housing. With this mitigation: Daytime noise impacts at 0 residential properties. Evening noise impacts at 0 residential properties. Night-time noise impacts at 0 residential properties. Weekend impacts at 0 residential properties. Places of worship: No noise impacts. Educational facilities: No noise impacts. Medical facilities: No noise impacts. Public open spaces: No noise impacts.</td>
<td>Not significant</td>
</tr>
<tr>
<td>Works</td>
<td>Potential Impact</td>
<td>Significance</td>
<td>Assumed Mitigation</td>
<td>Residual Impact</td>
<td>Significance</td>
</tr>
<tr>
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<td>NKL alignment changes, new Crossrail tracks from Plumstead Portal to Abbey Wood station. Inclusion of two new turnback sidings to the east of Abbey Wood station. Intensification of railway traffic on NKL.</td>
<td>Significant changes in operational railway noise at noise sensitive receptors – 67 properties in total. Places of worship: 1 Daytime noise impact at St Benets RC Church. Intensification of railway traffic on NKL. Inclusion of two new turnback sidings to the east of Abbey Wood station.</td>
<td>Significant</td>
<td>Southern Side of corridor 2 m high (above rail) reflective noise barrier from start of route window (extends from SE6 and SE7) to Abbey Wood station. 2.5 m high (above rail) absorptive noise barrier along length of platforms and south of new lines at Abbey Wood station. 2 m high (above rail) reflective noise barrier in front of properties along Coptefield Drive and Halifield Drive. Northern Side of Corridor 2 m high (above rail) reflective noise barrier from start of route window (extends from SE7) to Abbey Wood station. 2.5 m high (above rail) absorptive noise barrier along the length of platforms and to the north of Abbey Wood Station.</td>
<td>Negative Impacts Slight daytime and night-time noise impacts at: 16 – 18 Abbey Terrace (3 properties). N.B 19 Abbey Terrace to be demolished Blocks 1 – 5 Hermitage Close - multiple occupancy (2nd and 3rd floor only – est. 10 properties)</td>
<td>Not significant</td>
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<td>NKL alignment changes, new Crossrail tracks from Plumstead Portal to Abbey Wood station.</td>
<td>Increase in vibration dose value of 75% for one property in Abbey Terrace Increase in vibration dose value of 40% to 100% for 8 properties at Hermitage Close</td>
<td>Significant</td>
<td>Installation of resilient underballast mat for 35 m west of Abbey Wood Station Installation of resilient underballast mat for 170 m at Abbey Wood Station</td>
<td>None</td>
<td>Not significant</td>
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</table>
APPENDIX A

Construction Impact Summary Tables, Route Windows SE1 to SE8