

**Transport and Works Act 1992**

**Transport and Works  
(Inquiries Procedure) Rules 2004**

**CROXLEY RAIL LINK  
ORDER**

**Paul Reid**

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**Proof of Evidence**

**ENVIRONMENT**

**06/09/12**

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# **1 INTRODUCTION**

## **1.1 Personal details**

1.1.1 My name is Paul Jeffrey Reid. I am a technical director within the Engineering and Environment business unit of Mouchel. My specific responsibilities relate to environmental planning and design and the environmental assessment of many forms of development project.

1.1.2 I hold a Diploma in Landscape Design and have been a member of the Landscape Institute for thirty-eight years. I am a Corporate Member of the Institute of Environmental Assessment.

1.1.3 I have twenty-five years experience in the planning, design and environmental assessment of new development with a strong focus on major infrastructure projects. During that time, I have been responsible for directing, co-ordinating and undertaking detailed environmental assessments for over forty major infrastructure schemes and strategies throughout the UK and in Europe.

1.1.4 I currently deliver the Royal Town Planning Institute's (RTPI) masterclass on Environmental Impact Assessment.

## **1.2 Role in relation to the proposed scheme**

1.2.1 My evidence is submitted as the project director and lead consultant for the Mouchel environment team appointed by Hertfordshire County Council to:

- provide advice relating to environmental interests and issues as part of the preliminary planning and design for the proposed scheme; and
- co-ordinate environmental studies and assessments and prepare the Environmental Statement (ES) for the proposed scheme.

1.2.2 My involvement in the project dates back to August 2011 when I was asked to take on the role of technical director for the environmental inputs to the project following

the departure of the previous director from Mouchel to pursue a managerial post in another environmental consultancy. Since then I have overviewed the completion of the environmental studies and assessments identified in the scoping opinion for the Environmental Statement, undertaken the final review and editing of the completed ES prior to authorisation by the project promoters and been the principal environmental advisor within the project planning, design and assessment team .

## **2 SCOPE OF EVIDENCE**

### **2.1.1 My evidence comprises:**

- an explanation of how environmental resources and interests have informed the planning, design and assessment of the proposed scheme;
- an explanation of the purpose and required content of the ES in the context of the Transport and Works Act Order (TWAO); and
- an outline the findings of the studies and assessments reported in the ES published in January 2012 with particular reference to concerns raised in objections which have been submitted in relation to environmental interests.

## **3 PLANNING DESIGN AND ASSESSMENT**

### **3.1 Preliminary planning and design**

3.1.1 Environmental information has played an important part in the planning, design and assessment of the proposed scheme.

3.1.2 Environmental inputs during the preliminary planning and design stages involved the collection and evaluation of environmental data by a team comprising members with expertise and experience related to a wide range of environmental aspects. The team included consultants and specialists in air quality, archaeology, built heritage, contaminated land, geology and geotechnics, aquatic ecology, terrestrial

ecology, protected species, ornithology, noise and vibration, landscape, surface water quality and hydrology, hydrogeology and planning and land use. Data collection comprised desk-based studies of published documents and records, a review of internet based data, preliminary site visits and consultation with statutory consultees and a range of environmental organisations and groups.

3.1.3 The objectives for the environmental team were:

- the establishment of a suitably robust knowledge of the principal environmental resources associated with the proposed rail corridor and surrounding area; and
- identification of those resources which would constitute constraints and which would accordingly inform the development of the design strategy for the proposed scheme.

### **3.2 Environmental Assessment and the Environmental Statement (ES)**

3.2.1 Once a preferred scheme had been identified environmental inputs were focused on assessment of the scheme and preparation of an ES in accordance with the requirements of EC Council Directive 85/337/EEC as amended by EC Council Directive 97/11/EC and Directive No. 2003/35/EC of the European Parliament and Council and required by The Transport and Works (Applications and Objections Procedure) (England and Wales) Rules 2006 (the Rules).

3.2.2 This involved a review by the environment team of the preferred route and environmental data relating to the existing environment within the vicinity of and more widely associated with the route. A scoping report was prepared identifying issues and assessments which the promoters considered should be included in the ES. The scoping report was issued along with a request under Rule 8 of the Rules for a scoping opinion from the Secretary of State for Transport (SoS) in May 2011. The scoping opinion was received from the SoS in June 2011.

- 3.2.3 The information that must be included in an ES for works being promoted under the TWA is detailed in Rule 11 and Schedule 1 of the Rules. The information detailed in Rule 11 must be provided whilst so much of the information specified in Schedule 1 as is relevant to the proposed works must be provided.
- 3.2.4 The ES as submitted contains the information required in Rule 11 and Schedule 1 and the information identified by the SoS in the scoping opinion.
- 3.2.5 The ES describes environmental proposals which include landscape design proposals and environmental mitigation measures which have been developed in light of the findings of the assessments. These include planting proposals, fencing to ensure species such as badger are protected in accordance with statutory obligations and measures which the contractors appointed to construct the scheme will be required to adopt during construction to reduce the impact associated with a number of construction activities. The delivery of the construction related mitigation measures detailed in the ES have been secured by their inclusion in the Code of Construction Practice (CoCP) for the project which is in turn to be secured by way of the planning conditions committed to by the project promoters.

#### **4. THE FINDINGS OF THE ES AND CONSIDERATION OF OBJECTIONS**

##### **4.1 Environmental impacts**

- 4.1.1 Detailed description of the environmental studies and assessments undertaken and the findings is provided in chapter 7 and chapters 8 to 17 of the ES. In the following sub-sections of my evidence I outline the principal issues associated with the environmental topics considered and address concerns raised in objections which have been submitted following submission of the TWAO documentation.

## **4.2 Air quality**

- 4.2.1 The assessment related to air quality once the proposed scheme is operational has demonstrated there will be slight benefit in relation to local air quality and also in relation to greenhouse gas emissions as a result of a reduction in traffic on the local road network.
- 4.2.2 With regard to impacts during construction, concern has been raised that construction of the proposed scheme will result in dust and dirt being deposited at nearby properties and communal facilities.
- 4.2.3 The assessments have recognised that dust will be generated, particularly during excavation and modification to cutting and embankment slopes. Measures which are routinely adopted on construction sites where such activities are required have accordingly been identified and included as part of the proposed construction mitigation. These are detailed in section 8.5.3 of the ES and have been included as part of the CoCP. With these measures in place it has been concluded that impacts will be no greater than temporary and moderate and that they will generally be temporary and slight. The assessments have also demonstrated that emissions associated with construction traffic delivering and removing plant and materials will be very low in the context of existing concentrations of traffic related pollutants and that there will, accordingly, be no material impact.

## **4.3 Cultural heritage**

- 4.3.1 The assessments have demonstrated there will be no impacts on known archaeological or built heritage resources greater than slight and that the likelihood of there being impacts of high magnitude relative to unknown sites and features of higher cultural heritage value is low, and therefore, unlikely to be significant. A Working Scheme of Investigation will nonetheless be agreed with the County Archaeologist which will ensure that sites and features identified as being affected

and any currently unknown features or sites which are discovered will be adequately investigated and recorded.

- 4.3.2 Concern has been raised that the discontinuation of services to Watford Metropolitan Station will result in the deterioration of the existing grade 2 listed building. LUL has confirmed that the buildings and fabric of the station as a whole will be maintained to ensure there is no deterioration in the condition or composition of the listed building. Potential future use has, as of yet, not been identified pending the outcome of the application. Subject to the outcome, alternatives for future use will be considered taking into account the building's listed status and the procedures which owners of such assets are required to pursue in the context of the statutory protection they are afforded.

#### **4.4 Ecology**

- 4.4.1 The assessments have demonstrated that with the proposed design and mitigation measures identified in relation to designated sites, habitats and associated fauna there will be no significant effects on the conservation status of the resources or on their combined contribution to biodiversity value locally.
- 4.4.2 Concerns raised in objections relate to the waterways crossed by the proposed scheme, the disused branch line east of Ascot Road as an important green corridor within the town and species including badger, slow worm and bats associated with the disused branch line and neighbouring areas.
- 4.4.3 In relation to the waterways crossed by the proposed scheme, the assessment has concluded the use of open span structures over the River Gade and Grand Union Canal and retention of existing structures over the River Colne will involve minimal loss of marginal or aquatic habitat at localised points along these extensive watercourses/ecological corridors. It has also been demonstrated that with the adoption of mitigation measures as detailed in section 10.5.27 of the ES that

potential impacts, such as sedimentation or spillage associated with construction across the watercourses will be appropriately addressed.

4.4.4 A specific point of concern has been raised in relation to the requirement to replace an existing culvert carrying an un-named watercourse beneath the existing embankment which formed part of the branch line between the Ascot Road dual carriageway and the River Gade. The proposals provide for the introduction of a new and larger culvert along the existing line of the watercourse and the reinstatement of the profile in the channel of the watercourse and the marginal vegetation where it enters and exits the new culvert. This will ensure that the natural form and flow characteristics of the watercourse are safeguarded and the ecological value of existing green corridor is maintained. The appointed contractors will be required to prepare and include a specific method statement for these works as part of the finalised CoCP.

4.4.5 In relation to the value of the existing tree-lined disused branch line as a green corridor, the assessment has noted there will be temporary fragmentation of the tree and scrub canopy along some 50% of the corridor between the proposed Ascot Road station and Stripling Way as sections of cutting and embankment slope are re-graded as described in section 1.1.4 of Martin Morris's evidence (CRL/4/2). The proposals do, however, provide for the replanting of the sections which will be removed with native tree and shrub species and with mixes which will serve to enhance the diversity of the existing planting and the restored green corridor.

4.4.6 In relation to fauna associated with the proposed scheme corridor and neighbouring areas, the presence of a number of species has been established as part of the surveys and assessments undertaken. Appropriate design and construction-related measures have been identified as described in sections 10.5.34 to 10.5.56 of the ES to ensure the identified species are safeguarded in

keeping with their nature conservation value and statutory requirements specific to each. These measures include:

- pre-construction surveys for breeding birds, badgers and bats;
- the adoption of timing constraints relative to clearance of existing tree and shrub planting should the presence of breeding birds be established during the surveys;
- the introduction of fencing to exclude badgers from working areas during construction and from the operational rail corridor upon completion of construction;
- clearance of habitats and trapping of reptiles to exclude them from working areas during construction; and
- the introduction of bat boxes along the rail corridor.

4.4.7 The appointed contractors will be required to prepare and include specific method statements relating to pre-construction surveys, fencing during construction and timing of clearance for the works as part of the CoCP for the contract.

## **4.5 Geology and soils**

4.5.1 The assessments associated with geology and soils established that with appropriate investigations and identified mitigation measures in place it is unlikely the proposed scheme will have any significant effect on the geology and soils associated with the proposed scheme corridor or on at-risk receptors and construction workers. Further ground investigations will be implemented as part of the mitigation measures and will be used to inform the development of detailed working methods.

## **4.6 Townscape and visual impacts**

4.6.1 Issues considered as part of the assessments under townscape and visual impact and raised as concerns in objections relate to impacts on townscape and views associated with the introduction of the proposed viaduct at the western end of the proposed scheme corridor, the value of the tree-lined disused branch line in the townscape and visual impacts associated with the re-introduction of trains along the disused branch line, particularly between Ascot Road and Stripling Way.

### ***Proposed viaduct***

4.6.2 The need for an elevated structure to accommodate the link between the existing Metropolitan Line and the disused section of the former Croxley Branch Line at Ascot Road has been determined by:

- the location of the existing Metropolitan Line on high embankment where it is bridged over Baldwins Lane at Croxley;
- the level of the disused branch line immediately east of the existing bridge over old Ascot Road; and
- the requirement for crossings of the A412, Grand Union Canal, River Gade and Ascot Road dual carriageway.

4.6.3 It was concluded during the early planning and design stages of the project that there would, therefore, be a requirement for a viaduct to facilitate the linkage and maintain the access and continuity for the infrastructure and watercourses crossed by the alignment.

4.6.4 The design of the proposed viaduct has been determined by a combination of factors including appearance, minimisation of disruption, ease of construction and maintenance and cost.

4.6.5 As described in Section 3 of Martin Morris's evidence (CRL/4/2) the detailed design for the structure is yet to be finalised. Important design parameters have, however,

been established. The proposed nine-span design comprises a continuous structure with a steel/concrete composite deck and steel/concrete composite cantilevers. It is a form which provides for simple, conventional and safe construction. It provides a relatively shallow construction depth of deck which serves to reduce the bulk of the structure and allows the maintenance of the required highway clearance over the A412. It enables the width of the piers to be kept to a minimum such that they can take the form of an elongated ellipse which will serve to reduce their bulk when viewed in elevation.

4.6.6 The introduction of an enclosure encasing the steel beams that make up the spans to the structure will ensure what would otherwise appear as a series of straight sections comprising the individual spans appear as a smoothly curved alignment and that the jointing arrangement between the straight sections that form the spans can be concealed.

4.6.7 The result is a structure with relatively open spans which will:

- avoid more significant severance of the local townscape that would result from the introduction of a less expensive structure or the use of earthworks embankments with bridges at the required crossing points;
- require lesser removal of established tree planting than the alternatives; and
- achieve an appropriate balance between appearance and impact, cost and future maintenance.

4.6.8 The relationship of the proposed viaduct to established tree planting associated with the area between the existing Metropolitan Line and Ascot Road is described in detail in the ES (Chapter 12, Section 12.4). This recognises that whilst the viaduct will inevitably be a significant new component in the local townscape, the structure, which will vary in height from ground level to the top of the viaduct parapet from some 11.5m at the tie-in with the existing Metropolitan Line to 8.5m

above ground level will appear below the canopy level of the established tree planting which varies between 15 and 20m in height.

- 4.6.9 The appearance of the viaduct and its relationship to the existing tree planting within the local townscape is illustrated in Figures 1 and 2 in the Appendix A to this evidence (CRL/5/3). They comprise photomontages illustrating how the viaduct will appear in two viewpoints, the first along the towpath that runs alongside the Grand Union Canal in the vicinity of the A412, the second adjacent to the Harvester public house beer garden looking north-east along the A412. These represent the two viewpoints within this area which would be open to larger numbers of the public. Both of these winter views clearly demonstrate the relationship between the viaduct and the principal tree canopy within the area and the extent to which the canopy will reduce the potential prominence from the area as a whole.

***The disused branch line***

- 4.6.10 The removal of tree planting to facilitate the increase from single to dual-track and the re-grading of cutting and embankment slopes between Ascot Road and Stripling Way will partially break the integrity of a locally prominent linear landscape feature. It will also open some views across the corridor between areas of housing, and commercial/business development. The landscape proposals for the link recognise the impact and provide for the res-establishment of tree and scrub planting on the modified slopes. As the proposed planting establishes and begins to mature, the breaks in the existing tree line will be closed and the initial fragmentation of the planting as a distinctive component within the local townscape and as part of the local horizon to views will be substantially reinstated.

***Visual impacts between Ascot Road and Stripling Way***

- 4.6.11 Specific concerns relating to views of trains on the proposed section of the line between Ascot Road and Stripling Way have been raised by residents at Holm Oak

Park, and Stripling Way and by Laurance Haines School to the extent that the appearance of the trains could distract some of the pupils.

- 4.6.12 In the case of Holm Oak Park, existing tree planting along the rail corridor will be removed to enable cutting slopes to be re-graded. Views from the ground floor of the properties and external areas into the adjacent cutting will, however, continue to be screened by a dense evergreen hedge which marks the boundary with the rail corridor. Views from upper floor windows will tend to be focused over the corridor towards and beyond housing on the south side of the corridor. In the longer term they will be closed as the proposed planting closes the opening created during the re-grading of the cutting slopes.
- 4.6.13 In the case of Stripling Way, the removal of tree planting and re-introduction of trains along the disused branch line will open views from upper storey windows, in particular across the rail corridor towards planting on the northern side of the corridor. Whilst the quality of the permanent outlook will not be significantly modified, the appearance of trains at intervals and at the first floor viewing level will result in a sense of intrusion. It has accordingly been concluded that further measures to those detailed in the ES should be provided in the form of a screen extending along the southern margin of the track bed. Figure 3 in the Appendix A to this evidence (CRL/5/3) illustrates the location and height of the proposed screen in relation to properties at 42 and 44 Stripling Way, the properties with the most direct views of the proposed link .
- 4.6.14 In the case of Laurance Haines School, the potential for distraction has been discussed with the head of school and the chair of the governors and it has been agreed that a screen/barrier will be provided along the boundary with the rail corridor. There is, at the present time, no agreement with the school regarding the detailed height and design form of the screen/barrier. Figure 4 in Appendix A to this evidence (CRL/5/3) illustrates a 2.4m high screen located on the existing boundary

between the school and the railway land. This is the location and height which the promoters consider most appropriate. As the figure clearly indicates, a screen/barrier in this location of the proposed height will ensure children will not be able to view trains as they pass by and that the potential for visual distraction will be low. I discuss the value of the proposed screen/barrier relative to potential distraction associated with train-related noise in section 4.7 of my evidence.

#### 4.7 **Noise and vibration**

4.7.1 Concerns raised in relation to noise and vibration include:

- construction noise in close proximity to properties located in the vicinity of the proposed viaduct, along the section of the disused line between Ascot Road and Wiggshall Road and along the existing Overground line between Wiggshall Road and Watford Junction;
- noise associated with the introduction of trains on the proposed viaduct and along the former single track line between Ascot Road and Wiggshall Road; and with the proposed increase in frequency of trains along the existing Overground Line between Wiggshall Road and Watford Junction; and
- awareness of vibration either during construction or once the train service is running.

##### ***Construction-related noise***

4.7.2 The assessment reported in the ES recognises there will be disturbance associated with construction-related noise and demonstrates the basis upon which construction noise limits will be established and agreed with Environmental Health Officers (EHOs) within Watford Borough Council and Three Rivers District Council.

4.7.3 The approach to identifying potential noise levels and establishing appropriate control measures has been based on the guidance provided in British Standard

(BS) 5228, Code of practice for noise and vibration control on construction and open sites – Part 1: Noise. The BS acknowledges that noise is inevitably associated with built development and emphasises the need to strike a balance between construction-related noise and the adoption of practicable measures which can alleviate noise. Significant emphasis is placed on communication between the promoter and their contractors and people within the communities who will be affected.

4.7.4 Application of the guidance and the principles which underscore it up to submission of the Orders and ES has involved:

- surveys in the vicinity of a number of properties located closest to the proposed line to establish noise levels as they are currently experienced by residents and users of facilities and who will, therefore, be most likely to experience disturbance associated with construction activity;
- identification of noise levels specific to items of construction plant which are typically used for the type of work proposed (the levels have been based on guidance in BS5228);
- calculation of indicative noise levels which it would be appropriate to adopt as thresholds for construction activity based on methods recommended in BS5228; and
- identification of construction noise mitigation measures and protocols to ensure potential noise levels are controlled as far as is practicably possible.

4.7.5 The approach to date has necessarily been indicative, pending the decision to grant powers or not and the appointment of a contractor should the powers be granted. Should powers be granted, it will be the responsibility of the contractor to develop the proposals for the construction of the proposed scheme, detailing the

method and timing of construction and the type of plant to be used. It will be a requirement of the contract that the contractor, in doing this, takes into account commitments made in the ES concerning the type of plant used and the control of environmental impacts, including construction-related noise, defined in the mitigation proposals described in the ES.

- 4.7.6 This will involve liaison with the Environmental Health Officers (EHOs) at Watford Borough Council and Three Rivers District Council and the application of the guidance in BS 5228 in the context of the detailed proposals. The agreed measures will be formalised as part of the CoCP for the contract.
- 4.7.7 As indicated in the ES, certain of the construction activities, such as piling, will result in noise levels at some locations in the vicinity of the works which will exceed the general construction thresholds identified in accordance with BS5228. This is a situation which the guidance in the BS provides for. Such activity will be subject to detailed discussion between the contractor and promoters and the contractor and EHOs. The objective will be to ensure the construction plant chosen, the programming and duration of relevant activities and the control measures adopted will control levels and their duration to the best practicable minimum taking into account the effectiveness of the construction method and allowing for any other environmental considerations. Activities such as piling will not be undertaken outside of the daytime working period (7-00am – 6.00pm). The measures, levels and protocols agreed with the EHOs will be formalised in the CoCP for the contract and will form the subject of a Section 61 agreement with the councils as provided for under the Control of Pollution Act
- 4.7.8 Where it is anticipated levels exceeding the threshold will be likely to occur, the proposed mitigation measures provide for prior notification of such activities to residents and occupiers/users of non-residential buildings such as schools and other community facilities. This will involve an explanation of the activity, the

characteristics of the associated noise, the timing and likely duration of the activity, anticipated noise levels and the means of contact between the contactor and receptors to ensure people will be able to communicate any further concerns or ask for further information.

- 4.7.9 As indicated in the ES, the period during which noise levels associated with activity such as piling will occur will be of short duration in any one location (2-6weeks). This represents the period within which the activity will occur. The duration of the activity within the period will vary between locations but will not be continuous over the period.
- 4.7.10 A number of the objections make reference to construction noise currently being experienced as a result of works being undertaken on the Overground Line between Wiggshall Road and Watford Junction. These works have involved major replacement of existing infrastructure along this section of line whereas the works proposed as part of the scheme and associated with the Overground Line are, by comparison, of a minor nature and will be of much shorter duration.

***Operational train noise***

- 4.7.11 The assessment reported in the ES recognises that trains providing the service on the proposed link will increase noise for residents and occupiers/users of community facilities located in the vicinity of the proposed scheme. The design of the modern rolling stock which will provide the service, adoption of high standards of rolling stock maintenance, including lubrication of moving parts, and use of continuously welded track will ensure noise levels are limited.
- 4.7.12 Notwithstanding these design and maintenance measures, for those people located in the vicinity of sections of the link between the Grand Union Canal and the merge with the existing Overground Line at Wiggshall Road the experience will be one whereby the passing of trains will become a new and distinct noise event. For

those located in the vicinity of the existing Overground Line, there will be an increase in the frequency of such noise events which are currently part of the noise experienced by virtue of the existing Overground trains.

- 4.7.13 The assessments reported in the ES have demonstrated that the predicted noise throughout the new sections of the proposed link, taking into account the predicted contribution that these events would be likely to make, would not result in levels which are defined in the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996 as being levels at which provision should be made for noise insulation.
- 4.7.14 The method adopted for the assessment of operational noise has been the Department for Transport's Calculation of Rail Noise (CRN). It is an approach which has been developed in light of the specific characteristics of rail-related noise and one which is and has been applied throughout the UK for many years.
- 4.7.15 The predicted daytime noise levels for properties closest to the proposed scheme using the methodology defined in the CRN range from 51 to 67 dB  $L_{Aeq}$  for peak hours, with the large majority being less than 60 dB  $L_{Aeq}$ . The stipulated level in the Noise Insulation Regulations at, or above which, insulation should be provided is 68 dB  $L_{Aeq}$ .
- 4.7.16 The predicted night-time levels for properties closest to the proposed scheme using the methodology defined in the CRN range from 51 to 58 dB  $L_{Aeq}$ . The stipulated level in the Noise Insulation Regulations at, or above which, insulation should be provided is 63 dB  $L_{Aeq}$ . The night-time levels exclude the period between 01.00 and 05.00 when there will be no trains in service.
- 4.7.17 Notwithstanding the findings relative to the Noise Insulation Regulations, two events have occurred since publication of the ES which have led to the promoters re-considering the approach to mitigation in the context of the proposed scheme.

- 4.7.18 Firstly, the assessment of operating noise levels reported in the ES has been updated to reflect a change in proposed service levels to 6 trains in each direction per hour between 6.00am and midnight and one train in each direction between midnight and 1.00am and 5.00am and 6.00am.
- 4.7.19 Secondly, LUL have been considering in detail the approach to mitigation of train-related noise where there are proposals for the construction of a new line. As a result the company has recently published a set of guidelines 'Noise and Vibration Asset Design Guidance (G1323)'. The guidelines identify a design target for train related noise of less than a 5 dB(A) increase relative to residential and other sensitive receptors based on levels predicted in accordance with CRN. An abstract from the document which refers to the design target is provided in Appendix B to this evidence.
- 4.7.20 The results of the updated assessment relative to the representative receptors detailed in the ES are scheduled in Table 1. The results demonstrate that none of the receptors will qualify for assistance in accordance with the provisions of the Noise Insulation (Railways and Other Guided Transport Systems) Regulations but that two, receptors at the Gateway development (Receptor 3) and receptors on Cardiff Road to the west of the merge between the proposed link and existing Overground Line (Receptor 7) meet the 5 dB(A) parameter identified in LULs recently published guidelines. The project promoters have accordingly decided provision should be made for the introduction of environmental barriers in these two locations as indicated in Figure 5 in the Appendix A to this evidence (CRL/5/3). The proposed barrier at the Gateway will be of the order of 3m high and will be incorporated into the detailed station design in the form of a back wall extending along the rear of the platform to the south of the properties. The barrier will be extended beyond the platform to ensure mitigation is provided to the full frontage of the properties. The proposed barrier at Cardiff Road will be some 1.8m high and

will comprise a proprietary design such as a timber barrier of the type commonly seen on motorways. The results of the assessment, allowing for the introduction of the barriers, indicate the increase in noise in these two locations will be reduced from some 6 dB(A) to 1.5 dB(A).

**Table 1 – Updated operational noise assessment**

Receptor	Monitored Levels $L_{Aeq, 1hr}$	110 trains /day each way			
		No barrier $L_{Aeq}$	Increase	Barrier $L_{Aeq}$	Increase
1	56.8	57.1	0.3		
2	56.1	56.2	0.1		
3	48.7	54.5	5.8	50.4	1.7
4a	50.5	53.5	3.0		
4	50.1	53.2	3.1		
5	66.6	66.6	0.0		
6	48.8	52.3	3.5		
7	50.2	56.2	6.0	51.7	1.5
8	50.8	50.8	0.0		
9	55.9	58.1	2.2		
10	57.2	57.6	0.4		
11	61.3	61.3	0.0		

4.7.21 Concerns have been raised in letters of objection that train-related noise associated with an increase in service frequency will be unacceptable for properties located in the vicinity of the existing Overground Line at Neal Street, Dyson Court and Shaftesbury Road. As can be seen from the figures in Table 1 levels for representative receptors reflecting the proximity of these properties (Receptors 8 and 9) demonstrate that the predicted increases in noise levels will be no greater than 2-2.5 dB(A).

4.7.22 Concern has been raised by representatives of Laurance Haines School, a number of parents of pupils and some residents in the vicinity of the school that noise associated with trains running close the school boundary will, in combination with

the appearance of the trains beyond the boundary prove a distraction to some pupils,

4.7.23 As detailed in 4.6.14, the project promoters have held discussions with the school and concluded it would be appropriate to provide an environmental screen/ barrier between the school and the railway land. The proposal is that the screen/barrier will not only serve to prevent distraction associated with views of the trains but will mitigate train-related noise, particularly from the temporary classrooms which are the classrooms most closely located to the proposed scheme. The location and extent of the proposed screen/barrier is indicated in Figure 5 in the Appendix A to this evidence (CRL/5/3). A section indicating the location and height of the screen/barrier relative to the school buildings and playground is provided in Figure 4 in the Appendix A to this evidence (CRL/5/3). A screen/barrier in this location will have the effect of reducing the unmitigated increase in noise from the parts of the temporary classrooms and parts of the playground closest to the proposed scheme from some 5 dB(A) to less than 1 dB(A). This is a low level of increase which the promoters consider does not warrant consideration of further mitigation measures such as the introduction of double glazing.

4.7.24 A number of owners of house boats at Cassio Wharf have also raised concern in objections that noise associated with trains crossing the viaduct will have a detrimental effect on the amenity value of the moorings at the wharf. In light of these concerns changes in noise levels associated with trains passing over the viaduct in the immediate vicinity of the wharf have been calculated. These have been based on monitoring of existing noise levels at the wharf immediately north of the existing railway bridge, prediction of train related noise using the acoustic model for the proposed scheme and subsequent calculation of the anticipated noise levels based on the combination of the monitored levels and modelled levels. The results of the assessment have indicated there will be an increase in noise

levels from the existing monitored level of 53dB(A) to levels of between 54-56dB(A). The increase will, therefore, have an adverse impact on noise in the vicinity of the wharf. The impact will, however, be slight in terms of the impact ratings described in the ES and is below the 5dB(A) increase which LUL has adopted as an indicator that mitigation should be considered.

### ***Vibration***

- 4.7.25 Consideration of the extent to which potential ground-borne vibration during construction would be likely to result in concern that could give rise to complaint or might potentially result in cosmetic damage (such as hairline cracks) to buildings has been informed by surveys undertaken to monitor existing levels of ground-borne vibration in the vicinity of the proposed link.
- 4.7.26 The results of the surveys have been compared to guidance provided in BS6472 Guide to evaluation of human exposure to vibration in buildings, and BS7385 Evaluation and measurement for vibration in buildings - Guide to damage levels from groundborne vibration. BS6472 relates vibration levels to the likelihood of complaint. BS7385 provides guidance relating to levels at which cosmetic damage is likely to occur.
- 4.7.27 Based on data derived from the surveys it has been established that current levels of ground-borne vibration are markedly lower than the guidance levels detailed in the two standards. This would suggest that the risk of complaint or cosmetic damage during construction is likely to be low.
- 4.7.28 In relation to vibration associated with trains providing the service on the link, the detailed design will involve the application of appropriate standards relative to earthworks stability, track-bed design and tolerances for the installation of the continuously welded track. In light of these required design considerations it has

been concluded the risk of disturbance or cosmetic damage associated with operation of the proposed scheme will be low.

#### 4.8 **The water environment and drainage**

4.8.1 Issues considered as part of the assessments under the water environment and drainage and raised as concerns in objections relate to impacts on surface water quality and flow characteristics, groundwater quality and supply and potential flood risk as a result of the presence and operation of the proposed scheme within the River Colne and River Gade floodplains.

##### ***Surface water quality***

4.8.2 Risks identified in relation to surface water quality and flow characteristics relate to the discharge of run-off collected by the proposed drainage scheme to existing watercourses, the design of new structures over watercourses and pollution of watercourses where construction is required in close proximity to existing watercourses.

4.8.3 The proposals provide for surface water discharge at four locations on the River Colne. All four discharges provide for the passage of the drainage waters via petrol interceptors and silt traps and the regulation of discharge flow rates to a design standard of 5l/sec/ha as required by the Environment Agency. These are design measures which will ensure that the magnitude of impact will be negligible and that the proposed scheme will accordingly be neutral in relation to operational impacts associated with surface water discharge to existing watercourses. Planning conditions relating to the measures have been agreed with the Environment Agency subject to the approval of the local planning authorities.

4.8.4 The principal risk to surface water quality during construction will arise as a result of potential release of sediments associated with earthworks, aggregates and fines within storage areas and chemical pollutants such as cement, fuels and oils. The

potential for release of pollutants will arise where earthworks, construction compounds, storage areas and working areas will be in close proximity to any of the five watercourses which cross the alignment of the proposed scheme and where works are required to existing structures over watercourses.

- 4.8.5 As described earlier in section 4.4.2 (ecology) the use of open span structures over the River Gade and Grand Union Canal and retention of existing structures over the River Colne will involve minimal disruption at the crossing points whilst the adoption of mitigation measures as detailed in section 10.5.27 of the ES will ensure that potential impacts, such as sedimentation or spillage associated with construction across the watercourses will be appropriately addressed.

***Groundwater quality and supply***

- 4.8.6 The principal risks to groundwater quality and supply relate to the need for the use of piled foundations for the construction of the viaduct and at the proposed stations as a potential conduit for contaminants in an area which is underlain by a vulnerable aquifer and the potential for infiltration of potentially polluted surface water run-off leading to contamination of the aquifer.
- 4.8.7 The construction related risk has been addressed by a commitment to adopt the use of bored piles. Once material from the initial bore has been abstracted, the borehole will be lined to prevent encroachment of contaminated material that may otherwise be deposited into the borehole as it is deepened. In the context of the scale of the works, the very low order of risk in light of the proposed method of piling and the extent of the aquifer, the risk to the aquifer will be negligible.
- 4.8.8 Proposed procedures relating to detailed design and methods of working during construction relating to the vulnerable aquifer and contaminated land have been agreed with the Environment Agency subject to the approval of the local planning authorities.

4.8.9 The risk of infiltration has been addressed by the use of a sealed piped drainage system with oil interceptors and silt traps and geo-synthetic lining of ballast and drainage trenches will ensure that pollutants carried in surface water run-off are captured and prevented from percolating to the underlying aquifer.

***Flood risk***

4.8.10 Concerns which have been raised in relation to flood risk include impacts associated with the loss of existing floodplain capacity and obstruction of overland flood flows.

4.8.11 With regard to floodplain capacity, construction of the proposed scheme will involve localised extension of existing embankment slopes into the western margin of the River Colne floodplain and consequent displacement of some 500m<sup>3</sup> of existing floodplain capacity. Compensatory provision has accordingly been made on a level for level basis within an area of land located between the River Colne side channel and the proposed scheme thus ensuring that existing capacity will not be reduced.

4.8.12 With regard to obstruction of overland flows, the use of the open span viaduct within the River Gade valley, replacement of the existing culvert on the un-named watercourse between the River Gade and Ascot Road dual carriageway with a larger culvert on the alignment of the existing culvert and the retention of the existing structures crossing the River Colne will ensure there will be no new obstruction to existing flood flows.

4.8.13 Proposed procedures relating to flood risk and finalisation of the Flood Risk Assessment for the proposed scheme during detailed design have been discussed with the Environment Agency and proposed planning conditions have been agreed subject to the approval of the local planning authorities.

#### 4.9 **Traffic and transport**

4.9.1 It has been concluded that once the scheme is operational, the reduction in congestion and enhanced accessibility to public transport for local journeys and journeys to and from the wider area, including London, will be of significant practical and economic benefit to people within Watford and the surrounding areas.

4.9.3 The assessment of additional traffic expected during construction has concluded that the overall impact on existing traffic flows is unlikely to be significant. Minor disruption due to the construction works is not expected to have a significant effect on pedestrians, cyclists or users of bus and rail services.

#### 4.10 **Land use and community effects**

4.10.1 Principal concerns raised relate to the Watford Road Play Area, Rickmansworth Sea Cadets and Morris Minors, Cassio Wharf and the Grand Union Canal, Holywell Allotments, Harwoods Recreation Ground and Laurance Haines School.

##### ***Watford Road play area***

4.10.2 Issues related to the continued use of the play area are addressed in Mike Adams evidence (CRL/7/2). The issue of exchange land relative to the status of the play area as public open space is addressed in Rob Snell's evidence (CRL/6/2).

##### ***Rickmansworth and Watford Sea Cadets and Morris Minors playgroup***

4.10.3 The location of the proposed viaduct in close proximity to the sea cadets and playgroup will be detrimental to the amenity value of the building and site used by both groups by virtue of associated visual impact and noise. The redesign of the adjacent play area will provide for the inclusion of a hedgerow with specimen trees along the boundary with the site used by the two groups. This will reduce the immediate visual impact, the impact on amenity will, however, remain detrimental.

### ***The Grand Union Canal***

4.10.4 Issues related to the continued use of the moorings at Cassio Wharf are addressed in Mike Adams evidence (CRL/7/2). In the context of the canal as an important and extensive green corridor used by members of the public, impacts at Cassio Wharf will be highly localised and not significant to the overall amenity value of the waterway.

### ***Holywell Allotments***

4.10.5 Construction of the proposed Watford Hospital Station will involve the permanent loss of some 35m<sup>2</sup> of land along the northern margin of the allotments. It is land which is outside of any of the plots and which is on the margin of an area which has been planted with trees. As such there will be no impact on the functional value of the allotments.

### ***Harwoods Recreation Ground***

4.10.6 Issues related to the continued use of the recreation ground are addressed in Mike Adams evidence (CRL/7/2)

### ***Laurance Haines School***

4.10.7 I have outlined the impacts related to the proximity of Laurance Haines School to the reinstated rail corridor under my evidence on townscape and visual impacts (section 4.6.14) and noise and vibration (section 4.7.22 – 4.7.23).

## **5 WITNESS DECLARATION**

I hereby declare as follows:

- This proof of evidence includes all facts which I regard as being relevant to the opinions that I have expressed and that the inquiry's attention has been drawn to any matter which would affect the validity of that opinion;

- I believe the facts that I have stated in this proof of evidence are true and that the opinions expressed are correct: and,
- I understand my duty to the inquiry to help it with matters within my expertise and I have complied with that duty.