
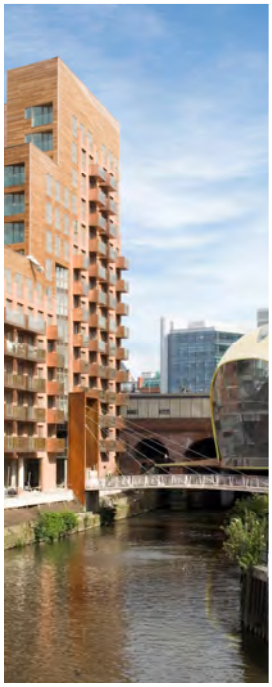
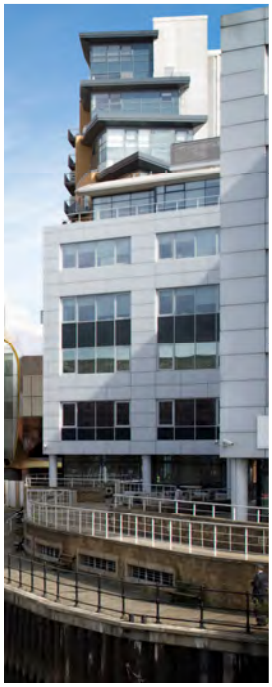

The Leeds Railway Station (Southern Entrance) Order

Flood Risk Assessment
296480RPT03

Revision D

April 2012
Metro & Network Rail

METRO

Network Rail

Mott MacDonald

The Leeds Railway Station (Southern Entrance) Order

Flood Risk Assessment
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C	5th April 2012	P Millard	R Gamble K Leather	J Smith	Final Issue
D	5th April 2012	P Millard	R Gamble K Leather	J Smith	Version for TWAO submission

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Abbreviations

EA	Environment Agency
FAS	Flood Alleviation Scheme
FRA	Flood Risk Assessment
km	Kilometre
LCC	Leeds City Council
LSSE	Leeds Station Southern Entrance
m	Metre
mAOD	Metres above Ordnance Datum
NPPF	National Planning Policy Framework
SFRA	Strategic Flood Risk Assessment
SoP	Standard of Protection
TWAO	Transport and Works Act Order

Executive Summary

Mott MacDonald has been appointed by Metro to undertake a Flood Risk Assessment (FRA) to inform and support the delivery of the Leeds Station Southern Entrance (LSSE) scheme. The scheme is intended to provide a new direct pedestrian link between Leeds railway station and redevelopment to the south of the railway viaduct. It comprises a concourse deck situated over the River Aire within an enclosed building which will provide pedestrian access to the station western footbridge (upper concourse) and ground level.

Metro is obliged to carry out a FRA to ensure that it meets its obligations under the National Planning Policy Framework (NPPF) and the accompanying Technical Guidance to the NPPF as part of the Transport and Works Act Order (TWAO) application process for the proposed development.

The purpose of this report is to present the results obtained from the FRA procedure carried out in accordance with the requirements and recommendations of NPPF. As such, it incorporates the particular requirements of the Environment Agency (EA), Leeds City Council (LCC), and the Leeds Strategic Flood Risk Assessment (SFRA). This procedure is dependent on the validity of the current conditions data available to Mott MacDonald as stated in this report, and the predictions of future climatic change which are implicit in NPPF. In terms of flood risk, Mott MacDonald's assessment has been made in accordance with the available EA and the Leeds SFRA Flood Zone Maps, and the results of hydraulic modelling undertaken previously by Faber Maunsell / Aecom.

The primary source of flood risk to, and resulting from, the proposed development, is considered to be fluvial flooding from the River Aire. The outline scheme design has been carried out in accordance with the requirements and recommendations of the Leeds SFRA, NPPF, LCC and the EA. The scheme is considered to be Essential Infrastructure (flood risk vulnerability category), and will be constructed in Flood Zones 2 (medium probability), 3a (high probability) and 3b (functional floodplain), as defined by the Leeds SFRA Flood Maps. The NPPF Sequential and Exception Tests have been applied, taking into account advice and recommendations from LCC and the EA, and are considered to have been passed. Therefore the level of flood risk to the proposed development is considered to be within acceptable limits.

The building structure and associated link bridges have been designed with reference to the predicted 1 in 200 year plus climate change fluvial flood level of 28.12m AOD upstream of the Dark Neville Street Bridge.

- the finished floor level of the LSSE will be set at 29.1m AOD,
- the LSSE soffit level is designed to be 28.63m AOD which provides 510mm freeboard and 980mm to the finished floor level;

The lift shaft and escalator pits have been designed with reference to the predicted 1 in 200 year plus climate change fluvial flood level of 27.84m AOD downstream of the Dark Neville Street Bridge.

- the escalator pit would infringe on the freeboard however, it is proposed to construct a streamlined deflector to minimise the risk of flood debris collecting against or damaging the upstream face of the pits;

- the lift shaft pit would intrude into the design flood risk level but is generally in line with the existing (and extended) piers so should not unduly obstruct water flow;

The LSSE will incorporate the following flood risk management measures:

- it is recommended that the Leeds station operators register with the Environment Agency flood warning scheme, such that the LSSE may be closed in advance of any forecast extreme flood events, with safe access to the station maintained via the existing north entrances.

- hydraulic modelling of the LSSE proposals demonstrate that the extended bridge piers, localised widening of the bridge piers (due to the new lift pits) and protruding escalator pits will not affect the predicted 1 in 200 year plus climate change fluvial flood levels;

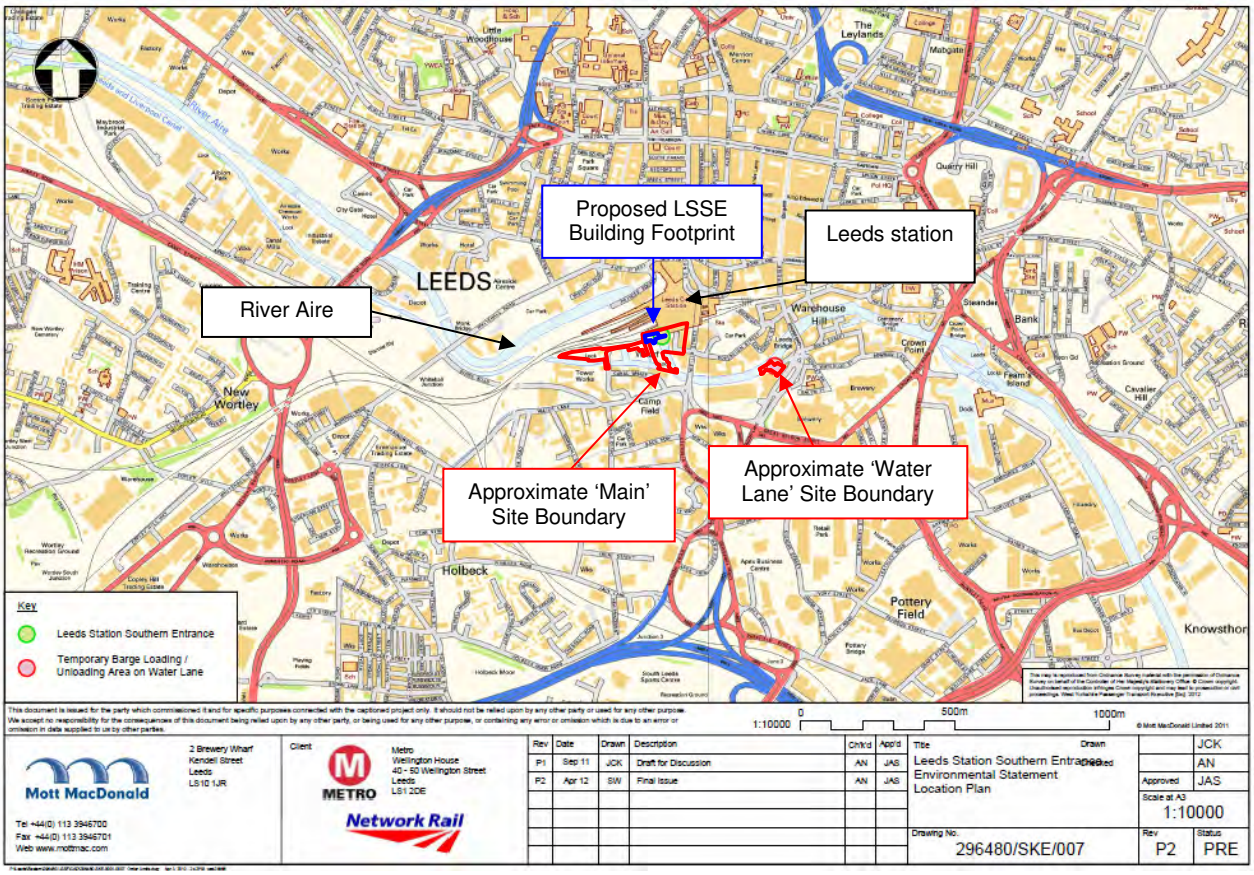
The residual flood risks have been assessed, and are considered to be within acceptable limits. Therefore, subject to implementation of the recommendations of this report it is anticipated that the proposed development should be considered acceptable from a flood risk standpoint.

1. Introduction

1.1 Overview

The Leeds Station Southern Entrance (LSSE) scheme is intended to provide a new direct pedestrian link between the Leeds railway station and redevelopment to the south of the railway viaduct. It comprises a concourse deck situated over the River Aire within an enclosed building which provides pedestrian access via stairs, escalators and lifts to the station western footbridge and upper concourse. The building is supported on piers within the river and has link bridges to either bank and also to Dark Neville Street within the railway viaduct structure itself. The location of the LSSE is shown in Figure 1.1 below.

Figure 1.1: Site location plan



Source: Mott MacDonald

Metro and Network Rail are together seeking powers for the LSSE scheme under sections 1 and 3 of the Transport and Works Act 1992 (TWA). A Transport and Works Act Order (TWAO) is required under sections 1 and 3 of the 1992 Act to authorise:

a) the construction and maintenance of a new station entrance at Leeds Railway Station;

b) the carrying out of works in the Aire and Calder Navigation adjacent to the southern boundary of Leeds Railway Station and associated with a) above;

c) the carrying out of other works and the exercise of powers required in connection with or ancillary to the matters set out in items a) and b) above; and

d) the acquisition of land and rights over land required in connection with items a), b) and c) above.

Although the LSSE scheme gained a grant of full planning approval in May 2010, the promoters now require works powers and therefore a TWAO application will be made. In addition a request for a direction as to deemed planning permission will also be submitted to the Secretary of State under section 90(2A) of the Town and Country Planning Act 1990. An application for conservation area consent is also being submitted in respect of works proposed to be undertaken at Water Lane, Leeds as part of the overall scheme. It is intended that an application for an order will be submitted to the Secretary of State in Spring 2012.

1.2 Scope and Limitations of the Report

Mott MacDonald has been commissioned by Metro to undertake a Flood Risk Assessment (FRA) for the LSSE scheme. This report presents a review of the existing available information and sets out the requirements of the National Planning Policy Framework (NPPF), and those of the Environment Agency (EA) in relation to flood risk and drainage. The scheme is considered to be Essential Infrastructure (flood risk vulnerability category) to be constructed in Flood Zones 2 (medium probability), 3a (high probability) and 3b (functional floodplain), Sequential and Exception tests have been applied taking into account advice and recommendations from the EA.

Mott MacDonald has followed accepted procedure in providing the services but given the residual risk associated with any prediction and the variability which can be experienced in flood conditions, Mott MacDonald takes no liability for and gives no warranty against actual flooding of any property (Client's or third party) or the consequences of flooding in relation to the performance of the service. This report has been prepared for the purposes of supporting a TWAO application only.

1.3 Purpose of the Report

This FRA has been prepared as a supporting document to the Environmental Statement and TWAO application. It will consider the flood risk to the proposed LSSE scheme and will assess the influences that the proposed development may have on the flood risk to adjacent areas.

The purpose of this report is to:

- identify measures to be incorporated into the design of the scheme such that flood risk is not increased and where possible reduce the rate of surface water runoff;
- satisfy the requirements of NPPF; and
- demonstrate that the recommendations of the EA have been incorporated into the proposal.

The report has been prepared with the primary aim of submission to the Environment Agency in order that its flood risk and development control specialists can consider the proposals in its role as statutory consultee. The report has therefore been written to target this audience. Its ultimate purpose is to provide the EA with sufficient confidence in the scheme so that they will not object to it, or at least to provide a basis for withdrawing an objection.

2. Existing Conditions

2.1 Study Area

2.1.1 Overview

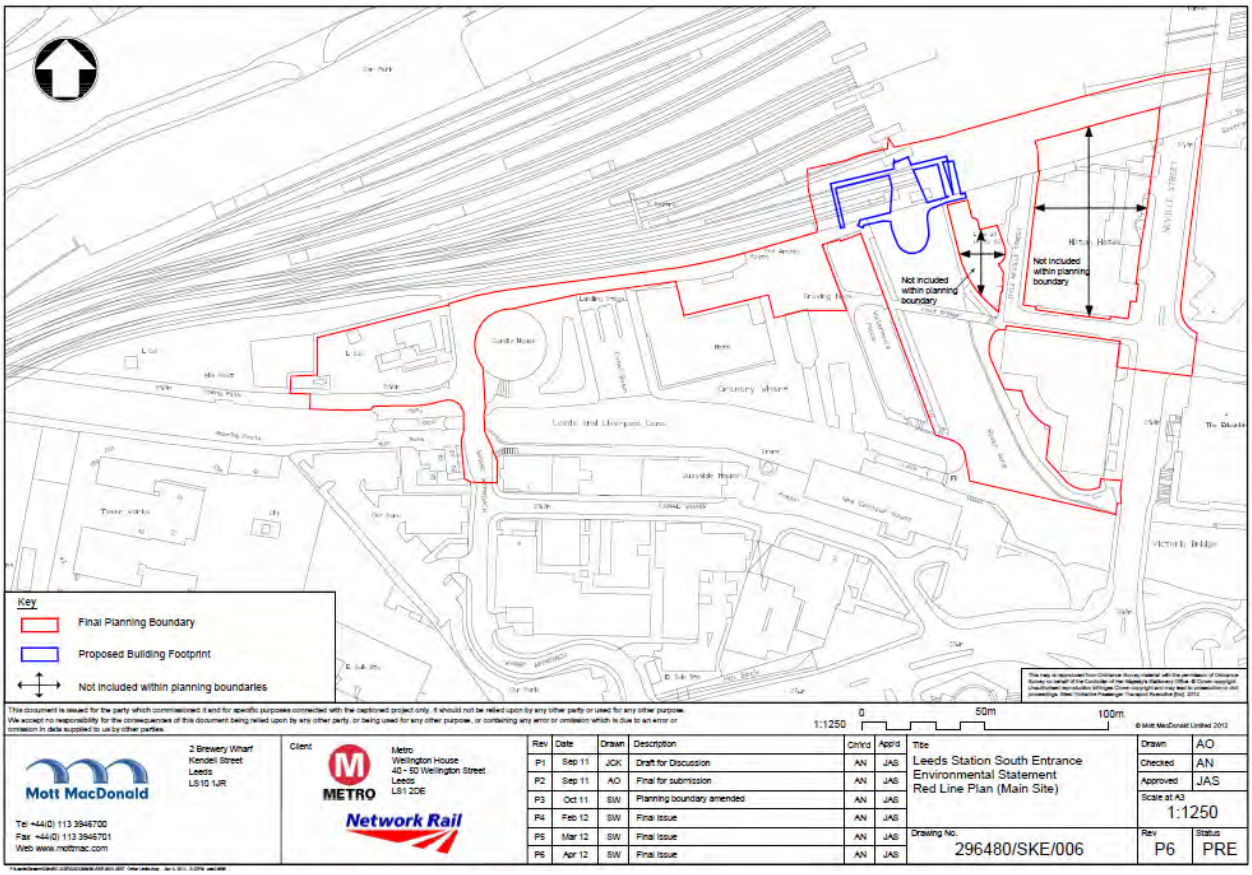
The extent of the study area is shown in Figure 1.1. The application boundary consists of two land parcels, the 'Main' site, adjacent to Leeds station, and the 'Water Lane' site, on the south bank of the River Aire.

2.1.2 Main Site

The 'Main' site incorporates areas around the south of Leeds station, beyond the footprint of the proposed LSSE building, which will be used for storage and access purposes during the construction phase of the development. The extent of the 'Main' site is shown in Figure 2.1, and encompasses a total area of approximately 1.9ha.

The main site is bounded to the north by the Leeds station and the Viaduct structure over the River Aire. To the south, the main site is bounded by Granary Wharf, the River Aire and the Leeds and Liverpool Canal. The main site is bounded by Neville Street to the east and the railway lines leading to Leeds station to the west. The main site includes the following existing infrastructure; Little Neville Street, Dark Neville Street Bridge over the River Aire (ref. DOL2/9A) two foot bridges; one immediately adjacent to Dark Neville Street Bridge (referred to as Dark Neville Street footbridge), and one just down stream (referred to as Little Neville Street footbridge, ref. AL-001-008), the Leeds station viaduct (referred to locally as the Dark Arches), parts of Granary Wharf and Wharf Approach.

Figure 2.1: Main site boundary



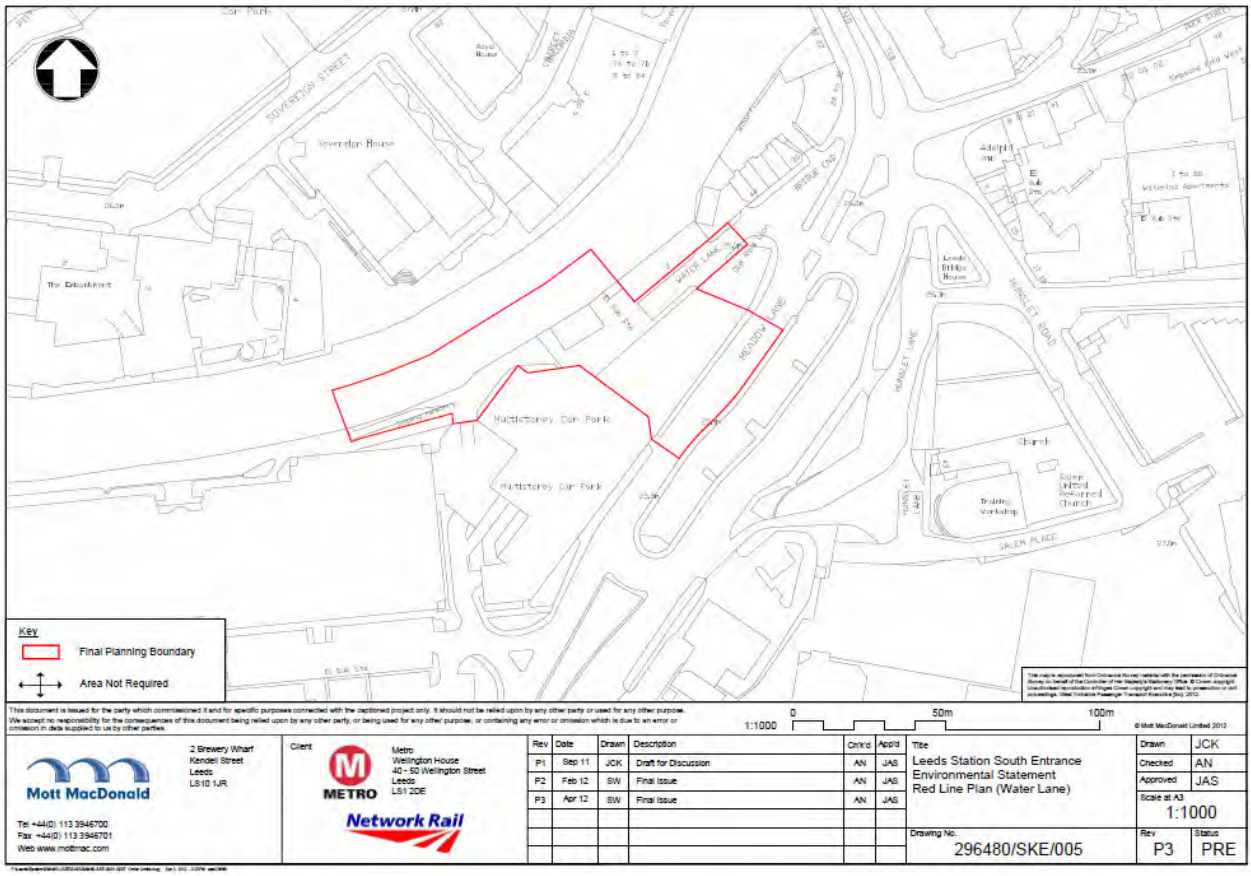
Source: Mott MacDonald

2.1.3 Water Lane Site

It is understood that during the construction of LSSE, materials could be transported by barge to the main site along the River Aire, and that a barge loading/unloading area is proposed on Water Lane adjacent to the River Aire (to the east of the main site). The extent of the 'Water Lane' site is shown in Figure 2.2, and encompasses a total area of approximately 0.3ha.

The Water Lane site is bounded to the north and west by the River Aire, to the south by a multi-storey and surface car park and to the east by Meadow Lane. The site includes the following existing infrastructure: an area of car parking, a stone arch remaining from a previous building located on site, scrub land and a canal tow path. Part of the site is within a Conservation Area.

Figure 2.2: Water Lane site boundary



Source: Mott MacDonald

2.2 Topography

Mott MacDonald visited the site on 14th September 2011. Photographs taken during the walkover survey of the site have been reproduced in Appendix A.

The topography of the site has been inspected in conjunction with the information provided from the site topographic survey of the Main Site undertaken on behalf of Metro as part of the preliminary design (GRIP4) development, and included in Appendix B. The main site is relatively flat with levels between approximately 26.43mAOD and 27.51mAOD, and the majority of the site raised above 27mAOD. A review of Ordnance Survey maps indicates that the water lane site is also relatively flat with levels between approximately 25.8mAOD and 25.9mAOD.

2.3 Watercourses Pertinent to Site

The LSSE building will be located directly above the River Aire. The River Aire is designated as a Main River (meaning that the EA have direct powers to act) and runs through the city centre of Leeds flowing from northwest to south east of the city. The Rive Aire flows beneath Leeds station, through an engineered channel within the Dark Arches. Immediately downstream of the Dark Arches, the River Aire forms part of the Aire and Calder Navigation. To the south of the main site, the Leeds and Liverpool Canal flows from west to east and converges with the River Aire via a canal lock and just east of this, the Millshaw Beck

tributary enters the River Aire. Further downstream (east of Leeds), the River Aire converges with the River Calder, west of Castleford and then with the River Ouse, west of Goole, before discharging to the North Sea at the mouth of the Humber.

2.4 Site History

The proposed LSSE building will be integrated into the existing Leeds station structure. Leeds station is constructed on a raised level across a viaduct consisting of multiple piers and arches over the River Aire and surrounding ground. The site is located in the heart of Leeds city centre, and as such is located in a heavily developed area. Historic maps indicate that the site has formed part of Leeds station since the expansion of the original 'Wellington Station' to form 'New Station' in the late 1800's.

3. Existing Conditions

3.1 Planning Policy

3.1.1 Overview

The National Planning Policy Framework (NPPF) sets out the Government's policy on development and flood risk. Its aims are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas of highest risk.

This FRA has been carried out in accordance with the requirements and recommendations of NPPF, published 27 March 2012, and the accompanying Technical Guidance to the NPPF, published 27 March 2012.

3.1.2 Flood zone classification

NPPF defines the level of flood risk to any given area using a series of 'Flood Zones'. Flood Zones refer to the probability of flooding from rivers, the sea and tidal sources and ignore the presence of existing defences, because these can be breached, overtopped and may not be in existence for the lifetime of the development.

Classifications of Flood Zones as defined in Table 1 of the Technical Guidance to the NPPF are summarised in Table 3.1.

Table 3.1: NPPF flood zone classifications

Flood Zone	Definition	Appropriate uses
Zone 1 - Low Probability	Land assessed as having less than 1 in 1000 annual probability of river or sea flooding in any year.	All land uses are appropriate in this zone.
Zone 2 - Medium Probability	Land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding and between a 1 in 200 and 1 in 1000 probability of sea flooding in any year.	Highly vulnerable developments in this zone must pass the Exception Test as outlined in NPPF. All development proposals in this zone should be accompanied by a FRA.
Zone 3a - High Probability	Land assessed as having 1 in 100 or greater annual probability of river flooding or a 1 in 200 or greater probability of flooding from the sea in any year.	Highly Vulnerable developments are not permitted in this zone; more vulnerable and essential infrastructure must pass the Exception Test as outlined in NPPF. All development proposals in this zone should be accompanied by a FRA.
Zone 3b - The Functional Floodplain	Local planning authorities should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters.	Only the water-compatible uses and the essential infrastructure listed in 2 of NPPF that has to be there should be permitted in this zone. It should be designed and constructed to: • remain operational and safe for users in times of flood; • result in no net loss of floodplain storage; • not impede water flows; and • not increase flood risk elsewhere. Essential infrastructure in this zone should pass the Exception Test.

Source: Table 1 of the Technical Guidance to the NPPF

3.2 Strategic Flood Risk Assessment

The Leeds Strategic Flood Risk Assessment (SFRA) referred to in this report is that issued in October 2007 and made available for public access on the Leeds City Council (LCC) website (www.leeds.gov.uk), accessed on 13 October 2011.

The Leeds SFRA outlines current and future broad scale flooding issues for proposed development in the LCC area. The SFRA includes information on key rivers and watercourses and a suite of SFRA flood risk maps to supplement the Environment Agency's Flood Maps, along with information on their use and interpretation.

The location of the development on the SFRA flood map is shown in Figure 3.1 below. A review of the SFRA flood map indicates that the proposed development site is within Flood Zone 3b, Zone 3a(ii) and Zone 2. The map indicates that the development is not located in a 'rapid inundation area', where failure of any existing flood defences would pose a significant hazard.

Section 5.2.1 of the SFRA states that "the Leeds City Council adopted definition for Zone 3b (Functional Floodplain) is land where water flows or has to be stored in times of flood, that is subject to flooding with a 1 in 20 year probability (or more frequently), and that may be reserved by Leeds City Council for this purpose". In addition, section 5.2.2 of the SFRA states that the Zone 3a 'High Probability' has been sub delineated in the Leeds SFRA in the following manner:

- "Zone 3a(ii) High Probability - areas that fall within the 5% (1 in 20 year) flood envelope; and
- Zone 3a(i) High Probability - areas that fall outside of the 5% (1 in 20 year) flood envelope, however are affected by flooding in the 1% (1 in 100 year) event".

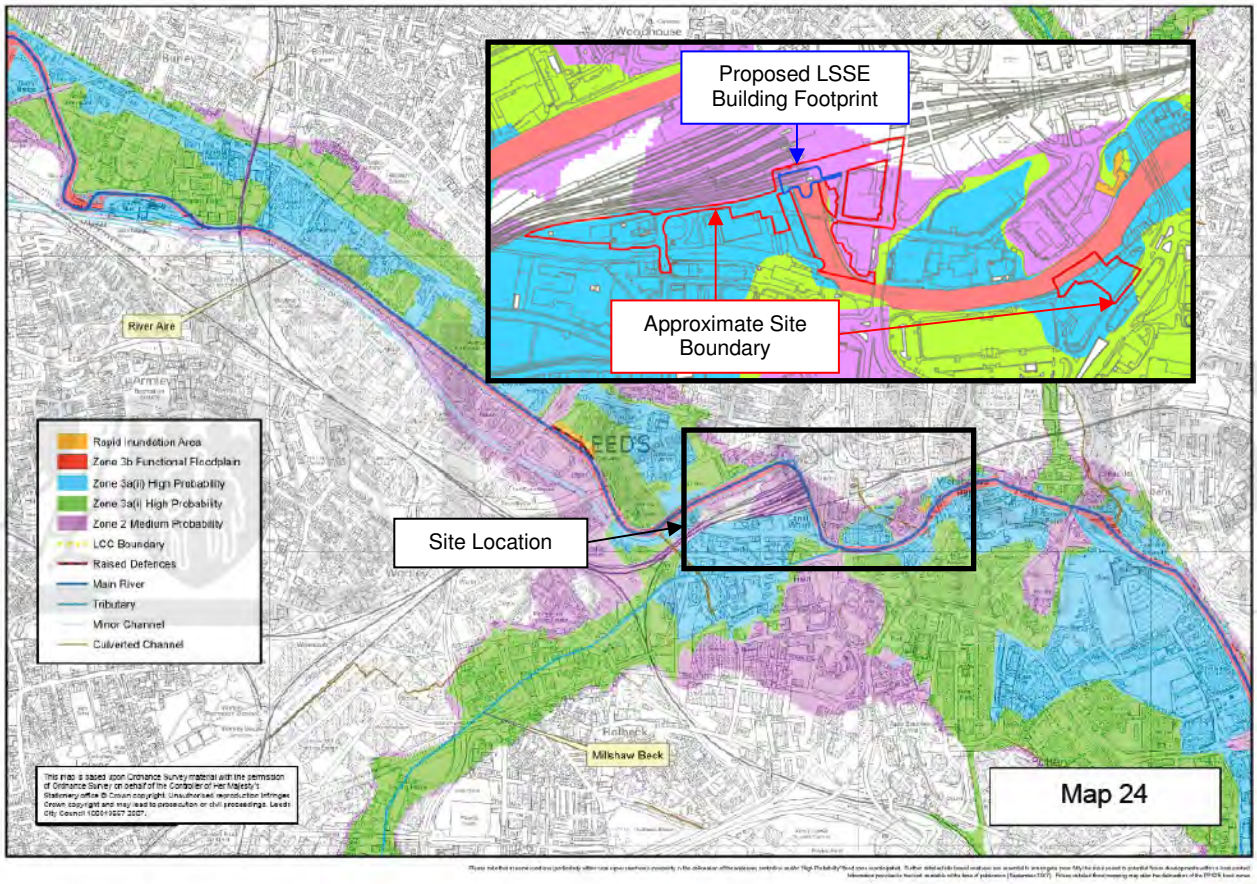
The SFRA adds that "areas of zone 3a(ii) can flood with the same frequency as functional floodplain; however, the Council recognises that as built development is already there, or is imminent through an existing planning permission…, then the whole site cannot perform a function as storage space for flood water".

Section 5.2.3 of the SFRA states that "Zone 2 'Medium Probability' is defined as those areas of the District that are situated between the 1 in 1000 year and the 1 in 100 year flood extents. In this instance, Zone 2 Medium Probability is defined in accordance with the Environment Agency Flood Zone Map".

The 2007 SFRA also states in Section 6.5.1 that "whilst the Environment Agency is investigating the economic viability of a possible flood alleviation scheme for Leeds City Centre, it is anticipated that it may be over a decade before this scheme is in place".

Section 6.4.3 of the SFRA states that "all proposed future development within Zone 3a(ii) High Probability will require a detailed Flood Risk Assessment".

Figure 3.1: Leeds SFRA flood map



Source: Leeds SFRA

This map is reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office. © Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings. West Yorkshire Passenger Transport Executive 100020521. 2011.

3.3 Previous Assessment of Flood Risk

During the preliminary development for the LSSE scheme, consideration was given to flood risk and appropriate flood risk management measures were discussed with the Environment Agency. The Faber Maunsell / Aecom report 'Leeds Station Southern Entrance Flooding Assessment' (October 2009) summarises the previous work undertaken during the scheme development.

The Faber Maunsell report was submitted with a previous planning application for the LSSE in 2009 and was subsequently accepted by the LCC in 2010, subject to a number of planning conditions. Therefore it is understood that LCC and the EA have accepted the principles of the Faber Maunsell report, including the methods of assessing flood risk and proposed mitigation measures outlined in the report.

This Flood Risk Assessment (FRA) is largely based on the approved content of the Faber Maunsell report, and the results of flood modelling of the River Aire presented in the report. Therefore, for completeness, a full copy of the Faber Maunsell report (including Addendum 1 and 2) is included in Appendix C.

3.4 Information provided by the Environment Agency

Mott MacDonald met with the Environment Agency (EA) on the 27th September 2011 to discuss the requirements and scope for the updated LSSE FRA. From this meeting, and further discussions, the requirements and recommendations of the EA were outlined and agreed. Copies of correspondence with the EA are included in Appendix D.

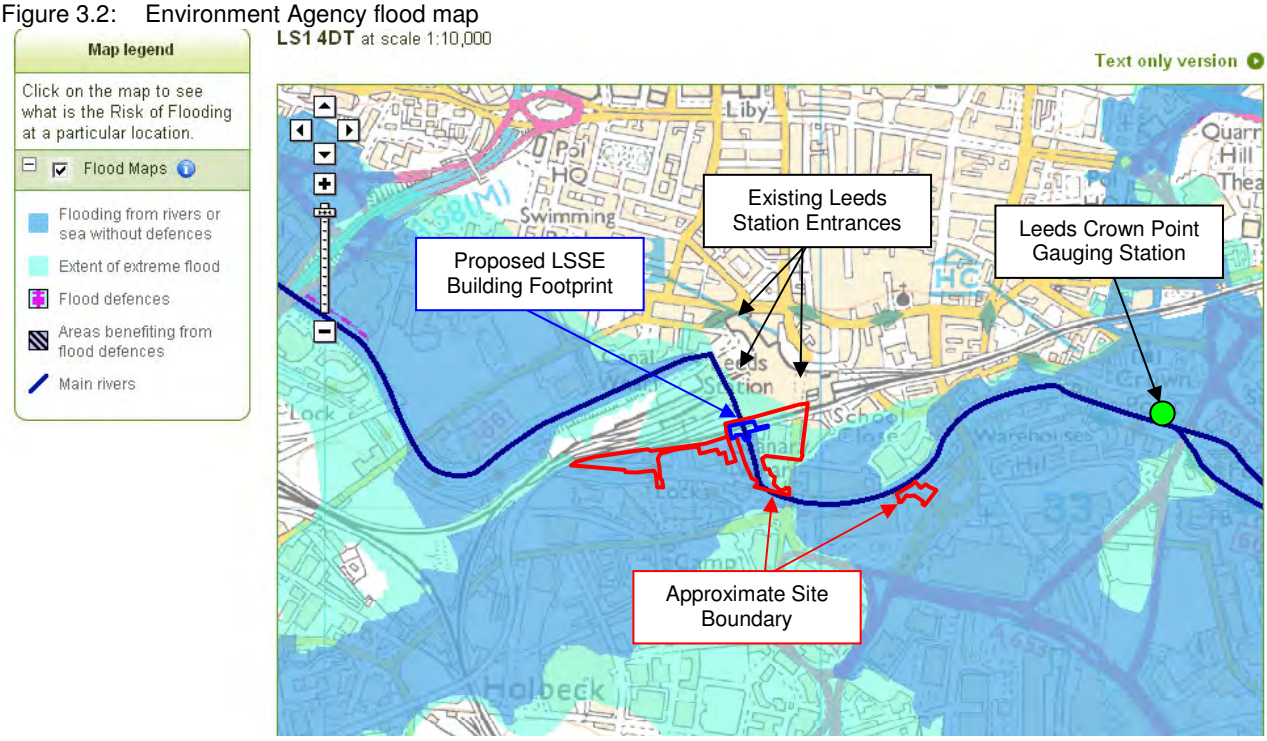
The EA stated that they are 'largely content with the GRIP 4 LSSE scheme' and that it would be appropriate to double check the current EA flood model results and confirm the flood levels in the Faber Maunsell / Aecom GRIP 4 Flood report are still correct. Subsequently, the EA provided details of the current results of hydraulic modelling of the River Aire (see Appendix D). These are consistent with the EA data used in the Faber Maunsell report, and therefore the report is considered to be current.

The Faber Maunsell / Aecom report included consideration of the proposed Leeds Flood Alleviation Scheme (FAS), which at that time was designed to provide a 1 in 200 year Standard of Protection (SoP). Since Faber Maunsell assessment, the proposals for the Leeds FAS have been revised to provide a lower SoP, and responsibility for the scheme has been passed from the EA to Leeds City Council. However, to ensure the proposed LSSE development would be unaffected should the 1 in 200 year FAS proceed in the future, as originally envisaged, the Environment Agency have specified the station entrance design needs to match their original possible scheme. As such this FRA considers the proposals in relation to the 1 in 200 year SoP FAS, and is therefore consistent with the scenarios considered in the Faber Maunsell report.

Section 2.2 of the Faber Maunsell report states that "as the new entrance will be above the river, the formal consent of the EA must be obtained for the structure, and any temporary works necessary to construct it". The EA confirmed that separate consents would be required for the permanent and temporary aspects of the development.

The EA website includes details of the recorded river levels on at the 'Leeds Crown Point Gauging Station' (Site ID 8061), which has records from December 2001; the station's location on the River Aire is shown in Figure 3.2 below. The EA data indicates that the typical river level range for this location is between 23.66mAOD and 24.48mAOD and that the highest river level recorded at this location is 25.58mAOD which was reached on 25 June 2007.

Figure 3.2: Environment Agency flood map



Source: The Environment Agency, contains Environment Agency information © 2012 Environment Agency and database right

3.5 Information provided by the Leeds City Council (Local Planning Authority)

Leeds City Council (LCC) was consulted on a pre-application basis to establish details of its requirements for the proposed development; copies of the correspondence are included in Appendix E.

LCC confirmed that the proposal should “not lead to additional flood risk nor create difficulties for the Leeds FAS”, and that the works should be” to at least the minimum standard of 1:200 plus climate change”.

3.6 Information provided by British Waterways

British Waterways (BW) was consulted on a pre-application basis to establish details of its requirements for the proposed development; copies of the correspondence are included in Appendix F.

BW stated that “prior to the commencement of development, full details of the surface water drainage arrangements including means of discharging into the watercourse should be submitted to and agreed by the local planning authority in conjunction with British Waterways. In order to prevent any damage to the waterway structure, protect water quality and users of the waterway and to make an assessment of the increased volume of water entering the watercourse.”

4. Development Proposals

4.1 Development Description

The proposed development will include the construction of a multi-storey building on the south side of Leeds station. Copies of the proposed development plan and elevation are reproduced in Figure 4.1 and Figure 4.2 below.

The building will be suspended above the River Aire and will incorporate a deck suspended between two piers in the River Aire. Internally, the building will incorporate stairs, lifts and escalators to enable circulation between the lower south side of the station and the upper main station concourse (with access to the station platforms).

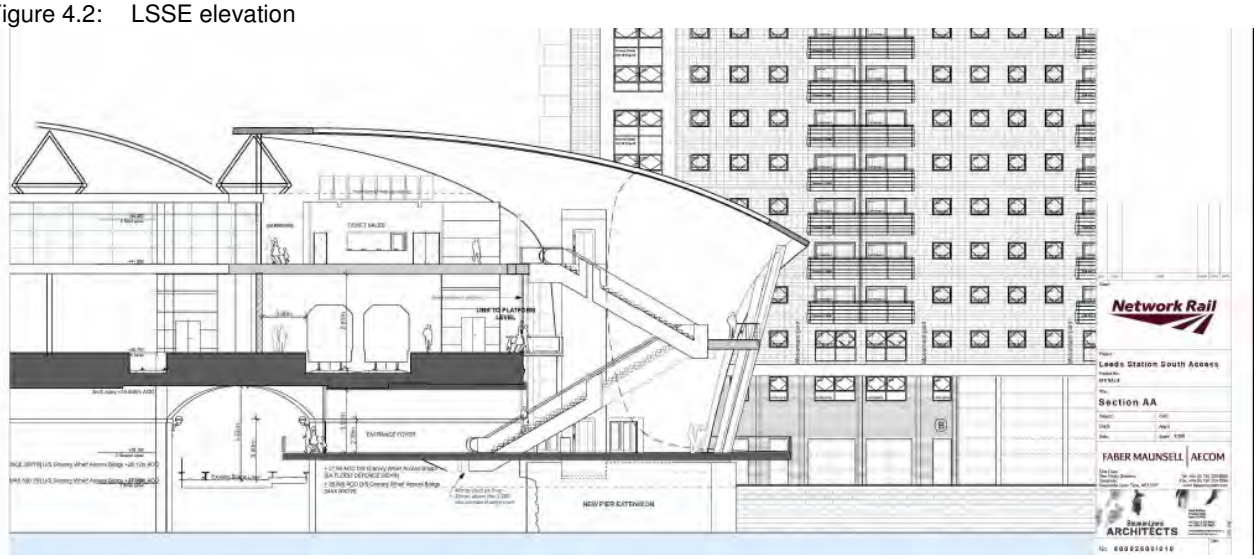
Section 1.3 of the Faber Maunsell Flood Assessment includes a detailed summary of the specific aspects of the development considered in the hydraulic modelling of the proposed LSSE. The key elements of the scheme are summarised below:

- the new access will consist of a new building situated over the River Aire and attached to the south face of the railway viaduct structure. It will be connected to an extended station western footbridge at the upper level and at the lower level link bridges will connect to either river bank. In addition at the lower level a concourse deck (Finished Floor Level at 29.1m AOD) will extend back (north) through the viaduct arch where ramps and stairs will overcome level differences to tie into Dark Neville Street;
- the existing Dark Neville Street footbridge (located immediately south of the highway bridge) will be replaced with a new footbridge structure at a higher elevation with ramps and stairs on either side of the river channel;
- to support the new river deck, downstream of the viaduct, the existing eastern and central piers will be lengthened by 15.1m (measured from the viaduct wall);
- within the viaduct arch, the underside of the new structures will be no lower than 28.6mAOD, and downstream of the viaduct, between the new pier extensions, the underside will be 28.5mAOD. This includes any supports, bracing or cladding;
- the new escalators will require a maintenance pit at each end. The lower of these will be situated within the viaduct arch, and will extend below the new deck to 27.86mAOD, into the river space below; and
- the new lifts will also require maintenance pits. These will be situated within the new extension of the eastern pier, and will cause the pier to widen locally by 250mm on each side above 27mAOD.

Figure 4.1: LSSE plan

Source: Network Rail

Figure 4.2: LSSE elevation



Source: Network Rail

4.2 Vulnerability Classification

Table 2 of the Technical Guidance to the NPPF defines Essential Infrastructure as "essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk". Therefore, the proposed LSSE scheme is considered to be Essential Infrastructure as it will form part of the Leeds Station transport infrastructure network. In addition, Addendum 1 to the Faber Maunsell report states that "Leeds City Council have indicated that they would class the new station entrance as being Essential Infrastructure".

In accordance with Table 3 of the Technical Guidance to the NPPF, it is considered that for the areas of development within:

- Flood Zone 1 – development is appropriate;
- Flood Zone 2 – development is appropriate; and
- Flood Zone 3a and 3b – the development must pass the NPPF Exception Test.

4.3 Sequential Test

The NPPF sequential test aims to steer new development to areas of the lowest probability of flooding – Flood Zone 1. NPPF states that only where there are no reasonably available sites in Flood Zones 1 or 2 should decision-makers consider the suitability of sites in Flood Zone 3, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

Addendum 1 to the Faber Maunsell report states that "the station entrance cannot be relocated away from this side of the station, and due to other existing buildings in the proximity, the entrance must be located at this position". In addition, given the nature of the development (providing an entrance to Leeds Station from the south), it is not considered possible to alter the development location or for the scheme to avoid areas of flood risk entirely. Therefore the LSSE will be located in Flood Zones 2, 3a and 3b, and as such must pass the NPPF Exception Test.

4.4 Exception Test

4.4.1 Overview

Paragraph 102 of NPPF outlines the requirements of the Exception Test as follows:

I. it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared; and
II. a site-specific FRA must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

This FRA is primarily concerned with addressing Part II of the NPPF Exception Test and demonstrating that the site is safe, as set out in the following sections of this report. Part I of the Exception Test is considered to have been passed, subject to confirmation from LCC, and as such is not covered in detail in this report. Part I of the Exception Test are briefly summarised below.

4.4.2 Part I

Part I of the NPPF Exception Test is considered to be passed; Addendum 1 to the Faber Maunsell report states that “the new entrance will improve commuter links from the railway station to the expanding commercial district to the south of the station. It will also improve passenger throughflow at the existing entrances. Usage of an essential transport link, and the continued redevelopment of this part of Leeds should be sustained”.

5. Sources and Forms of Flooding

5.1 Potential Sources of Flooding

5.1.1 Flooding from rivers

The primary source of flood risk to the LSSE is considered to be fluvial (river) flooding from the River Aire. Detailed hydraulic modelling of the watercourse has been undertaken to assess the fluvial flood risk, and is covered in Section 5.2 of this report below.

5.1.2 Flood Risk from surface water

Surface water runoff is considered to be the secondary source of flood risk resulting from the proposed development. The LSSE drainage proposals are outlined further in Section 6.6.2 of this report.

5.1.3 Flooding from failure of upstream reservoirs

A review of the EA reservoir flooding map indicates that parts of the study area are within the maximum extent of flooding from the Graincliffe, Thornton Moor and Reva Reservoirs upstream of the site, see Figure 5.1 below. The EA map shows the largest area that might be flooded if a reservoir were to fail and release the water it holds.

The extents of flooding from reservoirs are shown to be less than those for river flooding shown in Figure 5.1. Therefore, given the very low likelihood of reservoir failure, the flood risk from reservoirs is considered to be a secondary source of flood risk to the LSSE, as it is not expected to be significant compared to that from river flooding.

5.1.4 Flooding from groundwater

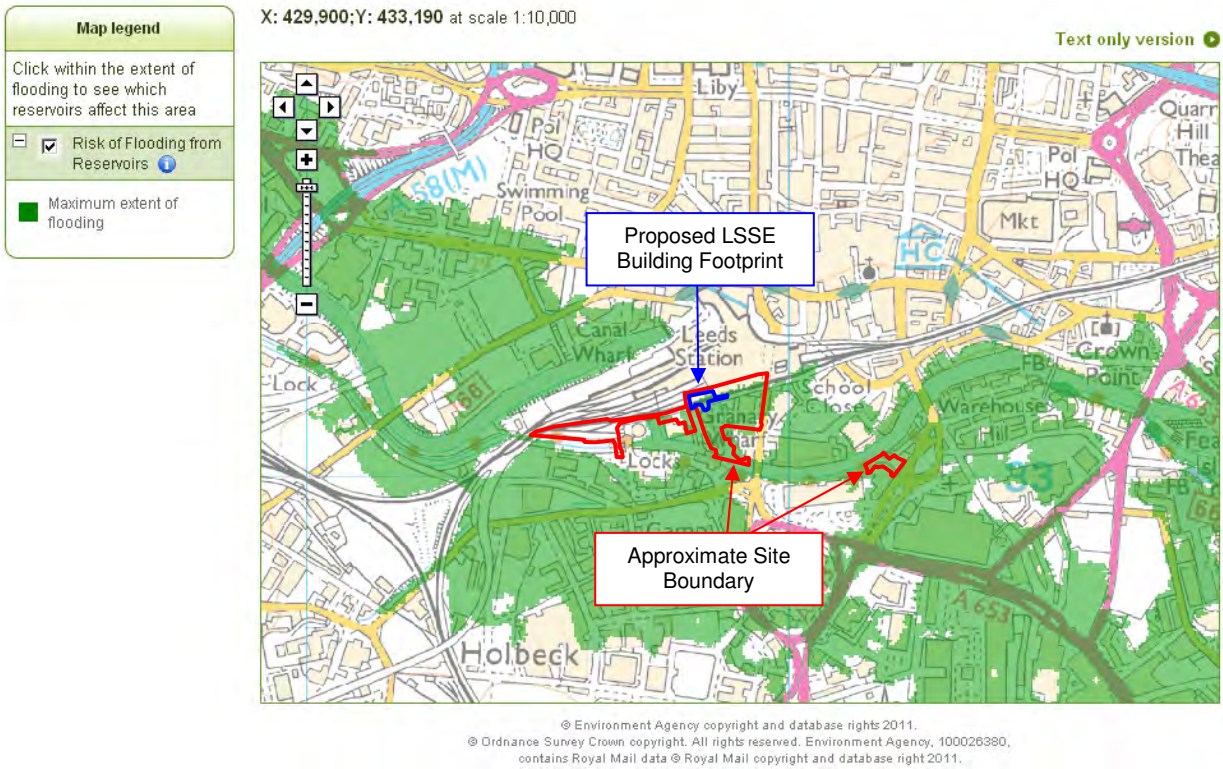
The flood risk to the LSSE from groundwater is considered to be low, as it is not expected to be significant compared to the risk of flooding from rivers. However, elevated groundwater levels adjacent to the River Aire pose a more significant risk to the aspects of the development which will be constructed at low levels, including during any excavations, where dewatering may be required.

5.1.5 Other sources of flood risk

The LSSE finished floor level will be raised approximately 1.5m above the existing ground level of the surrounding developments. Therefore, any potential overland flows from the surrounding developments (surface water runoff or flooding from sewers) would be intercepted by the River Aire, and as such, the site is not considered likely to be at risk of flooding from overland flows or sewers.

LSSE is located approximately 30km upstream of the normal tidal reach on the River Aire at the EA Carton Bridge Gauging Station (Site ID 8041), which has a typical river level range between 1.47mAOD and 5.97mAOD. Therefore, as the LSSE finished floor level will be over 23m above this typical range, the site is not considered to be at risk of tidal flooding from the sea.

Figure 5.1: Environment Agency reservoir flood map



Source: The Environment Agency, contains Environment Agency information © 2012 Environment Agency and database right

5.2 Hydraulic Modelling of the River Aire

5.2.1 Model data

The Faber Maunsell Flooding Assessment includes a summary of the ISIS hydraulic modelling of the River Aire, undertaken for two key scenarios:

- the undeveloped site with the 1 in 200 year SoP Leeds FAS, referred to as the 'Leeds Station Base Case ISIS Model'; and
- the developed site with the 1 in 200 year SoP Leeds FAS, referred to as the 'Leeds Station Southern Entrance ISIS Model'.

Full details of the Faber Maunsell models and modelling results are included in Appendix C. In addition to the modelled scenarios, the following scenarios have been considered:

- the undeveloped site without the Leeds FAS (based on EA hydraulic modelling of the River Aire); and
- the developed site without the Leeds FAS (not modelled).

5.2.2 Undeveloped Site without Leeds FAS Scenario

Section 2.1.1 of the Faber Maunsell Flooding Assessment states that the EA predictions for the current river configuration indicate that the 1 in 100 year probability flood event (including an allowance for the predicted effects of climate change) could be expected to reach 27.02mAOD at DOL2/9A (Dark Neville

Street bridge). The Faber Maunsell report adds that the crest level of both banks of the river at Dark Neville Street is approximately 27.5mAOD, and are therefore outside of Flood Zone 3, (or not at High Risk of flooding). In addition, the site topographic survey indicates that the existing deck level of Dark Neville Street is 27.5mAOD and therefore will also be above the 1% plus climate change flood level.

It is noted in the Faber Maunsell report that the upstream soffit of DOL2/9A is approximately 26.78mAOD, and therefore the soffit of the bridge deck is predicted to be partially submerged by the River Aire during the 1% plus climate change flood event. However, the LSSE scheme will not affect this existing structure.

5.2.3 Undeveloped Site with Leeds FAS Scenario

5.2.3.1 Flood Level

The original proposals for the Leeds FAS were developed by the EA and are designed to provide a 1 in 200 year SoP to the centre of Leeds. As part of this study the EA developed an ISIS hydraulic model for the River Aire, which incorporates the original FAS proposals. The Faber Maunsell report states that the EA have allowed an additional 510mm freeboard above the 1 in 200 year floodwater levels to generate the proposed FAS defence levels. Faber Maunsell report includes details of the EA FAS model flood levels, which are reproduced in Table 5.1 below. It is understood that the 1 in 200 year SoP FAS included proposals to raise/remove DOL2/9A.

Section 2.1.2 of the Faber Maunsell report states that “to ensure the entrance is unaffected should the alleviation scheme progress as envisaged, the Environment Agency have specified the station entrance design needs to match their possible scheme”. Therefore both the Faber Maunsell Flood Assessment and this FRA concentrate on the 1 in 200 year flood event (including climate change), which is referred to in the Faber Maunsell report as the 0.5% Annual Exceedance Probability (AEP) flood.

Table 5.1: Environment Agency Flood Levels

Location	0.5% probability flood including climate change
Upstream of Dark Neville Street Bridge (DOL2/9A)	28.12mAOD
Downstream of DOL 2/9A	27.84mAOD
Upstream of Little Neville Street footbridge	27.97mAOD

Source: Faber Maunsell Flood Assessment Table 1

5.2.3.2 Baseline Scenario

The Faber Maunsell report outlines a number of modifications made to the Leeds FAS ISIS Model obtained from the EA. Section 2.3 of the report states that these modifications were incorporated as “it was found that this model did not include sufficient detail around Leeds station to enable an accurate analysis of the effect of any changes due to the station entrance scheme”, full details of the modifications included in the ‘Leeds Station Base Case ISIS Model’ are outlined in Appendix C. In particular Section 2.3 of the Faber Maunsell report states "as the base case model is a representation of the river after the flood alleviation scheme is constructed, DOL2/9A has also been removed”.

Section 2.4 of the Faber Maunsell report states that “the improvements to the base case model geometry appear to cause water levels upstream of DOL2/9A to rise through the Dark Arches by up to 170mm (for the 0.5% probability flood with climate change), while downstream levels drop slightly”. However, the report adds that “the aims of this modelling though are to compare the effect of the new structure, not define an

absolute flood level, and so while an awareness of the potential issues should be maintained, other physical changes to the river or detailed modelling for the flood alleviation scheme may supersede these figures".

5.2.4 Developed Site with Leeds FAS Scenario

Section 2.3 of the Faber Maunsell report states that "geometry changes arising from the new entrance were incorporated, to form the Leeds Station Southern Entrance Model" and that "additional cross sections were created to represent the new geometry and hydraulic effects", full details of the modifications included in the 'Leeds Station Southern Entrance ISIS Model' are outlined in Appendix C.

Section 2.4 of the Faber Maunsell report states that "after the changes due to the escalator pit and piers are incorporated into the model, and the results compared to the Leeds Station Base Case Model, the predicted changes actually cause the water levels of the 0.5% probability flood (after climate change) beneath the station viaduct to fall by up to 30mm (when compared to the improved base case model)".

The Faber Maunsell report states that "the modelling shows that after the entrance scheme is completed, the 0.5% probability flood with climate change water level upstream of DOL2/9A could be 28.05mAOD, the level at the downstream face could be 28.04mAOD, and at the escalator pit, 27.73mAOD".

5.2.5 Developed Site without Leeds FAS Scenario

The Faber Maunsell Addendum 2 includes consideration of the 'intermediate' scenario, between development of the LSSE and Leeds FAS and states that if "the Dark Neville Street bridge will remain in its current level and position upstream of the new entrance…the flood analysis shows that for a 1 in 200 (+ Climate Change) flood event, the water level upstream of this bridge, does not rise above the level of the existing bridge girders. This analysis takes into account the possibility of debris building up against Dark Neville Street bridge and thus it is shown that water will not flow over this bridge. As this is the case no debris will be able to float over Dark Neville Street bridge and lodge in the gap between it and the new Southern Entrance".

It is noted that prior to the completion of the Leeds FAS the areas surrounding the LSSE (which are lower than the proposed LSSE floor level) would be unprotected during the 1 in 200 year event (including climate change), and hence would flood before inundation of the LSSE itself. Section 2.1 of the Faber Maunsell report states that "this flooding to either DOL2/9A, Dark Neville Street, or the new access bridges within the viaduct would mean that access to the station via this entrance would have to be temporarily suspended. Emergency evacuation of the station would also be impossible via this route until the flood event receded sufficiently".

6. Flood Risk Management Measures

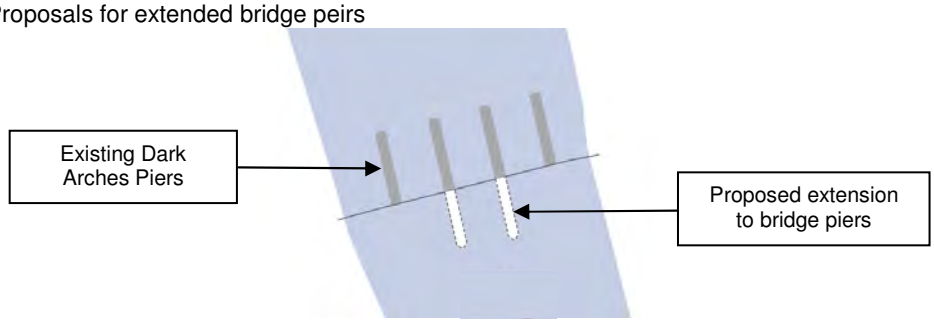
6.1 Entrance Deck

The LSSE floor level is proposed to be 29.1mAOD and therefore will be 980mm above the predicted 1 in 200 year (including climate change) EA FAS flood level of 28.12mAOD upstream of Dark Neville Street bridge. The soffit of the LSSE deck is proposed to be above 28.5mAOD and therefore will be 660mm above the predicted 1 in 200 year (including climate change) EA FAS flood level of 27.84mAOD downstream of Dark Neville Street bridge. Therefore, the LSSE deck will incorporate sufficient freeboards (over and above the 510mm freeboard incorporated into the Leeds FAS), such that the deck will be flood free during the predicted 1 in 200 year flood event, including climate change.

6.2 Bridge Piers

The LSSE scheme proposals include plans to extend two of the existing Dark Arches piers further south along the River Aire, as shown in Figure 6.1 below. The hydraulic modelling of the River Aire by Faber Maunsell included details of the extended piers to assess their impact on the flows in the river.

Figure 6.1: Proposals for extended bridge peirs



Source: Leeds Station South Entrance Planning, Design & Access Statement, 2009

Section 2.4 of the Faber Maunsell report states that “there appears to be no significant rise in water levels upstream or downstream of the new entrance arising from the scheme”. In addition, Section 6.2 of the Leeds Station South Entrance Planning, Design and Access Statement (2009) states that “hydraulic analysis has shown that no increase to river levels would occur as a result of extending piers”. Therefore the modelling results demonstrate that the extended bridge piers will not affect flood levels in the River Aire during the predicted 1 in 200 year flood event, including climate change.

It is noted that the extended piers will result in a very slight loss of storage volume within the channel of the River Aire. However, the proposals to extend the bridge piers are not considered to result in any significant loss of flood storage in the context of the wider River Aire channel. Furthermore, the extended piers will be designed to resist scour from flows in the River Aire and the potential increase in flood water levels resulting from the predicted affects of climate change over the lifetime of the development.

6.3 Escalator and Lift Pits

The bottom of the escalator pit is proposed to be 27.86mAOD and therefore will only be 20mm above the predicted 1 in 200 year (including climate change) EA FAS flood level of 27.84mAOD downstream of Dark Neville Street bridge. Section 2.4 of the Faber Maunsell Flood Assessment states that the escalator pit will be above “the modelled level arising from the entrance scheme, and so cannot influence the flood of the stated probability”.

Therefore where the escalator pits protrude beneath the main entrance deck (into the freeboard above the predicted 1 in 200 year plus climate change flood level), it is proposed to construct a streamlined deflector to minimise the risk of flood debris collecting against or damaging the upstream face of the pits. It is noted that the escalator pits will only result in local protrusions, and will not extend along the whole width of the deck. Furthermore, Section 2.2 of the Faber Maunsell report states that "the structure and material resilience should be considered to allow the pit to remain unaffected if water should act against it, and to ensure that safety is maintained while any maintenance is being undertaken, remembering that the pit is unsupported and above water. The pit opening should also be sealed to prevent water ingress to the deck during extreme flood events". Therefore it is recommended that during the development of the detailed design for the escalator pit defender, the EA are consulted regarding the proposals.

The lift pits will result in local widening of the bridge piers above 27mAOD. Section 3 of the Faber Maunsell report states "the new station entrance would currently appear not to cause a detrimental change to the flood regime of the River Aire, and also should not be affected by the currently predicted flood with a 0.5% probability of occurring, after an allowance for climate change has been included". Therefore, the modelling results demonstrate that the lift pits will not affect flood levels in the River Aire during the predicted 1 in 200 year flood event, including climate change.

6.4 Evacuation Routes

Section 5.1 of the Leeds SFRA states that "the Environment Agency issues warnings of anticipated flooding from the River Aire, and due to the relatively long catchment response times, substantial forewarning of a pending flood event can generally be provided". The SFRA also states that "floods from the River Aire typically inundate the areas for a few days". Therefore it is recommended that the Leeds station operators register with the EA Flood Warning scheme to provide prior warning of potential flooding.

In the event of a predicted extreme flood, where the LSSE is at risk of being flooded (i.e. those that exceed the 1 in 200 year including climate change event), it is recommended that the entrance be closed by the Leeds station operators, and that only the existing north entrances are used. The existing north entrances provide access to areas shown to be outside of the predicted extents of the 1 in 1000 year flood event on the EA and Leeds SFRA flood maps (i.e. in Flood Zone 1) and therefore will provide a safe evacuation route in the event of the LSSE being closed due to the risk of flooding.

6.5 Proposed Drainage Arrangements

6.5.1 Surface Water Disposal Options

The surface water run-off from the development will be managed in accordance with the hierarchy of disposal options set out in Building Regulations Part H (Requirement H3). This states that rainwater should be discharged to one of the following, listed in order of priority:

a) an adequate soakaway or some other adequate infiltration system; or, where that is not reasonably practicable;
b) a watercourse; or, where that is not reasonably practicable;
c) a sewer.

It is not considered reasonably practicable to dispose of the surface water via infiltration, as the LSSE will be located above the River Aire, and as such will not be located over ground into which a soakaway or infiltration device could be placed. Therefore, it is proposed to discharge the surface water runoff from the development to the River Aire.

6.5.2 Proposed Drainage System

The LSSE Planning, Design and Access Statement (2009) states that "there are no requirements for drainage of the new structure. Externally, the rain water which land on the roof, will drain off directly into the River Aire. Internally, there is no requirement for any services or facilities which would require drainage. No toilet or retail facilities will be present in the new entrance". In addition, Section 2.5 of the Faber Maunsell Flood Assessment states "the new access will not increase surface water runoff. The footprint of the extension is completely over the river and so there is no change in infiltration or runoff rates as precipitation should still pass directly to the river from the roof".

Therefore, it is understood that the development will mimic the existing conditions, and maintain the existing flow paths, where rainfall landing on the development area flows directly into the River Aire at an uncontrolled rate.

It is noted that that LCC requested that "full details of surface water drainage, arrangements including means of discharging into the watercourse should be submitted to and approved in writing by the Local Planning Authority", as part of the 2010 planning conditions. BW has also requested similar details, adding that this information was required "in order to prevent damage to the waterway structure, protect water quality and make an assessment of the increased volume of water entering the watercourse". As part of the scheme development during detailed design, it is recommended that the above comments are addressed.

6.6 Surrounding Developments

Subject to the implementation of the flood risk management measures outlined above the LSSE scheme is not considered to affect the flood risk to third party land.

The cumulative effects of proposed developments in the vicinity of the development have been considered. On the assumption that the proposals for the surrounding developments have satisfied planning requirements, including compliance with the requirements of NPPF, they should not affect the flood risk to third party land. Provided the surrounding developments are constructed in accordance with the approved plans, they should not affect the flood risk to the LSSE.

It is recommended that continued discussions are held with the EA and LCC regarding the Leeds FAS, to ensure the development is compatible with the latest proposals for the Leeds FAS.

7. Management of Residual Risks

7.1 Blockage of Bridges

There is a residual risk of localised fluvial flooding on River Aire at the upstream of bridges as a result of blockages. Periodic maintenance will be required to remove any build up of debris in the watercourse channels and reduce the risk of blockages during flood events. This duty is expected to be undertaken by the Environment Agency on a reactionary basis.

Section 2.1 of the Faber Maunsell Flood Assessment states that "during flooding, large debris such as uprooted trees can be carried by the high flows. These can often become caught by obstructions such as bridges. This could cause a blockage, and water levels can rise significantly. The existing DOL2/9A could easily cause this effect, although currently flooding would spill to Dark Neville Street before the new structure would be affected. If the flood defences are constructed, DOL2/9A would be raised to the same level as the new deck, but spilling to Dark Neville Street would not occur until a much higher level was reached".

7.2 Exceedance of the Design Flood

The Faber Maunsell report also states that it is "possible that under exceptional circumstances the new access bridges could be affected by some flooding. It may therefore be beneficial to design to exceedance of the specified flood. Protective permanent or demountable measures at the new entrance doorways could prevent floodwater ingress into the new concourse area". However, consideration should be given to the low predicted frequency of flood events exceeding the design event (1 in 200 year including climate change), and the requirement for an appropriate balance between the cost of damage caused by potential flooding to the LSSE lower concourse and the cost of providing flood control measures.

7.3 Temporary Works

7.3.1 Works in the watercourse channels

There is a residual risk of flooding caused by any temporary works in the River Aire channel, as any temporary obstructions in the channel may result in a reduction in the capacity of watercourse. During the construction it will be necessary to work in the watercourse channel at various locations along the River Aire (both at the Main site and at the Water Lane Site). Therefore any proposed works within the watercourse channel should incorporate appropriate measures in the method statement to manage this risk, and the necessary consents should be obtained from the relevant authority (British Waterways for any works in Leeds and Liverpool Canal and the EA for works in the River Aire).

7.3.2 Works in the floodplains

There is a residual risk of flooding of any temporary works located in the flood extents of the River Aire (both at the Main site and at the Water Lane site). In addition, these works could result in a temporary loss of floodplain storage, potentially increasing flood risk elsewhere. As such, it is recommended that the Contractor monitors the EA flood warnings for the River Aire, and incorporates appropriate control measures to enable the safe evacuation of the site should a flood warning be issued. Furthermore, the Contractor should implement safety measures to manage the risk of damage to property and pollution as a result of flooding of the site accommodation and storage areas.

8. Conclusions and Recommendations

The proposed Leeds Station Southern Entrance (LSSE) will provide a new direct pedestrian link between the Leeds station and redevelopment to the south of the railway viaduct.

From assessment of the existing site and proposed development plans, the conclusions and recommendations of the FRA are as follows:

- the proposed development comprises 'Essential Infrastructure';
- the scheme cannot be relocated to an area of lower flood risk and is considered to pass the NPPF Sequential and Exception Tests;
- the primary source of flood risk to, and resulting from, the proposed development, is considered to be fluvial flooding from the River Aire;
- the outline scheme design has been carried out in accordance with the requirements and recommendations of the Leeds SFRA, NPPF, Leeds City Council, and the Environment Agency;
- the following flood risk management measures have been recommended and incorporated into the LSSE scheme:
  - the finished floor level of the LSSE will be set at 29.1mAOD, and therefore will provide a 980mm freeboard above the predicted 1 in 200 year plus climate change fluvial flood level, for the future scenario incorporating the proposed Leeds Flood Alleviation Scheme;
  - hydraulic modelling of the LSSE proposals demonstrate that the extended bridge piers, localised widening of the bridge piers (due to the new lift pits) and protruding escalator pits will not affect the predicted 1 in 200 year plus climate change fluvial flood levels. Therefore, the development will not increase the fluvial flood risk to third parties;
  - where the escalator pits protrude beneath the main deck of the LSSE, it is proposed to construct a streamlined deflector to minimise the risk of flood debris collecting against or damaging the upstream face of the pits;
  - it is recommended that the Leeds station operators (Network Rail) register with the Environment Agency flood warning scheme, such that the LSSE may be closed in advance of any forecast extreme flood events, with safe access to the station maintained via the existing north entrances;
  - it is recommended that continued discussions are held with the Environment Agency and Leeds City Council, to ensure the development is compatible with the latest proposals for the Leeds Flood Alleviation Scheme.
- the residual flood risks have been assessed, and are considered to be within acceptable limits, subject to the adoption of the recommendations for management of residual risks as outlined in Section 7 of this report; and
- subject to implementation of the above proposals, from a flood risk standpoint Mott MacDonald would expect the proposed development to be allowed to proceed.

9. References

1 Communities and Local Government, National Planning Policy Framework, March 2012

2 Communities and Local Government, Technical Guidance to the National Planning Policy Framework, March 2012

3 Office of the Deputy Prime Minister, Building Regulations 2000, Drainage and Waste Disposal, Approved Document H, 2002 Edition

4 Leeds City Council, Core Strategy, Leeds Local Development Framework, Development Plan Document, Strategic Flood Risk Assessment, October 2007

5 Faber Maunsell / Aecom, Leeds Station Southern Entrance Flooding Assessment (document number: 60092600/1018), October 2009

6 Faber Maunsell / Aecom, Leeds Station Southern Entrance Flooding Assessment, Addendum 1, 13 November 2009

7 Faber Maunsell / Aecom, Leeds Station Southern Entrance Flooding Assessment, Addendum 2, 14 January 2010

8 Leeds Station South Entrance Planning, Design & Access Statement, 2009

9 Environment Agency, Aire Catchment Flood Management Plan, Summary Report, December 2010

10 Environment Agency / DEFRA, Water for Life and Livelihoods, River Basin Management Plan Humber River Basin District, December 2009

Appendices

Appendix A. Site Visit Photographs

LSSE – Site Visit Photos

14th September 2011

Photo 1: View of Granary Wharf and Leeds City Station, looking up stream along River Aire

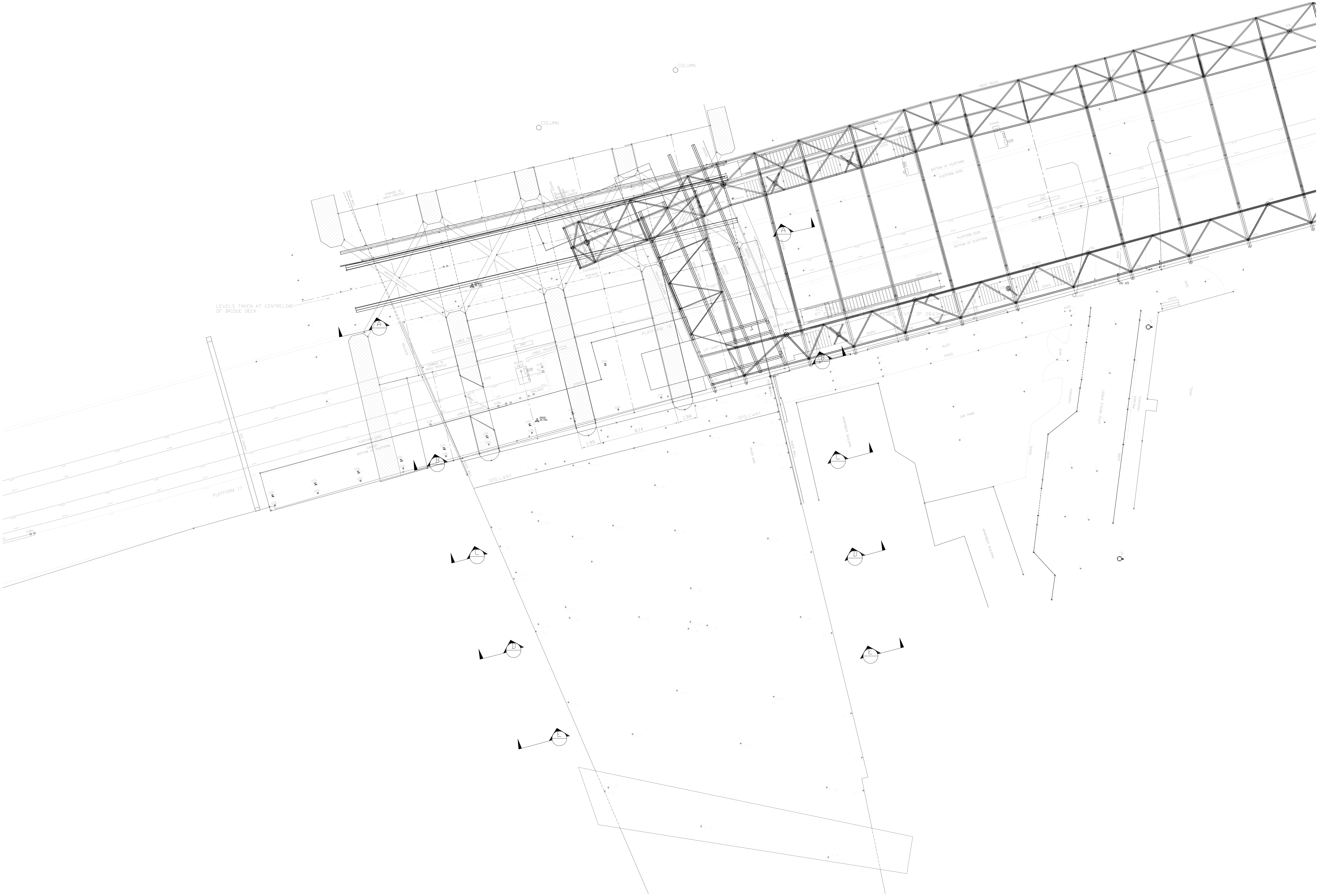
Photo 2: View of Little Neville Street footbridge, looking up stream along River Aire

Photo 3: View of Dark Arches, looking up stream from Little Neville Street footbridge

Photo 4: View of Dark Neville Street bridge, looking east down Dark Neville Street

Photo 5: View of River Aire / Dark Arches, looking up stream from Dark Neville Street bridge

Appendix B. Site Topographic Survey


COLUMN
COLUMN
LEVELS TAKEN AT CENTRELINE OF BRIDGE DECK
RIVER WALL
CHANGE IN ARCH PROFILE
RAISED WALKWAY
RAILINGS ON BRIDGE GIRDER
FOOTPATH
BRIDGE GIRDER
PIPE
KERB
UPPER ROOF TRUSS
ARCHED VAULTING
SIS01 35.723
CABLE TROUGHING
AWS
SIGNAL L3076
EJB
TEL
POST
RAILINGS
BUFFER
EJBs
CANOPY
PLATFORM EDGE
BOTTOM OF PLATFORM
SIS05 35.750
COL
OLE GANTRY
PLATFORM 17
PLATFORM 16
SPILLWAY
1.99
8.14
1.98
BRIDGE BEAM
LIFT SHAFT
BRIDGE LEVEL
RAFTER
SECTION THROUGH VIADUCT PIERS AT ENVIRONMENT AGENCY FLOOD LEVEL OF 28.63m
ROOF TRUSS
ESCALATOR
STEPS
VIADUCT
ALLEY
FENCE
GATE
BLIND ARCH
ARCH
FENCE HT 3.5M
26.65
RIVER AIRE
APARTMENT BUILDING
CAR PARK
FOOTPATH
LITTLE NEVILLE STREET
RAILINGS FOOTPATH
HOTEL
LP
A
B
C
D
E

Appendix C. Faber Maunsell / Aecom Leeds Station Flooding Assessment

Leeds Station Southern Entrance
Flooding Assessment

Document No : 60092600 / 1018

Network Rail
October 2009

Prepared by: Vincent Cooke
Senior Engineer

Approved by: Graham Knott
Regional Director

Leeds Station Southern Entrance

Version no	Comments	Date
1	Internal Document	
2	Issued Document	22 May 09
3	Final Document	01 Oct 09

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Job No 60092600 Reference 1018 / v3 Date Created October 2009

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Flooding Assessment

1 Leeds Station Southern Entrance

1.1 Introduction

Network Rail is planning to create a new entrance to Leeds City Station, to serve the expanding commercial areas around the south side of the station.

Ground levels to this side of the station are lower than those within the station, and so escalator and lift access is planned. Due to the presence of existing buildings, there are few points which could accommodate any new structure housing these and also improve the pedestrian circulation within the station.

A scheme has therefore been designed which will utilise the area above the River Aire and the existing viaduct arches beneath the station to create a distinctive entrance with no increase in the ground footprint to that of the existing station.

This document is part of a suite of environmental reports assessing the impact of this proposal, and looks at any flood risk to or arising from the new entrance.

1.2 Current Situation

The River Aire passes beneath Leeds City Station through a multi arch structure. Near the downstream end of this, the river is crossed by Dark Neville Street, via DOL2/9A, and a separate - but immediately adjacent – footbridge. Both structures are normally clear of the river, and are supported by three masonry piers. The upstream soffit of DOL2/9A is approximately 26.78 mAOD.

1.3 Proposals

The new access will consist of an extension over the river on the south face of the station, housing the staircases and escalators, which will then pass back northwards to join a new concourse within the viaduct. This will fill the area between two of the existing downstream piers, and will link to Dark Neville Street by both a new footbridge at the same level as the new deck, and the lower DOL2/9A by steps. The existing footbridge will be removed. A second new pedestrian bridge will also be created along the south face of the station to join the extension from the sides.

To support the new river deck, downstream of the viaduct, the existing eastern and central piers will be lengthened by 15.1m (measured from the viaduct wall).

Within the viaduct arch, the underside of the new structures will be no lower than 28.6 mAOD, and downstream of the viaduct, between the new pier extensions, the underside will be 28.5 mAOD. This includes any supports, bracing or cladding. The new floor levels will be 29.1 mAOD.

The new escalators will require a maintenance pit at each end. The lower of these will be situated within the viaduct arch, and will extend below the new deck to 27.86 mAOD, into the river space below.

The new lifts will also require maintenance pits. These will be situated within the new extension of the eastern pier, and will cause the pier to widen locally by 250mm on each side above 27 mAOD.

The proposals are shown in Appendix 2

Temporary Works either in or above the river during construction will also be required.

2 Flood Risk

2.1 Flood Risk at the Site

2.1.1 *Predictions for current river configuration.*
Information supplied by the Environment Agency indicates that the 1% probability flood at DOL2/9A could currently be expected to reach 26.64 mAOD. This rises to 27.02 mAOD due to the predicted effects of climate change.

Based on limited spot level information, both banks of the river at Dark Neville Street are approximately 27.5 mAOD. The areas adjacent to the river in this location are therefore outside of Flood Zone Three, (or not at High Risk of flooding).

During the works, some or the viaduct arches alongside Dark Neville Street will be used as a site compound. Based on the levels above there should be no restrictions to this from a flood risk point of view, although as floods greater than a 1% probability event could occur at any time, provision to protect plant and materials should be considered if necessary.

While most of the structure itself is above the current 1% probability flood, and indeed also the greater but less frequent current 0.5% and 0.2% probability floods, its location above the river means that flooding can never be ruled out. The pier extension works could also be affected by any higher than normal river levels, even if flooding does not literally actually occur. Further consideration will be needed to ensure that any potential effect of the river during construction does not cause additional Health and Safety issues, or any adverse impact to the works. Temporary works should also be safeguarded as far as possible.

2.1.2 *Predictions for future river configuration*
The Environment Agency is currently preparing proposals for a new flood alleviation scheme through Leeds. Detailed design has not been undertaken, and the scheme not yet approved. However, it is currently envisaged that new walls will be constructed across Dark Neville Street to contain the river channel. These are currently planned to offer protection against the flood with a 0.5% probability of occurring [(1)].

The current Environment Agency figure for the 0.5% probability flood at DOL2/9A after the scheme and allowing for climate change is 28.12 mAOD. The table below shows further predicted flood levels around the area of the new station entrance.

Location	0.5% probability flood with climate change
Upstream of Dark Neville Street Bridge (DOL2/9A)	28.12 mAOD (referred to as 28.119 mAOD in Appendix 1)
Downstream of DOL 2/9A	27.84 mAOD
Upstream of Little Neville Street footbridge	27.97 mAOD

Table 1 : Environment Agency predicted flood levels.

The Environment Agency have also allowed an additional 510mm freeboard above these levels to generate the proposed defence levels.

To ensure the entrance is unaffected should the alleviation scheme progress as envisaged, the Environment Agency have specified the station entrance design needs to match their possible scheme. Upstream of DOL2/9A, the level that therefore needs to be considered is 28.63 mAOD.

[1] Note that because the river channel will be enclosed upstream and downstream of Leeds City Station, the flows and levels will change from the current situation. The actual level of the 0.5% probability flood now and after the FAS will differ, and should not be confused.

The floor levels of the new entrance structure will be 980mm above the estimated flood level of 28.12 mAOD, and so will not be affected by the specified flood (although more extreme floods could still potentially pass into the structure).

During flooding, large debris such as uprooted trees can be carried by the high flows. These can often become caught by obstructions such as bridges. This could cause a blockage, and water levels can rise significantly. The existing DOL2/9A could easily cause this effect, although currently flooding would spill to Dark Neville Street before the new structure would be affected. If the flood defences are constructed, DOL2/9A would be raised to the same level as the new deck, but spilling to Dark Neville Street would not occur until a much higher level was reached. It is therefore possible that under exceptional circumstances the new access bridges could be affected by some flooding. It may therefore be beneficial to design to exceedance of the specified flood. Protective permanent or demountable measures at the new entrance doorways could prevent floodwater ingress into the new concourse area.

This flooding to either DOL2/9A, Dark Neville Street, or the new access bridges within the viaduct would mean that access to the station via this entrance would have to be temporarily suspended. Emergency evacuation of the station would also be impossible via this route until the flood event receded sufficiently.

2.2 Flooding and Design Criteria

The main design limitation apart from finished floor levels, as discussed above, is that the new entrance structure should not cause any adverse effect on the flood regime of the river.

This could occur if parts of the new structure contain or block flows to any extent, and would apply to both flood and normal situations in the river.

The effects of the underside of the deck, lengthened piers, and the escalator and lift pits should all be considered.

As discussed above, the Environment Agency have allowed 510mm freeboard to their predicted 0.5% probability flood level with climate change. Incorporating this freeboard to the entrance scheme also needs to be undertaken, both to allow additional protection to the entrance, and to be consistent with the possible new defences.

Upstream of DOL2/9A the required clear level is 28.63 mAOD, which is to some extent due to flows reaching and backing up behind the face of this bridge. As the river flows beneath the structure, water levels drop, and by the downstream face of the adjacent Dark Neville Street footbridge, the required freeboard level is predicted to be 28.35 mAOD.

Within the viaduct arch, which is immediately downstream of the Dark Neville Street footbridge, the underside of the new structures will be no lower than 28.6 mAOD, and downstream of the viaduct, between the new pier extensions, the underside will be 28.5 mAOD. Both the arch deck and the River Deck will therefore be at least 150mm above 28.35 mAOD.

It is also likely that the new footbridge will also be above the required freeboard level, (as it is not known how the hydraulic gradient changes from 28.63 to 28.35 beneath DOL2/9A) although at worst it will only reduce the freeboard by 30mm. It will remain 480mm above the actual flood level.

While DOL29A is currently being retained and unchanged, the entrance scheme includes a stepped access to the new footbridge and concourse deck. Despite being above the existing bridge the underside of the deck should be above 28.63 mAOD. DOL2/9A could be overtopped by the modelled 0.5% flood, and so retaining the higher deck will allow flood flows to pass beneath the new adjacent footbridge.

As part of any defence scheme, DOL2/9A will also be raised, and this should also be no lower at any point than 28.63 mAOD. [(2)]

The escalator pit will be within the viaduct arch, and so also downstream of the dark Neville Street footbridge. It will protrude through the arch deck to 27.86 mAOD, and so will locally reduce the freeboard to 20mm, but will therefore remain clear of the actual water level. The protrusion is also not for the full width of the deck.

It would therefore be beneficial to ensure that the upstream face of the pit is suitably shaped to minimise the risk of flood debris from collecting against the upstream faces. The structure and material resilience should be considered to allow the pit to remain unaffected if water should act against it, and to ensure that safety is maintained while any maintenance is being undertaken, remembering that the pit is unsupported and above water. The pit opening should also be sealed to prevent water ingress to the deck during extreme flood events.

The lengthening of the piers could potentially alter the flow of the river, and the widening effect caused by the lift pits could cause a blockage to flood flows. To ensure any impact of these is identified, and allowing redesign if necessary so that the structure does not significantly increase the water levels in the river, we have undertaken further computer hydraulic modelling. This is discussed in section 2.3

As the new entrance will be above the river, the formal consent of the Environment Agency must be obtained for the structure, and any temporary works necessary to construct it. This is in addition to any consultation as part of the planning application process which the Environment Agency may be required to undertake.

It may also be beneficial to liaise with the Environment Agency over their planned flood alleviation scheme. Depending on construction timetables, it may be possible to undertake joint works, or alternatively at least ensure that the two schemes are compatible. Considerations would include how the two schemes could eventually be physically joined, will the entrance create any gaps which cannot easily be filled (and thus creating problems for a continuous linear defence, could the disabled access lifts at the ends of the new footbridge be situated so that they can be eventually protected etc.

2.3 Summary of Additional Modelling

In order to assess any impact of the new escalator pit and pier extension and widening on the river, the existing ISIS computer hydraulic model used for the flood alleviation scheme preliminary design was obtained from the Environment Agency.

It was found that this model did not include sufficient detail around Leeds City Station to enable an accurate analysis of the effect of any changes due to the station entrance scheme. (This is a result of the different modelling requirements and scales between the Environment Agency flood alleviation scheme and the Network Rail scheme). To rectify this, and to make the model suitable for the purposes of this study, changes to the geometry of the received model were undertaken. Appendix 1 provides detailed information on this process.

The Leeds Station Base Case Model contains these amendments, and the proposed Environment Agency defences.

As the base case model is a representation of the river after the flood alleviation scheme is constructed, DOL2/9A has also been removed. In reality it is likely the bridge will be raised to match the defence height, and the removal in the base model will simulate this in a more appropriate way for the comparison of the changes due to the new station entrance.

The geometry changes arising from the new entrance were then also incorporated, to form the Leeds Station Southern Entrance Model. Additional cross sections were created to represent the new geometry and hydraulic effects. Appendix 1 again contains further detail.

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[2] The Environment Agency have retained the current DOL2/9A bridge in their post defence model. When DOL29/A is raised as part of the defence scheme, it will not cause the same level of afflux upstream, and so the freeboard above the 0.5% flood could actually increase. This can only be beneficial where flooding is a possibility.

2.4 Modelling results

The improvements to the base case model geometry appear to cause water levels upstream of DOL2/9A to rise through the Dark Arches by up to 170mm (for the 0.5% probability flood with climate change), while downstream levels drop slightly. At the upstream face of DOL2/9A, the predicted level is 28.08 mAOD, while at the downstream face, 28.07 mAOD could be attained. There is therefore some difference from the levels stated by the Environment Agency, as would be expected by the changes made to the base case. The aims of this modelling though are to compare the effect of the new structure, not define an absolute flood level, and so while an awareness of the potential issues should be maintained, other physical changes to the river or detailed modelling for the flood alleviation scheme may supersede these figures.

After the changes due to the escalator pit and piers are incorporated into the model, and the results compared to the Leeds Station Base Case Model, the predicted changes actually cause the water levels of the 0.5% probability flood (after climate change) beneath the station viaduct to fall by up to 30mm (when compared to the improved base case model), as shown in Appendix 1, table 4.

This is thought to be a result of the extended piers moving flow changes to deeper water downstream of the viaduct rather than in the current position on a shallower apron bed.

There appears to be no significant rise in water levels upstream or downstream of the new entrance arising from the scheme.

The modelling shows that after the entrance scheme is completed, the 0.5% probability flood with climate change water level upstream of DOL2/9A could be 28.05 mAOD, the level at the downstream face could be 28.04 mAOD, and at the escalator pit, 27.73 mAOD.

The bottom of the escalator pit at 27.86 mAOD is therefore above the both the predicted 0.5% probability water level originally specified by the Environment Agency, and the modelled level arising from the entrance scheme, and so cannot influence the flood of the stated probability.

2.5 Other forms of flooding

Other elements usually covered by a flood risk assessment are not as relevant here due to the nature of the new extension. It will not be affected by groundwater or surface water ponding, and there is no risk of flooding from external water supply or drainage networks.

The new access will also not increase surface water runoff. The footprint of the extension is completely over the river, and so there is no change in infiltration or runoff rates as precipitation should still pass directly to the river from the roof.

Finally, the new proposals will not generate any further load on the foul water drainage system.

3 Conclusion

The preliminary design of Leeds Station Southern Entrance takes into account a flood level specified by the Environment Agency of 28.12 mAOD.

The improvements required to the base case model caused water levels to increase from this, but after the entrance scheme was incorporated, water levels showed a slight overall decrease.

This decrease will therefore increase the factor of safety to the entrance structure design as outlined, although the design should not change to take into account the new levels, as these are only as a result of a comparison exercise, not a process to define an absolute flood level.

Similarly, the modelled levels including the entrance structure changes should not influence the Environment Agency scheme, as other changes to the whole river affected by the flood alleviation scheme could cause these to be superseded before construction of either the entrance or the flood defences. The Environment Agency has indicated their support for the scheme, in an email dated 26th March 2009. This is included in Appendix 3.

The new station entrance would currently appear not to cause a detrimental change to the flood regime of the River Aire, and also should not be affected by the currently predicted flood with a 0.5% probability of occurring, after an allowance for climate change has been included.

Table 2 below summarises the scheme and Environment Agency predicted flood levels. Modelling of the water levels for comparison before and after the scheme are included in Appendix 4, but as they do not change the scheme parameters, are not included below.

Description	Water Level (mAOD)	Entrance Structure Levels (mAOD)
Proposed floor level		29.1
Underside of deck though viaduct		28.6
Underside of deck downstream of viaduct		28.5
Predicted 0.5% probability flood with climate change upstream of DOL2/9A, and flood alleviation scheme, from Environment Agency	28.12	
Bottom of escalator pit		27.86
Predicted 0.5% probability flood with climate change downstream of DOL2/9A, with flood alleviation scheme, from Environment Agency	27.84	
Current 1% probability flood plus climate change prediction at DOL2/9A, from Environment Agency	27.02	
Bottom of lift pit (within river pier)		27.0

Table 2 : Summary of Levels.

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Appendices

Appendix 1
Modelling Technical Note

Technical Note

Project: Leeds Station Southern Entrance Job No: **60092600**

Subject: Leeds Station Base Case and Proposed Southern Entrance Design ISIS Model Development

Prepared by: Aoife McNally Date: 15th May 09

Checked by: Ian Bentley

Approved by:

Introduction

As part of the Leeds Station Southern Entrance project Faber Maunsell were commissioned to develop an existing ISIS model to assess the impact the proposed Southern Entrance design would have on River Aire water levels. The Environment Agency provided an existing Atkins ISIS model of the River Aire along with a water level table outlining the current modelled water levels for the Aire.

The initial ISIS model received from the Environment Agency was reviewed and was identified as the Atkins base case model. This model represented the River Aire without the proposed defence scheme or Goit controls incorporated, and so was not used further in this study.

Faber Maunsell contacted the Environment Agency and requested the Flood Alleviation Scheme model. This model represented the proposed flood defences through Leeds and the Goit controls which was the most appropriate model to develop for the Leeds Station Southern Entrance project, as it contained the previously advised predicted flood levels to be considered.

After receiving and reviewing this Atkins FAS model it was found that it simplified the Dark Arches and river channel downstream of Leeds Station. The lack of detail in this existing model meant that amendments would need to be made to ensure the base case model was sufficiently detailed around Leeds Station for the purposes of this modelling study.

Leeds Station Base Case ISIS Model

Therefore to develop the Atkins FAS model into the Leeds Station Base Case model several new river sections were added. Table 1 below summarises the additional sections added to improve the representation of the Dark Arches and the channel downstream to the Leeds Liverpool Canal in the Leeds Station Base Case Model. Where available SIS survey data received in March 2009 (\\eu.aecomnet.com\euprojectvol\UKNCL2-TP\PROJECTS\Structures - Leeds Station Southern Entrance\06_Drawings\02_Drawings_Received\06_Topographical\Full Survey\3127-LDS-004.dwg) was used to define the channel profile of the additional river sections.

Section ID	Comment
02671600120	U/s of Granary Wharf Bridge a section was added using SIS survey data. Section represents the correct number of piers and a more accurate channel width upstream of Granary Wharf Bridge. A Bernoulli loss unit has been put in place to account for any head loss between the end of the arches and the section of open channel at Granary Wharf.
02671600119	1m d/s of Granary Wharf Bridge. Section channel profile defined using SIS survey data. Upstream of this section a Bernoulli loss unit has been put in place to account for head loss following the end of the open channel and the beginning of the arches.
02671600112	Section added to represent approximate location of escalator pit between Granary Wharf and the end of the Dark Arches. Section interpolated from 02671600110 and 02671600119.
02671600110	14m d/s section created using SIS survey data to represent the end of the Dark Arches.
02671600110Z	Section added to represent unimpeded channel after Dark Arches. A Bernoulli loss unit has been put in place to take any head loss between the end of the Dark Arches and the open channel section into account in the model.
02671600109	Section added 9m d/s of the Dark Arches based on SIS river survey. Section represents channel narrowing downstream of the Dark Arches.
02671600108	Section added 8.5m d/s based on SIS river survey. Section represents further channel narrowing.
02671600107	Section added 7m d/s based on SIS river survey. Section represents further channel narrowing.

Table 1: Summary of additional sections added to the Leeds Station Base Case Model

Within the Dark Arches several amendments were made to improve the model configuration. Between section 02671600170Z and 02671600120 six interpolates were added to represent the decreasing channel width and number of piers. Granary Wharf Bridge was also removed from the model as it likely it will be raised during the flood alleviation scheme to match the new defences. This removal in the base case will simulate the raised deck, and will allow a better comparison of the effects of the entrance scheme as falsely high levels of afflux upstream will be discounted. The sections upstream and downstream of the Bridge, 02671600120C and 02671600120D, were kept in the model but they were clipped to only represent the channel and not the floodplain on either side. The bank tops were raised so that they were in line with the defence heights given in the EA Leeds FAS guidance (Table 2). An additional section was added into the base case between Granary Wharf and the end of the Dark Arches. This section was put in place to allow for a record of an additional water level prior to the proposed design components being modelled. The section was put in the approximate location of the escalator pit in the proposed design.

Following the initial model assessment the Little Neville Footbridge channel profile in the Atkins Model was queried as it seemed to be overestimating the channel width. The Atkins model infers that the channel increases in width from Granary Wharf Bridge (36m) to Little Neville Footbridge (41m). This may have been the result of the section being interpolated from Granary Wharf Bridge rather than using actual survey data. The footbridge skew has not been incorporated into the Atkins model so the bridge has been modelled as a straight bridge over the river channel. The distance in the Atkins FAS model between the two bridges has been set to 20m this distance seemed inaccurate following a brief site visit. The distance and channel width were confirmed as being incorrect following receipt of the SIS survey data.

The data in the footbridge section was amended in the Leeds Station Base Case model to ensure the section provided the most accurate representation of the bridge. The distance between the end of the Dark Arches and Little Neville Footbridge was updated based on the SIS survey data to 31.5m. The width of the footbridge based on the skew axis was measured using the new survey data, a more accurate width of 26.97m was incorporated into the model. The skew angle of 25 degrees was calculated using the SIS survey drawings. The sections directly upstream and downstream of the footbridge were updated to include the channel width of 25.1m.

Using the information provided by the EA the additional sections were modified to ensure that the bank tops included the Flood Alleviation Scheme defence levels plus 510mm freeboard see Table 2 below for the levels incorporated into the Leeds Station Base Case model.

Location Description	Max Stage 200yr+CC	Defence Level + Freeboard
u/s Granary Wharf Bridge	28.12	28.63
d/s Granary Wharf Bridge	27.84	28.35
u/s Little Neville Street Bridge	27.97	28.48
d/s Little Neville Street Bridge	27.95	28.46

Table 2: Defence Levels + Freeboard applied to the Leeds Station Base Case Model (Leeds Flood Alleviation Scheme, Environment Agency, 2009)

As can be seen in Table 1 several modifications were made to the Atkins FAS Model in order to make it suitable for using in this study. This model configuration ensured that the ISIS modelled water levels provided the best base case results possible.

Leeds Station Southern Entrance ISIS Model

The Leeds Station base case model was developed further to incorporate the proposed Leeds Station Southern Entrance design. Table 3 summarises the additional sections incorporated to represent the proposed entrance design.

Section ID	Comment
02671600112C	Section added to represent downstream extent of the elevator pit in the model. Bernoulli loss unit added upstream of this location to take any head loss caused by the elevator pit into account.
02671600110Z	Section amended to represent the removal of a pier downstream of Granary Wharf Bridge. A Bernoulli loss unit has been put in place to take any head loss following the removal of the column into account in the model.
02671600110Y	Section put in to represent the extended piers for the proposed Leeds Station Southern Entrance design. Eastern pier widened by 500mm.
02671600110X	Section added 15.1m downstream to represent the end of the extended piers of the proposed design. A Bernoulli loss unit has been put in place to take any head loss between the end of the extended piers and the open channel section into account.

Table 3: Summary of additional sections added to the Leeds Station Model

In the proposed design model several sections had to be added to ensure the pier extension downstream of the existing Dark Arches was represented correctly. Two piers have been extended by 15.1m and the eastern most pier has been widened by 500mm to take the lift bays into account. An additional Bernoulli loss unit was put into the model to account for any head loss at the end of the pier extensions and the open channel. The elevator pit was also taken into account in the model by putting in a Bernoulli loss unit to represent the loss of channel area caused by the protruding elevator pit.

Analysis of Results

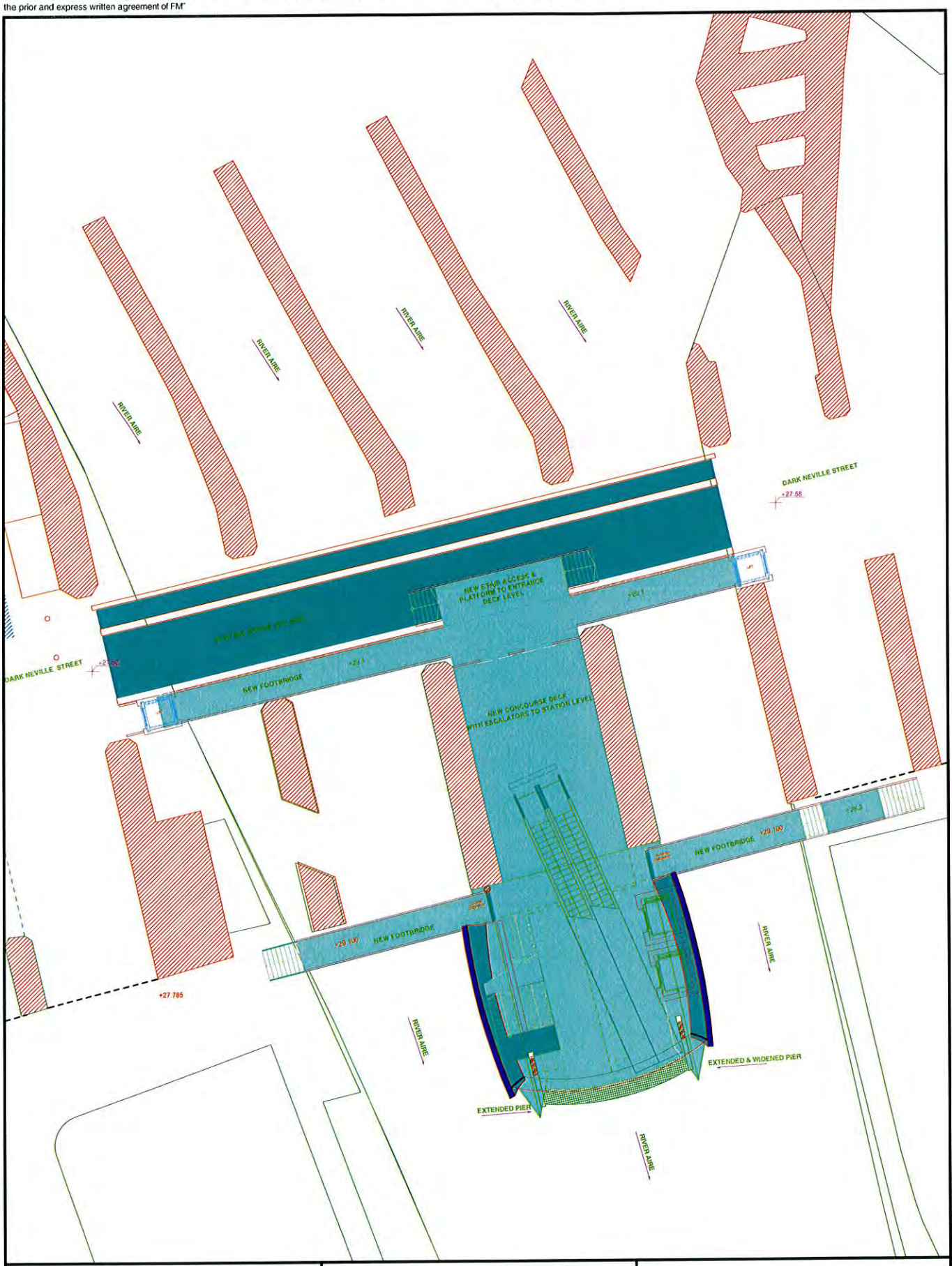
Table 4 below summarises the water levels derived following the development of the Leeds Station base case and the Leeds Station Proposed Design model. As can be seen from the water levels there is a small fall in water levels following the incorporation of the proposed design. This is because the transition at the end of the extended piers occurs in deeper water with lower velocity.

Following this model amendment it was confirmed that the proposed elevator pit does not interact with the 200yr+CC water levels.

		Atkins FAS Model			Leeds Station Base Case			Leeds Station Southern Entrance			Difference Between Proposed Design and Base Case		
Model Node	**Location**	**100yr**	**200yr**	**200yr+CC**	**100yr**	**200yr**	**200yr+CC**	**100yr**	**200yr**	**200yr+CC**	**100yr**	**200yr**	**200yr+CC**
0267160274C	Princes Square u/s of the Dark Arches	28.091	28.193	28.624	28.094	28.196	28.748	28.094	28.196	28.731	0	0	-0.017
02671600270	1st section representing arches	27.349	27.635	28.408	27.591	27.886	28.557	27.57	27.865	28.536	-0.021	-0.021	-0.021
02671600220Z	2nd section representing arches	27.272	27.568	28.366	27.533	27.834	28.511	27.512	27.812	28.49	-0.021	-0.022	-0.021
02671600170Z	3rd section representing arches	27.197	27.501	28.313	27.469	27.77	28.449	27.446	27.747	28.428	-0.023	-0.023	-0.021
02671600120	New section added to the model u/s of GW				27.042	27.342	28.032	27.011	27.312	28.004	-0.031	-0.03	-0.028
02671600120C	u/s of Granary Wharf	26.967	27.277	28.119	27.088	27.389	28.077	27.058	27.359	28.05	-0.03	-0.03	-0.027
02671600120D	d/s of Granary Wharf	26.81	27.124	27.838	27.08	27.381	28.071	27.05	27.352	28.044	-0.03	-0.029	-0.027
02671600119	New section added to the model d/s of GW				26.822	27.121	27.818	26.785	27.086	27.787	-0.037	-0.035	-0.031
02671600112	New section added to model allow for the inclusion of the elevator pit in the model				26.77	27.069	27.767	26.732	27.032	27.734	-0.038	-0.037	-0.033
02671600112C	New section added to model allow for the inclusion of the elevator pit in the model							26.732	27.032	27.734			
02671600110	New section added to model 14m ds to represent end of Dark Arches				26.757	27.051	27.742	26.719	27.015	27.71	-0.038	-0.036	-0.032
02671600110Z	New section added to represent extension of piers				26.808	27.103	27.791	26.741	27.036	27.73	-0.067	-0.067	-0.061
02671600110Y	New section added to represent extension of piers							26.957	27.245	27.914			
02671600110X	New section added to represent end of pier extensions							26.984	27.274	27.947			
02671600109	New section added to model using SIS survey to represent narrowing of river channel				26.986	27.277	27.949	26.986	27.277	27.949	0	0	0
02671600108	New section added to model using SIS survey to represent narrowing of river channel				26.957	27.245	27.915	26.959	27.249	27.918	0.002	0.004	0.003
02671600107	New section added to model using SIS survey to represent narrowing of river channel				26.894	27.18	27.847	26.897	27.183	27.851	0.003	0.003	0.004
02671600100C	u/s of Little Neville Footbridge	26.974	27.28	27.971	26.837	27.12	27.782	26.84	27.123	27.785	0.003	0.003	0.003
02671600100D	d/s of Little Neville Footbridge	26.965	27.267	27.949	26.837	27.12	27.779	26.84	27.123	27.783	0.003	0.003	0.004
02671600070z	30m d/s of Little Neville Footbridge	26.949	27.252	27.935	26.906	27.197	27.873	26.909	27.2	27.876	0.003	0.003	0.003

Table 4: Modelled Water Levels Extracted from River Aire ISIS Model Runs

Appendix 2
Proposals Drawing



Client: NETWORK RAIL	Title: PLAN OF PROPOSALS	FABER MAUNSELL | AECOM	cm
Project: LEEDS STATION SOUTHERN ACCESS	Design: / CAD:	5th Floor, 2 City Walk, LEEDS, LS11 9AR — Tel: +44 (0) 113 391 6800, Fax: +44 (0) 113 391 6899, www.fabermaunsell.com	
	Chk'd: / App'd:	No. Report 1018 Fig 1	Rev: --
	Date: MAY 09 / Scale: nts		

F:\GROUPS\Rivers\Leeds Station Southern Entrance\1018 fig 1.dwg [AutoCAD Location]

A4

Appendix 3
EA Correspondence

Wade, Tom

From: john turner [mailto:johnhw.turner@ntlworld.com]
Sent: 26 March 2009 13:25
To: Lewis, Christopher D.
Cc: john.turner@environment-agency.gov.uk; mark.garford@environment-agency.gov.uk
Subject: Re: Leeds Station Southern Entrance

Hi Chris,

I have discussed with our development control staff. Providing that the maximum projection is no more than 140mm and the modelling (yet to be completed), shows no significant adverse effects then we would not object to this proposal.

Regards,

John

----- Original Message -----
From: Turner, John
To: johnhw.turner@ntlworld.com
Sent: Thursday, March 26, 2009 9:46 AM
Subject: FW: Leeds Station Southern Entrance

From: Lewis, Christopher D.[SMTP:CHRIS.LEWIS@FABERMAUNSELL.COM]
Sent: Thursday, March 26, 2009 9:45:36 AM
To: Turner, John; Garford, Mark
Subject: Leeds Station Southern Entrance
Importance: High
Auto forwarded by a Rule

John / Mark

I am just following up from the meeting we had on 20th January, with regards to the projection of the escalator pit into the design flood levels.

You have previously agreed to the principal that we will have a discrete projection down into the design flood level of 1 in 200 years plus climate change.

I am therefore sending you a sketch showing the extent of the projection to confirm that this proposal is acceptable to the Environment Agency. All other parts of the structure (except the piers) will be above the 1 in 200 year plus climate change plus freeboard (510mm) level.

I would be grateful if you could review the attached proposal and confirm your acceptance at the earliest opportunity.

<<Escalator Pit Projection.pdf>>

Regards

Chris Lewis

Principal Engineer

Faber Maunsell | AECOM

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One Trinity Gardens

Broad Chare

Quayside

Newcastle Upon Tyne

NE1 2HF

Tel: 0191 224 6551

Fax: 0191 224 6599

09/04625 №

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LEEDS CITY COUNCIL
Please refer to Decision Notice
13 NOV 2009
ADDITIONAL

Leeds Station Southern Entrance
Flooding Assessment

Document No : 60092600 / 1018, Version 3 – 1st October 2009

ADDENDUM 13th November 2009

According to Planning Policy Statement 25, planning policy decisions should be undertaken in order to guide development towards the most suitable available site at the lowest possible flood risk. This is done by applying the Sequential Test, and then if necessary, the Exception Test at both a strategic and individual site level.

The Sequential Test is a risk-based test that should be applied at all stages of development and aims to steer new development to areas with the lowest probability of flooding (Zone 1). This is usually applied by the Local Authority by means of a Strategic Flood Risk Assessment (SFRA).

Depending on the vulnerability to flooding of the proposed development, and its final situation after a sequential test has been applied (and if necessary the location of the development changed), PPS25 may require the Exception Test to be applied, as shown below.

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	1	✓	✓	✓	✓	✓
	2	✓	✓	Exception Test required	✓	✓
	3a	Exception Test required	✓	×	Exception Test required	✓
	3b	Exception Test required	✓	×	×	×

Flood Risk Vulnerability and Flood Zone 'Compatibility' (PPS25, Table D.3)

Leeds City Council have indicated that they would class the new station entrance as being Essential Infrastructure. Ideally, according to the sequential approach, this should be located away from flood risk areas. However the station entrance cannot be relocated away from this side of the station, and due to other existing buildings in the proximity, the entrance must be located at this position.

Following the indication of the Sequential Test (that the entrance structure is in flood zone 3) and as such being Essential Infrastructure which cannot be relocated to a zone of lower flood risk, PPS25 instructs that a further Exception Test is carried out.

For the Exception Test to be passed, it must be demonstrated that:

- There are sustainability benefits that outweigh the flood risk;
- It is on previously developed land or there are no other suitable previously developed sites in lower flood risk zones; and

- The new development is safe and does not increase flood risk elsewhere.

The new entrance will improve commuter links from the railway station to the expanding commercial district to the south of the station. It will also improve passenger throughflow at the existing entrances. Usage of an essential transport link, and the continued redevelopment of this part of Leeds should be sustained.

Most of the structure does not have a ground footprint as such, and so it is neither on nor off previously developed land, but there are no other previously developed sites available which would be suitable. However, when its vertical situation is considered, the new floor slab will be above 28.5 mAOD, and so the entrance will actually be in the equivalent of Flood Zone 1 or 2, and so not at risk of flooding from the River Aire during the currently predicted 1% probability flood (or indeed also the greater but less frequent current 0.5% and 0.2% probability floods). The main report also demonstrates that no other source of flooding will affect the structure, and that the structure will not increase flood risk elsewhere or prevent maintenance access to the river. In the event of an extreme flood, it is likely that the southern entrance would be closed, in order to maintain public safety.

09/04625

AECOM

LEEDS CITY COUNCIL
Please refer to Decision Notice
5 - FEB 2010
ADDITIONAL

Leeds Station Southern Entrance
Flooding Assessment

Document No : 60092600 / 1018, Version 3 – 1st October 2009

ADDENDUM 2 - 14th January 2010

Access Lifts

The reference to the protection of lifts in Section 2.2 (page 5) of the FRA has been superceded. The reference referred to the use of lifts as opposed to ramps to access the walkways leading up to the Southern Entrance. The confirmed scheme does not utilise lifts, having only ramps. There is therefore no requirement to protect lifts from flood events, and this reference is removed.

Intermediate Case

The FRA concentrates on 2 N°. Scenarios, those being the existing situation and the future situation of both the Southern Entrance and the Leeds Flood Alleviation Scheme (FAS) having been constructed.

A third, intermediate case exists, where the new Southern Entrance is constructed but the Leeds FAS is not. In this case the existing Dark Neville Street bridge will still be in place at its current level. This leaves a difference in level between this bridge and the new Southern Entrance Deck. This gap could provide a catch-point for flood debris to become stuck in. However, we have reviewed the flood data provided by the Environment Agency and do not consider the risk of this occurring to be significant.

As the Dark Neville Street bridge will remain in its current level and position upstream of the new entrance, the flood analysis undertaken by the EA remains valid. The analysis shows that for a 1 in 200 (+ Climate Change) flood event, the water level upstream of this bridge, does not rise above the level of the existing bridge girders. This analysis takes into account the possibility of debris building up against Dark Neville Street bridge and thus it is shown that water will not flow over this bridge. As this is the case no debris will be able to float over Dark Neville Street bridge and lodge in the gap between it and the new Southern Entrance.

Leeds Flood Alleviation Scheme

This scheme is currently at the outline design stage and as such, details of the construction are limited. However, discussions with the EA indicate that the scheme will involve the construction of concrete walls along the river banks.

The proposed Southern Entrance has a number of structures constructed adjacent to the river banks. These structures will be designed in liaison with the EA to ensure they complement the proposed FAS. The structures have all been designed to present a solid concrete face to the river and will incorporate watertight connections into the existing railway viaduct, where this is directly adjacent to the new structures.

If desired, a planning condition could be added such that the final design is subject to approval by Leeds City Council and Environment Agency, prior to construction commencing.

Appendix D. Correspondence with the Environment Agency

Record of meeting

Mott MacDonald

Project Title	Leeds Station South Entrance	***Division***	WNE/EVT/EMS
Subject	Flood Modelling	***Project No.***	269480
Location	Metro Office Leeds	***Date of Meeting***	26/9/2011

Present

Paul Millard (MM)	Caroline Young (Metro)	Mark Garford (Environment Agency)
Jason Smith (MM)	Caroline Coy (Metro)	
	Joanne Blignaut (Metro)	

Recorded by	***Distribution***
PM	All

Item	***Text***	***Action on***
01	JS outlined the current 'Grip 4 LSSE' scheme and the possible 'Alternative LSSE' scheme (incorporating improved access).	
02	MG confirmed that the EA are largely content with the GRIP 4 LSSE scheme. MG added that it would be appropriate to double check the current EA flood model results and confirm the flood levels in the Aecom GRIP 4 Flood report are still correct (contact neyorkshire@enviornment-agency.gov.uk)	
03	MG outlined that one of the key requirements for the EA would be that the construction proposals should consider the flood risk. Therefore a 'top down' approach would be preferred, to avoid works in the channel or scaffolding in the river. MG did not specify which flood event would be the critical event for the construction phase. JS and CY outlined that these aspects would be considered in the Carillion 'Constructability Assessment' currently being undertaken, and that it is probable that barges on the River Aire would be used to transport materials and equipment to site. It was agreed that these could be moored in the adjacent Lochs during breaks in the construction works (e.g. Christmas shut down), or if a flood event is forecast.	
04	MG commented that for the Alternative LSSE scheme the EA's preference would be for the raised entrance on Little Neville Street Bridge to be constructed as a new bridge, with removal of the existing bridge (rather than a raised deck on top of the existing bridge)	
05	MG to confirm the current proposals for Leeds Flood Alleviation Scheme (FAS) and in particular the proposals in respect to Little Neville Street Bridge, which was previously proposed to be raised.	MG
06	JS and CY noted that proposals to replace the existing bridge may find that existing services/utilities running within the existing bridge	

Item	Text	Action on
	deck cannot be raised to a higher level, and would therefore need to be slung under the new bridge. MG commented that if this was found to be the case, it would be necessary to streamline the services/utilities ducts or casing to reduce the risk of debris getting trapped and causing blockages.	
07	MG agreed that the following scenarios should be modelled: 1a – GRIP 4 LSSE existing conditions (no FAS) 1b – GRIP 4 LSSE future conditions (including FAS) 2a – Alternative LSSE existing conditions (no FAS) 2b – Alternative LSSE future conditions (including FAS)	
08	MG outlined the requirements for flood defence consents associated with the works: • Consent(s) are required for all temporary works (including surveying and Ground investigations). Details required include method statements and plans/photos for the works. • Consent(s) are required for the permanent works. Details required will most likely be included with planning documents. • A single consent may be obtained for each stage (temporary and permanent works), or the works can be split into multiple consents, if this is preferred. • Each consent costs £50 (inc VAT), takes 2 months for the EA to determine and the final consent lasts 3 years.	
09	CY noted that Metro (Via Network Rail) are currently commissioning topographic survey (including river cross sections) of the LSSE site. It is anticipated that this survey data will not be available in time to form part of the flood modelling exercise.	

Minutes

Client:	LSSE, Metro
Meeting Title:	Meeting with EA regarding river surveys and constructability
Meeting Date:	10 October 2011
Meeting Location:	Wellington House
Meting No:	1

Attendees

Tom Gifford	Metro	TG
Caroline Young	Metro	CY
Joanne Blignaut	Metro	JBl
Andrew Farnworth	Network Rail	AF
Mark Garford	Environment Agency	MG
Matt Murr	Carillion	MM
John Bilcliffe	Carillion	JBi
Mike Widdicks	Carillion	MW
Jason Smith	Mott MacDonald	JS
Andrew Norman	Mott MacDonald	AN
John Bowes	Mott MacDonald	JBo
Additional Distribution		
Debra Armistead	Network Rail	DA
Steve Duffy	Network Rail	SD

	Action

1. Apologies

Apologies were received from Debra Armistead and Steve Duffy.

2. Consents for GI surveys

AF confirmed that the Section 71 Notice had been issued. It was noted, however, that the timescales referred to in the letter did not reflect Carillion's programme. In addition, the timescale for undertaking the surveys did not include for EA consent.

MG requested more detailed information from NR/Carillion on how the river bed surveys would be undertaken. NR/Carillion to apply for EA consent to undertake the surveys. AF to provide confirmation on when consent will be issued. — AF/JBi — AF

MG to confirm that GI surveys would not materially interfere with trout spawning season, which commenced on 1 October. — MG

JBi advised that Carillion would be able to undertake the GI surveys in one of two ways:

1. To build a pontoon (7.5m x 10m) in the river, float it up to the archways and wire strap it to the existing archways. This approach would take approximately 5 days and would allow for 2 bore hole samples to be taken from the general location of new piles.
2. To drill through the existing bridge on Dark Neville Street and take one bore hole sample to determine where the bedrock was. This approach could be done in one day. Carillion would then develop a foundation strategy over the next few months and then undertake further bore hole samples next year once the location of the new piles was known.

JBi explained that if the GI data was available for the Blue and Waterman's Place apartments then this would provide an indication of where the bed rock was under the river. AF to collate and circulate GI data for riverbank locations to MM and Carillion by 21/10/11 — AF

It was agreed that the preference was to undertake the GI surveys using option 2, subject to the bore hole being drilled from the section of the bridge which was owned by Network Rail. It was noted that the survey would realistically be undertaken at the beginning of December and that the results should be ready by the end of December. TG to discuss implications of this with DA. — TG

	Action
3. Constructability JS explained that Mott MacDonald had produced a draft Order Limits for the TWAO application and detailed the approach that had been taken to obtain these limits.	
Carillion confirmed that MM had very similar ideas as to how the new entrance would be constructed and agreed to ratify Mott MacDonald's draft Order Limits, within 2 weeks.	MM
Carillon confirmed that they would produce a draft constructability assessment by 4th November. This would include the proposed alternative option, with access through Dark Neville Street.	MM
JBi advised that Carillion would submit one application to the EA for consent for the whole scheme. MG confirmed that the EA may need the full 8 week period to consider the application, MG to provide clarification on likely timescales for considering consent.	JBi MG
A discussion took place about the proposed alternative design and the possibility of removing or jacking-up the existing bridge in Dark Neville Street. MG suggested speaking to Leeds City Council as they have a strategy to remove the bridge.	TG

Millard, Paul

From: Beech, Cheryl [Cheryl.Beech@environment-agency.gov.uk]
Sent: 27 October 2011 14:16
To: Millard, Paul
Subject: Your Enquiry: RFI/2011/20435
Attachments: Standard Notice.pdf; VAT Receipt.pdf; RFI 20135 - Node Location Map.pdf; RFI 20135 - Model Results.pdf; RFI 20135 - Modelling Report.pdf; PPS25 Climate Change.pdf

Our Ref: RFI/2011/20435

Your Ref:

Dear Paul

Provision of Product 4 for City Station, Leeds LS1 4DT

Thank you for your request of 7 October 2011 to use Environment Agency data, Product 4, in the development of the above site. The information is attached.

If you have requested this information to help inform a development proposal, then you should note the detail in the attached advisory text on the use of Environment Agency Information for Flood Risk Assessments / Flood Consequence Assessments.

Supporting Information

Modelling - River Aire Model in Leeds

See enclosed extracts from the Leeds Flood Alleviation Scheme Project Appraisal Report produced by Atkins in February 2007. Extracts consist of:

- A spreadsheet showing:
  - results for peak water levels for the 0.2% (1 in 500yr), 0.5% (1 in 200yr), 1% (1 in 100yr), 1.33% 1 in 75yr), 2% (1 in 50yr) annual chance events,
  - results for the 0.5% (1 in 200yr), 1% (1 in 100yr) peak water levels for the 2105 Climate Change Scenario (+30% flow)
- Map showing the location of the model node points.
- Report extract.

Climate Change

See attached appendix B, from the department for Communities and Local Government's PPS 25 (Planning Policy Statement), for Development and Flood Risk.

LIDAR Data

Light Detection and Ranging (LIDAR) is an airborne mapping technique, which uses a laser to measure the distance between the aircraft and the ground. This technique results in the production of an accurate, cost-effective terrain model suitable for assessing flood risk and other environmental applications.

The Environment Agency owns two LIDAR systems, which are installed in a survey aircraft along with its other operational remote sensing instruments.

The aircraft is positioned and navigated using Global Positioning System (GPS) corrected to known ground reference points. The aircraft typically flies at a height of about 800 metres above ground level and a scanning mirror allows a swath width of about 600 metres to be surveyed during a flight.

To get a license for the data you will need to contact our Science Group, stating the area you are interested in (preferably an OS Grid Reference, or a map with the area outlined). There may be a charge for this data.

Low resolution Data is returned as an ASCII grid, which can easily be converted to a surface model for use in most GIS applications, and is provided in 2km x 2km tiles, at a resolution of 2m.

High resolution Data is also returned as an ASCII grid, in 0.5km x 0.5km tiles, at a resolution between 0.125 and 0.5m.

For current catalogue of coverage see: http://www.geomatics-group.co.uk/GeoCMS/order.aspx

To obtain the data and license agreement, please contact:

Environment Agency Geomatics
Phoenix House
Lower Bristol Road
Bath BA2 9ES
Tel: 01225 487658
Fax: 01225 487643
E-mail: archived-lidardata@environment-agency.gov.uk

If you have any further questions regarding the site please contact Mark Garford who is the Development and Flood Risk Engineer for Bradford, Craven and Leeds on 0113 213 4763.

This information is provided subject to the enclosed notice, which you should read.

If you have any queries or would like to discuss the content of this letter further please do not hesitate to contact us on the number below.

Yours sincerely

Cheryl Beech
External Relations Team
Direct Dial 0113 2134732
Email neyorkshire@environment-agency.gov.uk

Please note: I job share with Stacey Riley. I cover Tuesday, Wednesday & Thursday - Stacey covers Monday & Friday.

Environment Agency
Phoenix House
Global Avenue
Leeds LS11 8PG

Part of the Environment Agency's Yorkshire and North East Region

Encs Detailed FRA/FCA Map

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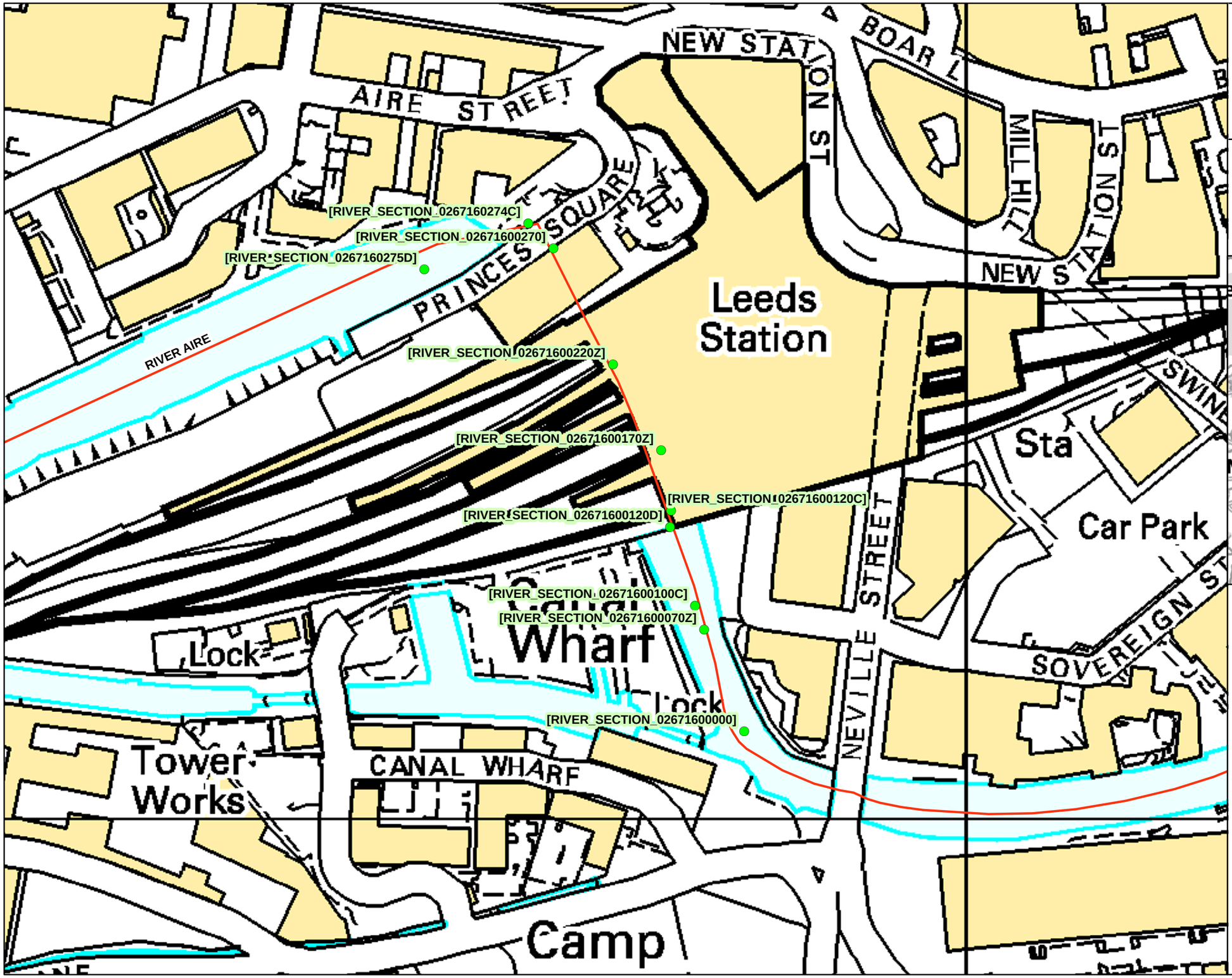
Contact: enquiries@environment-agency.gov.uk 08708 506506

Model Node Map for Leeds Station - Date Created : 27/10/2011 [Ref: 20135]



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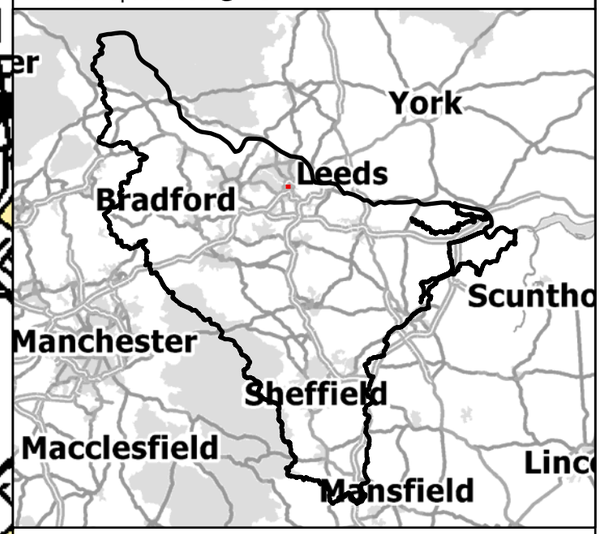

LEGEND

- Main River
- Node Locations - Leeds FAS Model

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Client: Environment Agency North East Region
Project: Leeds city FAS - project appraisal
Stage PA7 Hydraulic Modelling

ISIS model nodes and design water levels - Base Model (June 2006 - with the model changes at the Kirkstall Goit/Aire confluence) in comparison to the option models of Raised Defences and in combination with the Goit Controls

				Base model							Model 16 - Raised Defences							Model 17 - Raised Defences + K GOIT Controls							Model 19 - Raised Defences + Both GOIT Controls						
Model node	Description	Centreline Chainage (m)	Bed Level	Max Stage 50year	Max Stage 75year	Max Stage 100year	Max Stage 200year	Max Stage 100+CC year	Max Stage 500year	Max Stage 200yr +CC	Max Stage 50year	Max Stage 75year	Max Stage 100year	Max Stage 200year	Max Stage 101CC year	Max Stage 500 year	Max Stage 200yr +CC	Max Stage 50year	Max Stage 75year	Max Stage 100year	Max Stage 200year	Max Stage 101CC year	Max Stage 500 year	Max Stage 200yr +CC	Max Stage 50year	Max Stage 75year	Max Stage 100year	Max Stage 200year	Max Stage 101CC year	Max Stage 500 year	Max Stage 200yr +CC
River Aire: Newlay to Fleet (Leeds PAR study reach)																															
0267160275D		8,394.5	25.072	27.971	28.033	28.074	28.166	28.294	28.314	28.399	27.985	28.051	28.096	28.191	28.307	28.342	28.64	27.985	28.05	28.091	28.194	28.307	28.342	28.625	27.985	28.049	28.093	28.194	28.307	28.342	28.625
0267160274C	Leeds Station viaduct u/s	8,395.0	25.072	27.971	28.033	28.074	28.166	28.294	28.313	28.399	27.985	28.05	28.095	28.19	28.306	28.341	28.64	27.984	28.05	28.091	28.193	28.306	28.341	28.624	27.984	28.049	28.093	28.193	28.306	28.341	28.624
2671600270	Canal Wharf	8,398.0	25.700	26.928	27.053	27.129	27.301	27.52	27.556	27.738	27.089	27.259	27.359	27.624	28.02	28.073	28.426	27.086	27.256	27.349	27.635	28.021	28.074	28.408	27.087	27.254	27.355	27.635	28.021	28.074	28.409
02671600220Z	Duplicated sections (model overlap)	8,448.0	24.900	26.797	26.94	27.022	27.204	27.427	27.464	27.65	26.996	27.178	27.282	27.556	27.965	28.02	28.384	26.992	27.175	27.272	27.568	27.966	28.02	28.366	26.993	27.173	27.278	27.568	27.966	28.02	28.366
02671600170Z	Duplicated sections (model overlap)	8,498.0	24.100	26.702	26.846	26.927	27.11	27.334	27.371	27.56	26.915	27.102	27.208	27.489	27.904	27.96	28.332	26.912	27.098	27.197	27.501	27.905	27.96	28.313	26.913	27.096	27.203	27.501	27.905	27.96	28.313
02671600120C	U/s Granary Wharf access bridge	8,568.0	23.300	26.424	26.569	26.644	26.813	27.016	27.05	27.235	26.686	26.873	26.977	27.264	27.693	27.749	28.139	26.683	26.869	26.967	27.277	27.694	27.749	28.119	26.683	26.866	26.973	27.277	27.694	27.749	28.12
02671600120D	D/s Granary Wharf access bridge	8,590.0	23.300	26.222	26.365	26.437	26.596	26.777	26.809	26.991	26.527	26.717	26.82	27.111	27.482	27.548	27.853	26.524	26.713	26.81	27.124	27.483	27.548	27.838	26.525	26.71	26.816	27.124	27.483	27.548	27.838
02671600100C	U/S Little Neville Street footbridge (new)	8,598.0	21.365	26.449	26.591	26.667	26.835	27.037	27.072	27.258	26.697	26.881	26.984	27.267	27.627	27.691	27.985	26.694	26.878	26.974	27.28	27.628	27.691	27.971	26.695	26.875	26.98	27.279	27.628	27.691	27.971
02671600070Z	Duplicated sections (model overlap)	8,628.0	21.365	26.426	26.567	26.641	26.805	26.999	27.034	27.218	26.675	26.857	26.959	27.239	27.596	27.659	27.949	26.672	26.854	26.949	27.252	27.596	27.659	27.935	26.673	26.851	26.955	27.252	27.597	27.659	27.935
2671600000	Leeds Lock (u/s)	8,698.0	20.246	26.336	26.47	26.539	26.687	26.86	26.892	27.069	26.597	26.776	26.875	27.151	27.505	27.568	27.859	26.594	26.773	26.865	27.164	27.506	27.568	27.844	26.595	26.77	26.871	27.164	27.506	27.568	27.844

Appendix E. Correspondence with Leeds City Council

LEEDS STATION SOUTHERN ENTRANCE
COMMENTS ON EIA SCOPING REPORT

This EIA Scoping report identifies a range of topics for investigation, listed in Chapter 5. I realise there are several supporting documents that that will cover other environmental topics, listed in Section 1.6. However, I would be interested to know whether the relevant reports will cover climate change mitigation & adaptation. Both these topics relate to 'Climatic Factors' that need to be covered within the EIA Regulations

- **Climate change mitigation:** I would be interested to understand your approach & proposed actions to reduce energy demand & resultant GHG emissions arising from:-
    - All construction activities of the of the above project
    - The operation & use of the LSSE.

- **Climate change adaptation:** Would be interested to know how you propose to climate proof this development against:-
    - The effects of flooding & water scour on supporting river piers
    - Resilience to intense rainfall on proposed structure
    - Thermal comfort inside the LSSE structure, during heat wave conditions
    - Resilience to high winds etc.
    - To assist in the above, will you consider using the UK Climate Projections 2009?

Air Quality
As stated in the report AQMA's do exist in central Leeds, the closest AQMA is located just 800 metres from the development. Background emissions of NO_2 are generally high in the vicinity of the LSSE, due mainly to emissions from city centre road transport & local emissions from diesel trains.

An air quality assessment will be required to assess the likelihood of local air quality exceedances &/or potential air pollution or odour nuisance, & to develop appropriate mitigation. Our main concerns are likely at:-

- Any residential/hotel units affected by vehicular access & drop off points, especially if vehicles keep engines running in contained urban environment
- Potential dust & air pollution nuisance from construction activities, affecting the adjacent residential dwellings.

Noise

- Clearly during the construction phase there is massive potential for noise to affect the residents of the 2 apartment blocks overlooking the site
- Any measures to ameliorate these effects would obviously be good – enclosure/covering of works (working within Dark Arches where possible?)
- It will be important to keep affected residents informed in advance of works – when the particularly noisy activities are to take place, how long they will last etc and to avoid anti-social hours working where possible

- Any improvements to the current noise climate which could be achieved via the scheme would clearly be beneficial – it was noted during a site visit that the existing tannoys on the southern platform of the station are parallel to the station perimeter (rather than pointing inwards as might be expected) – as such announcements can be heard from outside the station and could potentially be an annoyance to the residents of the apartments. It is recommended that any new tannoys point back into the station (and if possible the existing ones could be re-aligned to do so too).
- If the existing barrier/shelter along the southern edge of the station were to be 'beefed-up', then some acoustic benefits might be felt by the apartment dwellers.
- It is possible that the structure of the proposal itself might screen some existing station noise from the apartments.

Vibration

- Vibration levels should be monitored during construction works and residents informed if perceptible levels are likely within the apartments (an explanation of the levels at which vibration is felt compared to that at which damage can occur could be reassuring).

Other

- Consideration should be given to the possibility of claims under Part 1 of the Land Compensation Act in relation to the public works associated with this scheme. (Claims may be put forward if the claimant feels there has been a change in physical factors such as noise, vibration, lighting, fumes etc as a result of the use of new public works).
- Care should be taken in relation to potential loss of privacy to the adjacent apartment buildings (frosted glass in appropriate areas of the entrance façade?).

conditions or ask for further/amended work) and return your comments to me by 18th November (2 weeks). Any problems please let me know.

Regards
Mark
07891 271824

Millard, Paul

Subject: RE: Leeds Station Southern Entrance Flood Risk Assessment

From: Davis, Pete
Sent: 07 November 2011 12:24
To: Philpott, Mark
Cc: Briggs, Chris
Subject: RE: Leeds Station Southern Entrance Flood Risk Assessment

Mark,

The assessments carried out by Mott McDonald and previously AECOM seem to meet our requirements for a FRA, however there are one or two details that need to be completed.

I assume that they have been in detail discussion with the EA regarding the modelling of River levels and that these proposal will not lead to additional flood risk nor create difficulties for the Leeds FAS - also that the works will be to at least the minimum standard of 1:200 plus climate change.

Thanks

Peter Davis
Flood Risk Manager

Flood Risk Management
(formerly Land Drainage)
Leeds City Council
Middleton Offices
Leeds
LS10 4AX
Tel: 0113 39 51525
Email: Peter.Davis@leeds.gov.uk
(address book "Davis, Pete")
land.drainage@leeds.gov.uk

From: Philpott, Mark
Sent: 03 November 2011 17:45
To: Davis, Pete
Cc: Briggs, Chris
Subject: Leeds Station Southern Entrance Flood Risk Assessment

Pete,

As discussed a couple of weeks back, Motts have been preparing a Flood Risk Assessment for the proposed Leeds Station Southern Entrance. The document has now been submitted to us in draft form and can be found in:-

G:\EVERYONE\Leeds Station Southern Entrance\TWAO Document Review\Flood Risk Assessment\RPT003 LSSE FRA REV A DRAFT.pdf

Please could you review the document from a Planning perspective (so we can set any necessary

Appendix F. Correspondence with British Waterways

From: Martyn Coy [Martyn.Coy@britishwaterways.co.uk]
Sent: 07 November 2011 10:19
To: Robert Fox
Cc: Enquiries Northeast
Subject: RE: Transport and Works Act 1992: Scoping Request consultation: Leeds Station Southern Entrance Scheme

Robert

Sorry for the delay in our response.

The main issues that need to be considered as part of the scoping request are:

· Prior to the commencement of development, full construction details of the foundations/ supporting structures on the river bed should be submitted to and agreed by the local planning authority in conjunction with British Waterways. In order to ensure that there will be no detrimental impact on the bed or banks of the River Aire and the associated waterway infrastructure.

· Prior to the commencement of development, full construction details of the bridge span where it lands on the side of the navigation should be submitted to and agreed by the local planning authority in conjunction with British Waterways. In order to ensure that there will be no detrimental impact on the bed or banks of the River Aire and the associated waterway infrastructure.

· Prior to the commencement of development, full details of the surface water drainage arrangements including means of discharging into the watercourse should be submitted to and agreed by the local planning authority in conjunction with British Waterways. In order to prevent any damage to the waterway structure, protect water quality and users of the waterway and to make an assessment of the increased volume of water entering the watercourse.

· The recommendations of the Ecological Assessment Report and Bat Survey Report must be fully implemented. Prior to the commencement of development, full details of the ecological mitigation measures must be submitted to and agreed by the local planning authority in conjunction with British Waterways. The ecological environment in this location is sensitive and should be protected from disturbance, dust, run off, waste etc. from entering the waterway, impacting on water quality and the environment.

· Prior to the commencement of development, full details of appropriate mitigation measures to prevent pollution of the waterway during construction of the proposed development shall be submitted to and agreed in writing by the Local Planning Authority and thereafter implemented in accordance with the agreed details unless otherwise agreed in writing. In order to avoid contamination of the waterway and ground water from wind blow, seepage or spillage at the site.

In addition, the applicant/developer is advised to contact British Waterways' Estates Manager Simon Currass (0113 281 6800) in order to negotiate our explicit agreement and approval to construct and locate the structure on our property and

our Third Party Works Engineer, Alan Daines (0113 200 5713) in order to ensure that all necessary consents are obtained and the works are compliant with the current British Waterways' "Code of Practice for Works Affecting British Waterways.

Regards,

Martyn Coy

Area Planner

British Waterways 0113 281 6803

From: Enquiries Northeast
Sent: 17 October 2011 10:49
To: Martyn Coy
Subject: FW: Transport and Works Act 1992: Scoping Request consultation: Leeds Station Southern Entrance Scheme
Importance: High

From: Robert Fox [mailto:]
Sent: 06 October 2011 16:23
To: Enquiries Northeast
Subject: Transport and Works Act 1992: Scoping Request consultation: Leeds Station Southern Entrance Scheme
Importance: High

Please see the attached 2 page letter formally consulting you in respect of these proposals, and an 81 page EIA Scoping Report.

As requested in the letter, please confirm within a week whether you or another is the person in your organisation who will be dealing with this matter, and provide your substantive response within 28 days.

Robert J Fox

Transport and Works Act Orders Unit

General Counsel's Office

Department for Transport

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