A63 Castle Street Improvement, Hull

Scheme Number: TR010016

6.1 Environmental Statement

APFP Regulation 5(2)(h)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 6

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Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

A63 (Castle Street Improvement, Hull) Development Consent Order 20[ ]

ENVIRONMENTAL STATEMENT

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A63 Castle Street Improvements, Hull
Environmental Statement

Volume 1 Main text

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A63 Castle Street Improvements, Hull

Environmental Statement

Volume 1

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Chapter 1. Introduction

1.1 A63 Castle Street Improvements, Hull

1.1.1 As the Applicant, Highways England is proposing to improve approximately 1.5 km of the A63 Castle Street in Hull in East Yorkshire between Ropery Street and the Market Place and Queen Street junctions. The route currently experiences congestion, particularly around Mytongate Junction, due to the volumes of traffic and delays caused by existing traffic signals.

1.1.2 The general location of the Scheme is shown in Volume 2, Figure 1.1 Scheme location.

1.1.3 This Environmental Statement (ES) is a report that documents the Environmental Impact Assessment (EIA) process which has been carried out for the A63 Castle Street Improvements (the Scheme).

1.2 The roles of Highways England and the designer

1.2.1 The Highways Agency became Highways England in 2015. Highways England is the Developer of the Scheme and is responsible for the maintenance and improvement of the trunk road and motorway network in England.

1.2.2 The Mott MacDonald Sweco Joint Venture (MMSJV) has been appointed by Highways England to prepare the Development Consent Order (DCO) application and undertake the EIA.

1.2.3 Balfour Beatty/Arup have been appointed by Highways England under an Early Contractor Involvement (ECI) design and build contract to develop the detailed engineering designs from the initial preliminary design carried out by MMSJV in 2014.

1.2.4 Arcadis has been appointed by Highways England to undertake the traffic modelling requirements of the project.

1.2.5 Together Highways England, Balfour Beatty/Arup, MMSJV and Arcadis make up the Project Team.

1.3 The statutory process

1.3.1 The Scheme is a Nationally Significant Infrastructure Project (NSIP) to which the Planning Act 2008[1] (the 2008 Act) applies. An NSIP is a type and scale of project which the government considers is of national importance, for which consent is required at a national level and by the responsible government minister,

[1] Planning Act 2008. Available online at: http://www.legislation.gov.uk/ukpga/2008/29/contents

specifically the 'Secretary of State' (SoS). Development consent to construct a NSIP may only be granted by DCO following an application under Section 37 of the 2008 Act. Section 37 of the 2008 Act also governs the content of an application for a DCO, including the requirements for the necessary accompanying documents. These requirements are given effect by the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (the APFP Regulations), which also require an application for a DCO to be accompanied by an ES if the scheme has been identified as an 'EIA project'.

1.3.2 In planning terms, the Scheme is a NSIP under Sections 14(1)(h) and 22 in Part 3 of the 2008 Act as amended by the Highway and Railway (Nationally Significant Infrastructure Project) Order 2013[2]. This is because the Scheme involves the improvement of a highway wholly in England for which the SoS is the highway authority and is likely to have a significant effect on the environment.

1.3.3 Other elements of the Scheme that are not directly related to the highway are termed 'associated development' and permitted under Section 115 of the 2008 Act. For this Scheme, this includes the bridges, drainage (other than that within the road boundaries), service relocations, setting out of replacement land for public open space and some of the works in Trinity Burial Ground which do not form part of the highway structure.

1.3.4 This ES will be submitted as part of the application to the Planning Inspectorate[3] for a DCO alongside a number of other relevant documents, see Section 1.8. More information about the 2008 Act and the process for applying for a DCO can be found on the Planning Inspectorate National Infrastructure Planning website: https://infrastructure.planninginspectorate.gov.uk/.

Princes Quay Bridge

1.3.5 Planning permission for Princes Quay Bridge, a pedestrian, cycle and disabled user bridge, located between Ferensway and Princes Dock Street which forms part of the Scheme, was obtained on 7 October 2015 under the Town and County Planning Act 1990[4] (reference: 15/00965/FULL).

1.3.6 When the DCO submission date for the Scheme was re-scheduled to summer 2018 and the start of works date moved to March 2020, the local Member of Parliament, Hull City Council (HCC) and key stakeholders adjacent to the Scheme requested that Highways England was to deliver Princes Quay Bridge in advance of the DCO decision for the Scheme. This was in order to provide accessibility and connectivity benefits to the Scheme at the early stages of the Construction Phase.

[2] Highway and Railway (Nationally Significant Infrastructure Project) Order 2013. Available online at: https://www.legislation.gov.uk/ukdsi/2013/9780111539408

[3] The Planning Inspectorate can be found online at: https://www.gov.uk/government/organisations/planning-inspectorate

[4] Town and Country Planning Act 1990. Available online at: http://www.legislation.gov.uk/ukpga/1990/8/contents

The construction phasing of the Scheme is such that for a significant period of time, pedestrian access across the A63 will be restricted due to the construction of the underpass. Early completion of the Princes Quay Bridge will aid pedestrian and other NMU movement in this area. This proposal was considered and approved by Highways England in November 2017 and subsequently the Project Team have been working towards a start on site for Princes Quay Bridge in October 2018. However, early construction of Princes Quay Bridge is subject to Highways England being able to reach voluntary land agreements with all affected landowners. If the land and rights in land cannot be acquired by agreement, and therefore delivered under the Town and County Planning Act 1990, Princes Quay Bridge will be built as part of the Scheme.

1.3.7 As a result, within the DCO application there will be reference made to Princes Quay Bridge being built in advance of the Scheme and also delivered as part of the DCO. For the purposes of the ES, the EIA process has assumed that Princes Quay Bridge is being built as part of the Scheme and the topic Chapters 6 to 16 make reference to this accordingly. This is in order to assess the 'worst case scenario' and to align with the Traffic Assessment process. If Princes Quay Bridge is constructed early, there will be no adjustment to the DCO application to ensure consistency across the application. Staggered delivery is not anticipated to have any significant effect on any assessments within the ES.

1.4 Planning policy

National policy

National Policy Statement

1.4.1 The government has produced a series of National Policy Statements (NPSs), including one on National Networks[5], which covers roads. The NPS for National Networks (NN NPS) sets out "*the need for, and the Government's policies to deliver, development of nationally significant infrastructure projects on the national road and rail networks*". The NPS provides guidance for promoters of NSIPs and also provides the basis for examination by the examining authority (the Planning Inspectorate in this instance) and decision making by the SoS. The Scheme's fit with the NN NPS is set out in Sections 2.3.4 to 2.3.7 and Chapter 2, Figure 2.2 Alignment of NN NPS and Scheme objectives. Compliance with the NN NPS is set out in more detail in the Planning Statement (document reference TR010016/APP/7.1).

[5] National Policy Statement for National Networks December 2014 Department for Transport, document. Available online at: https://www.gov.uk/government/publications/national-policy-statement-for-national-networks

National Planning Policy Framework

1.4.2 The National Planning Policy Framework[6] (NPPF) was published in March 2012 and sets out to make the planning system less complex by replacing Planning Policy Statements (PPSs) and Planning Policy Guidance (PPGs). The NPPF sets out the government's planning policies for England and how these are expected to be applied and provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities. The NPPF does not contain specific policies for NSIPs for which particular considerations apply as determined by the NN NPS.

Summary

1.4.3 The aims of the Scheme are directly in line with the national frameworks and illustrate the need for the Scheme on a national level. The government has highlighted the requirement for further growth and improvements to the national networks within the NN NPS. The Road Investment Strategy[7] (RIS) 2015 to 2020 which sets out a long-term approach to improving England's motorways and major roads (i.e. the 'strategic road network'), examines these needs in further detail and supports the Scheme as a required improvement to the network. It can be concluded therefore, that the Scheme receives full national policy support.

Local policy

Statutory development plan

1.4.4 In line with the NPPF, HCC have produced the Hull Local Plan[8] 2016 to 2032 as part of the statutory development plan for Hull. This was adopted on 23 November 2017 and will be used to guide new development in the city up to 2032.

1.4.5 Paragraph 2.18 of the Hull Local Plan states that HCC has a legal duty to cooperate with Highways England when planning for strategic transport issues that affect a wider area than Hull. In addition, a number of policies and statements acknowledge the limitations that are caused by current congestion levels and clearly demonstrate the need for the Scheme in terms of facilitating future growth and development:

- Paragraph 6.42: "*The A63 Castle Street Improvement Scheme will help to reduce congestion as well as improve access, both to the city centre and the*

[6] National Planning Policy Framework March 2012 Department for Communities and Local Government, document. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

[7] Road Investment Strategy 2015 to 2020 document. Available online at: https://www.gov.uk/government/collections/road-investment-strategy

[8] Hull Local Plan 2016 to 2032 Hull City Council document. Available online at: http://www.hullcc.gov.uk/portal/page-_pageid=221,52707&_dad=portal&_schema=PORTAL

port and areas along Hedon Road. It will also reduce pollution and bring connectivity between the city centre and waterfront area."

- Policy 26: "Development should… deliver, where relevant…proposals, in terms of the A63/A1033 (Strategic Road Network), that can be accommodated within the existing capacity of a section (link or junction) or they do not increase demand for use of a section that is already at full capacity unless it can be demonstrated that mitigation measures can be introduced to address the projected impact; and new cycle, pedestrian routes, public transport facilities which serve the site."

- Paragraph 10.18: "Hull's future growth and development is heavily dependent on the ability of A63 Castle Street / A1033 to continue to have sufficient highways capacity to absorb extra traffic flows generated by new development"

- Paragraph 10.24, which stresses that without the development of the Scheme, there will remain the challenge to manage the heavily congested A63.

- Policy 29 identifies the "A63 Castle Street Improvement Scheme" as a project for which land and routes are protected. This confirms that the proposed Scheme is at the forefront of transport development for the City.

Local Transport Plan

1.4.6 HCC produces a Local Transport Plan (LTP) which sets out the vision and aims for transport in Hull. The council has published the third Local Transport Plan (LTP3[9]) covering the period 2011 to 2026. The vision for LTP3 is:

"To provide and develop a safe and efficient transport system that contributes to the social, environmental and economic well-being of the residents, businesses and visitors to the City and provides equal opportunities for everyone to access key services using, where possible, 'green' alternatives to the private car."

1.4.7 The LTP3 vision is supported by a suite of objectives, based on the Department for Transport (DfT) national policy framework as follows:

- To ensure that good levels of accessibility, especially by public transport, are integrated with planned changes to the City in the health, housing, education and employment sectors

- To maintain and improve road safety on the City's road network

[9] Local Transport Plan 3 2011 to 2026 Hull City Council, document. Available online at: http://www.hullcc.gov.uk/portal/page-_pageid=221,161326&_dad=portal&_schema=PORTAL

- To help facilitate the regeneration of the City and the expansion of the Port of Hull in a sustainable manner
- To promote a healthier City through improving air quality and encouraging active travel

Section 9.5 of LTP3 references the A63 Castle Street Scheme and ongoing consultations between the council, Highways Agency (now Highways England) and the DfT. It highlights the key role of the A63/A1033 Trunk Road in the development of Hull with congestion identified as a major problem on the route as follows:

> *"The heavy traffic levels coupled with the high proportion of heavy goods vehicles … in an urban area with high levels of pedestrian and cycle activity lead to Castle Street forming a barrier between the City Centre and the prime regeneration and leisure areas along the Humber Waterfront*."

Network Management Plan

1.4.8 HCC's Network Management Plan (NMP[10]) 2009 sets out the council's approach to the management of its road network. The NMP identifies a number of issues including congestion and journey times on the city's radial routes, the A63 trunk road corridor and, in particular, Castle Street. The NMP recognises that effective management of the road network is a key step in tackling congestion, particularly in Hull where its strategic importance and role as a 'gateway to Europe' creates unique challenges.

Humber Local Enterprise Partnership Strategic Economic Plan

1.4.9 The Strategic Economic Plan (SEP[11]) 2014 to 2020 for the Humber is an integrated plan for growth, informed by experience and expertise from across the Humber Local Enterprise Partnership (LEP) area. The Humber LEP and local authorities are committed to producing a Humber Spatial Plan as part of the Hull & Humber City Deal[12], setting out the key strategic employment locations. The Plan will be used to inform future investment proposals and will be the basis for collecting up-front environmental data to reduce barriers for new investment.

1.4.10 The Scheme is flagged within the document, highlighting its importance in opening Hull for economic growth. Is it stated that the A63 Castle Street dual carriageway is an important link between the M62 and the Port of Hull yet it is one of the

[10] Network Management Plan 2009 Hull City Council, document. Available online at: http://www.hullcc.gov.uk/portal/page-_pageid=221,605689&_dad=portal&_schema=PORTAL

[11] Humber Local Enterprise Partnership Strategic Economic Plan 2014 to 2020 document. Available online at: http://www.humberlep.org/assets/uploads/user/strategies/StrategicEconomicPlan.pdf

[12] Hull & Humber City Deal, document. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/265969/Hull___Humber_City_Deal_document.pdf

busiest sections of road in the region. It continues to acknowledge that the Scheme will relieve congestion and address opportunities for development and regeneration and identifies that these improvements will provide an opportunity to address severance issues within the city through a new pedestrian bridge over the A63 connecting the waterfront area with the city centre, helping to maximise the benefit of the City of Culture[13] designation.

Summary

1.4.11 The need for the Scheme has been identified in local policy documents, and its development is supported by both HCC and the Humber LEP. It is specifically noted in the Hull Local Plan, and it is identified that future growth and development in the area is reliant on the delivery of the Scheme. The Scheme is therefore a critical piece of infrastructure in terms of unlocking the area for future economic development.

1.4.12 The LTP3 outlines clearly the current constraints on the Hull road network and highlights the A63 area as a key area for improvement. The Scheme will actively support achieving the objectives stated within the LTP3, in addition to providing necessary infrastructure required on a national level. The Scheme is therefore supported by transport policies and guidance at the National and Local level.

1.5 Highways England Licence

1.5.1 The SoS has appointed Highways England Company Limited (the "*Licence holder*") as a strategic highways company by way of an Order in accordance with Section 1 of the Infrastructure Act 2015. The Licence came into force on 1 April 2015 and as a result Highways England is the highway authority, traffic authority and street authority for the strategic road network in England.

1.5.2 The Licence document[14] sets out key requirements which Highways England must comply with in exercising its functions and complying with its legal duties and obligations. This includes:

- minimising the environmental impacts of operating, maintaining and improving its network
- seeking to protect and enhance the quality of the surrounding environment
- conforming to the principles of sustainable development

[13] Hull City of Culture 2017 website. Available online at: https://www.hull2017.co.uk/

[14] Highways England licence 2015 document. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/431389/strategic-highways-licence.pdf

1.5.3 Highways England also has a general duty under Section 5(2) of the Infrastructure Act 2015[15] to have regard to the effects of its functions on the environment. In complying with its general duty, Highways England should:

- Ensure that protecting and enhancing the environment is embedded into its business decision-making processes and is considered at all levels of operations
- ensure the best practicable environmental outcomes across its activities, while working in the context of sustainable development and delivering value for money
- consider the cumulative environmental impact of its activities across its network and identify holistic approaches to mitigate such impacts and improve environmental performance
- where appropriate, work with others to develop solutions that can provide increased environmental benefits over those that it can achieve alone, where this delivers value for money
- calculate and consider the carbon impact of road projects and factor carbon into design decisions, and seek to minimise carbon emissions and other greenhouse gases from its operations
- adapt its network to operate in a changing climate, including assessing, managing and mitigating the potential risks posed by climate change to the operation, maintenance, and improvement of the network
- develop approaches to the construction, maintenance and operation of its network that are consistent with the government's plans for a low carbon future
- take opportunities to influence road users to reduce the greenhouse gas emissions from their journey choices

1.5.4 The ES describes how these requirements will be fulfilled and delivered within the Scheme. The approach to this is outlined in Chapter 2 The Scheme and detail provided within the topic Chapters 6 to 16.

1.6 The purpose of the Environmental Statement

1.6.1 The purpose of this ES is to provide information to the Planning Inspectorate and any other interested parties about the effects of the Scheme on the environment and to ensure that these effects are fully considered before the decision on whether to grant a DCO is made.

[15] Infrastructure Act 2015. Available online at: http://www.legislation.gov.uk/ukpga/2015/7/contents/enacted

1.6.2 The principle legislation governing EIA is European Directive 85/337/EEC[16] and its subsequent amendments, codified in Directive 2011/92/EU[17] as amended (the EIA Directive). The EIA Directive is given effect in the UK by a range of different regulations applicable to various sectors and geographic jurisdictions.

1.6.3 In the case of the Scheme, the relevant regulations are the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009[18], as amended (the EIA Regulations 2009). This is because transitional provisions in the more recent Infrastructure Planning (Environmental Impact Assessment) Regulations 2017[19] (the EIA Regulations 2017) which replace the 2009 Regulations provide that the 2009 Regulations remain applicable to any NSIP that is subject to a requirement for EIA, and that had its 'scoping' phase before 16 May 2017. The Environmental Statement Scoping Report[20] for this Scheme was submitted to the SoS on 4 March 2013 under Regulation 8 of the EIA Regulations 2009 in order to request a Scoping Opinion (document reference TR010016/APP/6.9). The Scoping Opinion for the Scheme was subsequently issued by the Planning Inspectorate in April 2013[21]. Therefore, this ES is prepared in accordance with the EIA Regulations 2009. See Volume 3, Appendix 1.1 Applicability of the EIA Regulations 2009 for more information. The production of this ES is required by law under the EIA Regulations 2009.

1.7 Content of the Environmental Statement

1.7.1 This ES is structured as follows:

- Non-Technical Summary
- Volume 1 Main Text
- Volume 2 Figures
- Volume 3 Appendices

1.7.2 The Non-Technical Summary (document reference TR010016/APP/6.4) is a plain language summary of the content and conclusions of the ES.

[16] European Directive 85/337/EEC. Available online at: http://ec.europa.eu/environment/eia/eia-legalcontext.htm

[17] European Directive 2011/92/EU. Available online at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32011L0092

[18] Planning Act (2008) Infrastructure Planning (Environmental Impact Assessment) Regulations 2009. Available online at: http://www.legislation.gov.uk/uksi/2009/2263/contents/made

[19] Infrastructure Planning (Environmental Impact Assessment) Regulations 2017. Available online at: http://www.legislation.gov.uk/uksi/2017/572/pdfs/uksi_ and/ or0572_en.pdf

[20] Scoping Report 2013 Highways Agency, document. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/244110/a63-castle-street-hull-es-scoping-report.pdf

[21] Scoping Opinion 2013 Planning Inspectorate document. Available online at: https://infrastructure.planninginspectorate.gov.uk/wpcontent/ipc/uploads/projects/TR010016/TR010016-000061-130410_TR010016_Scoping%20Opinion.pdf

1.7.3 The main text of the ES has been written to be easily understood and with minimal use of technical terms. Where the use of technical terms is unavoidable, every effort has been made to provide an explanation. A Glossary of technical terms and abbreviations is also included.

1.7.4 The preliminary chapters within the ES provide background information to the Scheme and explain the design, consultation and EIA process as follows:

- Chapter 1 Introduction
- Chapter 2 The Scheme
- Chapter 3 Consideration of alternatives
- Chapter 4 Consultation
- Chapter 5 Environmental Impact Assessment process

1.7.5 Topic Chapters 6 to 15 describe the assessment of impacts for each of the environmental topics: Air quality, Noise and vibration, Cultural heritage, Landscape, Ecology and nature conservation, Road drainage and the water environment, Geology and soils, Materials, People and communities and Effects on all travellers.

1.7.6 Chapter 16 Combined and cumulative effects considers the inter-relationships between the impacts of the Scheme identified for different topics, and also between the impacts of the Scheme and impacts of other planned developments. The 'in combination' effects of climate change have also been considered on a topic by topic basis in this chapter.

1.7.7 Chapter 17 Summary of Environmental Statement findings presents a summary of the ES findings and tables those effects that are significant.

1.7.8 The figures contained within ES Volume 2 Figures comprise supporting plans and images that cannot be embedded within the chapter text due to their size.

1.7.9 ES Volume 3 Appendices provide supporting technical documentation to the ES chapters. These include Volume 3, Appendix 9.7 Tree survey appended at Chapter 9 Landscape; Volume 3, Appendix 10.2 Bat survey report appended to Chapter 10 Ecology and nature conservation; and Appendix 13.2 Outline Site Waste Management Plan (Outline SWMP) appended to Chapter 13 Materials.

1.7.10 The Health Impact Assessment (HIA) has been integrated into the EIA process. A summary of health impacts is provided within Chapter 16 Combined and cumulative effects.

1.8 Other relevant documents

1.8.1 Although this ES is a standalone report, there are other documents that have been produced by the MMSJV to support the application for DCO and which are relevant to the EIA process. Such documents include as follows:

- The Outline Environmental Management Plan (Outline EMP or OEMP) (document reference TR010016/APP/7.3). This is a plan that presents all environmental objectives and risks and identifies actions to ensure mitigation and commitments are delivered by the contractor. The OEMP is explained in more detail at Chapter 5 EIA process.
- The Book of Reference (document reference TR010016/APP/4.3) which details land rights for the Scheme.
- The Consultation Report (document reference TR010016/APP/5.1) which provides an account of matters relating to consultation undertaken in respect of the Scheme. For more details see Chapter 4 Consultation.
- The Assessment of the Implications for European Sites (AIES) (document reference TR010016/APP/6.13) is required as parts of the Scheme are within 2km of the Humber Estuary European Protected Sites. The process has been undertaken on behalf of the Secretary of State for Transport as the Competent Authority for the Scheme and requires consultation with Natural England and subsequent consent from the Marine Management Organisation (MMO) prior to the issue of the marine licence for works in the Humber Dock Marina. For more details see Section 2.5.8.
- A Statement of Common Ground (SoCG) is being prepared relating to proposed mitigation works within Trinity Burial Ground, see Chapter 8 Cultural heritage.
- A Statement of Statutory Nuisance is provided at document reference TR010016/APP/6.5.

1.9 Other regulatory regimes

1.9.1 In addition to the ES, and outside of the DCO process, there are certain regulatory regimes and consents that need to be followed or obtained to allow the Scheme to proceed. These include:

- faculties issued through the Diocesan Advisory Committee under the Care of Churches and Ecclesiastical Jurisdiction Measure 1991[22]

[22] Care of Churches and Ecclesiastical Jurisdiction Measure 1991. Available online at: http://www.legislation.gov.uk/ukcm/1991/1/contents

- licence from the SoS pursuant to Section 25 of the Burial Act 1857[23]
- licences from Natural England to affect European Protected Species pursuant to regulation 53 of the Conservation of Habitats and Species Regulations 2010[24]
- consents from Natural England to work in Sites of Special Scientific Interest under regulation 28E of the Wildlife and Countryside Act 1981[25]
- permits and exemptions from the Environment Agency pursuant to the Environmental Permitting (England and Wales) Regulations 2010[26]
- Vehicle Special Order(s) from the Vehicle Certification Agency under Section 44 of the Road Traffic Act 1988[27]

1.9.2 Other consents can be included as part of the DCO when discussed and agreed including:

- deemed marine licence from the Marine Management Organisation[28]
- consent(s) from the relevant sewerage undertaker to discharge waste water to a sewer pursuant to Section 118 of the Water Industry Act 1991[29]
- consent(s) from the relevant local authority pursuant to Section 61 of the Control of Pollution Act 1974[30]

1.10 Availability of this Environmental Statement

1.10.1 If the application for a DCO is accepted, all application documents including this ES will be published on the Planning Inspectorate website: https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/a63-castle-street-improvement-hull/.

[23] Burial Act 1857. Available online at: http://www.legislation.gov.uk/ukpga/Vict/20-21/81/contents

[24] Conservation of Habitats and Species Regulations 2010. Available online at: http://www.legislation.gov.uk/uksi/2010/490/contents/made

[25] Wildlife and Countryside Act 1981. Available online at: http://www.legislation.gov.uk/ukpga/1981/69

[26] Environmental Permitting (England and Wales) Regulations 2010. Available online at: http://www.legislation.gov.uk/ukdsi/2010/9780111491423/contents

[27] Road Traffic Act 1988. Available online at: http://www.legislation.gov.uk/ukpga/1988/52/contents

[28] Marine Management Organisation website. Available online at: https://www.gov.uk/government/organisations/marine-management-organisation

[29] Water Industry Act 1991. Available online at: http://www.legislation.gov.uk/ukpga/1991/56/contents

[30] Control of Pollution Act 1974. Available online at: http://www.legislation.gov.uk/ukpga/1974/40

1.10.2 This ES will also be available to view for the duration of the examination stage of the DCO application process at the following locations which should be contacted directly for opening times:

- Hull Central Library, Albion Street Telephone: 01482 210 000
- Bransholme Library, Northpoint Shopping Centre Telephone: 01482 331 234
- Ings Library, Savoy Road Telephone: 01482 331 250
- Gipsyville Library, Hessle High Road Telephone: 01482 616 973
- Avenues Library, Chanterlands Avenue Telephone: 01482 331 280
- Holy Trinity Church, Kings Street Telephone: 01482 224 460
- Hull City Council, Guildhall Telephone: 01482 300 300
- Highways England, Lateral, 8 City Walk, Leeds, LS11 9AT Telephone: 0300 470 2450

1.10.3 Copies of the ES may also be requested from Highways England using contact details below. A CD copy can be provided free of charge. Paper copies of the Non-Technical Summary can also be provided free of charge. Paper copies of the ES main text, figures and appendices are available subject to a charge for printing. Please contact Highways England at the address below for prices.

1.10.4 Highways England can be contacted:

- By email: A63CastleStreet.Hull@highwaysengland.co.uk
- In writing: The A63 Castle Street Improvements Project Team, Highways England, Lateral, 8 City Walk, Leeds, LS11 9AT
- By telephone: 0300 470 2450 (9am-5pm, Monday to Fridays)

1.11 Availability of other information

1.11.1 Any requests for further information about the Scheme should be made in writing to the Highways England A63 Castle Street Improvements Project Team at the address above, see Section 1.10.4.

1.12 What happens next

1.12.1 After the application for the DCO has been submitted and if it is accepted, the Scheme will proceed through the application process. Further information on the next steps in the application process can be found from the National Infrastructure Planning website https://infrastructure.planninginspectorate.gov.uk.

1.12.2 If a decision is reached to grant the DCO, then Highways England will progress the Scheme to prepare for construction. The process to appoint a contractor responsible for the construction of the Scheme, is currently underway.

1.12.3 Key programme dates, subject to the DCO being granted would be:

- Start of works on site: March 2020
- Open to traffic: May 2025

Chapter 2. The Scheme

2.1 Introduction

2.1.1 This chapter explains why the A63 Castle Street needs to be improved and what the proposed improvements would be. An overview of the need for the Scheme, the Scheme objectives, Scheme history and a description of the Scheme Site and surrounding area including environmental mitigation design measures are provided at Section 2.6. An outline of the proposed improvements, traffic flow, elements of the Scheme yet to be finalised are provided in Sections 2.6 to 2.8. The construction stage (see Section 2.9) and operation and maintenance requirements (see Section 2.10) are also described.

2.2 The existing road

2.2.1 The existing A63 Castle Street comprises approximately 1.5km of dual carriageway from the eastern side of Rawlings Way grade separated junction (also known as a split level junction) in the vicinity of Ropery Street, to the Market Place and Queen Street junctions.

2.2.2 The A63 Castle Street is located within Hull city centre, close to the River Hull and the Humber Estuary. To the north of Castle Street are the major shopping areas within the city centre. To the south are the Humber Dock and Railway Dock marinas and developments providing shops, offices, tourist and recreational facilities, along with some residential properties.

2.2.3 The A63 Castle Street is approached from the west along a dual, two lane all-purpose carriageway known as A63 Clive Sullivan Way and Hessle Road. Hessle Road becomes Castle Street near the junction with Porter Street. Continuing eastwards away, the road becomes Garrison Road (now known as Roger Millard Way) at the junction with Market Place and Queen Street, and then crosses the River Hull via Myton Bridge.

2.2.4 The A63 Castle Street forms part of an east to west route connecting Hull city centre to the Port of Hull and the docks to the east; the M62 and strategic road network to the west; and the Humber Bridge and the A15 and M180 to the south. The A63 is also part of the E20 Euroroute, which for the UK, connects Hull to Liverpool.

2.2.5 Features of the existing highway are set out in Table 2.1 and shown in Volume 2, Figure 2.1 The existing road corridor.

Table 2.1: Existing road features

Feature	Description
Junctions	• Mytongate Junction is a large signalised at-grade 'hamburger' layout junction, located between the A63 and Ferensway (towards Hull city centre to north) and

Feature	Description
	Commercial Road (towards waterfront, commercial and retail areas to the south). • Market Place and Queen Street connect to the A63 via at grade signalised junctions.
Side roads	• Westbound access to: Queen Street, Humber Dock Street, Commercial Road Spruce Road, Waverly Street and St James Street. • Eastbound access to: Porter Street, Ferensway, Myton Street, Waterhouse Lane, Princes Dock Street, Dagger Lane, Fish Street, Vicar Lane and Market Place.
Private accesses (vehicular)	• Westbound: Holiday Inn • Eastbound: 65 Castle Street
Footpaths and cycleways	• There are footways on both sides of the A63. A combined footway and cycleway separated by white lining, is provided on the north side of Hessle Road (400m west of Porter Street continuing to Ferensway) and also on the north west, north east, south east and south west sides of Mytongate Junction.
Public Rights of Way (PRoW)	• There are two PRoW that connect directly to the A63. Route 23 begins at Minerva Pier, runs along the east side of Humber Dock Street and ends at the A63 Castle Street. Route 25 begins at the A63 Castle Street, goes along Princes Dock Street and ends at Whitefriargate. The PRoW do not cross the A63. • Route 24 runs west from Humber Dock Street along the southern edge of the Humber Dock Marina and along Wellington Street.
Pedestrian crossings	• Signalised pedestrian crossings at Porter Street, west of Princes Quay shopping centre, east of Princes Quay Shopping Centre and at Market Place. • Uncontrolled crossings in vicinity of Spruce Road, and on Ferensway and Commercial Road arms of Mytongate Junction. • Signal controlled Toucan crossings on A63 west of Mytongate Junction and A63 east of Mytongate Junction. • Existing ramp on north side of A63 to access High Street and crossing under the A63.
Lighting	• Existing lighting is provided with high pressure sodium luminaires (known as SON) located on lighting columns at the back of the footways.
Drainage	• The existing highway drainage discharges unrestricted into the Yorkshire Water combined sewer network via highway gullies and kerb drains.
Public utilities	• Statutory Undertaker services present include: Yorkshire Water (sewers and water mains); Northern Gas (gas mains); Yorkshire Electricity (YEDL); Kingston Communications and British Telecom.

Traffic flows

2.2.6 A63 Castle Street attracts the following categories of traffic:

- Regional traffic between the commercial and dock areas east of the city and the M62 and Humber Bridge, including Heavy Goods Vehicles (HGVs).
- Local through traffic, for example commuters travelling between the western residential areas and places of work to the east of the city.
- Local commuter, shopping, business and recreational traffic with destinations along the A63 Castle Street.

2.2.7 In 2015, there were approximately 50,000 vehicles (two-way flow) using the A63 on an average day, of which 11% were HGVs. Existing traffic flows are summarised in Table 2.2.

Table 2.2: Existing traffic on the A63

Road Section	Direction	2015 Average Annual Daily Traffic (AADT)
A63 Clive Sullivan Way - Between Priory Way and A1166 Brighton Street	2-Way	53,500
A63 Clive Sullivan Way - Near St Andrews Quay	2-Way	41,500
A63 Clive Sullivan Way - Between Brighton Street Interchange and Rawling Way Roundabout	2-Way	54,000
A63 Hessle Road near Porter Street	2-Way	50,500
A63 Castle Street - Between Mytongate and Market Place	Westbound (Between Queens Street and Humber Dock Street)	24,000
	Eastbound (Between Myton Street and Princes Dock Street)	26,500
A63 Castle Street - Between Market Place and Garrison Road Roundabout (now known as Roger Millard Way Roundabout)	2-Way	46,500
A63 Hendon Rd - Between Garrison Road Roundabout and Southcoates Roundabout	2-Way	39,000

Source: Traffic Flow Data System (TRADS) (April 2014 – March 2015)

2.2.8 The signalised Mytongate Junction restricts the through flow of traffic along the A63. Other bottlenecks are the signalised junction at Market Place and the three further signalised pedestrian crossing facilities which cause delays to traffic, as well as having safety implications associated with pedestrians crossing the road at-grade.

2.2.9 The mixture of local traffic accessing side roads around Market Place, Humber Dock Street and Princes Dock Street, and strategic traffic accessing the Port of Hull and the M62, causes problems with weaving and traffic turning onto and emerging from side roads.

Journey times

2.2.10 During the morning and evening peak hours (08:00-09:00 and 17:00-18:00), there are approximately 5,000 vehicles (two-way flow) on the A63. The average journey times between Hessle Road Roundabout and Mount Pleasant Roundabout (approximately two miles) are as follows:

- eastbound morning peak journey time - around three minutes, but this time can double on occasions
- eastbound evening peak journey time - five minutes
- westbound morning and evening peak hours journey time - between five and six minutes, which equates to an average speed of 40mph to 20mph

Accidents

2.2.11 Accident records for the six year period 2011 to 2016[31] shows there have been 191 Personal Injury Accidents (PIAs) along the route, of which 23 were classified as serious and 168 as slight severity. There were no fatalities. The highest number of PIA occurred in 2012 (3 serious and 35 slight severity).

2.2.12 The proportion of killed and serious injury (KSI) casualties in the six year period is 7.69%. This is lower than the comparable national average of 10.31%, based on casualty records occurring on 'built-up A roads' in 2014[32].

2.2.13 Of the 191 PIAs recorded in the area in the six year study period, the following patterns and trends have been determined:

- The largest proportion of accidents, 54 PIAs, have occurred in the winter months (December, January and February). November had the highest accident total of 22 PIAs in six years.
- Accidents are most prevalent during the evening traffic peak. The highest number being recorded were between 17:00hrs – 17:59hrs, where 30 PIAs have occurred.
- 18% of the total PIAs were reported to involve vehicles skidding.
- 6% of the casualties were pedestrians and 4% were cyclists.

[31] The six year study period for PIA records is between 1 January 2011 and 31 December 2016

[32] Reported Road Casualties Great Britain Annual Report: 2014, Table RAS 30009, page 133, Department for Transport September 2015. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/467465/rrcgb-2014.pdf

- A large number of accidents involving queuing vehicles have been recorded. Of the 399 vehicles involved in accidents, 4% were listed as 'waiting to go but held up'.

2.2.14 Accident rates have been calculated using AADT flow data from TRADS and the Web based Traffic Information System (WebTRIS). The six year average accident rate for the A63 Castle Street is 245 PIAs per billion vehicle kilometres travelled (10^9 veh-km). This is well under the 2014 national average accident rate of 536 PIAs per 10^9 veh-km, calculated from Reported Road Casualties Great Britain 2014[33] (DfT, September 2015).

Severance

2.2.15 The A63 acts as a barrier to the free movement of people. This creates severance between the city centre, main shopping areas and transport links to the north and the waterfront, developments, tourist and recreational facilities to the south. Further information on existing severance is provided in Chapter 14 People and communities.

2.3 The need for the Scheme

2.3.1 The Scheme to improve the A63 Castle Street is needed to reduce the existing levels of congestion experienced on a strategic route which carries a mixture of regional traffic accessing the Port of Hull, through traffic and local traffic. The congestion is caused by restrictions to traffic flow at Mytongate Junction, three further signalised pedestrian crossings and from traffic turning and weaving to access side roads. Relieving the congestion would improve the currently poor journey times, and in turn improve access to the Port of Hull as well as access generally in the local area.

Scheme objectives

2.3.2 The Scheme has the following key objectives:

- Improved access to the Port of Hull
- Congestion relief
- Improved safety
- Improved connections between the city centre to the north and developments and tourist and recreational facilities to the south

2.3.3 Environmental objectives are explored in detail in each environmental topic Chapters 6 to 16.

[33] Reported Road Casualties Great Britain 2014. Available online at: https://www.gov.uk/government/statistics/reported-road-casualties-great-britain-annual-report-2014

2.3.4 The government has produced a series of NPSs, including the NN NPS which covers the national road network (see Section 1.4.1). The NPS states that "*the government will deliver national networks that meet the country's long-term needs; supporting a prosperous and competitive economy and improving overall quality of life, as part of a wider transport system*".

2.3.5 The NN NPS lists four strategic objectives that national networks aim to deliver:

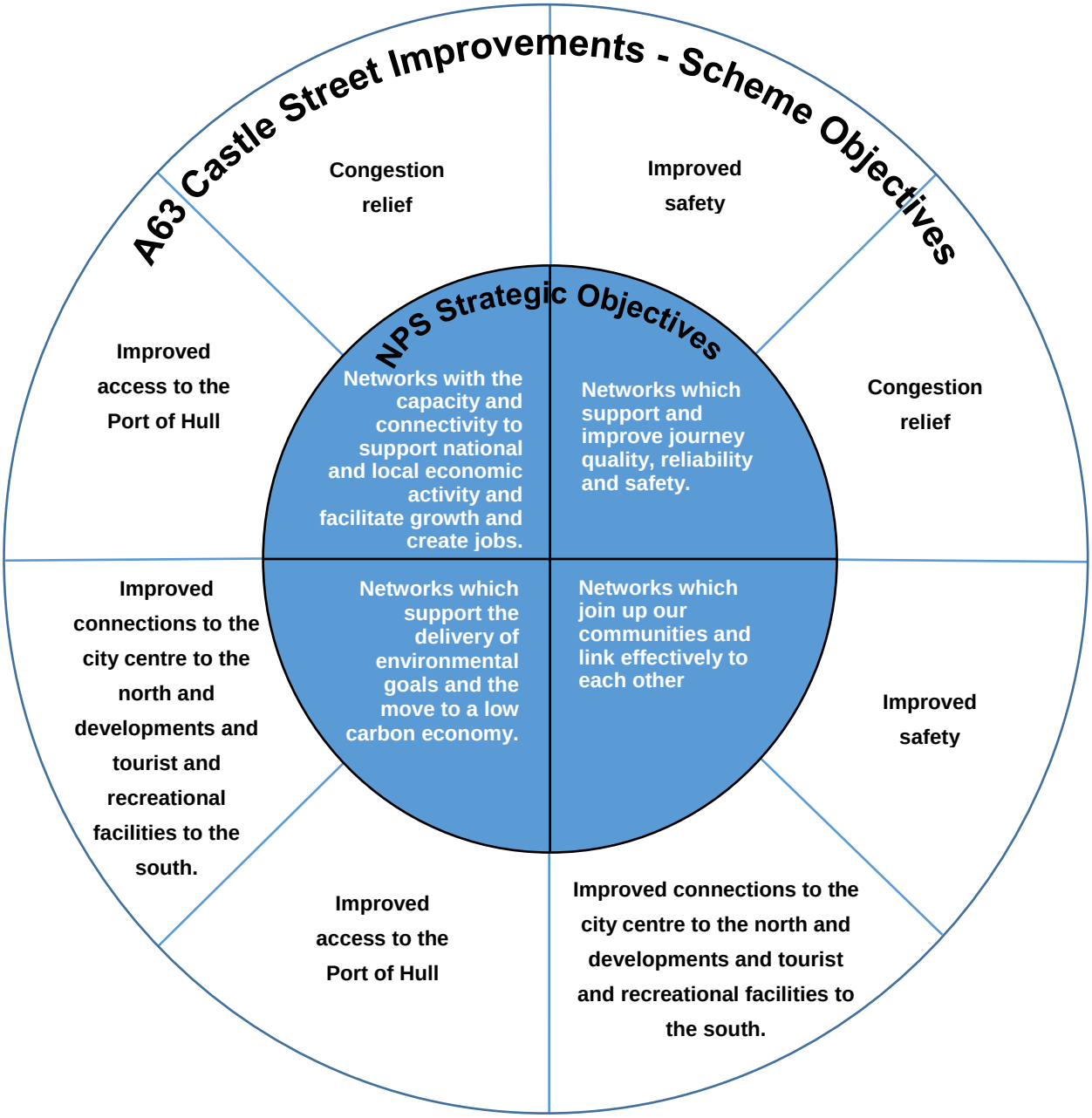
- *"Networks with the capacity and connectivity and resilience to support national and local economic activity and facilitate growth and create jobs.*
- *Networks which support and improve journey quality, reliability and safety.*
- *Networks which support the delivery of environmental goals and the move to a low carbon economy.*
- *Networks which join up our communities and link effectively to each other."*

2.3.6 Figure 2.2 below shows how the Scheme's key objectives are aligned to the NN NPS objectives, and as such the NPS supports the need for the Scheme at a strategic level.

2.3.7 The NN NPS also states that it is government policy for development to improve the road network to include enhancements such as *"junction improvements, new slip roads and upgraded technology to address congestion and improve performance and resilience at junctions, which are a major source of congestion"* and *"improvements to trunk roads, in particular dualling of single carriageway strategic trunk roads and additional lanes on existing dual carriageways to increase capacity and to improve performance and resilience"*.

2.3.8 The A63 Castle Street is currently a strategic trunk road, and the Scheme proposes to improve the road with a grade separated (split level) junction and associated slip roads, and is therefore aligned to government policy.

Figure 2.2: Alignment of National Networks National Policy Statement and Scheme objectives



2.4 Scheme history

2.4.1 Improvements for the A63 Castle Street have been proposed since the early 1990s and a number of studies and designs have been undertaken and developed since that time. The history of the Scheme to date is summarised in Table 2.3 below which includes key government decisions or interventions that have had an influence on the development of the Scheme.

2.4.2 A description of alternative options that have been considered is provided in Chapter 3 Consideration of alternatives.

Table 2.3: Summary of previous Scheme development

Date	Study / Event
1991 - 1992	Initial design for options to increase traffic capacity of Castle Street carried out on behalf of the Department of Transport, now Department for Transport (DfT).
February 1992	Preferred option taken forward to public consultation.
1997	Comprehensive review of the Highways Agency roads programme resulted in Scheme development being halted.
1998	'A New Deal for Trunk Roads in England' DfT 1998[34] proposed a number of multi-modal studies to address problems on the trunk road network.
Spring 2000 - July 2002	The 'Hull East-West Corridor Multi Modal Study' (HUMMS) 2002[35] was commissioned as a strategic level study to consider the congestion problems and possible solutions on routes to the Port of Hull. Part of the study outcome was to identify five initial options for improvements to A63 Castle Street, including a tunnel and on line improvement options.
January - April 2002	A validation study was carried out on the HUMMS recommendations, to further develop the five options and identify preferred options. The tunnel options were discounted due to cost, engineering difficulties and operational problems. Two on line improvement options were recommended as preferred options for further study: an on line improvement with a Landmark structure over a pedestrian concourse; and an on line improvement with a wide pedestrian landbridge.
May - July 2003	A feasibility study of the two preferred options was carried out, which recommended that the on line improvement with a wide pedestrian landbridge option should be included within the Highways Agency's Targeted Programme of Improvements (TPI). A separate feasibility report also considered that a cut and cover tunnel option should be further developed. The preferred option did not achieve entry into the TPI, as the Transport Minister considered the brief that had been worked to was too restrictive and that the footprint of land required in the city centre was too great. A wider review and consultation was instructed.
October 2003	As instructed, a wider feasibility study was carried out and further options developed for assessment and consultation.
November 2004	The preference of consultees was for cut and cover tunnel followed by landbridge option with A63 having three lanes eastbound and two lanes westbound. The study recommended an on line improvement with short section of cut and cover tunnel to carry A63 through a grade separated junction should be put forward for entry to the TPI.
2004	A government announcement on the review and prioritisation of housing and transport schemes in Yorkshire and Humberside meant that the Yorkshire and Humberside Regional Transport Board (YHRTB) was responsible for prioritising 'regional' Highways Agency schemes (of which the A63 Castle Street was one) and any funding would be from a Regional Funding Allocation (RFA). On this basis, the scheme was not put forward for TPI entry, pending decision on RFA.

[34] A New Deal for Trunk Roads in England' DfT 1998. Available online at: http://www.semmms.info/wp-content/uploads/2016/06/A-new-deal-for-Trunk-Roads-in-England-1998-PDF-479Kb.pdf

[35] The Executive Summary for the Hull East-West Corridor Multi Modal Study (HUMMS) 2002

Date	Study / Event
January 2006	YHRTB included the A63 Castle Street as a priority transport scheme for RFA.
2006 - 2007	Following decision on RFA, development of the scheme resumed to progress towards entry into TPI, namely reassessing three options: • Base Scheme: grade separation of Mytongate Junction • Landbridge: grade separation of Mytongate Junction; three lanes eastbound and four lanes westbound; pedestrian landbridge • Cut and Cover Tunnel: grade separation of Mytongate Junction with A63 carriageway carried through cut and cover tunnel
2007	Following floods in Hull in June 2007, three new options were developed to mirror the existing three (base scheme, landbridge, cut and cover tunnel), but where each were above existing ground level.
2008	In response to 'Review of the Highways Agency's Major Roads Programme' by Mike Nichols published in 2007 (Nichols' Review)[36], a new framework was implemented – the Project Control Framework (PCF)[37] which presented a joint DfT and Highways Agency approach to managing major projects. This replaced the process of TPI entry.
2008	Under the PCF, all six options (three underground and three overground) were developed to a comparable level and assessed to allow a recommendation regarding which to take to public consultation. Two options were identified as providing sustainable solutions, which represented good value for money, were affordable and had least overall impact on the environment: • A63 in cutting at Mytongate Junction (Underground option) • A63 on flyover at Mytongate Junction (Overground option) The four remaining options were non-preferred: • Underground landbridge • Underground cut and cover tunnel • Overground landbridge • Overground extended viaduct
2009	The two preferred and four non-preferred options were presented at public consultation. The outcome of the consultation, together with technical appraisal, economic assessment and environmental assessment were used to inform the option selection process, which identified the Underground option as the preferred option.
March 2010	A Preferred Route Announcement for the Underground option was made by SoS for Transport.
April 2010	Preliminary design of preferred option began.
June 2010	Work was halted due to a government Comprehensive Spending Review.
May 2012	Roads Minister announced that the A63 Castle Street Improvements had been selected to receive funding for development work to maintain a future pipeline of major investment in the strategic road network.

[36] Review of the Highways Agency's Major Roads Programme, Mike Nichols 2007. Available online at: http://webarchive.nationalarchives.gov.uk/20100202135703/http:/www.dft.gov.uk/pgr/roads/nicholsreport/nicholsreport.pdf

[37] Project Control Framework Handbook Highways Agency 2013. Available online at: http://assets.highways.gov.uk/our-road-network/managing-our-roads/project-control-framework/The%20project%20control%20framework%20handbook%20v2%20April%202013.pdf

Date	Study / Event
January 2013 - August 2014	Preliminary design of preferred option continued to progress project towards application for DCO. This included carrying out a Preliminary Environmental Information Report (PEIR) and conducting a second public consultation.
August 2014	ECI design and build contract awarded to develop the detailed engineering designs from the initial preliminary design.
August 2015	At the request of HCC, the design for Princes Quay Bridge was brought forward as part of the Scheme prior to the 2017 UK City of Culture celebrations. As such, it was removed from the A63 Castle Street Improvements and a separate planning application for the bridge was submitted to HCC on 4 August 2015 (reference 15/00965/FULL). The application was granted consent by HCC on 7 October 2015.
March 2016	Due to the potential risk of programme delays associated with delivering the Princes Quay Bridge early, there were concerns over the potential disruption to the UK City of Culture events proposed around Hull starting in January 2017. As such, the Bridge was brought back into the main A63 Castle Street Improvements and is now included in the DCO application.
August 2014 - May 2018	Series of ground investigations, traffic modelling and surveys carried out to support development of the detailed engineering design, including the design for the underpass at Mytongate Junction, Princes Quay Bridge and clearance of Trinity Burial Ground. Design of the preferred option further developed and further public consultation exercise (January – February 2017) to obtain views on the changes made to the preliminary design since 2013. EIA was undertaken for the updated design to support the DCO application.

2.5 Scheme Site and the surrounding area

2.5.1 The Scheme Site for the A63 Castle Street Improvements consists of the footprint of the road to be improved and the land needed both permanently and temporarily during construction. The different areas are shown on Volume 2, Figure 2.3 Scheme Site Boundary Sheets 1 to 8.

2.5.2 Two options exist for the location of the bentonite processing compound. Option A is located on the site of the current Arco Store and is the preferred option. Option B is on the current Staples, American Golf and Maplin site and is the alternative site should Option A be unobtainable. In totality the areas measure approximately: Option A 332,534m^2 (Arco) and Option B 332,157m^2 (Staples), which is around 33 hectares (see Sections 2.9.14 to 2.9.15 for more details). All subsequent area measurements within this Section represent those associated with the Arco site as this is the preferred Option A.

2.5.3 The permanent area of land required for the footprint of the Scheme (excluding the land needed temporarily during construction) measures approximately 79,926m^2. The current land use for the permanent footprint for the Scheme is primarily the existing road, associated footways, cycleways, roadside verges and central reserve. The realignment of Mytongate Junction and the addition of slip roads however require additional permanent land take from the following sites as shown on Volume 2, Figure 2.3 Scheme Site Boundary. The approximate areas are as follows:

- Arco Ltd - 3,501m^2
- Staples - 10m^2
- Kingston Retail Park - 937m^2
- Trinity Burial Ground - 2,632m^2
- Holiday Inn - 2,249m^2

2.5.4 Land requiring permanent rights of access for maintenance and easement on land other than the public highway (in the vicinity of the Arco site and at Humber Dock Marina), totals approximately 23,551m^2.

2.5.5 The Scheme Site also includes the land required temporarily to construct the Scheme. This land measures approximately 232,420m^2. It includes the sites of the Myton Centre (approximately 4,400m^2), Earl de Grey public house and Castle Buildings (approximately 968m^2) and an area within the Humber Dock Marina (approximately 8,463m^2). The temporary land required can be categorised as follows:

- Land for enabling or advanced works, which are activities required to prepare for construction
- Physical space and working areas to construct the Scheme, which would be required along the length of the Scheme
- Land for accommodation works at specific locations. Accommodation works are activities that are required to 'make good' land or property owned by third parties, where it has been affected by the Scheme
- Land for site compounds or material storage areas
- Land required for archaeological trench excavations, for example at Princes Dock Street to investigate Hull's medieval and later defences

2.5.6 All land that is required temporarily would be reinstated to its existing use and handed back to the landowner at the end of the construction period, although there may be rights of access or easements applied. Land at the Myton Centre would be reinstated as replacement public open space (see Sections 2.6.77 and 2.6.80).

2.5.7 The Scheme's land requirements are detailed fully in the Book of Reference (document reference TR010016/APP/4.3) and Statement of Reasons (document reference TR010016/APP/4.1) that accompany the application for DCO.

Environmental designations and sensitive sites

2.5.8 The Scheme Site and surrounding area includes some designated and sensitive sites, as listed below and shown on Volume 2, Figure 2.4 Environmental

constraints. These sites and any possible impacts on them are discussed fully in the relevant ES topic Chapters 6 to 16. Key constraints relevant to the Scheme include:

- The Humber Estuary lies approximately 0.5km south of the Scheme. It has three international environmental designations for its important wetland habitats: Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar site. Together these designations form a European Marine Site (EMS). The part of the Scheme Site in which Princes Quay Bridge is to be located is adjacent to the standing water of Princes Dock and Humber Dock Marina which is a Priority Habitat Inventory. These are not part of the Humber Estuary SAC/SPA/Ramsar site but the waters from the Humber Dock Marina feed into the wider Humber environment and ultimately the protected sites. The Humber Estuary is also a Site of Special Scientific Interest (SSSI) national statutory designated site. Impacts to these sites are considered further in Chapter 10 Ecology and nature conservation, Chapter 6 Air quality, Chapter 11 Road drainage and the water environment and Chapter 16 Combined and cumulative effects.

- The DCO submission for the Scheme requires an Assessment of the Implications for European Sites (AIES) as parts of the Scheme are within 2km of the European Sites as named above. The AIES is undertaken on behalf of the Secretary of State for Transport as the Competent Authority who needs to demonstrate that they have considered the requirements of Regulations 60 to 67 of the Habitats Regulations 2010, implementing Article 6(3) of the Habitats Directive (92/43/EEC on the Conservation of natural habitats and of wild fauna and flora[38]) and the Conservation of Habitats and Species Regulations 2017[39]. The process requires consultation with Natural England and subsequent consent from the MMO prior to the issue of the marine licence for consent to the works. The AIES is a separate DCO document reference TR010016/APP/6.13.

- Trinity Burial Ground is designated by HCC as an area of public open space and as a Site of Nature Conservation Interest (SNCI). It is valued as a green space in an urban area and for its mature tree habitats. The south east corner of the new Mytongate Junction and the westbound diverge slip road would be constructed in the northern third of Trinity Burial Ground necessitating significant excavation works. This would require trees and vegetation to be cleared, monuments to be removed and the excavation, removal and reburial of an estimated 17,000 human burials. Some of the mature trees within the remaining area of the burial ground would also

[38] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Available online at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31992L0043

[39] Conservation of Habitats and Species Regulations 2017. Available online at: http://www.legislation.gov.uk/uksi/2017/1012/pdfs/uksi_20171012_en.pdf

require removal or treatment (for example pollarding or crown lifting) to enable the construction works to take place. The area and impacts on it are considered further in Chapter 8 Cultural heritage, Chapter 9 Landscape, Chapter 10 Ecology and nature conservation, Chapter 13 Materials, Chapter 14 People and communities and Chapter 16 Combined and cumulative effects. An archaeological method statement setting out the proposed approach to the excavation of the burials is set out in Volume 3, Appendix 8.7 Trinity Burial Ground - project design for main phase clearance of burial remains and archaeological works. The programme and timing of the archaeological excavations is noted in Table 2.5 as part of the construction strategy. The treatment for the remainder of the area is illustrated at Volume 2, Figure 2.10 Environmental masterplan and discussed at Sections 2.6.79 to 2.6.90.

- Humber Dock Marina (Humber Dock, south swing bridge and lock, south side of Castle Street), Castle Buildings, Earl De Grey public house and Warehouse No. 6 (Ask Restaurant) are all grade II listed buildings located within or adjacent to the Scheme Site. Of these, there would be direct impacts to Humber Dock Marina where sections of the wall would be realigned. The impacts on all listed buildings are considered fully in Chapter 8 Cultural Heritage.

- The Scheme Site includes areas of the Old Town conservation area, designated by HCC for its architectural and historic interest. The impacts on the conservation area are considered fully in Chapter 8 Cultural heritage.

- The Scheme Site lies fully within Hull city centre Air Quality Management Area (AQMA). The extent of the AQMA, which is larger than the Scheme Site is shown on Volume 2, Figure 2.4 Environmental constraints. There are also residential properties in the vicinity which are considered as sensitive receptors. The impacts on the AQMA and on sensitive receptors including residential properties, are considered fully in Chapter 6 Air quality.

- The Scheme Site lies within a Noise Important Area (NIA) which is shown on Volume 2, Figure 2.4 Environmental constraints. For NIAs there is a requirement for the Department for Environment, Food and Rural Affairs (Defra) to produce noise maps every 5 years to show where noise may be impacting residential properties. More details can be found in Chapter 7 Noise and vibration.

Local environment context

2.5.9 The local environment surrounding the Scheme Site is made up of a variety of land uses, consistent with the urban location and adjacent waterfront, as shown in Volume 2, Figure 2.4 Environmental constraints. Land uses in the locality include:

- Residential properties, comprising semi detached and terraces, small scale flats, residential tower block and waterfront apartment developments

- Commercial properties including the Arco Ltd site, Marina Court offices (Humber Dock Street) and Island Wharf offices (Humber Quays)
- Retail premises including Kingston Retail Park, Princes Quay Shopping Centre and associated car parks, retail outlets along Ferensway and retail outlets along High Street
- Leisure facilities including Holiday Inn, Hull Arena, Vue Cinema, Ask restaurant, restaurants and bars on Humber Dock Street and within the Fruit Market area and the Spurn Lightship which is moored in Humber Dock Marina
- Development land including land at Quay West (off Myton Street and Waterhouse Lane and currently under development with the Hull Venue), Fruit Market area and Humber Quays
- Public open space at Trinity Burial Ground and small parks at Great Passage Street (adjacent to Mytongate Junction), off Porter Street (Jubilee Arboretum) and off William Street
- Public Rights of Way (PRoW). These include Route 23 which ends at A63 Castle Street; Route 24 which runs west from Humber Dock Street along the southern edge of the Humber Dock Marina and along Wellington Street; and Route 25 which begins at A63 Castle Street. Footways align both sides of the A63 and a combined footway and cycleway is located on the north side of Hessle Road and also on the north east, south east and south west sides of Mytongate Junction.
- Marinas at Humber Dock and Railway Dock
- The Humber Estuary

2.6 Description of the proposed improvements

2.6.1 To reduce congestion and improve traffic flow and safety, the Scheme proposes improvement works to approximately 1.5km of the A63 Hessle Road and Castle Street and connecting side roads between Ropery Street and the Market Place and Queen Street junctions.

2.6.2 The works include lowering the level of the road into an underpass to create a grade separated junction, road widening, the pedestrian, cycle and disabled user bridges at Porter Street Bridge and Princes Quay Bridge, drainage (other than that within the road boundaries), service relocations, setting out of replacement land (for public open space), works in Trinity Burial Ground (that do not form part of the road structure) and other elements of the development that are not the highway.

2.6.3 The overall layout of the Scheme is shown on Volume 2, Figure 2.5 The Scheme proposals with the main aspects detailed below:

- Lowering the level of the road by approximately 7m into an underpass at Mytongate Junction and raising Ferensway and Commercial Road by approximately 1m creating a grade separated (split level) junction.
- New east and westbound slip roads would link the A63 and Mytongate Junction.
- Widening the eastbound carriageway to three lanes between Princes Dock Street and Market Place, with the nearside lane being marked for local traffic.
- Removing six existing signal controlled pedestrian crossings on the A63 at locations near Porter Street, Mytongate West and East, Princes Dock West, Humber Dock Street, Market Place and Queen Street.
- Removing one existing uncontrolled crossing on the A63 near Spruce Road
- Providing a new bridge over the A63 for pedestrians, cycles and disabled users at Porter Street.
- Providing a bridge over the A63 for pedestrians, cycles and disabled users south of Princes Quay Shopping Centre.
- Upgrading of the existing route that runs from Market Place under the A63 using High Street to allow pedestrians, cycles and disabled users to cross underneath the A63.
- Restricting access to the A63 by closing some junctions and restricting movements on some side roads to improve safety.
- Changes and enhancements to existing highways to maintain access to all properties.
- Vegetation clearance and exhumation and reburial works within Trinity Burial Ground resulting in a loss of approximately a third of the area to accommodate the new Mytongate Junction.
- Demolition of the Myton Centre to enable the development of replacement public open space for the loss of land at Trinity Burial Ground.
- Dismantling of the Grade II listed Earl de Grey public house.
- Localised diversion of statutory utilities that currently cross beneath the existing A63.
- A water storage and pumping station structure to collect the drainage from the underpass and pump it away so it can be sent to the Humber Estuary.

Main carriageway and Mytongate Junction

2.6.4 From Spruce Road, the A63 would gradually lower so that it would be approximately 7m below the existing level at the location of the current Mytongate Junction. When it is lowered, the A63 would be in a cutting, with the ground material excavated to leave an open trench for the underpass. Retaining walls would be built to support the sides of the cutting. East of Mytongate Junction, the A63 level would gradually rise from being in cutting to be at existing ground level in the vicinity of the Earl de Grey public house. Ferensway and Commercial Road would be raised by approximately 0.5m and cross over the A63 on a new bridge to make Mytongate Junction a grade separated (split level) junction. This arrangement would allow traffic on the A63 to pass freely through the junction, that is the eastbound carriageway between Ropery Street and Dagger Lane, and the westbound carriageway between Myton Bridge and Ropery Street, would maintain two lanes of traffic as existing. On the eastbound carriageway between Dagger Lane and Market Place an additional lane would be added for local traffic between Mytongate and Market Place.

2.6.5 Eastbound between Princes Dock Street and Market Place, the A63 carriageway would become three lanes wide, with the nearside lane used for merging traffic from the slip road, and for diverging traffic weaving to exit at Market Place.

2.6.6 On the eastbound carriageway at Market Place junction, the local traffic lane would allow vehicles to join Market Place, and a merge lane would be provided east of the junction to allow traffic from Market Place to join the A63. Two lanes would be provided on the A63 through the junction. There would be no right turn or straight ahead movements permitted from Market Place or Queen Street, the modified junction operating as a left in and left out junction as existing.

2.6.7 In order to permit all traffic movements at the proposed Mytongate Junction, new slip roads would be constructed as below. See also the proposed phases of construction as set out in Table 2.5.

- Eastbound traffic leaving the A63 at Mytongate Junction would use a single lane diverge (exit) slip road which would have a hard shoulder. The slip road would widen to three lanes at the top of the slip road for the junction with Ferensway. The wall between the slip road and mainline A63 would be a retaining wall with a parapet barrier mounted on top, approximately 1.5m high. Eastbound traffic joining the A63 at Mytongate Junction would use a short length of two lane slip road, with the nearside (left hand) lane of the slip road dedicated as a local access road for Myton Street, including for access to the Princes Quay Shopping Centre car park. Beyond Myton Street, the slip road would reduce to one lane with a hard shoulder up to Princes Dock Street. The wall between the slip road and the A63 mainline would be a retaining wall with a parapet barrier mounted on top approximately 1.5m high. For safety reasons, the slip road lane would be physically separated from the main eastbound carriageway as far as Princes Dock Street by a paved verge.

- Westbound traffic leaving the A63 at Mytongate Junction would use a two lane slip road. The slip road would widen to three lanes at the junction with Commercial Road. The wall between the slip road and the A63 mainline would be a retaining wall with a parapet barrier mounted on top, approximately 1.5m high. The wall between the slip road and the grounds of the Holiday Inn and Trinity Burial Ground would also be a retaining wall, which would also serve as a boundary wall. The retaining wall would remain visible and would be faced in new red brick to be in keeping with the existing boundary wall.

- The south east corner of the new Mytongate Junction and the westbound diverge slip road would be constructed in the northern third of Trinity Burial Ground. This would require vegetation to be cleared, monuments to be removed, the excavation, removal and reburial of an estimated 17,000 human burials, and the backfilling for the affected area of the burial ground.

- The provision of the proposed westbound merge slip road from Mytongate Junction would require land from the Kingston Retail Park, resulting in the loss of some car parking spaces. As a result, part of the Kingston Retail Park car park would be reconfigured to minimise the loss of car parking spaces.

- Westbound traffic joining the A63 from Mytongate Junction would use a single lane merge (entry) slip road which would have a hard shoulder. The wall between the slip road and mainline A63 would be a retaining wall with a parapet barrier mounted on top, approximately 1.5m high. From the slip road, a limited movements junction (it would only be possible to turn left into it, and to turn left out of it) into Spruce Road would provide access for delivery vehicles for Arco and Kingston Retail Park and for all vehicles to ATS Euromaster and Armstrong Hydraulic Services. If the Arco site is selected as the bentonite compound, a link road would be constructed during phase 0 between Spruce Road and Lister Street as a replacement and permanent access for local businesses. Spruce Road would be closed once construction had finished. See Section 2.9.15 for more details.

- A diverge lane will be provided at the Queen Street junction for westbound traffic from Garrison Road to turn left, and two lanes will be continued through the junction. A westbound merge slip road will be provided at Queen Street to allow traffic from Queen Street to join the A63.

2.6.8 The central reserve would be a minimum width of 1.8m, widening to accommodate sight lines as necessary. A 900mm high rigid concrete step barrier (CSB) would be installed.

2.6.9 From Ropery Street to St James Street and Porter Street, the central reserve area would be narrowed in places to be a consistent width of 1.8m. Where it is currently wider to accommodate the existing pedestrian crossing, both the eastbound and westbound carriageways would move slightly closer to the central reserve. This would create a wider area of grass verge between the carriageways and the

existing footways and cycleways. Both the eastbound and westbound carriageways in this section would remain as two lanes.

2.6.10 The existing 40 miles per hour (mph) speed limit would be retained.

Junction strategy and signals

2.6.11 Mytongate Junction would be controlled by traffic signals (traffic lights).

2.6.12 Both Market Place and Queen Street junctions would be free flow junction arrangements with no traffic signals.

Side roads and access

2.6.13 To improve safety, junctions between the side roads St James Street and Waverley Street and the A63 Hessle Road would be closed.

2.6.14 Direct access to A63 Hessle Road from Spruce Road would be restricted but maintained using the Mytongate Junction westbound merge slip road. This would restrict direct access from the A63 Hessle Road via Spruce Road to Arco Ltd, Kingston Retail Park service yards, ATS Euromaster and Armstrong Hydraulic Services. If the Arco site is selected as the bentonite compound. a link road would be constructed during Phase 0 between Spruce Road and Lister Street as a replacement and permanent access for local businesses. Spruce Road would be closed once construction had finished. See Section 2.9.15 for more details.

2.6.15 The provision of the proposed eastbound diverge slip road to the Mytongate Junction would encroach on William Street and Cogan Street, requiring the two streets to be closed for through traffic, creating two cul-de-sacs where they meet. A T-shaped turning head would be provided on William Street where it is to be closed and parking in the turning head prohibited to enable emergency access. A safe access for pedestrians would be maintained via a footway between William Street and Cogan Street. Cyclists would be directed onto the shared cycleway and footway just to the south alongside the A63 eastbound. Noise impacts to residential properties on William Street resulting from the provision of the new slip road are considered in full in Chapter 7 Noise and vibration.

2.6.16 To improve safety on the A63 Castle Street, direct access from the Holiday Inn would be closed and the existing access via Commercial Road would be provided as an alternative. As a result of the Scheme requirement to acquire land in front of the hotel adjacent to A63 Castle Street, some car parking spaces would be lost and the area left in front of the hotel would become unsuitable for the coaches and buses. The private roads in front of the hotel would be modified to allow coaches and buses to access the front of the building using the Commercial Road access. The hotel car park would be reconfigured to maximise capacity and compensate for lost car parking spaces.

2.6.17 The junction between the A63 Castle Street and Humber Dock Street would be closed and a T-shaped turning head, sufficient for cars and light goods vehicles, would be created at the dead end. Vehicles would be re-routed to access Humber Dock Street from the A63 via the Queen Street junction. Westbound traffic would travel via Market Place and High Street or divert via Garrison Road Roundabout to join the eastbound traffic. Access for pedestrians and cyclists, known as non-motorised users (NMUs) would be retained. Humber Dock Street would not be suitable for HGVs north of Humber Street.

2.6.18 Access from the A63 to Princes Dock Street would change to a left in one-way only up to Whitefriargate. Posterngate would become one-way between Princes Dock Street and Zebedee's Yard, but remain a two way up to Trinity House Lane. There would be no change to parking provision on Princes Dock Street. Whitefriargate, Trinity House Lane, North Church Side and Parliament Street one-way systems would be retained. However, the direction of the one-way along Whitefriargate would be converted between Princes Dock Street and Parliament Street.

2.6.19 Retractable bollards secured by padlocks and raised flush footways would be installed at the ends of Dagger Lane, Fish Street and Vicar Lane to prevent direct access for vehicles to and from the A63. These roads would allow two-way traffic with Dagger Lane, which is currently one-way. Pedestrian and cyclist access would be maintained and access for emergency vehicles would be retained by retracting the bollards.

2.6.20 The existing access to number 65 Castle Street due to the safety risks posed by providing an access on a 4-mph road. Access to number 65 Castle Street will be provided through the Grammar School Yard, via Fish Street, with a new electric access gate at the rear parking. The archway access would be closed and retractable bollards will be installed to allow access for emergency vehicles.

2.6.21 In the Old Town, South Church Side would be reinstated to a two-way road to allow vehicles to egress from Vicar Lane and Fish Street onto Market Place. Parking provision on the north side of South Church Side would be removed. A priority system could be provided to manage vehicle movements between South Church Side and Fish Street as there would be insufficient width on the bend to accommodate two-way traffic. This would be developed further during Detailed Design stage. The southern section of Dagger Lane would also be reinstated to a two-way road to allow egress from Trinity Court onto Posterngate and North Church Side.

2.6.22 Several amendments have been made to North Church Side as part of the Old Town public realm schemes. These amendments would be retained as part of the new Old Town proposal.

Structures

2.6.23 The principal structures which are proposed as part of the Scheme are described below and shown on Volume 2, Figure 2.5 The Scheme proposals.

Mytongate Bridge

2.6.24 The new overbridge at Mytongate Junction would be a two-span precast concrete structure with a supporting pier in the central reserve of the A63. The width of the bridge would measure approximately 25.1m to accommodate two 7.3m carriageways, a 4.5m central reserve and 3m wide footway on either side.

Retaining walls to cutting

2.6.25 The construction of a deep cutting at Mytongate Junction would be required to create an underpass for the A63 improvements. The underpass would be approximately 400m long and mainly built from reinforced concrete diaphragm walls which would be structurally connected to a reinforced concrete ground slab to provide an embedded retaining wall.

2.6.26 The process of constructing the retaining wall would comprise cutting a deep, narrow trench in the ground. To support the sides during excavation the trench would then be filled with a bentonite[40] suspension which would enable excavation works to continue. Once any loose material had been removed from the bottom of the trench, a reinforcement cage for the wall would be lowered into position through the bentonite and fixed. Concrete would then be placed, displacing the bentonite as the trench filled. When the concrete had gained sufficient strength, the material in the trench contained by the walls would then be excavated. More details of this process can be found at Volume 3, Appendix 2.1 Geotechnical works.

2.6.27 The base of the underpass would comprise a reinforced concrete slab on top of a jet grout[41] layer of varying thickness depending on the depth of dig below ground water level. The jet grout would provide several functions in the temporary construction conditions:

- To act as a water cut-off acting in combination with the tension piles
- To act as a temporary base prop prior to the installation of the permanent reinforced concrete ground slab
- To provide a stable substrate to allow construction vehicles and personnel to access the base of the excavation and to cast the base slab

[40] Bentonite is a thixotropic clay (has the property of becoming fluid when agitated) mixed with water to form a slurry

[41] Jet grouting is a construction process that uses a high-pressure jet of fluid to break up and loosen the soil at depth and mix it with a cementitious slurry to produce a stabilised soil cement material.

2.6.28 More details of jet grouting can be found at Volume 3, Appendix 2.1 Geotechnical works.

2.6.29 The walls would be a minimum of 19m apart to accommodate the two 7.3m wide carriageways, central reserve and footways. The tops of the walls would be capped with a reinforced concrete capping beam, with parapets (pedestrian or vehicular as appropriate) fixed to them.

Pumping station

2.6.30 A water storage and pumping station structure would be required to collect the drainage of the underpass and pump it away for discharge.

2.6.31 The pumping station is located to the south east of the proposed Mytongate Bridge, shown on Volume 2, Figure 2.5 The Scheme proposals, Sheets 1 to 7 and would comprise a single storey brick building with a vegetated green roof. Under the building would be a circular reinforced concrete shaft with an internal diameter of approximately 11.5m to accommodate the interceptor within the shaft and desired pump size. The structure would have a storage volume of approximately 300m³ below interceptor outlet invert, which means that with pumps operational the whole of the storm event could be contained without impact on the operation of the interceptor or upstream drainage system. This volume has been calculated on average annual rainfall, balancing the requirement for the number of times the pump would need to be in operation per annum and the size of the storage required.

2.6.32 The structure would consist of a ring of reinforced concrete secant piles[42] which would be structurally connected to a base slab supporting the pump and associated equipment. A reinforced concrete roof slab would be structurally connected to the shaft wall at the top. It is assumed that the secant piles would be 1.2m in diameter with 250mm interlock, that is the piles would be at 950mm centres. To prevent the base slab from being forced upwards by groundwater pressures, it would be connected to bored reinforced concrete tension piles.

2.6.33 Removable openings would be provided in the roof slab for the removal of the pump and access for maintenance.

Retaining walls between the Holiday Inn and Trinity Burial Ground

2.6.34 A retaining wall would be constructed between the westbound diverge slip road and the grounds of the Holiday Inn and Trinity Burial Ground to the south. This wall would retain a height of up to 2.2m and with the additional height of wall above would form a boundary wall for the Holiday Inn and Trinity Burial Ground.

[42] Secant pile walls are formed by constructing intersecting reinforced concrete piles which are reinforced with steel beams or rebar. See Volume 3, Appendix 2.1 Geotechnical works for more information.

2.6.35 The exposed face of the wall would have a brick finish to complement the character of the area. Given the limitations on land availability, proximity of the retaining walls to existing properties and the possibility of poor ground conditions, it is assumed that these retaining walls would be formed of sheet piles.

2.6.36 Existing ground profiles and the existing retaining wall on the western boundary of Trinity Burial Ground boundary which is perpendicular to the new wall, would facilitate a transition to a much smaller boundary brick wall part way along its length. This would be approximately 1m high and formed of reclaimed brick. It would have a 1.1m railings attached to the top to ensure that it is in keeping with existing townscape.

Porter Street Bridge

2.6.37 A single span pedestrian, cycle and disabled user bridge over the A63 would be provided near Porter Street to replace the current signalised pedestrian crossing at this location.

2.6.38 The main span measured along the centreline of the new bridge would be approximately 38m and lit by lighting units which are integral to the bridge parapet. The bridge deck width would be 3m to allow for un-segregated foot and cycle use.

2.6.39 Each approaching ramp would have eight spans with a maximum span length of 13.8m and an overall length of approximately 106m. Each stair would have two spans with a maximum span length of 7.5m and an overall length of approximately 17m. The widths for the stairs and ramps between the inside faces of the pedestrian and cycling parapets would be 2m. This recognises that the majority of pedestrians would use the stepped access whilst cyclists and other NMUs would use the ramps, and therefore be segregated from most of the pedestrians.

2.6.40 For details of Porter Street Bridge refer to Figure 2.6 below.

Figure 2.6: Illustrative view of Porter Street Bridge looking east

Princes Quay Bridge

2.6.41 The pedestrian, cycle and disabled user bridge would be a single span integral structure over the proposed A63 corridor between Princes Quay Shopping Centre and Humber Dock Marina, replacing the current pair of signalised crossings. To achieve the required clearance over the highway, the bridge deck would be suspended from an arched shell structure to minimise the height users would have to climb to on approach. The arched shell would also be utilised as a canopy to provide some shelter to people crossing the A63 highway and also to those enjoying the new views from the bridge's cantilevered balconies at each end.

2.6.42 The main span of the bridge measured along the centreline of the bridge would be 40m. The bridge deck width varies from a minimum 4m at the mid-span to 6m at the side access locations for the ramps and stairs. The arched shell structure would be supported on piled foundations.

2.6.43 Both the north and south approaches to the bridge would be formed from a combination of elevated ramps, stairs and landscaped embankments. The widths for the main access ramps and stairs between the inside faces of the pedestrian and cycle parapets would be 4m. Each elevated ramp would have three spans with a span length of approximately 13.6m, 14m and a short cantilever span of 1.2m.

2.6.44 At the northern approach, the embankment would have a stepped terrace form predominantly of soft landscape character, with trees and slopes of ornamental grasses. Unsegregated paths of 4m width would gently climb the embankment up to the bridge deck. A wide main stair and a series of smaller 'short-cut' stepped

routes would also be provided. Flat landings at regular intervals would include bench seating to create places to rest and enjoy the views. The paving would be integrated with the existing public realm around the dock.

2.6.45 From the south, the approach to the bridge would be built on the top of a platform over a small part of the marina. The platform would consist of precast reinforced concrete beams and slabs supported on two rows of piles, one on-land and one in the marina. The platform would have a maximum length of 90m and a width of approximately 20m.

2.6.46 The proposals for the landscaped approaches aim to provide a high quality public realm, creating the primary public space in the historic docklands whilst also integrating the new pedestrian bridge into a landscape setting. The pathway route to the bridge crossing from the north is positioned within a mounded landscape that unites the dockside level with that of the bridge. This landscaped embankment also screens the A63 from the plazas creating new pedestrian spaces that are less dominated by the road. The plazas provide a variety of spatial experiences with large terracing creating space for groups and social interaction, whilst sub-spaces and features are designed to enable flexibility of use where the individual would feel comfortable. Whilst providing a place for users to stop and linger, the design also considers those who will pass through the area, with routes sub-divided to increase the permeability of the pedestrian flows through the area.

2.6.47 For details of the Princes Quay Bridge and associated works refer to Figure 2.7 and Figure 2.8 below.

Figure 2.7: Illustrative view of Princes Quay Bridge looking south east

Figure 2.8: Illustrative view of Princes Quay Bridge looking north east

Spurn Lightship

2.6.48 The Spurn Lightship would be temporarily relocated by HCC alongside the eastern quay wall area in the south east corner of the Humber Dock Marina to allow for the construction of the Princes Quay Bridge. A separate planning application would be submitted for the re-siting of the Lightship as it is a significant heritage feature which has been in situ in Humber Dock Marina since 1987. More details can be found at Chapter 8 Cultural heritage.

2.6.49 The Lightship would be repositioned west of its current location in Humber Dock Marina when the Princes Quay Bridge is complete as shown in Volume 2, Figure 2.5, Sheet 5 The Scheme proposals. It would then be re-opened to the public.

Footpaths, cycleways and pedestrian crossings

2.6.50 A combined footway and cycleway along the length of both sides of the A63 would be provided where possible as shown on Volume 2, Figure 2.5 Sheets 2, 3 and 5 The Scheme proposals. The shared facility would generally be 3m wide, however there are some locations where space is restricted and the width would be reduced to a minimum of 2m as follows:

- between Castle Buildings and Princes Quay car park on the north side of the A63 for approximately 55m
- in front of Warehouse No. 6 (Ask restaurant) on the north side of the A63 for approximately 25m
- in front of Humber Dock Marina, Holiday Inn and Trinity Burial Ground on the south side of the A63 for approximately 400m
- adjacent to Kingston Retail Park and in front of Arco on the south side of the A63 for approximately 450m

2.6.51 Specific NMU crossing facilities would be provided as follows:

- a pedestrian, cycle and disabled user bridge at Porter Street, see Sections 2.6.37 to 2.6.40
- signalised crossings at Mytongate Junction
- a pedestrian, cycle and disabled user bridge at Princes Quay, see Sections 2.6.41 to 2.6.47
- a ramp from the A63 to High Street, see Section 2.6.52

2.6.52 The existing signalised pedestrian crossings at Market Place would be removed and pedestrians and cyclists would use a ramp from the A63 to access High Street to take them under the A63. The ramp would be realigned and the visibility for NMUs would be further improved by removing existing dense vegetation. A

replacement planting scheme has been proposed in front of the Magistrates' Court which consists of tree planting with low growing shrub understorey, therefore ensuring no net loss of vegetation, but improved visibility long term. See Volume 2, Figure 9.8 Landscape proposals for more details. On the south side of the A63, pedestrians and cyclists would be routed along Humber Street. This would also be improved for NMUs with a new combined footway and cycleway with vegetation clearance to improve visibility. Users would re-join the A63 either via Queen Street or by continuing along Blanket Row and Humber Dock Street.

2.6.53 It would be possible for NMUs to cross other side roads, as at present. With the exception of Mytongate Junction, crossings of side roads would be uncontrolled. Casual crossing of the A63 by NMUs would be prevented by a barrier within the central reserve and provision of pedestrian guard rails in footways or nearside verges at high-risk locations.

2.6.54 The assessment of the effects on NMUs is provided in Chapter 15 Effects on all travellers.

Lighting

2.6.55 The lighting layout for the Scheme provides for:

- replacement lighting which would be provided along the length of the improved road using modern Light-emitting Diode (LED) lamps located at the back of the footways and on the capping beams of the underpass retaining walls
- lighting along Spruce Road, Arco access road and the boundary between Kingston Retail Park and the Scheme
- wall mounted lighting for the A63 under Mytongate Junction
- lighting to High Street where it passes under the A63 and lighting to Blanket Row
- lighting to pedestrian, cycle and disabled user bridges to achieve acceptable night time light levels

2.6.56 Modern LED lights provide a white light source, rather than typical yellow or orange from sodium lights which is generally more aesthetically pleasing and provides an improved view on Closed Circuit Television (CCTV). They can provide the benefits of being more energy efficient, with a longer life and reduced maintenance requirements and offer greater control of light levels and light distribution.

Road surface

2.6.57 The road would be surfaced with a thin surface course on the main A63 carriageway and its slip roads. Under appropriate conditions, a thin surface course

can provide noise reduction benefits that traditional hot rolled asphalt (HRA) does not. The potential for these benefits is considered in Chapter 7 Noise and vibration. A HRA surface would be provided on all other local roads.

CCTV and other technologies

2.6.58 Two CCTV Pan/Tilt/Zoom (PTZ) cameras on 5 to 8m poles would be installed to monitor the underpass at Mytongate Junction and connected to the Highways England Regional Control Centre at Wakefield. Options for other technology to monitor the underpass for flood risk are also being prepared for consideration. The exact approach has not yet been confirmed, but is likely to be an alarm system triggered by water level, which would allow staff to view the location using CCTV and take appropriate action, for example notifying Hull City Council, Humberside Police or Highways England Traffic Officers. The provision of Variable Message Signs (VMS) to provide information on traffic conditions, diversions and closure of the underpass is also being considered. In addition, two PTZ CCTV cameras on 6 to 8m poles may be provided to monitor the ramp to High Street.

2.6.59 A CCTV camera to monitor the operation of Myton Bridge may be reinstated, a capability which is currently provided by a camera on the corner of Queen Street and Garrison Road.

Road signs and markings

2.6.60 Replacement Advance Directional Signs (ADS) and tourist destination road signs would be provided to reflect the new layout at Mytongate Junction and to direct traffic to use the local access road between Mytongate Junction and Market Place as appropriate. Emergency Diversion Route signage would also be replaced. Where possible, existing signs would be retained and reused. Details are provided in the Signage Plan at Volume 2, Figure 2.9 Signage.

2.6.61 Due to the improved layout of Mytongate Junction, the ADS would be simplified and fewer in number than at present. Road signs would be located to minimise street clutter and align with requirements for visual amenity.

2.6.62 Updated and replacement signage would be required to reflect changes to vehicle access on side roads as described in Sections 2.6.13 to 2.6.22.

2.6.63 Road sign supports along the A63 would be ‘passively safe’ where appropriate, which means that they would be designed to reduce the risk of personal injury in the event of a road traffic accident.

Drainage

2.6.64 There would be two drainage systems for the Scheme. The systems have been designed with a 30% allowance for climate change which is in excess of the

current Highways England standard of 20%[43]. This departure from the highways standard has been agreed in principle at the express request of the Environment Agency to meet a 'site specific' situation and in consideration of historic flooding in Hull. The systems are described below.

At-grade drainage system

2.6.65 The at-grade drainage system would be for highway drainage that would discharge into existing Yorkshire Water sewers. This presents no change over the existing situation except for the greater allowance for climate change.

2.6.66 The at-grade highway surface water flows would be diverted into an underground highway drainage network by combined kerb drains and existing gullies. The proposed highway drainage would discharge flows into the existing Yorkshire Water outfalls at existing (or a reduced) rates. Flows in excess of the existing rates would be attenuated below ground in oversized pipes.

Underpass drainage system

2.6.67 The underpass drainage system would be for highway drainage that would discharge to the low point of the underpass at Mytongate Junction. This has been designed to cater for highway runoff and overland flows from a 1 in 100 year storm event, plus the 30% allowance for climate change referenced at 2.6.64.

2.6.68 The underpass highway surface water flows would be collected by combined kerb drains. Flows from the kerb drains would be discharged to a petrol interceptor within the pumping station.

2.6.69 A pumping station control kiosk would be located at existing ground level at the pumping station compound with access provided from Commercial Road, see Volume 2, Figure 2.5, Sheet 3 The Scheme proposals. The pumping station would have the following features:

- a multi-pump pumping station on a duty-standby[44] or duty-assist-standby basis
- telemetry alarms linked to the maintenance contractor, to alert of a pump failure
- provision of back-up power source (generator, uninterruptable power supply (UPS) or grid)

[43] Technical Guidance to the National Planning Policy Framework (NPPF) March 2012 includes guidance on taking climate change into account. Table 5 of this guidance gives sensitivity ranges for considering climate change as a result of peak rainfall. Based on a service life of the drainage system of 60 years, this would bring it within the 20% category, and so the 30% that has been applied is in excess of the required standard.

[44] Duty standby means that the two pumps operate alternately, but in the event that one fails, the other can operate by itself. Duty-assist-standby means that one pump operates at times of low flow, with another to support during high flow and a third on standby in case of a pump failure.

- high Level float switch included to start the pumps should the ultrasonic instruments fail
- high Level alarms linked to the Highways England Regional Control Centre
- provisional pumping rate of 200 litres per second (l/s)

2.6.70 A rising main downstream of the pumping station would transfer flow to a receiving network or watercourse. At present, it is proposed to outfall (discharge) directly to the existing Yorkshire Water sewer however if consent is not granted the outfall would discharge to the River Humber through an existing sheet piled wall.

2.6.71 There are alternative proposed locations for the outfall to the River Humber as shown on Volume 2, Figure 2.5 Sheet 5 The Scheme proposals. Selection of the preferred outfall location will depend on investigation of the existing sheet piled wall and any constraints due to land use. This proposal is being discussed with Natural England, the Environment Agency and the land owner.

2.6.72 Parts of the existing drainage would be diverted or abandoned as the proposed layout and drainage design necessitates.

Statutory Undertakers diversions

2.6.73 Localised diversions of third party utilities that currently cross beneath the existing A63 Castle Street are required as part of the Scheme.

2.6.74 Under the New Roads and Street Works Act 1991, enquiries have been made to establish which undertakers have apparatus that would require diverting. These statutory undertakers are listed below:

- British Telecom (BT) Openreach
- Kingston Communications
- Northern Gas Networks
- Northern Power Grid
- Yorkshire Water
- MS3 and CityFibre

2.6.75 The enquiries made to date have established the services that would need to be diverted, and the undertakers have provided budget estimates for the diversions to be carried out. Actual agreements, method statements and approaches to the diversions would be agreed with a contractor at the Detailed Design and Construction Preparation stage.

Demolition of buildings

2.6.76 To construct the underpass and enable two lanes of traffic to be maintained in each direction during the Construction Phase, the former Earl de Grey public house, located to the north east of the Mytongate Junction would be dismantled. The Grade II listed building description was revised by Historic England in July 2017 and as a result a large two-storey extension built in 2003 at the rear of the Earl de Grey public house is no longer included in the revised listing description. The location of this building is shown on Volume 2, Figure 2.5 The Scheme proposals Sheet 3.

2.6.77 The Myton Centre would also be demolished to enable the development of replacement public open space for the loss of land at Trinity Burial Ground. The Arco buildings would be demolished to clear the area for use as a construction compound if the preferred bentonite compound Option A was implemented. If the alternative Option B was progressed, then Staples, American Golf and Maplin buildings would demolished instead.

2.6.78 With exception of the Holiday Inn electricity substation, no other buildings will be demolished.

Environmental mitigation design and compensation proposals

2.6.79 The areas adjacent to the road that are within the Scheme Site Boundary would be subject to environmental design to integrate the Scheme into the surrounding environment. The urban context of the Scheme is a key factor for the design, which has been developed to be in keeping with the distinct characters of the urban areas to the east and west of Mytongate Junction.

2.6.80 The landscape proposals include:

- tree, shrub and wildflower planting along the length of the route
- the resurfacing of footways
- the upgrading of the green space on the site of the former Myton Centre including improvements to Porter Street, William Street and Cogan Street through the introduction of hard and soft landscaping. This is replacement public open space for the loss of land at Trinity Burial Ground
- replacement tree and shrub planting within the Arco and Kingston Retail centre car parks
- seeding, tree planting and the introduction of high quality hard landscape materials within Trinity Burial Ground
- the introduction of high quality hard landscape materials within the Old Town conservation area

- ornamental shrub and tree planting on the approaches to Princes Quay Bridge
- ornamental planting to the pedestrian crossing islands at Market Place and Queen Street
- lighting and access improvements to the Myton Bridge underpass on High Street.

This design is detailed fully in Chapter 9 Landscape and illustrated at Volume 2, Figure 2.10 Environmental masterplan.

2.6.81 The Scheme would require the removal of approximately 317 trees along the existing route and within Trinity Burial Ground, Kingston Retail Park, Arco car park and the Magistrates' Court. In addition to this a number of trees would be subjected to arboricultural works within Trinity Burial Ground to accommodate the required reinternment construction activity. None of the trees to be removed or which require arboricultural works are subject to a Tree Preservation Order. Trees to be removed are shown on Volume 2, Figure 2.10 Environmental masterplan.

2.6.82 Approximately 362 replacement trees and shrubs are proposed where there is sufficient space along the new route, as illustrated on Volume 2, Figure 2.10 Environmental masterplan. The majority would be planted as standard, semi mature specimens. Tree species have been selected for their resilience to both a maritime and roadside setting and include a range of broadleaf and evergreen species. This should result in an overall increase in the number of trees along the route compared to the existing situation. The effects of removing trees is considered in Chapter 9 Landscape and Chapter 10 Ecology and nature conservation.

2.6.83 Hard landscape materials have been chosen to reflect the surrounding townscape character and to tie-in with the existing hard landscape. Proposed paving materials include Yorkstone paving with granite kerbs within the Old Town conservation area and asphalt with concrete kerb outside the conservation area. Cast iron bollards used to close off Daggar Lane, Fish Street and Vicar Lane would match those used within the wider Old Town conservation area.

2.6.84 Existing walls adjacent to Holiday Inn, Princes Quay Shopping Centre and William Street pocket park would be realigned. Within the Old Town conservation area, boundary treatments consist of reclaimed brick and railings along the north boundary of Trinity Burial Ground and Holiday Inn. Outside of the conservation area, boundary treatments are proposed to provide a like for like replacement of the existing with weldmesh fencing proposed along the boundary of the Arco car park.

2.6.85 Approximately one third of the Trinity Burial Ground would be lost to accommodate the Scheme. The remaining area would be retained as a public open space with displaced monuments and paths reinstated. Semi-mature tree planting with an

understorey of wildflower meadow planting is proposed within the burial ground to mitigate for tree losses. Three access points would be provided including level access from the north, stepped access from the north west adjacent to the top of the A63 westbound off slip and ramped access to the south west from near the Holiday Inn entrance. The existing boundary wall would be reinstated on top of the new retaining wall. Gates from Holy Trinity Church would be used at the entrances on Castle Street. A maintenance vehicle entrance would be provided at the north west corner of the area and would be accessed through the pumping station area.

2.6.86 A pumping station building is proposed immediately to the west of the Trinity Burial Ground consisting of a single storey brick building with a vegetated green roof, see Section 2.6.30. A reinforced grass maintenance vehicle track would provide access from Commercial Road. Semi-mature trees and a 1.5m high boundary hedgerow are proposed to provide some screening of the building and access track.

2.6.87 To compensate for the area of Trinity Burial Ground impacted by the Scheme, an area of replacement public open space is proposed on the current site of the Myton Centre and Jubilee Arboretum (see Volume 2, Figure 2.10 Environmental masterplan). This area would provide an informal green space with tree and shrub planting, timber seating, wayfinding signage and litter bins. Trees within the existing Jubilee Arboretum would be relocated and integrated within the new design. Rendered feature walls of 1.5m in height are proposed to define entrances. Mounding within the green space would create both an amphitheatre style space and assist in screening views of the A63. The existing play area wall would be integrated into the proposals. Footpaths within the greenspace would be resin bound gravel with steel edging.

2.6.88 The proposals aim to improve the streets surrounding the new green space which would be closed off to Castle Street as part of the Scheme. Shared surfaces paved with concrete setts are proposed on Cogan Street and William Street. Raised planters with ornamental shrub and tree planting would be introduced on both streets to provide seating, informal play opportunities, restrict traffic access and reduce vehicle speeds. Further informal play opportunities could be provided by painted pavement graphics.

2.6.89 Improvements to Ferensway central reserve are proposed including the removal of the existing barrier and introduction of a raised planter constructed from stone setts with evergreen shrub planting. The proposals would match the treatment of the central reservation further to the north of Ferensway.

2.6.90 The area on the approaches of Princes Quay Bridge would be landscaped with ornamental shrub and tree planting. Reclaimed, low, brick walls would be located within planting beds to the north of the bridge. Benches would be provided along the bridge ramps on both sides of the A63. In addition to this, stepped seating is located either side of the southern ramp. The ramps to the bridge are to be paved

with granite paving flags with the surrounding paving in Yorkstone. This is described in more detail at Sections 2.6.41 to 2.6.47.

2.6.91 Improvements to the existing underpass beneath Myton Bridge are proposed to enhance user experience and create a landmark feature. The proposals include:

- the regrading of the access ramp from Market Place
- the introduction of a lighting scheme
- additional wayfinding signage
- the resurfacing of pavements on High Street leading to Humber Street

2.7 Changes in traffic flows

2.7.1 In the opening year (2025), it is expected that the A63 will have an increase in traffic flow of around 20% as shown on Table 2.4. The increase would be as a result of traffic from local roads reassigning to the A63, made possible by removing the junction which causes a capacity constraint to users in the Do Nothing scenario.

Table 2.4: Changes in traffic flows with the Scheme

Road section	Direction	2015 AADT	2025		% Change (2025-2015)	
			Do Minimum45	Do Something	Do Minimum	Do Something
A63 Clive Sullivan Way - Between Priory Way and A1166 Brighton Street	2-Way	53,271	60,581	62,824	14%	18%
A63 Clive Sullivan Way - Near St Andrews Quay	2-Way	41,598	46,396	48,886	12%	18%
A63 Clive Sullivan Way - Between Brighton Street	2-Way	54,207	58,832	62,557	9%	15%

[45] The absence and presence of the proposed project are referred to as the Do Minimum and Do Something scenarios respectively. The potential significant environmental effects need to be defined for the Do Minimum and Do Something scenarios in the baseline year and a future year, or series of future years depending on the topic. See Section 5.5.

Road section	Direction	2015 AADT	2025		% Change (2025-2015)	
			Do Minimum45	Do Something	Do Minimum	Do Something
Interchange and Rawling Way Roundabout						
A63 Hessle Road - Near Porter Street	2-Way	50,526	50,639	62,590	0%	24%
A63 Castle Street - Between Mytongate and Market Place	Westbound (Between Queen Street and Humber Dock Street)	23,774	23,293	29,632	-2%	25%
	Eastbound (Between Myton Street and Princes Dock Street)	26,748	26,476	32,756	-1%	22%
A63 Castle Street - Between Market Place and Garrison Road Roundabout	2-Way	46,560	44,599	51,946	-4%	12%
A63 Hedon Road - Between Garrison Road Roundabout and Southcoates Roundabout	2-Way	39,105	43,641	48,556	12%	24%

Source: 2015 AADT – TRADS (April 2014 – O March 2015), 2025 AADT – A63 Castle Street Traffic Forecast Models

2.8 Elements of the Scheme yet to be finalised

2.8.1 No major modifications to the Scheme are anticipated, but as the Scheme is at Preliminary Design stage, it is expected that refinements would be made during the Detailed Design stage in advance of construction. The DCO application allows for the Scheme to be constructed within certain limits of deviation. In relation to the highway alignment, any change would not exceed a change in 0.5m (plus or minus) to the vertical alignment. Horizontal deviation would be within the limits of the DCO boundary. As a result, there is some flexibility as to the exact Scheme

detail. The EIA is therefore based on the maximum design parameters and assesses the worst case scenario – see Section 5.8.2.

2.9 Construction stage

2.9.1 The construction stage for the Scheme is described below. This description has been informed by the appointed contractor, although some aspects are likely to be refined during the Detailed Design stage of the Scheme.

2.9.2 The impacts of construction activities are considered for each environmental topic in ES topic Chapters 6 to 16. Assessment has been based on the information provided in this chapter and on standard best practice construction techniques being used in accordance with an Environmental Management Plan (EMP). The EMP is described in Sections 5.10.1 to 5.10.4. An outline Environmental Management Plan (OEMP) for the Scheme is provided – document reference TR010016/APP/7.3.

2.9.3 Construction is anticipated to take approximately five years. This would be carried out in phases, so not all sections of the road would be under construction for the full five year period.

2.9.4 The construction process would include piling, diaphragm wall installation and jet grouting for the underpass, slip roads, the pedestrian, cycle and disabled user bridges and within Trinity Burial Ground. Diaphragm wall installation and jet grouting are described at Sections 2.6.25 to 2.6.29. The likely piling techniques are set out in Volume 3, Appendix 2.1 Geotechnical works.

2.9.5 The proposed phases of construction are set out in Table 2.5 below. Enabling and site preparation work would be largely carried out as Phase 0, with the main works carried out during Phases 1 to 7.

Table 2.5: Construction Phases and traffic management

Phase and duration	Traffic management (TM)	Construction activities
Phase 0 15 months March 2020 to June 2021	0.1: Mainly away from A63 Castle Street, local to A63 side roads, retail car parks, pavement and pedestrian route diversions. 0.2: A63 closures to enable crossings to be installed	0a: Enabling works away from main A63 west side of Mytongate - retail car parks, revised highway boundaries, side road and footpath diversions and enhancements prior to west slip roads construction, side road junction revisions and introduction of narrow lanes on main A63. 0b: High Street upgraded route under A63 constructed to open at end of phase. Commence enabling works between Princes Dock Street and Market Place to enhance traffic and pedestrian movements north of A63. 0c: Trinity Burial Ground (TBG) enabling works and archaeology. Investigation of gaol archaeology adjacent to TBG (as detailed in Volume 3, Appendices 8.6 and 8.7), sheet

Phase and duration	Traffic management (TM)	Construction activities
		piling, hoardings, welfare etc. Commence TBG archaeology and exhumation programme. 0d: Service diversions for example gas, water, electricity and communications to east and west of Mytongate Junction.
Phase 1 9 months June 2021 to March 2022	1.1: Narrow lanes towards central reserve on A63 eastbound and westbound. 1.2: 30mph temporary speed limit in place. 1.3: Free recovery service provided. 1.4: Right turn removal at Mytongate with signed diversions in place. 1.5: Ferensway south closed from Osborne Street.	1a: Completion of service diversions east and ongoing diversions west. 1b: New central reserve at night, day time east and west bound lane, verge tie ins and new slip roads west of Mytongate, new footpaths extended. 1c: Completion of Trinity Burial Ground works and commence earthworks for slip road and underpass. 1d: Commence Princes Quay Bridge and Porter Street Bridge foundations. 1e: Ground improvement to Mytongate roundabout and westbound off slip. 1f: Temporary hardening central reserve. 1g: Temporary widening between Ferensway and Princes Quay. 1h: Construction of Market Place junction eastbound slip roads and verges.
Phase 2 3 months March 2022 to June 2022	2.1: Narrow lanes towards verges on A63 eastbound and westbound. 2.2: 30mph temporary speed limit in place. 2.3: Free recovery service provided. 2.4: Right turn removal at Mytongate with signed diversions in place. 2.5: Ferensway south closed from Osborne Street.	2a: Completion of Porter Street Bridge and open to pedestrians, cyclists and disabled users. 2b: Western underpass ground improvement and wall commencement. 2c: Temporary road construction Mytongate roundabout and ramps to slip roads. 2d: Westbound off slip piling, jet grouting to east underpass. 2e: Construct on slip between Ferensway and Waterhouse Lane. 2f: Temporary hardening central reserve east of Ferensway. 2g: Princes Quay Bridge foundations.
Phase 3 7 months June 2022 to January 2023	3.1: Narrow lanes towards verges to the west of Mytongate, with traffic in contraflow to the east between Mytongate and Market Street junction. 3.2: 30mph temporary speed limit in place. 3.3: Free recovery service provided. 3.4: Right turn removal at Mytongate with signed diversions in place.	3a: Continue west underpass wall construction. 3b: Piling to pumping station. 3c: Westbound off slip wall construction and completion. 3d: Construction of Ferensway southbound. 3e: Installation of rising main to outfall. 3f: Princes Quay Bridge construction. 3g: Slip road construction at Market Place westbound.

Phase and duration	Traffic management (TM)	Construction activities
	3.5: Ferensway south closed from Osborne Street.	
Phase 4 3 months January 2023 to April 2023	4.1: Narrow lanes towards the verge on the A63 eastbound approach to Mytongate, then narrowed towards the central reserve from Mytongate onwards. 4.2: Narrow lanes towards the verge on the A63 westbound. 4.3: 30mph temporary speed limit in place. 4.4: Free recovery service provided. 4.5: Right turn removal at Mytongate with signed diversions in place. 4.6: Ferensway south closed from Osborne Street.	4a: Continuation of underpass works west of Mytongate. 4b: Commence Mytongate Bridge construction. 4c: Eastern underpass south wall construction. 4d: Construction of eastbound on slip and local access road. 4e: Princes Quay Bridge construction and hard landscaping.
Phase 5 12 months April 2023 to March 2024	5.1 Narrow lanes towards the verges on A63 eastbound and westbound. 5.2 30mph temporary speed limit in place. 5.3 Free recovery service provided. 5.4 Right turn removal at Mytongate with signed diversions in place. 5.5 Ferensway south closed from Osborne Street.	5a: Continue underpass construction. 5b: Continue Mytongate Bridge construction. 5c: Continue underpass wall to eastern end. 5d: Reconstruct central reserve. 5e: Princes Quay Bridge in use.
Phase 6 4 months March 2024 to July 2024	6.1: Narrow lanes towards the verges on A63 eastbound and westbound with traffic being split into separate lanes on the eastbound between Mytongate and Market Street. 6.2: 30mph temporary speed limit in place. 6.3: Free recovery service provided. 6.4: Right turn removal at Mytongate with signed diversions in place. 6.5: Ferensway south closed from Osborne Street.	6a: Complete underpass construction. 6b: Complete Mytongate Bridge construction. 6c: Continue underpass wall to eastern end. 6d: Reconstruct central reserve for local access road.
Phase 7 4 months July 2024 to	7.1: Lane and slip road closures. 7.2: 30mph temporary speed limit in place.	7a: Complete surfacing at western end of scheme. 7b: Construct north and south junctions at Mytongate Bridge.

Phase and duration	Traffic management (TM)	Construction activities
November 2024	7.3: Free recovery service provided.	7c: Completion of access road and hard landscaping. 7d: Install and commission traffic signal equipment.
Open to traffic - May 2025	N/A	N/A

Traffic management, transport routes and Scheme Site access

2.9.6 Volume 2, Figure 2.11 Temporary traffic management phases 1 to 7 as shown on Sheets 1 to 8 show the proposals for traffic management for each phase, which is the way that A63 and local traffic would be accommodated during the construction period. There is no traffic management requirement for phase 0.

2.9.7 As a principle, two lanes of traffic would be retained in each direction during the construction period. All movements would be retained at Mytongate Junction during phase 0. Right turn movements will be prohibited at Mytongate Junction during phase 1 to phase 7. Routes for NMUs would be provided with north to south routes at the eastern and western ends of the Scheme Site. The pedestrian, cycle and disabled user bridges at Princes Quay and Porter Street would be used as NMU crossing points when completed.

2.9.8 Construction traffic would use the existing local road network to access the Scheme Site and compounds. No temporary haul roads would be constructed. Details of traffic management during construction can be found on Figures 2.11.1 to 2.11.7: Temporary traffic management phases 1 to 7.

Materials used and disposal arrangements

2.9.9 Use would be made of locally sourced materials (where possible) to minimise environmental impacts associated with transportation and to invest in the local community. Details are provided in Chapter 13 Materials. Materials used for the Scheme would include as follows:

- imported aggregate or fill for temporary works platforms, backfill requirements and road construction, approximately 151,000 tonnes and also potentially for compound construction, quantities yet unknown
- tankered cement for jet grouting and soil mixing and bentonite for diaphragm wall construction and piling, approximately 50,000 tonnes excluding requirements for concrete
- concrete for bridge construction, retaining walls, secant pile walls and the diaphragm wall, drainage channels, vehicle restraints systems and various foundations, approximately 50,000 tonnes

- asphalt for road surfacing and PRoWs, approximately 24,000 tonnes

2.9.10 Disposal arrangements are as follows:

- Slurry generated from jet grouting, piling and diaphragm wall construction is estimated at up to 130,000m^3 subject to site requirements. This would be treated on site and water recycled where possible and treated before discharge.

- Total spoil would be up to 170,000m^3 depending on ground conditions, bulking factors and use of materials such as grout for ground improvements. This would include slurry which would require treatment on site due to the anticipated high water content, followed by disposal off site to existing licensed facilities. The method of soil treatment on site would aim to reduce disposal to a practical minimum and recover spoil for re-use as restoration soils locally rather than disposal to landfill. Other forms of disposal streams are discussed in Chapter 13 Materials.

Residues and emissions

2.9.11 Emissions from construction and subsequent effects are considered in detail in Chapter 7 Noise and vibration, Chapter 11 Road drainage and the water environment, Chapter 12 Geology and soils and Chapter 13 Materials.

Construction site compounds

2.9.12 Eight potential sites have been identified as being suitable locations for construction compounds. These sites are listed below and shown on Volume 2, Figure 2.12 Construction site compound locations.

1. Arco site (preferred Option A) or Staples site (alternative Option B) – bentonite compound (see Sections 2.9.14 to 2.9.15)

2. Wellington Street Island Wharf (Spencers) - main site offices

3. A63 Eastbound Recovery Base (A63 layby eastbound to the north of St Andrews Quay) - vehicle recovery

4. Livingstone Road (South Humber Properties Ltd) - materials compound

5. Land south east of Mytongate Junction - Trinity Burial Ground compound

6. Neptune Street Set Down – Princes Quay Bridge compound, vehicle recovery and traffic management

7. A63 Westbound Recovery Base (A63 layby westbound to the west of Garrison Road roundabout) – vehicle recovery

2.9.13 The construction compounds would usually be operated by security staff and surrounded by security fencing with 24 hour smart lighting (LEDs with some sensor lighting) installed for security, safety and access. The compounds would typically be used for:

- siting temporary cabins for staff welfare facilities (changing, storage, toilets, washing facilities, drying areas and canteens)
- construction vehicle parking and construction staff car parking
- material, plant and equipment storage
- materials processing (dewatering and bentonite slurry handling)
- site offices
- parking for recovery vehicles

2.9.14 There are currently two locations proposed for the site compound for the production of bentonite. The Arco site to the west of Mytongate Junction and to the south of the A63 is the preferred Option A. The Staples site incorporating American Golf and Maplin to the north east of Mytongate, is the alternative Option B. Both sites would require the demolition of existing buildings if they were selected for use. Boundary treatment for both areas would be a 2.4m hoarding for safety and security purposes. 24 hour lighting would be implemented to enable night working, and for security and safety purposes.

2.9.15 If the Arco site was selected as the bentonite compound location, access from A63 Hessle Road to Spruce Road would be limited to local businesses and construction traffic and closed to the public. A link road would be constructed between Spruce Road and Lister Street as a replacement and permanent access for local businesses during Phase 0. Access between the A63 and Spruce Road would be maintained for construction purposes and permanently closed at the end of the works. Footpaths are proposed on either side of the new link road with an NMU diversion proposed along Lister Street to ensure the safety of the public. If the Staples site was selected as the bentonite compound, access between Spruce Road and the A63 would remain open.

2.9.16 HCC are working with Arco to locate a new head office for their staff should the site at Waverley Street be used as the preferred production compound. Several options are currently being explored, all of which are within the Hull Economic Development Zone (EDZ).

2.9.17 The Myton Centre is proposed as replacement public open space for loss of green space incurred at Trinity Burial Ground (see Sections 2.6.77 and 2.6.80). Prior to the landscaping of this area, the Myton Centre would be demolished and the area used for the duration of the works (5 years), as a temporary car park for contractor staff working on either the Arco or Staples sites. Parking provision would be limited

to cars and small vans with disabled spaces provided. The temporary car park would not be used for operational plant or HGVs. Hours of use may be up to 24 hours a day, 7 days a week. The temporary car park would have 24 hour lighting and a 1.8m high hoarding on the boundary for security and safety purposes. The area of the Myton Centre temporary car park is shown at Volume 2, Figure 2.12.

2.9.18 Compound areas would be reinstated to their existing condition and handed back to previous land owners at the end of the Construction Phase. With respect to the handover of either the Arco or Staples site, the site would be cleared with no above ground structures left in situ and the hoarding removed.

Construction traffic and staff

2.9.19 There is no current estimate of construction traffic by volume including construction staff traffic. It is likely that site staff working at either the Arco or Staples site compound would utilise parking facilities at the Myton Centre temporary car park (see Section 2.9.17). Staff parking at the other compounds would be limited due to the space available in these locations.

2.9.20 Staff numbers are estimated to be in the range of 100 to 200 operatives, but not all would be working continually for the full five year period. It is expected that most staff would work during the typical hours of day time construction (to be specified), although it is possible that some activities, for example piling operations, would be carried out in longer 12 hour shifts.

2.9.21 Where possible, there would be a preference to employ staff from the local area, but this is dependent on availability of suitable personnel locally, including for specialised roles or activities. Provision of accommodation for non-local workforce has not been specially considered, and any requirement is unlikely to present a significant change to the demand for accommodation in the area.

Construction plant

2.9.22 The likely construction plant, equipment and vehicles by type are listed below, although this list is not exhaustive:

- Transit pick-up
- All terrain fork lifts
- 7.5t tonne (t) lorries
- Loader crane lorries
- Crawler cranes (30t, 40t, 60t)
- Mobile cranes (40t, 500t, 800t)
- Slip form paver
- Road marking lorry
- Well Pointing Drilling Rig, Drilling Rig
- Hydraulic pile breaker
- Piling rig (60t, 30t)
- Generator

- Dumpers (6t, 20t)
- All terrain forklifts
- Mobile Elevating Work Platforms (MEWP)
- Cement mixer
- Piling hammer
- Roller
- 360 excavators (6t, 13t tyred, 20t, 25t, 35t)
- Asphalt paving machine
- Cones
- Compressor
- Silo
- Water tank
- Agitation tanks
- Pump
- Concrete pump
- Mobile Variable Message Signs (VMS)
- Temporary traffic lights, pedestrian crossing lights, signs and lighting

Other considerations

2.9.23 Areas of the Scheme Site would be lit for construction tasks and temporary road lighting would also be in place.

Construction uncertainty

2.9.24 As the Scheme is currently at Preliminary Design stage there is a level of uncertainty about the construction stage. The key areas of uncertainty for construction are:

- Ground conditions and dewatering – although extensive investigation and modelling of ground conditions has been carried out, until construction commences, there can be no absolute certainty. See Chapter 12 Geology and soils and Appendix 12.1 Ground contamination assessment for more details.
- Trinity Burial Ground – the advance works proposed to exhume remains from the burial ground also carries uncertainty related to the condition of the remains, the number of remains and possible risk of unexploded ordnance. See Chapter 12 Geology and soils and Appendix 12.1 Ground contamination assessment for more details.
- Statutory undertakers' diversions – the detailed methodology for statutory undertakers' diversions would be agreed between the undertakers and the contractor during Detailed Design, and as such this remains uncertain at this stage.

2.10 Operation and maintenance requirements

2.10.1 Following completion of the Scheme, all side roads (generally referring to all except for the main carriageway and slip roads) would be adopted by HCC and become their responsibility for maintenance purposes.

2.10.2 Private land that had been part of the construction area, for example Kingston Retail Park car park, would remain the responsibility of the landowner.

2.10.3 Following the aftercare period, the road would be handed over to the Highways England Operations Directorate for ongoing maintenance together with a Handover Environmental Management Plan (HEMP), see Sections 5.10.6 to 5.10.7. Maintenance would follow Highways England's Routine and Winter Service Code and Network Management Manual (RWSC and NMM[46]) which sets out mandatory requirements for the delivery of routine maintenance and operational service.

2.10.4 The design life of the Scheme is 60 years and there is no planned decommissioning stage. If an alternative route to the A63 were to be identified in the future, a full assessment of the decommissioning of the existing carriageway would need to be undertaken as part of the environmental assessment of any proposed new route.

[46] Highways England's Routine and Winter Service Code and Network Management Manual are. Available online at: http://www.standardsforhighways.co.uk/ha/standards/nmm_rwsc/index.htm

Chapter 3. Consideration of alternatives

3.1 Introduction

3.1.1 This chapter describes the main alternatives considered historically as part of the Scheme development and explains why they were not preferred over the Scheme now being progressed (see also Table 2.3 which sets out a summary of previous Scheme development).

3.2 Options considered

3.2.1 The six options identified and assessed and taken forward to public consultation in 2009 are described below.

Option 1 A63 in cutting at Mytongate Junction (underground option)

3.2.2 This option is the Scheme that is being progressed as described in Chapter 2 The Scheme.

Option 2 A63 on flyover at Mytongate Junction (overground option)

3.2.3 This option would have raised the existing A63 Castle Street at Mytongate Junction approximately 8m with Ferensway and Commercial Road being lowered by 1m and passing beneath the A63 bridge.

3.2.4 Between Mytongate Junction and Market Place, the eastbound carriageway would have been widened to three lanes, with the nearside lane being marked for local traffic only and which, for safety reasons, would be physically segregated from the main eastbound carriageway from Mytongate Junction as far as Princes Dock Street. Vehicles wishing to access Myton Street and Princes Dock Street from the A63 Castle Street would have done so via the eastbound exit and entry slip-roads.

3.2.5 The westbound carriageway would have had two lanes, as at present. The realigned A63 and the westbound exit slip road to Commercial Road would have passed over and/or through the northern part of the Trinity Burial Ground.

3.2.6 East of Mytongate Junction the A63 Castle Street would have tied back into existing ground level where a pedestrian, cycle and disabled user bridge would have been provided in front of Princes Quay Shopping Centre and the Humber Dock Marina. This bridge would have been approximately 7m above existing road level and would have allowed pedestrians to cross above A63 Castle Street, eliminating the current pedestrian and vehicle conflict caused by the existing signalised crossing.

3.2.7 Signalised pedestrian crossings at Market Place would have been removed and replaced with a new pedestrian, cycle and disabled user bridge removing the

pedestrian and vehicle conflict at this location. Vehicle movements would have been restricted to left in and left out as at present.

3.2.8 To construct the eastbound entry slip road, nearside eastbound local traffic lane and improved A63 Castle Street, the former Grade II listed Earl de Grey public house property would have required demolition.

3.2.9 It would have been necessary to close the accesses from the A63 Castle Street to the Holiday Inn, Spruce Road and Waverley Street on safety grounds. Alternative means of access would have been provided.

3.2.10 In addition to the bridge opposite Princes Quay and at Market Place, to further improve pedestrian facilities, a pedestrian, cycle and disabled user bridge would also have been provided near Porter Street, to replace the current signalised pedestrian crossing facility at this location. Pedestrian footways would also have been provided along the length of the scheme with a replacement cycleway to the north of the A63 Castle Street.

Option 3 Underground landbridge

3.2.11 As with the preferred option, this option would have consisted of lowering the A63 in the vicinity of Mytongate Junction to pass below Ferensway and Commercial Road. East of Mytongate Junction the A63 Castle Street would have remained in cutting passing beneath a 25m wide pedestrian landbridge in front of Princes Quay Shopping Centre. The landbridge would have been approximately 2.5m above adjacent ground level.

3.2.12 Between Mytongate Junction and Market Place, the eastbound carriageway would have been widened to three lanes with the nearside lane marked for local traffic only. The westbound carriageway would have had two lanes, as at present.

3.2.13 Pedestrian, cycle and disabled user bridges over the A63 Castle Street would have replaced the current signalised pedestrian crossing facilities at Porter Street and Market Place. There would have been no direct access from the A63 to the Holiday Inn, Spruce Road or Waverley Street. Alternative means of access would have been provided.

Option 4 Underground cut and cover tunnel

3.2.14 As with the preferred option, this option would have consisted of lowering the A63 in the vicinity of Mytongate Junction to pass below Ferensway and Commercial Road. East of Mytongate Junction the A63 would have continued at a low level before entering a tunnel between Myton Street and Finkle Street and then rising to tie into existing levels just west of Myton Bridge.

3.2.15 Within the tunnel the A63 Castle Street would have been a dual carriageway. Above the tunnel a single carriageway Local Access Road would have been constructed between Ferensway and Market Place and would have linked with the

local roads that presently connect to the A63. The Market Place junction with the A63 Castle Street would have been closed with the exceptions of the eastbound entry onto the A63 and the westbound exit onto Queen Street.

3.2.16 A pedestrian, cycle and disabled user bridge would have been provided over the A63 at Porter Street. There would have been no direct access from the A63 Castle Street to Spruce Road or Waverley Street. Alternative means of access would have been provided.

Option 5 Overground landbridge

3.2.17 As with Option 2, this option would have consisted of raising the level of the existing A63 in the vicinity of Mytongate Junction to pass over Ferensway and Commercial Road. East of Mytongate Junction, the A63 Castle Street would have remained on flyover passing over a 25m wide pedestrian walkway in front of Princes Quay Shopping Centre. The walkway would have been approximately 1.5m below adjacent ground level.

3.2.18 Between Mytongate Junction and Market Place, the eastbound carriageway would have been widened to three lanes with the nearside lane marked for local traffic only. The westbound carriageway would have had two lanes, as at present.

3.2.19 Pedestrian, cycle and disabled user bridges over the A63 Castle Street would have replaced the current signalised pedestrian crossing facilities at Porter Street and Market Place. There would have been no direct access from the A63 to the Holiday Inn, Spruce Road or Waverley Street. Alternative means of access would have been provided.

Option 6 Overground extended viaduct

3.2.20 As with Option 2, this option would have consisted of raising the level of the existing A63 in the vicinity of Mytongate Junction to pass over Ferensway and Commercial Road. East of Mytongate Junction the A63 Castle Street would have continued on a viaduct, tying into existing levels just west of Myton Bridge.

3.2.21 On the viaduct, the A63 Castle Street would have remained as a dual carriageway. Below the viaduct a single carriageway Local Access Road would have been constructed between Ferensway and Market Place and would have linked with the local roads that presently connect to the A63. The Market Place junction with the A63 would have been closed with the exceptions of the eastbound entry onto the A63 and the westbound exit onto Queen Street.

3.2.22 A pedestrian, cycle and disabled user bridge over the A63 Castle Street would have been provided at Porter Street. There would have been no direct access from the A63 to Spruce Road or Waverley Street. Alternative means of access would have been provided.

3.3 Option selection

3.3.1 A technical appraisal process was carried out for the six options and the findings presented in a Technical Appraisal Report (TAR) in October 2008 at Volume 3 Appendix 3.1 TAR guidance required consideration of the following factors:

- An economic assessment which takes into account affordability against the available budget, and the benefit cost ratio (BCR) which represents value for money (vfm).
- The engineering constraints that influence how complicated the construction process would be, including likely disruption to the general public and road users during construction, property demolition required, the amount of material to be excavated against the amount that would need to be imported, and the duration of the construction period.
- The likely environmental impacts of the options, considering effects on all the environmental topic areas (air quality, noise and vibration, cultural heritage, landscape, ecology and nature conservation, road drainage and water environment, materials, geology and soils, people and communities, and effects on all travellers).
- The degree to which the options met the Scheme objectives, is set out in Section 2.3.2.

3.3.2 The TAR concluded that Option 1 and Option 2 were preferred over the remaining four (unpreferred) options, as they would provide a sustainable solution which represented good value for money, they were affordable and had the least overall impact on the environment. A simplified summary of the TAR is provided in Table 3.1 below.

Table 3.1: Changes in traffic flows with the Scheme

Option / TAR factors	Option 1 Under-ground	Option 2 Over-ground	Option 3 Under-ground landbridge	Option 4 Cut and cover tunnel	Option 5 Over-ground landbridge	Option 6 Over-ground extended viaduct
Value for money (vfm) represented by BCR[a]	High	High	Medium	Medium	Medium	Medium
Within budget[b]	Yes	Yes	No	No	No	No
Buildability ranking[c]	3rd	1st	5th	6th	2nd	4th
Construction duration[d]	2 years and 3 months	1 year and 10 months	3 years and 2 months	4 years	2 years and 6 months	3 years and 9 months

Option TAR factors	Option 1 Under-ground	Option 2 Over-ground	Option 3 Under-ground landbridge	Option 4 Cut and cover tunnel	Option 5 Over-ground landbridge	Option 6 Over-ground extended viaduct
Environmental impacts[e]	Impacts on heritage features. Demolition of property for construction.	Impacts on heritage features. Demolition of property for construction and visual intrusion of raised bridge.	Impacts on heritage features. Demolition of property for construction and visual intrusion of landbridge.	Impacts on heritage features. Demolition of property for constructio n. Impact on townscape.	Impacts on heritage features. Demolition of property for construction. Impact on townscape and visual intrusion.	Impacts on heritage features. Demolition of property for construction. Impact on townscape and visual intrusion. Noise impacts.
Meets Scheme Objectives[f]	Yes	Yes	Yes	Yes	Yes	Yes
Preferred option[g]	Yes	Yes	No	No	No	No

Notes:

a. BCR classification for vfm: BCR 4 = very high; BCR 2.0 - 4.0 = high; BCR 1.5 - 2.0 = medium; BCR 1.0 - 1.5 = low; BCR<1.0 = poor.

b. Regional Transport Advisory Budget of £189m from July 2009.

c. The ease with which the Scheme can be constructed, where a rank of 1 is the easiest and a rank of 6 is most difficult. Based on input from construction contractor in 2009.

d. Based on input from construction contractor in 2009, not including any preliminary works that would be required in advance of construction.

e. Based on environmental assessment carried out during options selection stage. Demolition of property for the underground option has since been designed out during preliminary design stage.

f. Scheme objectives listed in Section 2.3.2.

g. From options selection stage (see Table 2.3: Summary of previous Scheme development).

3.3.3 Having determined that Option 1 and Option 2 were preferred, these were both presented at public consultation on 2 to 4 April 2009 and 8 May 2009. Although the four unpreferred options offered poor value for money, these were also presented alongside the two preferred options.

3.3.4 Following public consultation and in consideration of the TAR, the underground option (Option 1) was recommended as the overall preferred option. In summary, Option 1 was preferred for the following reasons:

- All project objectives were met.
- The total cost was within the available budget and was also lower than the Option 2.
- The BCR was higher than Option 2, which means it represented better value for money. Option 1 also had lower maintenance costs than the Option 2.

- Option 1 was assessed as being less visually intrusive within the landscape than the Option 2.

3.3.5 Members of the public living close to the Scheme and the majority of key stakeholders who expressed a preference, preferred Option 1 to Option 2 following public consultation. The Environment Agency were the only key stakeholder who did not prefer Option 1, but mitigation against flood risk, and collaborative working with the Environment Agency during preliminary design were proposed, and have since been undertaken, see Chapter 4 Consultation.

3.4 Preliminary design of the preferred option

3.4.1 Following the Preferred Route Announcement in May 2010, the MMSJV were appointed in January 2013 to progress the Scheme through a preliminary design stage, in line with Highways England's own project life cycle. This stage focuses on the design of a project to go through the required statutory processes up to a point where a decision can be made by the SoS, see Section 1.3.

Chapter 4. Consultation

4.1 Introduction

4.1.1 This chapter of the ES gives a summary of the statutory and non-statutory public consultation exercises which have been carried out during the Preliminary Design stage, and then focuses on the consultation that has been integral to the EIA process.

4.2 Statutory process

4.2.1 As part of an application for a DCO, the 2008 Act (see Section 1.3) requires specific consultation activities to be carried out. These requirements are shown below at Table 4.1, alongside the actions taken by Highways England to comply.

4.2.2 Highways England has worked closely with local authorities, statutory bodies and other stakeholders such as landowners, business owners, tenants and people with other land interests located within or around the Scheme area since 1991. This has enabled a better understanding of local concerns and the application of a carefully considered design to reduce environmental effects.

Table 4.1 Statutory consultation and publicity requirements of the Planning Act 2008 at pre-application stage

Consultation and publicity requirement	Reference to legislation	Scheme action
Notify the SoS of the proposed application for DCO.	Planning Act 2008 Section 46	Highways Agency letter to the Planning Inspectorate dated 22 June 2013 to advise of application, that is considered EIA development, and submission of Environmental Scoping Report to invite opinion on the proposed scope of the EIA and content of the ES. On 11 January 2017, an email was sent to the Planning Inspectorate with an attached letter as notification under Section 46 of the 2008 Act of the intention to commence pre-application consultation on the Scheme.
Identify if the project requires EIA and if so, confirm that an ES will be submitted with the application, or that an EIA screening opinion will be requested before the application is submitted.	Regulation 6 of the EIA Regulations 2009	
Identify and consult statutory consultees, local authorities and affected land owners.	Planning Act 2008 Section 42	Letters and consultation information sent and consultation exhibitions undertaken: • Between 28 June and 15 August 2013 • Between 16 January and 13 February 2017.
Produce a Statement of Community Consultation (SoCC), in consultation with local authorities, to describe	Planning Act 2008 Section 47 (2) Regulation 10 EIA Regulations 2009	In 2013, a SoCC was issued to Hull City Council on 9 May with a 28 day period to respond. Changes were made to the SoCC in line with HCC comments.

Consultation and publicity requirement	Reference to legislation	Scheme action
how the local community will be consulted. SoCC to note if development is EIA development.		In 2016, a SOCC was issued to HCC on 6 May and to ERYC on 28 June with a 28 day response period. Changes were made in line with comments made.
Publish and make the SoCC available to the public living in the vicinity of the Scheme and set a deadline of a minimum of 28 days by which consultation responses must be received to SoCC.	Planning Act 2008 Section 47 (6)	SoCC published in Hull Daily Mail on 2 and 9 July 2013 and also on 9 and 16 January 2017.
Publish a notice of the proposed application, to inform the public and stakeholders that there is an intention to submit an application.	Planning Act 2008 Section 48(1)	Notice published in Hull Daily Mail (2 July and 9 July 2013), The London Gazette (9 July 2013) and The Times (9 July 2013). Notice published in Hull Daily Mail (9 January and 16 January 2017), The London Gazette (10 January 2017) and The Times (9 January 2017).
Duty to send a copy of the Section 48 notice to (environmental) consultation bodies.	Regulation 11 EIA Regulations 2009	Copies of Section 48 notices were issued to prescribed consultation bodies on 2 July 2013 and 9 January 2017.
Carry out the consultation described in the SoCC.	Planning Act 2008 Section 47 (7)	At the request of HCC an extended seven week consultation period was held between 28 June and 15 August 2013 to facilitate an additional public exhibition event. Three public events were held at the Royal Hotel, Hull on 19 and 20 July 2013 and on 10 August 2013. Scheme leaflet and consultation information was published on the Scheme website. Consultation leaflets were distributed to local residents by Royal Mail. Consultation information was deposited at seven local community facilities. A four week consultation period was held between 16 January and 13 February 2017. Two public consultation exhibitions were held at The Royal Hotel, Hull on 27 and 28 January 2017. Scheme leaflet and consultation information was published on the Scheme website. Consultation leaflets were distributed to local residents by Royal Mail. Consultation information was deposited at seven local community facilities.
Take account of responses to publicity and consultation.	Planning Act 2008 Section 49	Set out in Consultation Report (document reference TR010016/APP/5.1).

Consultation and publicity requirement	Reference to legislation	Scheme action
Prepare a consultation report to be submitted as part of the application.	Planning Act 2008 Section 37	Consultation Report prepared (document reference TR010016/APP/5.1).

4.2.3 The Consultation Report prepared for the DCO application (document reference TR010016/APP/5.1) provides full details of all of the actions summarised in Table 4.1 and includes:

- details of non statutory consultation regarding the Scheme options carried out between 9 March and 5 June 2009
- the programme of formal statutory consultation carried out in compliance with the 2008 Act between 28 June and 15 August 2013
- the series of targeted statutory consultations undertaken between 2 September 2013 and May 2018
- the planning application process undertaken for the Princes Quay Bridge
- the programme of formal statutory consultation carried out in compliance with the 2008 Act for a period of 28 days from 16 January and 13 February 2017; and a further consultation period with local residences which were missed from the letter drop between 17 February and 27 March 2017
- a copy of the Statement of Community Consultation (SoCC)
- lists of statutory consultees, non-statutory consultees and affected land owners consulted
- a summary and analysis of consultation responses from prescribed consultees, local authorities, affected landowners and the community
- the consideration of those responses in compliance with Section 49 of the 2008 Act and the impact on the Scheme
- details of how the ongoing liaison since August 2014 and results of the 2017 consultation have influenced the Scheme

4.3 Public consultation

2009 Consultation

4.3.1 A period of non-statutory options consultation was held from 9 March to 5 June with two preferred and four non-preferred options presented for public consultation as follows:

- Approximately 132,000 leaflets, accompanied by a questionnaire, were distributed to local households and businesses, t and other businesses

associated with the port. The leaflets described the options for the A63 Castle Street Improvements and provided details of the forthcoming exhibitions.

- A total of 544 visitors attended the public exhibitions. These were held on 2, 3 and 4 April at The Deep venue and at the Royal Hotel, Ferensway on 8 May.

4.3.2 The outcome of the consultation, together with technical appraisal, economic assessment and environmental assessment were used to inform the option selection process. This identified Option 1 A63 in cutting at Mytongate Junction (underground option) as the preferred option.

2013 / 2014 Consultation

4.3.3 At the request of HCC, an extended seven week consultation period was conducted on the two preferred options. This was held between 28 June and 15 August to facilitate an additional public exhibition event. Three public events were held at the Royal Hotel, Hull to gain feedback on the draft proposals. A total of 318 attendees visited on 19 and 20 July and 10 August. Scheme leaflet and consultation information was also made available. Following this, further environmental surveys and traffic assessment were undertaken to ensure plans were robust.

4.3.4 Additional targeted statutory consultation exercises on the preferred options were carried out under the 2008 Act from 2013 to 2014 as listed below:

- Market Place - consultation on the improvement of the existing route via High Street as an alternative to providing a pedestrian, cycle and disabled user bridge at the Market Place and Queen Street junction
- Princes Quay Bridge - consultation on options
- Temporary land and rising main - consultation on the locations of temporary site compounds during construction and the proposed rising main outfall route for the Mytongate Junction pumping station
- Extended Scheme - consultation on alterations to the A63 improvement at the western end of the Scheme to enable tie-in with the existing A63
- Public Open Space - consultation to demolish the Myton Centre and propose the site as an area of Public Open Space, to replace public open space lost at Trinity Burial Ground

2017 Consultation

4.3.5 Since June to August 2013 when the main public consultation was carried out, the Scheme slightly altered (see Table 4.1). Highways England subsequently decided that an additional round of consultation would be appropriate.

4.3.6 Statutory consultation under Sections 42 and 47 of the 2008 Act was held over 4 weeks between 16 January and 13 February 2017. This provided an update on proposed design changes and updated environmental assessment information. Approximately 6,744 leaflets and questionnaires were distributed. Consultation exhibitions were held at The Royal Hotel in Hull on 27 and 28 January 2017. Additional consultation was also held with residences on Amy Johnson Court which had been inadvertently missed from the letter drop. This was undertaken between 17 February and 27 March 2017.

4.3.7 In response to the consultation, approximately 260 completed or partially completed questionnaires and a further 66 letters and emails were received. All responses received were carefully considered and where appropriate, measures were incorporated into the final scheme proposal.

4.3.8 Additional consultation carried out on the proposals during this period included:

- Traffic management proposals at Mytongate Junction and to the west and east of the junction
- The level of interest in the social history of the previous residents of Hull following excavation works at Trinity Burial Ground
- The route of the rising main discounting one of the original options
- The location of the Mytongate Junction pumping station to west of Trinity Burial Ground
- Proposals for traffic through the Old Town of Hull

4.3.9 Two targeted non statutory consultation drop-in events were held on 29 November and 7 December 2017 at the Parish Centre, Hull to discuss the proposed changes in the Old Town and the Fruit Market. The proposals were consulted on as part of the statutory consultation in January and February 2017, however the drop-in events were held to discuss these in more detail. Letters informing people of the events were issued to properties within these areas.

4.3.10 As the design development progressed it was necessary to hold additional targeted statutory consultation in compliance with the 2008 Act on proposed changes to utility diversion routes, the proposed turning head at Dagger Lane and changes to the marina entrance. These were held from 18 December 2017 to 26 January 2018.

4.3.11 Additional targeted statutory consultation in compliance with the 2008 Act - for additional temporary land requirements for utility diversions (10 January to 7 February 2018); proposed temporary construction compound on the Staples site (25 January to 22 February 2018); proposed vehicle recovery area (15 March to 12 April 2018); and proposed ‘Arco’ construction compound (25 April to 23 May).

4.3.12 Further details of the public consultation events are included in the Consultation Report (document reference TR010016/APP/5.1).

4.4 Consultation with land owners and stakeholders

4.4.1 The 2008 Act requires that consultation must be undertaken on the Scheme proposals with the parties defined in the Act. In line with Sections 42 and 47 of the Act, consultation has taken place with the local authority within whose boundary the project falls, specifically HCC. In addition, owners, lessees, tenants and occupiers of the land within these areas including those directly and indirectly affected by the proposals have also been consulted. This includes prescribed consultees as set out in Schedule 1 of the APFP Regulations 2009. Consultation has helped to establish and agree access points, maintenance agreements and any due compensation arrangements. Further details of these can be found in the Consultation Report prepared for the DCO application (document reference TR010016/APP/5.1).

4.5 Consultation relating to environment

4.5.1 Alongside complying with the statutory requirements for consultation, consultation with key stakeholders (people, groups or organisations with an interest) and statutory environmental bodies is integral to the EIA process. Consultation has been carried out to:

- gather information on the existing environment
- obtain views and opinions on EIA methodology
- discuss likely environmental impacts and proposals for mitigation
- record where agreements have been reached

4.5.2 The consultation carried out with key stakeholders and statutory environmental bodies is described below at Sections 4.5.5 to 4.5.17 and also detailed within the relevant topic Chapters 6 to 16 of this ES.

4.5.3 A Scoping Report was sent to the Planning Inspectorate to request a Scoping Opinion (document reference TR010016/APP/6.9) under Regulation 8 of the EIA Regulations 2009 (see Section 1.6.3 and Section 5.4.2).

4.5.4 In accordance with Regulation 8(6) of the EIA Regulations 2009, the Planning Inspectorate consulted a prescribed list of consultation bodies in the preparation of their Scoping Opinion (their response to the Scoping Report). The Scoping Opinion contained a number of comments and issues to be addressed as part of the EIA and preparation of the ES, both from the Planning Inspectorate and from the bodies they consulted. These comments are tabled in Volume 3, Appendix 4.1 Response to the Planning Inspectorate Scoping Opinion and stakeholder

comments together with the Project Teams' response as to how they have been addressed within the ES and the wider DCO application as appropriate.

Consultation with third parties

4.5.5 Key consultation that has been carried out with third parties specifically as part of the EIA process is summarised below. A full account of the consultation referred to here is tabled in the Consultation Report (document reference TR010016/APP/5.1).

Cultural Heritage Liaison Group

4.5.6 A Cultural Heritage Liaison Group (CHLG) has been established with representatives from Historic England, HCC, Humber Archaeology Partnership and the Project Team. Regular meetings have been held to keep all members up to date on the Scheme and to seek views from members on approaches, for example the design of Princes Quay Bridge. The role of the CHLG is further referred to in Chapter 8 Cultural heritage.

Historic England (formerly English Heritage)

4.5.7 In addition to being represented on the CHLG, Historic England have been consulted specifically in their role as a statutory environmental body, on the approach to EIA including possible impacts to listed buildings, archaeological remains, Historic Landscapes and a programme for archaeological and historical evaluation and recording. There are no conservation area consents.

Holy Trinity Church and Diocese of York

4.5.8 Representatives of the Parochial Church Council for Holy Trinity Church Hull, and the Diocese of York, have been consulted regarding the treatment of remains at Trinity Burial Ground and the need for a Faculty Transfer to facilitate the advance works that need to be carried out. This consultation is detailed fully in the Consultation Report.

Natural England

4.5.9 Natural England have been consulted on the presence of European protected species, and the need for licenses. They have also been consulted regarding the Habitats Regulations Assessment[47] process and the proposed location of the rising main outfall into the Humber Estuary.

[47] The Habitats Regulations Assessment Advice Note 2010 Planning Inspectorate. Available online at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2011/04/Advice-note-10-HRA-web.pdf

Environment Agency

4.5.10 The Environment Agency have been consulted extensively on issues relating to flood risk and drainage of the Scheme. They have been involved in the development of the flood risk modelling, groundwater modelling and the location and nature of groundwater testing.

4.5.11 The Environment Agency have also been consulted with regard to environmental permit requirements for the re-burial of remains within Trinity Burial Ground. Environment Agency guidance has been followed with regard to the assessment of soils and hazardous waste in Chapter 13 Materials. The Environment Agency would also be consulted on the options for re-use of soils during development of the Materials Management Plan as part of the Detailed Design Stage.

4.5.12 There has been a collaborative approach to working with the Environment Agency and sharing of test results has been welcomed.

Hull City Council

4.5.13 Consultation with HCC has been ongoing via meetings and email exchange to keep HCC up to date with the Scheme and to obtain their views on a range of issues, including:

- Princes Quay Bridge
- Land contamination and ground investigation testing
- Groundwater pumping tests
- Drainage options and rising main outfall
- NMU proposals
- Noise
- Landscape design

Marine Management Organisation

4.5.14 Consultation with the Marine Management Organisation (MMO) has related to drainage outfall, site compound locations and the AIES for any consents and licences required, including for works in the Humber Dock Marina.

Public Health England

4.5.15 Public Health England (PHE[48]) were contacted in February and March 2014 and in January 2017. PHE agreed that a full Health Impact Assessment (HIA) was not required for the Scheme and that the health impacts could be covered within the ES. They advised that this should include impacts to human health, any residual risks and any mitigation measures proposed plus an assessment of the risks associated with the clearance of Trinity Burial Ground. For specific advice regarding potential biological risks associated with the clearance of the burial ground, PHE indicated that this could be sought from the Director of Public Health at the local authority and the Health and Safety Executive (HSE). A summary of Health Impacts is provided within Chapter 16 Combined and cumulative effects.

Health and Safety Executive

4.5.16 The Health and Safety Executive (HSE) were consulted during the 2013 Scoping process. They advised that checks should be made to determine if a Hazardous Substances Consent (HSC) would be required in accordance with Part A and Part B of the Planning (Hazardous Substances) Regulations 2010[49]. HSC is needed if specified hazardous substances are stored or used at or above specified controlled quantities, as set out in Schedule 1 of the Planning (Hazardous Substances) Regulations 2015[50]. No storage or use of hazardous substances at or above specified controlled quantities is proposed.

Hull Access Improvement Group

4.5.17 Meetings with the Hull Access Improvement Group (HAIG) have been held to provide an update to the group on the Scheme, and for the group to share their concerns about the facilities for vulnerable users. Further information is provided in Chapter 15 Effects on all travellers.

Statement of Common Ground

4.5.18 A Statement of Common Ground (SoCG) is a written statement prepared jointly by the applicant and any interested party, which contains agreed factual information about the application, in line with the Infrastructure Planning (Examination Procedure) Rules 2010[51]. SoCGs are generally prepared at the examination stage of an application for DCO to allow the examination to focus on matters of material difference between parties.

[48] Public Health England (PHE) is an executive agency of the Department of Health and Social Care in the United Kingdom that began operating on 1 April 2013 taking on as part of its remit the role of the Health Protection Agency (HPA).

[49] Planning (Hazardous Substances) Regulations 2010. Available online at: http://www.legislation.gov.uk/uksi/2010/1050/contents/made

[50] Planning (Hazardous Substances) Regulations 2015. Available online at: http://www.legislation.gov.uk/uksi/2015/627/contents/made

[51] The Infrastructure Planning (Examination Procedure) Rules 2010 is secondary Legislation to Planning Act 2008. Available online at: http://www.legislation.gov.uk/uksi/2010/103/contents/made

4.5.19 A SoCG has been prepared relating to proposed mitigation works within Trinity Burial Ground, see Chapter 8 Cultural heritage.

4.6 Consultation with the community

4.6.1 An analysis of consultation responses from the community is provided in the Consultation Report.

4.7 Future consultation

4.7.1 Following the application for a DCO, the Scheme would continue to be developed through Detailed Design. Consultation at this stage would be ongoing, as required, to ensure that statutory environmental bodies and other stakeholders are involved in the design process.

4.7.2 As the DCO application progresses through to examination stage, there is likely to be a requirement for ongoing consultation, for example to confirm SoCGs.

Chapter 5. EIA process

5.1 Introduction

5.1.1 EIA is a process which identifies the effects that development proposals would have on the environment. When impacts are identified, steps can be taken as part of the EIA process to prevent, reduce or offset any adverse effects.

5.1.2 This chapter explains how EIA has been carried out for the Scheme and then reported in this ES.

5.1.3 In this ES, impacts are considered to be the changes resulting from an action (the Scheme) and effects are considered to be the consequences of those impacts on the environment.

5.2 Objectives of the EIA process

5.2.1 The objectives of the EIA are to provide information, advice and reports to:

- facilitate the consideration of environmental effects and opportunities in the development of the design
- enable the avoidance and minimisation of environmental effects through design, and the identification of environmental mitigation measures where required
- seek the opportunity to provide environmental improvements where possible
- contribute to the information about the project to be presented at any public consultation
- ensure that decision making about the project is based on sound environmental information and takes environmental effects into account

5.2.2 Priority shall be given to the avoidance of impacts at source, whether through the re-design of the project or by regulating the timing or location of activities. If it is not possible to avoid significant negative impacts, opportunities shall be sought to reduce the impacts, ideally to the point that they are no longer significant. If this is not possible, but the Scheme is permitted, compensation may be appropriate. This shall be designed to meet specific environmental objectives that would deliver meaningful compensation for the negative impacts that are predicted.

5.2.3 Topic specific environmental objectives are to be found in the ES topic Chapters 6 to 16.

5.3 Legislation and guidance on EIA

5.3.1 This ES has been prepared to meet the requirements of the EIA Regulations 2009 (see Section 1.6.3). It has also followed guidance in the DMRB which is explained below. Guidance in DMRB is supported by other relevant best practice guidance on a topic by topic basis, and where this is the case, it is explained in the topic Chapters 6 to 16.

5.3.2 This ES has also taken account of guidance on how impacts should be considered as set out in the draft NN NPS.

Design Manual for Roads and Bridges

5.3.3 The DMRB[52] is a comprehensive manual system published by Department for Transport (DfT) which includes all current standards, advice notes and other published documents relating to the design, assessment and operation of trunk roads (including motorways).

5.3.4 Volume 11 of DMRB covers Environmental Assessment and is split into four Sections:

- Section 1 Introduction
- Section 2 General Principles of Environmental Assessment
- Section 3 Environmental Assessment Techniques
- Section 4 Assessment of Implications on European Sites (AIES)

5.3.5 Since it was first published in 1993, DMRB Volume 11 has been progressively updated. Before updates are formally published in DMRB, they can be published as Interim Advice Notes (IAN). The approach to EIA for the Scheme has taken account of the most up to date guidance either in DMRB Volume 11 or relevant IANs as shown in Table 5.1 below.

5.3.6 Sections 1, 2 and 3 of DMRB Volume 11 were substantially updated in 2008 by IAN 125/08 and then again in 2015 by IAN 125/15 Environmental Assessment Update[53] which introduced new guidance and further changes to some environmental topics that should be assessed. Where specific guidance on the EIA techniques for new topics has not yet been published in DMRB Volume 11 Part 3, this is noted in Table 5.1 and the approach taken for the Scheme is set out. Further details of EIA methodologies used are described in the relevant topic Chapters 6 to 16 of this ES.

[52] Design Manual for Roads and Bridges, Department for Transport is. Available online at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/

[53] IAN 125/15 Environmental Assessment Update is. Available online at: http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian125r2.pdf

Table 5.1 EIA guidance for environmental topics

Environmental topic[54]	Published DfT Guidance	Notes on approach for the Scheme*
Air quality (Chapter 6)	• DMRB Volume 11, Section 3, Part 1 Air Quality (2007) • IAN 170/12 Updated air quality advice on the assessment of future NOx and NO2 projections (2012) • IAN 174/13 Updated air quality advice on risk assessment related to compliance with the EU Directive on ambient air quality (2008) and on the production of Scheme Air Quality Action Plans (2013) • IAN 175/13 Updated air quality advice on risk assessment related to compliance with the EU Directive on ambient air quality (2008) and on the production of Scheme Air Quality Action Plans (2013) • IAN 185/15 Updated traffic, air quality and noise advice on the assessment of link speeds and generation of vehicle data into 'speed-bands' (2015)	In line with guidance
Noise and vibration (Chapter 7)	• DMRB Volume 11, Section 3, Part 7 Traffic Noise and Vibration (2011)	In line with guidance
Cultural heritage (Chapter 8)	• DMRB Volume 11, Section 3, Part 2 Cultural Heritage (2007)	In line with guidance
Landscape (Chapter 9)	• IAN 135/10 Landscape and Visual Effects Assessment (2010)	In line with guidance
Ecology and nature conservation (Chapter 10)	• IAN 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment (2010)	In line with guidance
Road drainage and the water environment (Chapter 11)	• DMRB Volume 11, Section 3, Part 10 Road Drainage and the Water Environment (2009)	In line with guidance
Geology and soils (Chapter 12)	• DMRB Volume 11, Section 3, Part 11 Geology and Soils (1993)	In line with guidance
Materials (Chapter 13)	• IAN 153/11 Guidance on the Environmental Effects of Materials Resources (2011)	In line with guidance
People and communities (Chapter 14)	• DMRB Volume 11, Section 3, Part 6 'Land Use' (2001) • DMRB Volume 11, Section 3, Part 8 'Pedestrians, Cyclists, Equestrians and Community Effects'.	People and Communities is an emerging topic outlined in IAN 125/15 Environmental Assessment Update produced by the Highways Agency in August 2015. The topic combines elements of the former Land Use topic with the Community Effects element of the former DMRB topic Pedestrians, Cyclists,

[54] DMRB Volume 11, Section 2, Part 1

Environmental topic[54]	Published DfT Guidance	Notes on approach for the Scheme*
		Equestrians and Community Effects. New guidance has not been published. The approach set out in this ES draws on guidance from the superseded topics in the DMRB and professional judgement.
Effects on all travellers (Chapter 15)	• DMRB Volume 11, Section 3, Part 8 'Vehicle Travellers' (1993) • DMRB Volume 11, Section 3, Part 9 'Pedestrians, Cyclists, Equestrians and Community Effects' (1993)	The topic of 'Effects on All Travellers' incorporates the former Vehicle Travellers topic and relevant parts of Pedestrians, Cyclists, Equestrians and Community Effects topic. Guidance has not been published, and the approach set out in this ES is based on professional judgement, drawing on guidance from the superseded topics.
Combined and cumulative effects (Chapter 16)	• DMRB Volume 11, Section 2, Part 5 'Assessment and Management of Environmental Effects'	The topic also draws upon guidance in the recently published the Planning Inspectorate Advice Note 17: Cumulative Effects Assessment[55].

* All chapters in the ES are Detailed assessments

5.4 Scope of the EIA

5.4.1 It is part of the EIA process to first determine the scope of the assessment that is required. The scope of an EIA is concerned with which environmental topics are relevant to consider and also the level of assessment detail that is appropriate.

5.4.2 A Scoping Report was written to set out the proposed scope of the EIA for the Scheme. This report followed guidance from DMRB Volume 11. As the project is a NSIP (see Sections 1.3.1 to 1.3.2), the Scoping Report was issued to the Planning Inspectorate to provide a Scoping Opinion. As part of the scoping opinion process, the Planning Inspectorate consulted third parties and included third party comments in their Scoping Opinion (see also Section 1.6.3).

5.4.3 The Scoping Opinion has been fully taken into account during the EIA process and in preparing this ES. Volume 3, Appendix 4.1 Response to the Planning Inspectorate Scoping Opinion and stakeholder comments details how each comment in the Scoping Opinion has been addressed.

[55] Planning Inspectorate Advice Note 17: Cumulative Effects Assessment. Available online at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2015/12/Advice-note-17V4.pdf

Assessment

5.4.4 Aligned to the EIA regulations and DMRB, the EIA process has considered:

- Impacts during construction of the Scheme
- Impacts during the operation of the Scheme and related to ongoing maintenance
- Impacts that would be temporary
- Impacts that would be permanent
- The significance of likely effects

5.4.5 Following guidance in DMRB Volume 11, short or medium term impacts are those that would last less than 15 years. Long term impacts are those that would last for 15 years or longer.

5.4.6 The EIA process has not considered any impacts associated with decommissioning of the Scheme, as there is no plan for this to take place. If an alternative route to the A63 was to be identified in the future, a full assessment of the decommissioning of the existing carriageway would need to be undertaken as part of the environmental assessment of any proposed new route.

5.4.7 No environmental topics have been fully scoped out of the EIA during the scoping process. The following elements of some topics have been scoped out, with full explanations provided in the relevant chapters:

- Chapter 7 Noise and vibration - Operational ground borne vibration because the carriageway surface will have no significant discontinuities and the Scheme is expected to improve upon the condition of existing carriageway
- Chapter 12 Geology and soils - Impacts on local geology or geomorphology because none are present in the study area
- Chapter 12 Geology and soils - Impacts on geological designated sites, because none are present in the study area
- Chapter 14 People and communities - Impacts on soils and land under agricultural use, because there is no agricultural land within the study area
- Chapter 15 Effects on all travellers - Impacts on bridleways or equestrian users, because there are no bridleways within the study area, or evidence of equestrian users

5.4.8 The impact of the Scheme on wider environmental receptor vulnerability and the capacity to adapt to climate change has been reviewed as ‘in combination’ climate effects within Chapter 16 Combined and cumulative effects.

5.4.9 A Health Impact Assessment (HIA) has been integrated into the EIA process and as such, a separate HIA chapter or report has not been produced. A summary of health impacts is provided within Chapter 16 Combined and cumulative effects.

Study areas

5.4.10 The physical scope of the EIA includes the footprint of the Scheme itself, together with any areas that would be used for its construction. Study areas are defined per topic, in line with DMRB guidance where it is available. Each study area is described in the relevant topic Chapters 6 to 16. Where study areas are defined as distance from the Scheme, this is largely distance from the main works, rather than associated works.

Chapter structure

5.4.11 Each topic Chapter 6 to 16 follows IAN 125/15 Environmental Assessment Update requirements for a Detailed level assessment and includes:

- Executive summary
- Introduction to the topic
- Legislative and policy background
- Approach to EIA specific to the topic
- Description of the baseline conditions for the topic
- Proposed enhancement measures where appropriate
- Proposed measures to avoid, reduce or mitigate possible adverse environmental effects
- Explanation of the predicted significance of environmental effects as a result of the Scheme, after measures to avoid, reduce or mitigate any adverse impacts are taken into account
- Conclusion

5.5 Existing situation, baseline, future conditions and the 'Do Minimum' scenario

5.5.1 To establish how the Scheme would impact on the environment, different scenarios are required as a basis for comparison.

5.5.2 The existing situation is the situation at the present time, without the Scheme, referred to as 'Do Nothing' scenario.

5.5.3 The baseline is the situation as it would exist immediately before the Scheme. The baseline is identified by predicting how the existing situation would change

between now and the time immediately before the Scheme. The effect of the Scheme is therefore any change from the baseline scenario that the Scheme causes.

5.5.4 Two baseline years are referred to: the baseline year for impacts predicted to be caused by construction of the Scheme is the date when construction is proposed to start (2020); and the baseline year for impacts predicted to be caused by the operation of the project is the date the road is due to be open to traffic (2025).

5.5.5 For some topics, impacts will be predicted for a future year (for example 15 years after opening, or the worst year in the first 15 years of operation), in line with relevant guidance. The process involves forecasting the effects by comparing a scenario with the Scheme against one without the Scheme, over a period of time.

5.5.6 The absence and- presence of the proposed project are referred to as the Do Minimum and Do Something scenarios respectively. The likely significant environmental effects need to be defined for the Do Minimum and Do Something scenarios in the baseline year and a future year, or series of future years depending on the topic.

5.6 Data gathering and consultation

5.6.1 Data gathering and consultation has been required to identify the existing situation. Data has been gathered during previous stages of the Scheme's development and has been updated where necessary as part of the EIA process. Data gathering also varies between environmental topics, but broadly includes:

- Consultation with third parties for factual information
- Consultation with third parties for opinion and comments
- Desk based surveys and information collection
- Field and site surveys

5.6.2 Consultations which have occurred to date are covered in Chapter 4 Consultation of this ES.

5.7 Potential impacts

5.7.1 Potential impacts of the Scheme have been identified by considering the change that the Scheme would cause from the baseline conditions. Impacts have been described as direct or indirect; temporary or permanent; beneficial or adverse.

5.7.2 Direct impacts are those caused by the Scheme itself. Indirect impacts can be 'those that alter the character, behaviour or functioning of the affected environment because of encroachment of the Scheme impacts over a wider area or timescale' (DMRB Volume 11, Section 2, Part 5).

5.7.3 Temporary impacts are those that would only last for a certain amount of time, for example a change in noise levels during a construction period. Permanent impacts are those that would last for the lifetime of the Scheme and possibly beyond, for example a change to a view because a new bridge would be built, or a change to a pedestrian route because a pedestrian crossing has been relocated.

5.7.4 Positive, or beneficial effects are those which provide a benefit to the environment. Negative, or adverse effects are those that cause a worsening of the environment.

5.7.5 Combined and cumulative effects are considered in Chapter 16 of this ES. There are two types of cumulative effects which have been identified for the Scheme. Firstly, where the Scheme has more than one impact on the same receptor (environmental feature), for example an individual property that would experience noise, air quality and visual amenity impacts as a result of the Scheme. Secondly where a receptor is affected by the Scheme and another planned development, for example where an individual property would experience noise impacts from the Scheme and from another development that is proposed.

5.7.6 It should be noted that cumulative effects may be of greater significance than the individual significance of any of the singular effects.

Significance of effects

5.7.7 The EIA process aims to determine whether or not identified impacts have significant effects. The impact is the action, or consequence of the project, for example a tree is removed. The effect is how that matters to the environment, for example the tree may have provided bird nesting habitat which has been lost.

5.7.8 To determine the significance of an environmental effects, two key factors are considered:

- The ‘value’ or ‘sensitivity’ of the receptor
- ‘The magnitude’ or ‘scale’ of the impact

5.7.9 Table 5.2 and Table 5.3 below set out typical criteria for the value or sensitivity of receptors and for the magnitude of impacts. Some topic guidance (see Table 5.1) includes specific criteria on determining significance, while other topic guidance includes no criteria at all. The approach used in this EIA is set out in the relevant topic Chapters 6 to 16.

Table 5.2: Environmental value of receptors (DMRB Volume 11, Section 2, Part 5)

Value (sensitivity)	Typical descriptors
Very High	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.

Value (sensitivity)	Typical descriptors
Medium	High or medium importance and rarity, regional scale, limited potential for substitution.
Low (or Lower)	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

Table 5.3: Impact magnitude (DMRB Volume 11, Section 2, Part 5)

Magnitude of impact	Typical criteria descriptors
Major	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Moderate	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Minor	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse).
	Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

5.7.10 When the value of the receptor and the magnitude of the impact have been identified, these two factors can be used together to determine how significant the effect is, using a typical matrix as shown in Table 5.4 Typical significance matrix (DMRB Volume 11, Section 2, Part 5). For example, a slight adverse impact on a receptor of medium importance would have a slight adverse effect.

Table 5.4: Typical significance matrix (DMRB Volume 11, Section 2, Part 5)

Value / Sensitivity	Magnitude of impact (adverse or beneficial)				
	No change	Negligible	Minor	Moderate	Major
Very high	Neutral	Slight	Moderate or Large	Large or Very Large	Large or Very Large
High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large

Value / Sensitivity	Magnitude of impact (adverse or beneficial)				
	No change	Negligible	Minor	Moderate	Major
Medium	Neutral	Neutral or Slight	Slight	Slight or Moderate	Moderate or Large
Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

5.7.11 To take account of published DMRB guidance, the typical significance matrix cannot be applied consistently for all environmental topic areas. Some environmental topics have topic specific criteria for value and/or impact magnitude which then gives a topic specific matrix. Where impacts can be quantified, for example for changes in noise and air quality, thresholds have been set which represent a significant change. Where environmental topics have no agreed methods of assessment or scales of measurement for either the value/sensitivity of the receptor or the magnitude of impact, assessment is based on professional judgement, and impacts are assessed simply as being either significant or not significant. Where it is applied, professional judgement takes account of whether the effect is adverse or beneficial, the nature of the receptor affected and the duration of the effect (temporary or permanent, short term or long term).

5.7.12 Professional judgment is a process that is used to reach a well-reasoned conclusion, based on the relevant facts and circumstances available at the time. A fundamental part of the process is the involvement of individuals with sufficient knowledge and experience. The decision made must be impartial, even though the use of judgment is a subjective process.

5.7.13 Any effects that are assessed as being moderate adverse, moderate beneficial or greater are considered as significant for the purpose of this ES.

5.8 Limitations

5.8.1 The EIA has been carried out during the Preliminary Design stage of the Scheme. This means that the design of the Scheme has not been absolutely finalised, and there are some elements that are still uncertain. While this allows for an iterative design process that can be informed by the EIA, it also means that there are elements of the Scheme which have not been agreed, meaning there is no firm design to assess.

5.8.2 As a consequence of some level of uncertainty for some elements, EIA best practice has been to assess the worst case scenario of environmental impacts[56]. Where relevant this is explained in detail in the topic chapters. Where there is

[56] DMRB Volume 11 Section 2 Part 6 paragraph 3.17 (HD48/08)

uncertainty in the Scheme design, the suggested approach from the NN NPS[57] is to set out the maximum extent of the proposed development and to assess the potential adverse effects which the Scheme could have to ensure impacts have been properly assessed.

5.8.3 The environmental impacts that are reported in this ES, and the level of mitigation described effectively set the standard which would be achieved by the final Scheme.

5.9 Mitigation measures and enhancements

5.9.1 Mitigation is the way that adverse effects can be avoided or reduced. All mitigation measures which are committed to and are deliverable form part of the Scheme and have therefore been taken into account as part of the EIA.

5.9.2 Impacts that would still occur after the mitigation measures are taken into account are referred to as 'residual' impacts. The impacts reported in this ES are the residual impacts. Some measures that are designed to mitigate an adverse impact may leave the environment improved over even its existing state. In these cases, the residual impact recorded would be beneficial.

5.9.3 Construction and operational mitigation measures are identified in each topic chapter and are taken into account in the assessment of residual effects for each topic. The residual effects with a significance of 'moderate adverse' or 'moderate beneficial' or greater are summarised in Chapter 17 Summary of Environmental Statement findings, Table 17.1 Summary table. This information is also included in the Register of Environmental Actions and Commitments (REAC) which forms an appendix of the OEMP, see document reference TR010016/APP/7.3.

Mitigation through design

5.9.4 Mitigation through design refers to the way the Scheme has been designed to avoid, or reduce, adverse effects. This process of mitigation through design, or an iterative design and assessment process, has been ongoing throughout the Scheme's development and has informed the current proposals as described in Chapter 2 The Scheme.

Other mitigation options

5.9.5 Where impacts could not be avoided or reduced by the design process, other mitigation measures have been considered. These are broadly categorised below:

- Additional measures that avoid or reduce negative effects for example provision of acoustic fencing to reduce noise or planting trees to screen the view of a road.

[57] National Policy Statement for National Networks, Department for Transport, December 2014, paragraph 4.19

- Compensation for or replacement of features and resources, for example replacing trees that would be removed with new areas of planting in a nearby location, or replacing a wall.

- Offsetting impacts by providing a beneficial effect that is related to the impact, but is not a like-for-like replacement of the feature to be lost. For example, an archaeological excavation which provides detailed archaeological records of the archaeological remains to offset the loss of the remains themselves.

5.9.6 In some cases, it may be necessary to apply a combination of two or more of these mitigation approaches.

5.9.7 Where appropriate, the measures or combinations of measures to be used in mitigation have been decided in consultation with statutory consultees and/or other third parties.

Enhancements

5.9.8 An enhancement is provided where measures are put in place that improve the environment over its existing state, but which were not put in place to mitigate an adverse effect. Enhancements that are committed and deliverable as part of the project have been identified as beneficial effects.

5.10 Environmental Management Plan

5.10.1 As part of the EIA process, an Environmental Management Plan (EMP) is prepared to manage the environmental effects of projects and to demonstrate compliance with environmental legislation. The EMP evolves through the development of a project and helps to ensure that the impacts of the Scheme on the environment are not worse than reported in the ES. Highways England guidance on EMPs is provided in IAN 183/14 Environmental Management Plans.

Construction Environmental Management Plan

5.10.2 At Preliminary Design stage, an outline Environmental Management Plan (OEMP) is prepared by the designer to capture construction and operational mitigation identified in the ES. For more details see the OEMP for the Scheme at document reference TR010016/APP/7.3. Mitigation requirements are identified in the outline REAC (document reference TR010016/APP/6.11) which is appended to the OEMP at Annex B.

5.10.3 Before the start of construction work, the contractor will develop the OEMP into a Construction Environmental Management Plan (CEMP) during the Construction Preparation and Detailed Design stages of the Scheme. The CEMP forms a written plan that is updated throughout the construction process. It aims to present details of all environmental objectives, risks, mitigation and commitments against

clearly identified actions to ensure that each are effectively considered and managed. The REAC will be updated on an ongoing basis.

5.10.4 An approach to avoid or reduce environmental 'risks' during the construction of the Scheme is detailed in the CEMP. Risks are different from the impacts that this ES has identified during construction, as risks are not predictable in the same way as impacts. Risks might include a fuel spillage, or dust drifting from the construction site. As such the CEMP represents a form of mitigation and is referred to as a mitigation measure against some construction impacts in this ES.

Environmental Masterplan

5.10.5 The Environmental Masterplan is a drawing (or set of drawings) which includes all the environmental requirements of the Scheme. It is a key plan and instrumental in ensuring the environmental elements of the Scheme are delivered. It is provided at Volume 2, Figure 2.10 Environmental masterplan.

Handover Environmental Management Plan

5.10.6 Towards the end of construction, the contractor would develop the CEMP into a Handover Environmental Management Plan (HEMP). A HEMP is a written plan that sets out the long-term maintenance and management works required to ensure the continued effectiveness of environmental mitigation measures that form part of the Scheme and also to prevent unexpected environmental impacts during the operation of the Scheme.

5.10.7 The HEMP is prepared by the contractor who constructs the Scheme at the end of the aftercare period, before handover to Highways England and their Managing Agents for long term maintenance of the Scheme.

Chapter 6. Air quality

6.1 Executive summary

6.1.1 This chapter provides an assessment of the potential air quality effects of the A63 Castle Street Improvements (the Scheme). The Scheme Site is located in the Hull Air Quality Management Area (AQMA) and current baseline NO2 concentrations exceed the annual mean NO2 objective at roadside locations adjacent to the Scheme.

6.1.2 A qualitative assessment of potential dust effects has been undertaken, based on a review of likely dust raising activities and identification of sensitive receptors within 200m of the Scheme Site. Potential dust effects would be suitably controlled using the best practice mitigation measures proposed, are not expected to cause statutory nuisance or loss of amenity and are therefore concluded to be not significant.

6.1.3 Traffic management measures associated with the Construction Phase have been assessed quantitively. The assessment has focused on a selection of sensitive receptors which are expected to experience the greatest impacts as a result of the traffic management measures which are located along the A63. During construction, there is expected to be an increase in traffic along the A63 Hessle Road, west of Mytongate Junction, resulting in a temporary worsening in air quality at receptors in this area. However, resultant annual mean NO_2 concentrations remain below relevant air quality objectives and are therefore not considered significant. Elsewhere, east of Mytongate Junction, there are improvements in air quality as the traffic management measures would lead to reductions in vehicle flows on this section of the A63.

6.1.4 A Detailed level of assessment, using atmospheric dispersion modelling, has been undertaken to assess the air quality impact of the operation of the Scheme at sensitive receptors. The model has been verified against air quality monitoring data and has been used to estimate the air quality impacts of changes in traffic associated with the Scheme.

6.1.5 During operation, the Scheme is expected to lead to an increase in traffic along the A63 between Daltry Street and Market Place, which is located within the Hull AQMA. However, the Scheme will increase capacity on the A63 and is therefore expected to reduce traffic congestion. This reduced congestion is predicted to improve air quality within the AQMA and remove exceedances of the NO_2 objective in the Opening Year of the Scheme at some sensitive receptors. Furthermore, the operation of the Scheme is not expected to affect compliance

with the European Union (EU) Directive 2008/50/EC on ambient air quality[58]. The assessment has therefore concluded that no significant air quality effects would result from the operation of the Scheme.

6.2 Introduction

6.2.1 This chapter presents the assessment of the potential air quality effects relating to the Scheme. The Scheme has the potential to influence traffic movements in Hull and within the Air Quality Management Area (AQMA) where the annual mean NO_2 objective is currently exceeded (see Volume 2, Figure 6.1 Air quality constraints).

6.2.2 The Scheme would create a new junction by lowering the level of the A63 at Mytongate Junction. Ferensway and Commercial Road would cross the A63 creating a split level junction. Between Princes Dock Street and Market Place, the eastbound carriageway of the A63 would be widened to three lanes. A number of pedestrian crossings would also be removed and replaced with bridges over the A63 at Porter Street and Princes Quay.

6.2.3 The Scheme has the potential to cause air quality effects, both positive and negative, during the Construction and Operation Phases. The air quality topic encompasses two sub-topics:

- Local air quality, which is concerned principally with emissions of pollutants that are of concern to human health and ecosystems, at a local level
- Regional impacts, which is concerned with total emissions of pollutants that can disperse over longer distances, affecting both human health and ecosystems

6.2.4 This assessment considers both Construction Phase and Operation Phase effects. Site clearance and the Construction Phase of the Scheme has the potential to result in temporary air quality impacts from emissions of dust. Road closures and enforcement of speed limits during the Construction Phase also have the potential to result in temporary air quality impacts from changes in the flow, speed and composition of traffic on the road network.

6.2.5 The Operation Phase of the Scheme would affect air quality due to:

- a change in vehicular emissions and pollutant concentrations due to a change in the flow, speed and composition of traffic on the road network
- a change in road layout and alignment, leading to a change in vehicular emissions and a change in the distance between vehicular emissions and receptors

[58] European Union. (April 2008) Directive on ambient air quality and cleaner Air for Europe, Directive 2008/50/EC Official Journal, vol. 152, pp. 0001-0044

6.2.6 This chapter provides an assessment of the potential air quality effects of the Scheme in accordance with the DMRB Volume 11 Section 3, Part 1 – Air Quality (HA207/07)[59] and Interim Advice Notes (IAN 170/12[60], 174/13[61], 175/13[62] and IAN 185/15[63]). The predicted changes in air quality at sensitive receptors affected by the Scheme have been considered in the context of relevant legislation and policy and existing air quality in the study area.

6.3 Legislative, regulatory and policy background

Legislation

European Union

6.3.1 Directive 2008/50/EC on ambient air quality and cleaner air for Europe was adopted in May 2008. This Directive defines limit values and times by which they are to be achieved for the purpose of protecting human health and the environment by avoiding, reducing or preventing harmful concentrations of air pollutants.

6.3.2 The Directive sets out that the European Union (EU) limit values apply everywhere with the exception of:

a) any locations situated within areas where members of the public do not have access and there is no fixed habitation

b) in accordance with Article 2(1), on factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply

c) on the carriageway of roads; and on the central reservations of roads except where there is normally pedestrian access to the central reservation

6.3.3 The Department for Environment, Food and Rural Affairs (Defra) assesses and reports on the compliance with the EU Directive on ambient air quality for each of the 43 zones and agglomeration across the UK.

[59] Highways Agency (2007) Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1, HA 207/07, Air Quality.

[60] Highways Agency (2012) Interim Advice Note 170/12 v3: Updated air quality advice on the assessment of future NO_x and NO_2 projections for users of DMRB Volume 11, Section 3 Part 1 'Air Quality' (HA207/07). Available online at: http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian170.pdf

[61] Highways Agency (2013) Interim Advice Note 174/13. Update advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 'Air Quality' (HA207/07). Available online at: http://www.standardsforhighways.co.uk/ians/pdfs/ian174.pdf

[62] Highways Agency (2013) Interim Advice Note 175/13 Updated advice on risk assessment related to compliance with the EU Directive on ambient air quality and on the projection of Scheme Air Quality Action Plans for user of DMRB Volume 11, Section 3, Part 1 'Air Quality' (HA207/07). Available online at: http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian175.pdf

[63] Highways Agency (2015) Interim Advice Note 185/15. Updated traffic, air quality and noise advice on the assessment of link speeds and generation of vehicle data into 'speed-bands' for users of DMRB Volume 11, Section 3, Part 1, 'Air Quality' (HA207/07). Available online at: http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian185.pdf

6.3.4 The Air Quality Standards Regulations 2010 came into force in June 2010. They implement the EU Directive on ambient air quality for the UK.

National

6.3.5 Part IV of the Environment Act 1995[64] requires that every local authority shall periodically carry out a review of air quality within its area, including likely future air quality. As part of this review, the local authority must assess whether air quality objectives are being achieved, or likely to be achieved within the relevant periods. Any parts of a local authority's area where the objectives are not being achieved or are not likely to be achieved within the relevant period must be identified and declared as an AQMA. Once such a declaration has been made, authorities are under a duty to prepare an Action Plan which sets out measures to pursue the achievement of the air quality objectives within the AQMA.

6.3.6 The air quality objectives specifically for use by local authorities in carrying out their air quality management duties are set out in the Air Quality (England) Regulations 2000[65] and the Air Quality (England) (Amendment) Regulations 2002[66].

6.3.7 The Air Quality Strategy establishes the UK framework for air quality improvements. The Air Quality Strategy objectives (AQOs) are a statement of policy intentions and policy targets. As such, there is no legal requirement to meet these objectives, although local authorities are also required to work towards achieving the Air Quality Strategy's objectives.

6.3.8 The AQOs and limit values relevant to the assessment are summarised in Table 6.1.

Table 6.1: Air quality objectives and limit values

Pollutant	Averaging period	Concentration	Allowance	Attainment date	
				Air Quality Objectives	EU Limit Values
Nitrogen dioxide (NO2)	Annual	40 µg/m^3	-	31 December 2005[(a)]	1 January 2010[(c)]
	1 Hour	200 µg/m^3	18	31 December 2005[(a)]	1 January 2010[(c)]
Particulates (PM_{10})	Annual	40 µg/m^3	-	31 December 2004[(a)]	1 January 2005[(c)]

[64] Defra (2003) Part IV of the Environment Act 1995 Local Air Quality Management. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69348/pb13566-laqm-policy-guidance-part4-090302.pdf

[65] Air Quality (England) Regulations 2000 No. 928. Available online at: http://www.legislation.gov.uk/uksi/2000/928/contents/made

[66] Air Quality (England) (Amendment) Regulations 2002 No. 3043. Available online at: http://www.legislation.gov.uk/uksi/2002/3043/contents/made

Pollutant	Averaging period	Concentration	Allowance	Attainment date	
				Air Quality Objectives	EU Limit Values
	24 Hour	50 µg/m^3	35	31 December 2004[(a)]	1 January 2005[(c)]
NO_x[(d)]	Annual	30µg/m^3	-	31 December 2000[(c)]	

Notes: [(a)] Air Quality (England) Regulations 2000 as amended in 2002

[(b)] Air Quality Strategy 2007

[(c)] EU Directive 2008/50/EEC on ambient air quality and cleaner air for Europe and The Air Quality Standards Regulations 2010. Derogations (time extensions) have been agreed by the EU for meeting the NO_2 Limit Values in some zones/agglomerations;

[(d)] Critical level for the protection of vegetation

6.3.9 Table 6.2 provides details of where the respective objectives should and should not apply and therefore the types of receptors that are relevant to the assessment of air quality.

Table 6.2: Locations where AQOs should and should not apply

Averaging period	Objectives should apply at:	Objectives should not apply at:
Annual	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.
24 Hour	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.
1 Hour	All locations where the annual mean and 24 hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.

Source: Defra (2016) Local Air Quality Management – Technical Guidance[67]

[67] Defra (2016) Part IV of the Environment Act 1995, Environment (Northern Ireland) Order 2002 Part III: Local Air Quality Management – Technical Guidance LAQM.TG (16). Available online at: http://laqm.defra.gov.uk/documents/LAQM-TG16-April-16-v1.pdf

6.3.10 DMRB Volume 11 Section 3, Part 1 – Air Quality (HA207/07) guidance states that the policy of the UK statutory nature conservation agencies is to apply the annual mean NO_x criterion (30µg/m^3) in internationally designated conservation sites and Sites of Special Scientific Interest (SSSI) on a precautionary basis[68].

Construction dust

6.3.11 Section 79(1)(d) of the Environmental Protection Act 1990[69] defines one type of 'statutory nuisance' as *"any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance"*. Where a local authority is satisfied that a statutory nuisance exists, or is likely to occur or recur, it must serve an abatement notice. Failure to comply with an abatement notice is an offence. However, it is a defence if an operator employs the best practicable means to prevent or to counteract the effects of the nuisance.

National policy

National Policy Statement for National Networks

6.3.12 The government has produced a series of National Policy Statements (NPS), including one on National Networks[70], which covers roads. The NPS for National Networks (NN NPS) sets out "*the need for, and the Government's policies to deliver, development of nationally significant infrastructure projects on the national road and rail networks*". The NPS provides guidance for promoters of NSIPs and also provides the basis for examination by the examining authority (the Planning Inspectorate in this instance) and decision making by the Secretary of State.

6.3.13 The NN NPS notes that the applicant should undertake an assessment of the impacts of the Scheme as part of the Environmental Statement (ES) and that the ES should describe:

- existing air quality levels
- forecasts of air quality at the time of opening, assuming that the Scheme is not built (the future baseline) and taking account the impact of the Scheme
- any significant air quality effects, their mitigation and any residual effects, distinguish between the construction and operation stages and taking account of the impact of road traffic generated by the Scheme

6.3.14 Sections 5.12 and 5.13 of the NN NPS provide advice for decision makers:

[68] The Limit Value applies only to locations more than 20 km from towns with more than 250,000 inhabitants or more than 5 km from other built-up areas, industrial installations or motorways.

[69] Environmental Protection Act 1990. Available online at: http://www.legislation.gov.uk/ukpga/1990/43/contents

[70] National Policy Statement for National Networks December 2014 Department for Transport. Available online at: https://www.gov.uk/government/publications/national-policy-statement-for-national-networks

"The Secretary of State must give air quality considerations substantial weight where, after taking into account mitigation, a project would lead to a significant air quality impact in relation to EIA and / or where they lead to a deterioration in air quality in a zone / agglomeration".

"The Secretary of State should refuse consent where, after taking into account mitigation, the air quality impacts of the Project will:

- *Result in a zone / agglomeration which is currently reported as being compliant with the Air Quality Directive becoming non-compliant.*
- *Affect the ability of a non-compliant area to achieve compliance within the most recent timescales reported to the European Commission at the time of the decision".*

6.3.15 Advice set out in IANs 174/13 and 175/13 ensures that an assessment to inform the reasonable and robust decision making on the judgements of significant air quality impacts (NN NPS Section 5.12) and determining whether a scheme would affect the UK's reported ability to comply with the EU Directive on ambient air quality (NN NPS Section 5.13) can be completed and evaluated in line with the requirements of the NN NPS.

National Planning Policy Framework

6.3.16 The National Planning Policy Framework (NPPF)[71] sets out the government's planning policies for England. With regard to air quality the NNPF states at paragraph 109 that:

"The planning system should contribute to and enhance the natural and local environment by: . . preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability…"

6.3.17 And at paragraph 124 that:

"Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative effects on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan."

[71] Communities and Local Government (2012) National Planning Policy Framework. Available online at: http://webarchive.nationalarchives.gov.uk/20180608213715/https://www.gov.uk/guidance/national-planning-policy-framework

6.3.18 Whilst the NPPF does not contain specific policies for nationally significant infrastructure projects, the policies in the NPPF and NN NPS are consistent.

Air Quality Plan for Nitrogen Dioxide in UK

6.3.19 The latest plan for tackling roadside NO_2 concentrations was published by the Defra in July 2017 and details the government's plan to reduce NO_2 concentrations within statutory limits within the shortest possible time[72]. Within this plan, several local authorities with exceedances of the NO_2 limit values are named and therefore are required to undertake a local assessment to consider the best options to achieve compliance with this limit value. While Hull City Council (HCC) is not named within the plan as a local authority required to produce a local action plan, the Air Quality Plan is still relevant as the Scheme should not contradict with the main aim of plan: to achieve compliance with the NO_2 limit values in the shortest time possible.

Highways England Policy

6.3.20 The Highways England Air Quality Strategy[73] outlines Highways England's approach to improving air quality as part of the Road Investment Strategy. The strategy details different actions to help improve air quality such as:

- Exploring new and innovative approaches to improve air quality, such as air quality barriers
- Working with key stakeholders such as DfT and Defra to develop and deliver policies to improve air quality
- Where appropriate, designing out or mitigating poor air quality for Highways England road schemes
- Improving air quality monitoring across the Highways England road network e.g. by installing 50 new continuous air quality monitoring stations
- Working to optimise use of the road network e.g. by informing customers of alternative routes for journeys to avoid sensitive areas

[72] Defra (2017). UK plan for tackling roadside nitrogen dioxide concentrations: an overview. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/633269/air-quality-plan-overview.pdf

[73] Highways England (2017) Our strategy to improve air quality. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/634933/N160081_Air_Quality_Strategy_Final_V18.pdf

Local Policy

Local Plan

6.3.21 The Hull Local Plan 2016-2032[74] which will guide development in Hull until 2031, was adopted by HCC in November 2017.

6.3.22 Policy 47 of the Local Plan relates to atmospheric pollution and outlines the criteria when an air quality assessment is expected to be required for development applications. It also outlines the assessment requirements, including the need to assess existing air quality and the impact of the proposal on air quality in conjunction with committed development. The assessment should also identify mitigation measures and quantify the impact of those measures. The policy also states that development which cannot appropriately mitigate air quality concerns, including dust and odour, will only be supported where the social and economic benefits significantly outweigh the negative impact on air quality.

6.3.23 There are also several transport policies within the Local Plan related to air quality. Of most importance is Policy 25 Sustainable Travel, which states that transport improvements should have a minimal impact on environment and public health and, wherever possible, improve air quality.

Hull Air Quality Action Plan

6.3.24 HCC published its Air Quality Action Plan[75] (AQAP) in 2007 in response to declaring an AQMA within Hull City Centre. The AQMA (as shown within Volume 2, Figure 6.1 Air quality constraints) was declared due to exceedances of the annual mean objective for NO_2, primarily as a result of road traffic emissions. The AQAP proposes a number of measures designed to improve air quality both within the AQMA and generally across Hull. As road traffic is a dominant source of NO_x emissions in the area, measures have been grouped into packages including awareness raising, reducing vehicles, minimising emissions and demand management. Most of packages within the AQAP complement the third Local Transport Plan (LTP3) published by HCC, of which one of the objectives is to "*promote a healthier City through improving air quality and encouraging active travel*"[76].

6.3.25 The objectives of the AQAP are as follows:

"*Primary*

[74] Hull Local Plan 2016-2032. Available online at: http://hullcc-consult.objective.co.uk/portal/localplan/lppub?pointId=1452248979939#section-1452248979939

[75] Hull City Council, Air Quality Action Plan 2007. Available online at: http://www.hullcc.gov.uk/pls/portal/docs/PAGE/HOME/ENVIRONMENT/POLLUTION/AIR%20QUALITY/AIR%20MANAGEMENT/ACTION%20PLAN/AIRQUALITYACTIONPLAN.PDF

[76] Further details on LTP3 can be found in Chapter 1, Section 1.4.6 of the Environmental Statement

- *To achieve the National Air Quality objective for nitrogen dioxide (annual average), of 40 µg/m^3, within the Air Quality Management Area for the A63 Trunk Road (AQMA No.1 Order 2005).*

Secondary

- *To reduce air pollution as a whole within the entire City.*
- *To inform the public and provide relevant and up to date air quality information.*
- *To continue to enforce air quality legislation within the City.*
- *To continue to work with the HCC Transportation and Strategy Unit to improve air quality via initiatives in the Local Transport Plan.*
- *To ensure that all council activities are considered with reference to their effect on air quality.*
- *To support National Initiatives to improve air quality including liaison with Defra and the Department of Transport."*

6.3.26 One of the ways to help achieve the objectives of the AQAP is through the development of a Local Air Quality Strategy.

Hull Local Air Quality Strategy

6.3.27 The Hull Air Quality Strategy[77] was published in June 2017 to demonstrate HCC's commitment to tackling poor air quality and associated health issues. The Strategy sets out air quality aims and policy options to improve air quality in Hull, the primary aim of which is *"to improve the quality of air for the people of Hull and to provide the framework with which to enable the improvement of air quality in Hull, in line with both National Air Quality Standards and the principles of best practice."*

6.3.28 In accordance with this, the secondary aims of the Local Air Quality Strategy are:

"1. *To lead by example by minimising the environmental impact of Council activities.*
2. *To ensure the air quality and climate change impact of development within the district is minimised and, wherever possible, helps to improve local air quality.*
3. *To minimise and control polluting emissions from industrial, transport and other sources by working with business, residents and other stakeholders"*

[77] Kingston upon Hull City Council 2017 Air Quality Strategy, June 2017

6.4 Study area

Construction Phase

Construction dust

6.4.1 During the Construction Phase there would be potentially dust generating activities, such as earth moving and demolition. The distances from the emission source at which significant construction dust effects are likely to occur are dependent on the extent and nature of mitigation measures, the prevailing wind conditions, rainfall and the presence of screening etc. However, research indicates that effects from construction activities that generate dust are generally limited to within 150-200m of the construction site boundary.

6.4.2 Following the advice set out in paragraph 3.45 of DMRB Volume 11 Section 3, Part 1 – Air Quality (HA207/07), sensitive features within 200m of any construction activities and site compounds have been identified. The construction dust study area for the Scheme is presented within Volume 2, Figure 6.2 Construction Phase: Construction dust study area.

Construction traffic management measures

6.4.3 In accordance with DMRB Volume 11 Section 3, Part 1 – Air Quality (HA207/07), as construction is expected to last for more than six months, an assessment of the Construction Phase traffic management measures has been undertaken. The extent of the area considered in this assessment is presented in Volume 2, Figure 6.3 Construction Phase: Construction traffic study area.

6.4.4 During the Construction Phase, the Scheme would introduce new emission sources in the form of plant and traffic from construction vehicles and affect existing emission sources from the implementation of traffic management measures, including:

- speed limit of 50mph at Brighton Street Roundabout
- temporary speed limit of 30mph eastbound from the Brighton Street Roundabout to the Myton Bridge
- closure of Ferensway southbound from Osbourne Street to Mytongate Junction
- closure of Vicar Lane, Fish Street, Dagger Lane and Humber Dock Street

6.4.5 The assessment of the potential impacts of the construction traffic management measures has focussed on the areas that will experience the highest pollutant concentrations and / or the greatest changes in traffic during the Construction Phase (and therefore the greatest changes in pollutant concentrations). These changes are the result of vehicle rerouting or the traffic management measures themselves e.g. speed limit reductions.

6.4.6 The study area for the construction traffic management measures has therefore considered:

- A1105 Anlaby Road, Rawling Way, A165 Freetown Way, A1165 and Daltry Street as vehicles which would usually travel along A63 Castle Street are predicted to travel on these local roads to avoid construction works, increasing traffic flows on these roads.
- The A63 Castle Street east of Mytongate Junction which, because of the closure of Ferensway southbound to the Mytongate Junction, would experience a decrease vehicle flows on the A63 Castle Street.
- The A63 Hessle Road west of Mytongate Junction, because the permanent removal of the signals at the Mytongate Junction at the start of the Construction Phase would increase vehicles travelling on this section of the A63. This is because, despite the temporary speed limit being in place, the removal of the signals would reduce congestion and increase vehicles.

Operation Phase

Local air quality

6.4.7 During the Operation Phase, the Scheme would alter parts of the existing road network through the junction improvements at Mytongate Junction and the widening of the eastbound carriageway between Princes Dock Street and Market Place. This would move emission sources closer to some receptors in the vicinity of the Scheme. In addition, the Scheme would change the characteristics of traffic flows on the existing road network by increasing the capacity on the network, reducing congestion.

6.4.8 In accordance with DMRB Volume 11 Section 3, Part 1 – Air Quality (HA207/07), the following criteria have been applied to the Scheme Do Minimum and Do Something scenario traffic flows in order to identify which roads are likely to be affected by the Scheme (referred to as 'affected roads') to the degree that they require consideration within the local air quality assessment.

6.4.9 The criteria are:

- road alignment would change by 5m or more; or
- daily traffic flows would change by 1,000 Annual Average Daily Traffic (AADT) flow or more; or
- Heavy Duty Vehicle (HDV) (HDVs are a sum of Heavy Goods Vehicles and buses) flows would change by 200 AADT or more; or
- daily average speed would change by 10km/hr or more; or
- peak hour speed would change by 20km/hr or more.

6.4.10 Following a review of traffic data for the Opening Year (2025) of the Scheme, the affected roads identified for the local air quality assessment included the A63 between the Humber Bridge and Southcoates Roundabout and a number of other roads in and around Hull city centre. These affected roads (the affected road network (ARN)) are presented in Volume 2, Figure 6.4 Operation Phase: Local air quality study area 2025. Modelled traffic data used for this assessment to determine affected roads has been provided in Volume 3, Appendix 6.1 SATURN traffic data and Volume 2, Figure 6.14 Summary of traffic data (sheets 1 to 12).

6.4.11 Increases of approximately 12,000 to 13,000 AADT are predicted on the A63 between Daltry Street and Market Place. These changes are due to increased capacity on the A63 as a result of the improvements associated with the Scheme, such as the changes to Mytongate Junction and the widening of the carriageway east of Mytongate Junction to three lanes.

6.4.12 The local road network is predicted to experience a maximum decrease of approximately 4,000 AADT along the A165 on Freetown Way. These changes are predicted due to the rerouting of traffic away from the local road network, onto the A63.

6.4.13 Speed changes are also predicted along the majority of the A63 due to reductions in the amount of traffic congestion. This is primarily due to:

- the removal of traffic signals at the Mytongate Junction
- the removal of a number of signalised pedestrian crossings
- the addition of the third lane east of Mytongate Junction
- restricting access to the A63 on some side roads

6.4.14 The assessment has considered properties and designated sites for ecology within 200m of affected roads, as presented in Volume 2, Figure 6.5 Operation Phase: Modelled receptor locations (human health) and 6.6 Modelled receptor locations (ecological) respectively.

6.4.15 Additional road links within 200m of affected roads have been included in the air quality dispersion model where their emissions contribute to total concentrations at identified receptors.

Regional air quality

6.4.16 The study area for the regional air quality assessment is defined by the traffic impacts of the Scheme in the Opening Year (2025) and Design Year (2040). Under DMRB Volume 11 Section 3, Part 1 – Air Quality (HA207/07) guidance, affected roads are defined where:

- daily traffic flows (AADT) would change by more than 10%; or

- HDVs would change by more than 10%; or
- daily average speed would change by more than 20km/hr.

6.4.17 The affected roads identified for the regional air quality assessment are shown in Volume 2, Figure 6.7 Operation Phase: Regional air quality study area 2025 & 2040.

6.5 Approach and methodology

Scope of the assessment

6.5.1 Potential air quality effects have been assessed in accordance with the DMRB Volume 11 Section 3, Part 1 – Air Quality (HA207/07) and the following IANs:

- IAN 170/12v3 – Updated air quality advice on the assessment of future NOx and NO_2 projections for users of DMRB Volume 11, Section 3, Part 1 'Air Quality'
- IAN 174/13 – Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 'Air Quality'
- IAN 175/13 – Updated air quality advice on risk assessment related to compliance with the EU Directive on ambient air quality and on the production of Scheme Air Quality Action Plans for user of DMRB Volume 11, Section 3, Part 1 'Air Quality'
- IAN 185/15 – Updated traffic, air quality and noise advice on the assessment of link speeds and generation of vehicle data into 'speed-bands' for users of DMRB Volume 11, Section 3, Part 1 'Air Quality and Volume 11, Section 3 Part 7 Noise'.

Construction methodology

Construction dust

6.5.2 Construction activities can result in temporary effects from dust. The word 'dust' usually refers to particulate matter in the size range 1-75 microns in diameter[78].

6.5.3 In accordance with DMRB Volume 11 Section 3, Part 1 – Air Quality (HA207/07), a qualitative assessment of potential dust effects has been undertaken following a review of likely dust raising activities and identification of sensitive receptors within 200m of these activities. Volume 2, Figure 6.2 Construction Phase: Construction

[78] Building Research Establishment -The Control of Dust from Construction and Demolition Activities 2003. Available online at: https://www.rbkc.gov.uk/pdf/Document%2012%20-%20BRE%20-%20Control%20of%20Dust%20from%20Construction%20&%20Demolition%20Activities.pdf

dust study area, shows the area considered in the assessment and the main areas where there are residential receptors.

6.5.4 Best practice mitigation measures have been proposed commensurate with the dust effects identified. These are presented in Section 6.7.

Construction plant and construction vehicle traffic

6.5.5 At this stage, the total number of construction vehicles using the local road network is not confirmed (both in terms of HDVs and Light Duty Vehicles (LDVs) associated with workers travelling to and from the site).

6.5.6 Based on professional judgement and experience of undertaking assessments on schemes of a similar nature, the additional traffic associated with construction vehicles are not expected to meet the criteria for assessment described in Section 6.4.9. Therefore, potential air quality effects from the Scheme's construction vehicle traffic are considered to be not significant and have not been assessed further.

6.5.7 Combustion related emissions (such as NO_2, SO_2 and fine particulates) from on site plant and vehicles would also occur during the Construction Phase and could affect local air quality. However, given the local and temporary nature of site plant and potential effects of emissions on local air quality, the assessment of construction plant emissions has not been considered further. Mitigation measures to reduce the effect of site plant on local air quality are nevertheless discussed in Section 6.7.1 of this chapter.

Construction traffic management measures

6.5.8 The Construction Phase of the Scheme would comprise of 8 phases which are expected to last a total of 56 months, commencing in March 2020 and finishing in November 2024.

6.5.9 Table 6.3 below summarises the key traffic management measures which would be implemented during different phases of the Scheme. Phase 1 is considered to represent the 'worst case' phase from an air quality perspective as it includes a large number of measures which would affect traffic distribution on the local network. It also commences in an earlier year than the other phases (so would coincide with higher background pollutant concentrations and higher vehicle emission factors). Predicted changes in traffic flow in the study area from Phase 1 have therefore been used to assess the construction traffic management measures.

Table 6.3: Construction Phase traffic measures

Phase	Duration	Phase start date	Location			
			Brighton Street Roundabout	Brighton Street Roundabout to Hessle Road	Hessle Road to Mytongate Junction	Mytongate Junction to Myton Bridge
0	15 months	March 2020	No traffic management			
1	**9 months**	**June 2021**	**Speed limit of 50mph**	**Speed limit of 30mph eastbound, coded speed westbound**	**Speed limit of 30mph** **Lane width reduction around Mytongate Junction** **Closure of Ferensway outbound at Mytongate Junction from Osbourne Street** **Removal of right turn at Mytongate Junction** **Pedestrian signal on Hessle Road near Porter Street**	**Speed limit of 30mph** **Closure of Vicar Lane, Fish Street, Dagger Lane and Humber Dock Street.** **Pedestrian signal on Castle Street near Dagger Lane and at Market Place Junction**
2	3 months	March 2022				
3	7 months	June 2022			Same as above except: Removal of pedestrian signal on Hessle Road near Porter Street	Same as above except: Removal of pedestrian signal on Castle Street near Dagger Lane and at Market Place Junction Contraflow – reduced land capacity between Mytongate and Market Street Junctions
4	3 months	January 2023				
5	12 months	April 2023				
6	4 months	March 2024				Same as above except: Split of lanes eastbound between Mytongate and
7	4 months	July 2024			Speed limit of 30mph New grade-separated	

Phase	Duration	Phase start date	Location			
			Brighton Street Roundabout	Brighton Street Roundabout to Hessle Road	Hessle Road to Mytongate Junction	Mytongate Junction to Myton Bridge
					junction at Mytongate Junction	Market Place Junctions

Note: measures highlighted in bold have been included in the Construction traffic assessment below

6.5.10 Traffic data for phase 1 of the traffic management measures was provided using the same model and approach as the Operation Phase traffic (see Section 6.5.13 onwards below).

6.5.11 Atmospheric dispersion modelling has been undertaken to assess the potential local air quality impacts from construction traffic management measures along the A63, A1105 Anlaby Road, Rawling Way, A165 Freetown Way, A1165 and Daltry Street. The same method for assessing the impact at human health receptors using dispersion modelling as was undertaken for the Operation Phase assessment has been used, details of which can be found in the 'Operation Methodology' sections. Volume 2, Figure 6.8 Construction Phase: Construction traffic receptors shows the locations of worst case receptors considered in this assessment.

6.5.12 It should be noted that PM_{10} has not been considered within the local air quality assessment for the Construction Phase. Background concentrations provided by Defra and monitored by the local authorities in the area show that background PM_{10} concentrations are significantly below the AQOs in the study area, as indicated in Section 6.6. Additionally, as modelled concentrations of PM_{10} in the Operation Phase assessment are well below the PM_{10} air quality objectives, it is therefore considered unlikely that Scheme effects during the Construction Phase would be sufficient to lead to exceedances of PM_{10} AQOs or limit values and as such construction traffic PM_{10} impacts have not been considered further.

Operation methodology

6.5.13 The operational assessment has considered Scheme impacts on local and regional air quality. The local air quality assessment focuses on concentrations of air pollutants which have immediate impacts at a local level. However, it is recognised that many of these pollutants can travel longer distances and have impacts on a regional, national or international scale. The regional air quality assessment therefore considers total pollutant emissions.

Local air quality

Traffic data – Operation Phase

6.5.14 Outputs from the SATURN traffic model developed for the Scheme have been used for this assessment. Data on vehicle flows, speed and percent of HDVs was

used for the following periods in the base, Do Minimum and Do Something scenarios:

- AM peak period (07:00 to 10:00)
- Inter-peak (IP) period (10:00 to 16:00)
- PM peak period (16:00 to 19:00)
- Off-peak period (19:00 to 07:00)

6.5.15 The diurnal traffic flow characteristics and therefore emissions, are represented in the dispersion model using time varying emission factors. The same profile used for weekdays has been applied to the weekend in order to assess a worst case as weekend traffic flows are lower than on a weekday.

6.5.16 Speed data have also been derived from the SATURN traffic model and has been Speed Banded following application of derived speed pivots in accordance with IAN 185/15. Volume 3, Appendix 6.1 provides a summary of traffic data used in the assessment.

6.5.17 Committed developments with potential to generate traffic have been incorporated into the traffic model developed for this Scheme. Further discussion of included committed developments is presented within the Transport Assessment Report document reference TR010016/APP/7.4.

Scenarios – Operation Phase

6.5.18 Outputs from the traffic model are available for the following assessment years:

- 2015 - Base Year
- 2025 - Opening Year (Do Minimum without the Scheme)
- 2025 - Opening Year (Do Something with the Scheme)
- 2040 - Design Year (Do Minimum without the Scheme)
- 2040 - Design Year (Do Something with the Scheme)

6.5.19 The local air quality assessment has compared predicted concentrations against the AQO and assessed compliance with the EU Directive on ambient air quality for the Opening Year of the Scheme only. The Opening Year of the Scheme is expected to be worst case in terms of local air quality impacts, as forecast annual traffic growth along the affected sections of the A63 (where greatest traffic and air quality effects arise) is lower than the anticipated annual rate of improvement in air quality. Air quality is predicted to improve in future years in response to the uptake

of vehicles which meet more stringent emissions standards[79]. This is described further in the context of the assumptions used in the assessment in Sections 6.5.35 to 6.5.40 and is consistent with the approach outlined within DMRB Volume 11 Section 3, Part 1 – Air Quality (HA207/07).

6.5.20 The regional air quality assessment has assessed changes in total pollutant emissions for the Opening Year and the Design Year of the Scheme in accordance with the requirements of DMRB Volume 11 Section 3, Part 1 – Air Quality (HA207/07).

Air quality model

6.5.21 A detailed assessment has been undertaken and therefore modelling for the local air quality assessment has been carried out using the ADMS-Roads (v4.1) dispersion model[80] developed by Cambridge Environmental Research Consultants.

6.5.22 The dispersion model was built by digitising traffic model links to the OS Master Map Integrated Transport Network and assigning road widths based on OS mapping. The highway design associated with the Do Something scenario was digitised based on a geo referenced CAD drawing of the Scheme. Road widths and alignments were adjusted to represent the Scheme.

Emission factors

6.5.23 Road traffic emission factors for NO_x and PM_{10} have been derived from an update to the speed band emission factors published in IAN 185/15. The speed band emission factors have been updated by Highways England following the release of EFT v8.0[81] in December 2017. Emissions were defined according to the speed band category of the traffic link or road.

6.5.24 Although IAN 185/15 provides predictions of future emissions, there remains some uncertainty over these forecasts, particularly regarding emissions from Euro 6/VI vehicles[82]. This uncertainty has been addressed through applying Long Term Trend gap analysis factors to uplift Opening Year concentrations, as described in Section 6.5.35.

[79] Defra (2015), Air Quality in the UK: plan to reduce nitrogen dioxide emissions

[80] ADMS-Roads (v4.1) dispersion model[80] developed by Cambridge Environmental Research Consultants. Available online at: http://www.cerc.co.uk/environmental-software/assets/data/doc_userguides/CERC_ADMS-RoadsExtra4.1.1_User_Guide.pdf

[81] Defra (2017). Emissions Factors Toolkit (version 8.0.1). Available online at: https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html

[82] Highways Agency (2012) Interim Advice Note 170/12 v3: Updated air quality advice on the assessment of future NO_x and NO_2 projections for users of DMRB Volume 11, Section 3 Part 1 'Air Quality' (HA207/07). Available online at: http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian170.pdf

6.5.25 A time varying emission file has been used to represent vehicle emissions for each of the traffic periods discussed in Section 6.5.14. The same emissions profile was used for weekdays and weekends to assess the worst case.

NO_x to NO_2 calculator

6.5.26 Emission rates used within dispersion modelling are based on NO_x to represent all nitrogen-oxygen species emitted in exhaust gases. The proportion of NO_2 is needed for comparison with the AQOs and EU limit values.

6.5.27 In accordance with Defra guidance (TG16), modelled road-traffic NO_x has been converted to annual mean NO_2 using the Defra 'NO_x to NO_2' calculator (Version 6.1)[83] assuming a traffic mix of 'all other urban UK traffic'.

Assessment of short term NO_2 concentrations

6.5.28 Defra's Technical Air Quality guidance (TG16) advises that exceedances of the 1 hour mean objective for NO_2 are only likely to occur where annual mean concentrations are 60µg/m^3 or above. Therefore, exceedances of 60µg/m^3 as an annual mean are used as an indicator of potential exceedances of the 1 hour mean NO_2 objective.

Background pollutants

6.5.29 Total air pollutant concentrations comprise a background and local component, both of which have to be independently considered for the air quality assessment. The background component is determined by regional, national and international emissions and often represents a significant proportion of the total pollutant concentration. The local component is affected by emissions from sources such as roads and chimney stacks, which are less well mixed locally and add to the background concentration.

6.5.30 Only road traffic emission sources have been explicitly included within the dispersion model. Non-road traffic related emission sources, such as industrial and domestic emissions, have been accounted for within the assessment by assigning appropriate 'background' concentrations to modelled receptor locations. Further details on 'background' concentrations used within the assessment are provided in Section 6.6.10.

Meteorology

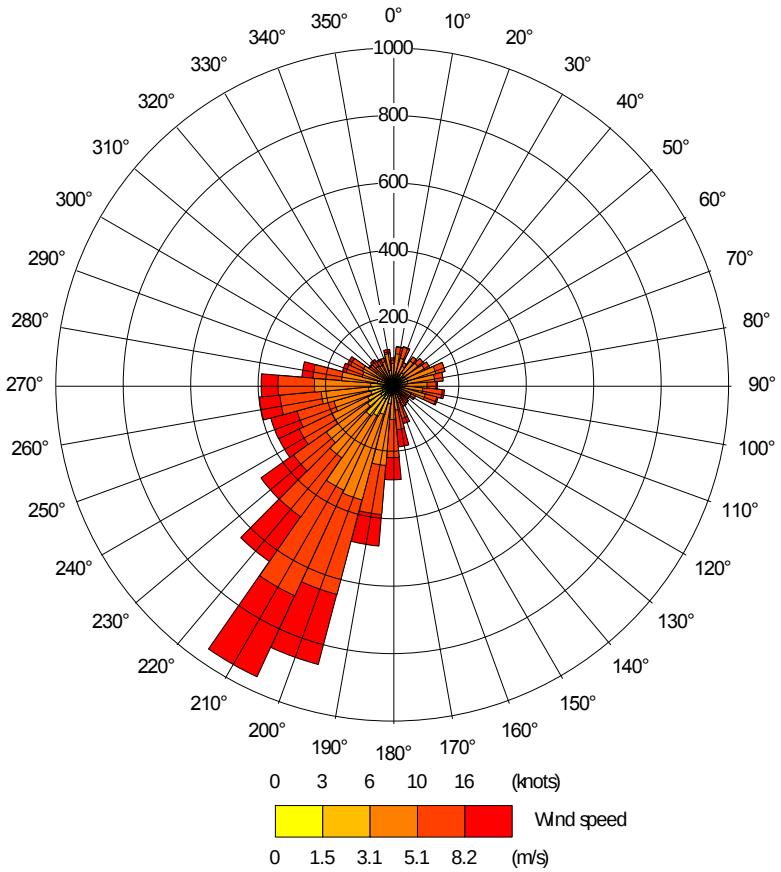
6.5.31 The most important meteorological parameters governing the atmospheric dispersion of emissions are wind direction, wind speed and atmospheric stability.

[83] Defra (2016) NO_x to NO_2 Calculator, Version 4.1. Available online at: http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc

6.5.32 For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological parameters need to be measured on an hourly basis. There are only a limited number of sites where the required meteorological measurements are made.

6.5.33 Hourly sequential meteorological data for 2015 from Humberside Airport, which is located approximately 16km south of the study area was used within the assessment and is considered representative of the modelled area due to its close proximity to the Scheme. The wind rose for the meteorological station is presented in Figure 6.9 Windrose for Humberside Airport 2015 below and highlights that the predominant wind direction is from the south-south-west. There are very low occurrences of wind from other directions and these tend to be associated with low wind speeds.

Figure 6.9: Windrose for Humberside Airport 2015



Model verification

6.5.34 Modelled pollutant concentrations have been verified against HCC monitoring data and Scheme specific monitoring data undertaken by Highways England. Model verification has been undertaken in accordance with the principles outlined in Defra guidance (TG16). A detailed description of the model verification process undertaken for the assessment is provided in Volume 3, Appendix 6.3 Model

verification. The locations of verification monitoring sites are indicated in Volume 2, Figure 6.13 Air quality verification sites.

Long term NO_2 trends – Operation Phase

6.5.35 The Defra background pollution maps and vehicle emission factors assume that air quality improves in future years, as older vehicles are replaced with modern cleaner vehicles (amongst others)[84]. However, generally, UK monitored roadside and background NO_2 concentrations have not declined as would be expected in recent years. This trend is thought to be related to the increased use of modern diesel vehicles, which emit more NO_x than expected under urban driving conditions and have higher primary NO_2 emissions than petrol vehicles[85].

6.5.36 IAN 170/12 (v3) provides advice on taking account of the effect of future alternative NO_2 projections. The IAN is in response to Defra's advice on long-term trends that there is a gap between current projected vehicle emission improvements and projections on the annual rate of improvements in ambient air quality as previously published in Defra's technical guidance.

6.5.37 The assessment of local air quality NO_2 effects has been undertaken in accordance with IAN 170/12. The IAN describes three potential approaches for future projections of NOx and NO_2 and requires professional judgement to be used to determine the most appropriate approach. The three approaches described are:

- Defra's technical guidance (TG16)
- Interim alternative long term trend projections[86] (LTT_{E6})
- Long term trend projections[87] (LTT)

6.5.38 Determining the most appropriate approach requires consideration of the following aspects:

- Trends in ambient background and roadside NO_2 concentrations in the study area in recent years.
- How far in to the future the Opening Year of the proposed scheme is. This relates to the proportion of vehicles on the road network in the Opening Year

[84] Defra Air Quality in the UK: plan to reduce nitrogen dioxide emissions 2015. Available online at: https://www.gov.uk/government/publications/air-quality-in-the-uk-plan-to-reduce-nitrogen-dioxide-emissions

[85] Defra Trends in NOx and NO_2 emissions and ambient measurements in the UK 2016. Available online at: https://uk-air.defra.gov.uk/assets/documents/reports/cat05/1108251149_110718_AQ0724_Final_report.pdf

[86] Highways Agency Interim Advice Note 170/12 v3 2012: Updated air quality advice on the assessment of future NO_x and NO_2 projections for users of DMRB Volume 11, Section 3 Part 1 'Air Quality' (HA207/07)

[87] Highways Agency Interim Advice Note 170/12 v3 2012: Updated air quality advice on the assessment of future NO_x and NO_2 projections for users of DMRB Volume 11, Section 3 Part 1 'Air Quality' (HA207/07)

which would be subject to more stringent Euro emission standards and the degree to which national reductions in emissions of NOx (particularly from road transport) can be expected to reduce ambient NO_2 concentrations. The LTT_{E6} assumes there is a greater reduction in emissions compared to the LTT due to the expected benefit of Euro 6/VI vehicles entering the fleet.

6.5.39 The baseline air quality presented in Section 6.6 of this chapter demonstrates that there is an overall slight decreasing trend in annual mean NO_2 concentrations in the study area between 2013 and 2017. In addition, considering the Opening Year is expected to be 2025, there would be an increased uptake of new Euro 6/VI compliant vehicles, which came into force in 2014. Therefore, Highways England's LTT_{E6} has been used within the assessment.

6.5.40 It is important to note that the LTT_{E6} gap analysis factors have been developed based on a precautionary approach, derived by assuming the mid-point between LTT and the forecast that would be produced if Euro 6/VI vehicles met the emissions performance assumed in the Emission Factor Toolkit. Uncertainty in Euro 6/VI emissions performance is therefore built into LLT_{E6}.

Human health receptors

6.5.41 Pollutant concentrations have been predicted at sensitive receptors, defined according to Defra in TG16 as:

> *"Locations where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the relevant air quality objective."*

6.5.42 Table 6.2 shows the locations where the air quality objectives apply. A total of 98 residential receptors were selected for the assessment at worst case locations within 200m of the affected road network as shown in Volume 3, Appendix 6.2 Local air quality receptor results and indicated in Volume 2, Figure 6.5 Modelled receptor locations (human health). Worst case locations were selected where total pollutant concentrations were expected to be greatest (typically closest receptors to roads), or where the greatest change in air quality was anticipated based on the traffic impacts. All receptors considered to be at risk of exceeding NO_2 objectives were included in the model, based on the baseline NO_2 concentrations monitored and the criteria above. Human health receptors were modelled at the height of residential properties ranging from ground floor (1.5m) to second floor height (7.5m) as shown in Volume 3, Appendix 6.2 Local air quality receptor results.

6.5.43 Receptors for the Fruit Market Development, which would be open prior to the Scheme, have also been included within this assessment. These are receptors 14 and 15 presented in Volume 2, Figure 6.5 Operation Phase: Modelled receptor locations (human health).

Assessment of ecological designated sites

6.5.44 Elevated NO_x concentrations can adversely affect ecosystems. DMRB Volume 11 Section 3, Part 1 – Air Quality (HA207/07) recommends that the following designated nature conservation sites are considered: Special Areas of Conservation (SACs), Special Protected Areas (SPAs), Special Sites of Special Scientific Interest (SSSI) and Ramsar sites. The assessment of changes in NO_x in designated sites has included the following key stages (following DMRB Volume 11 Section 3, Part 1 – Air Quality (HA207/07) methodology):

- Identification of designated sites within 200m of roads 'affected' by the Scheme, which have designated features sensitive to air pollutants.
- Calculation of annual mean NO_x concentrations at the designated sites with and without the Scheme.

6.5.45 IAN 174/13 requires that where NO_x concentrations exceed the annual objective and Scheme associated changes in NO_x are greater than 0.4µg/m^3, then nutrient nitrogen deposition should also be calculated and used to determine the overall significance of the Scheme impact.

6.5.46 When assessing the impact of a specific road on local nitrogen deposition, only the road contribution to dry deposition requires consideration as wet deposition occurs over much greater distances. The assessment of nitrogen deposition includes the following key stages (following DMRB Volume 11 Section 3, Part 1 – Air Quality (HA207/07) methodology):

- Obtaining total average nitrogen deposition from the Air Pollution Information System (APIS)[88] for the 5km by 5km grid square(s) corresponding with the designated site receptor
- Averaging Defra background NO_2 concentrations across the corresponding APIS 5km^2 grid square(s)
- Calculation of annual mean NO_2 concentrations at the designated site receptor with and without the Scheme
- Estimating dry deposition of NO_2 at the designated site receptor with and without the Scheme (1 µg m^{-3} of NO_2 = 0.1 kg N ha^{-1} yr^{-1})
- Determining the road contribution to NO_2 dry deposition by subtracting the 5km^2 average Defra background from the receptor dry deposition result

[88] Air Pollution Information System (APIS). Available online at www.apis.ac.uk

- Adding the road contribution to nitrogen deposition to the APIS average total nitrogen deposition and comparing with the relevant critical load[89]

6.5.47 The Humber Estuary (SSSI, SAC, SPA, Ramsar) is located within 200m of the affected road network (specifically the section of A63 between St Andrews Quay and Humber Bridge). The designated site has been considered using three transects each with a series of receptors (spaced at 10m intervals) extending into the site from the closest point between the designated site and the A63. The location of the receptors considered is presented in Volume 3, Appendix 6.2 Local air quality receptor results and Volume 2, Figure 6.6 Operation Phase: Modelled receptor locations (ecological). The ecological receptors were modelled at a height of 0m.

Compliance with the EU Directive on ambient air quality

6.5.48 IAN 175/13 provides guidance in relation to the assessment of the risk of the Scheme being non-compliant with EU Directive on ambient air quality. The compliance risk assessment is undertaken using the modelling results obtained from the local air quality assessment. To undertake the compliance risk assessment the following information is required:

- Local air quality modelled results
- Defra's Pollution Climate Mapping (PCM) model outputs for the compliance road network
- Defra's zones and agglomeration maps

6.5.49 Defra uses the PCM model to report compliance with EU Directive on ambient air quality. PCM projections are available for all years from 2017 to 2030 from the base year of 2015. In general, NO_2 concentrations decline into the future, mainly in response to cleaner vehicles and technologies and actions in Defra's AQAP.

6.5.50 The most recent PCM model was released in August 2017 following the release of Defra's AQAP and has a reference year of 2015. The 2017 PCM model provides projections for three different scenarios:

- Baseline – projected concentrations assuming no further action beyond the air quality measures that were committed by 2015 (worst case scenario)
- Clean Air Zone (CAZ) scenario – actions that are known to be possible (primarily CAZs and updated Government Buying Standards)
- CAZ plus additional actions scenario – includes additional actions which may be possible but are highly uncertain

[89] Critical loads for the deposition of nitrogen, which represent the exposure below which there should be no significant harmful effects on sensitive elements of the ecosystem (according to current knowledge).

6.5.51 For this assessment, the Baseline PCM model has been used as this represents a worst case scenario.

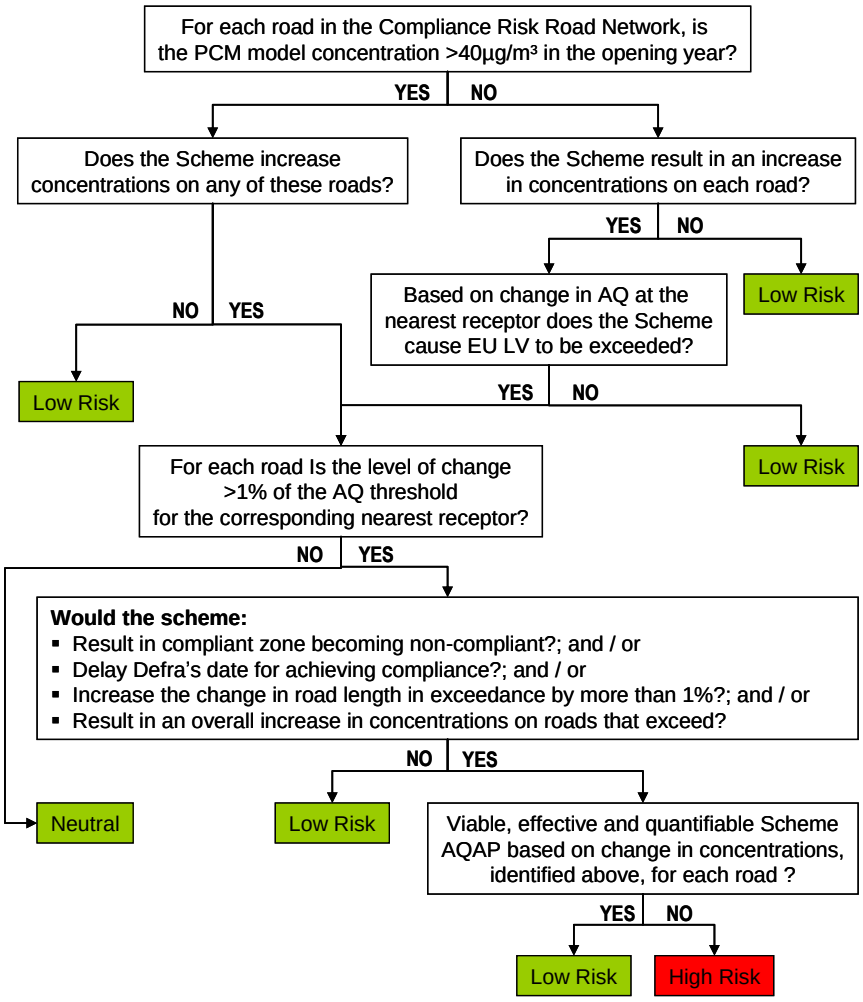
6.5.52 To determine the study area for the compliance risk assessment, the local air quality study area is compared to the compliance risk road network in the PCM. A Compliance Risk Road Network (CRRN) is then defined where the two networks intersect, which then forms the basis for the assessment of compliance risk.

6.5.53 The effect of the Scheme (i.e. the change in concentrations at receptors) are added to the modelled concentrations in the Defra PCM for the Opening Year where:

- the equivalent Opening Year PCM or the equivalent Scheme PCM modelled total NO_2 concentration is greater than 40µg/m^3
- the change in NO_2 concentrations at receptors is 0.4µg/m^3 or more

6.5.54 The compliance risk of the Scheme has been determined in line with the flow chart shown in Figure 6.10 Compliance risk assessment flow chart. The outcome of the compliance risk assessment has also been used to inform the overall judgement on significance of effects (see Section 6.5.60).

Figure 6.10: Compliance risk assessment flow chart



Assessment methodology - Regional air pollution

6.5.55 Following DMRB Volume 11 Section 3, Part 1 – Air Quality (HA207/07), regional emissions of NO_x, PM_{10} and carbon dioxide (CO_2) have been predicted for the Base Year, Opening Year and Design Year scenarios, based on the affected network defined in Section 6.4.10. Emissions have been calculated from an update to the speed band emissions factors published in IAN 185/15, using traffic data (AADT flows for LDVs and HDVs and speed band category) and road lengths for each affected road in the study area.

6.5.56 Vehicle emission factors are not available beyond 2030 and consequently, emission factors for 2030 have been used for the Design Year, which represents a worst case.

Assessment of value / sensitivity

6.5.57 All human health and ecological receptors are treated as being of high sensitivity and value.

Assessment of magnitude

6.5.58 IAN 174/13 provides advice for evaluating significant local air quality effects for public exposure and designated sites. Evaluation of the significance of local air quality effects has been undertaken in accordance with IAN 174/13, a summary of which is provided here.

6.5.59 Sensitive receptors that have a reasonable risk of exceeding an air quality threshold have been assessed in both the Do Minimum and Do Something scenario. The difference in pollutant concentration between the two scenarios is used to describe the 'magnitude' of change in accordance with Table 6.4. The larger the magnitude of change, the more certainty there is that there will be an effect as a result of the Scheme. Where the effect of a Scheme on concentrations is less than 1% of the air quality threshold, then the change at these receptors is considered to be imperceptible and these receptors are scoped out of the judgement on significance.

Table 6.4: Magnitude of change criteria

Magnitude of change in concentration	Value of change in annual average NO_2 and PM_{10}
Large (>4)	Greater than full MoU value of 10% of the AQO (4µg/m^3)
Medium (>2)	Greater than half of the MoU (2 µg/m^3), but less than the full MoU (4 µg/m^3) of 10% of the AQO
Small (>0.4)	More than 1% of objective (0.4 µg/m^3) and less than half of the MoU i.e. 5% (2 µg/m^3). The full MoU is 10% of the AQO (4 µg/m^3)
Imperceptible (</= 0.4)	Less than or equal to 1% of objective (0.4 µg/m^3)

Notes: MoU = Measure of Uncertainty (10% of the objective)

Assessment of significance

6.5.60 Only receptors which exceed the AQO in either the Do Minimum or Do Something scenarios are used to inform significance. The total number of receptors in each magnitude band are then aggregated and compared to the guideline number of receptors constituting a significant effect as shown in Table 6.5.

6.5.61 The guideline bands have been developed for each magnitude category and set the upper level of likely non-significance and the lower level of likely significance. Between these two levels are the ranges where likely significance is more uncertain and therefore professional judgment would be required.

Table 6.5: Guideline to number of properties constituting a significant effect

Magnitude of change in concentration	Number of receptors with:	
	Worsening of air quality objective already above objective or creation of a new exceedance	Improvement of an air quality objective already above objective or the removal of an existing exceedance
Large (>4)	1 to 10	1 to 10
Medium (>2 to 4)	10 to 30	10 to 30

Magnitude of change in concentration	Number of receptors with:	
	Worsening of air quality objective already above objective or creation of a new exceedance	Improvement of an air quality objective already above objective or the removal of an existing exceedance
Small (>0.4 to 2)	30 to 60	30 to 60

6.5.62 If a Scheme effect is above the lower level of likely significance, consideration should be given to all the evidence that may support or detract from the conclusion of a significant effect. Where no exceedances of AQOs are predicted at receptors, IAN 174/13 states that the air quality effects are unlikely to be considered significant.

6.5.63 For air quality effects on ecological designated sites, changes in NO_x concentrations and nutrient nitrogen deposition (where required) are provided to the Scheme ecologist to determine significance of effects based on professional judgement.

6.5.64 The air quality effects predicted at receptors have been compared to the criteria described in Table 6.4 and Table 6.5, along with the following key criteria to determine the overall local air quality significance:

- Is there a risk that environmental standards will be breached?
- Will there be a large change in environmental conditions?
- Will the effect continue for a long time?
- Will many people be affected?
- Is there a risk that protected sites, areas, or features will be affected?
- Will it be difficult to avoid, or reduce, or repair, or compensate for the effect?

Consultation

6.5.65 Discussions were undertaken with the Environmental Health Officer at HCC via email. During this consultation, the methodology for the air quality assessment was discussed, including the location of sensitive receptors and the EHO confirmed they were satisfied with the extent of assessment (with regards to the ARN and locations of sensitive receptors).

Limitations and assumptions

6.5.66 The air quality modelling predictions are based on the most reasonable, robust and representative methodologies, however, there is an inherent level of uncertainty associated with the model predictions, including:

- uncertainties with model input parameters such as surface roughness length (defined by land use) and minimum Monin-Obukhov length (used to calculate stability in the atmosphere).
- uncertainties with traffic forecasts
- uncertainties with vehicle emission predictions
- uncertainties with background air quality data
- uncertainties with recorded meteorological data
- simplifications made in the model algorithms or post processing of the data that represent atmospheric dispersion or chemical reactions

6.5.67 In order to best manage these uncertainties, the air quality model has been evaluated using air quality measurements to verify model outputs. This model verification process has been undertaken in line with Defra guidance[90] in order to manage the uncertainties referred to above. It does this by comparing modelled and monitored pollutant concentrations and if necessary adjusting the model output to account for systematic bias. In addition, IAN 170/12 addresses uncertainty in future NO_x and NO_2 projections.

6.5.68 Following the verification process for this Scheme an overall Root Mean Square Error value of less than 10% of the mean annual AQO is achieved, which is considered robust according to Defra guidance (TG16). On this basis the modelled results are considered appropriate to allow a robust professional judgement of significance to be determined. The model verification for this Scheme is presented in Volume 3, Appendix 6.3 Model verification.

6.6 Existing environment

Overview

6.6.1 Information on air quality in the UK is available from a variety of sources including local authorities, national network monitoring sites and other published sources. The primary sources examined in this assessment are from HCC, Defra and from the 12 month Scheme specific monitoring survey.

Local authority review and assessment

6.6.2 The study area for the Scheme is predominantly located in the administrative boundary of HCC, although the far western extent of the study area (west of Priory Way) is located in the boundary of the ERoYC.

[90] Defra (2016) Part IV of the Environment Act 1995, Environment (Northern Ireland) Order 2002 Part III: Local Air Quality Management – Technical Guidance LAQM.TG (16). Available online at: http://laqm.defra.gov.uk/documents/LAQM-TG16-April-16-v1.pdf

6.6.3 HCC and ERoYC undertake regular review and assessments of local air quality as part of the Local Air Quality Management (LAQM) process. HCC have declared an AQMA in an area of the city centre, which the Scheme passes through, for exceedances of the annual mean NO_2 objective. This AQMA is shown in Volume 2, Figure 6.1 Air quality constraints. No AQMAs have been declared by ERoYC.

HCC air quality monitoring

6.6.4 HCC operates one automatic monitoring station within the study area and there are two Automatic Urban Rural Network (AURN) stations operated by Defra. However, only the Hull Freetown AURN is located within the study area, as indicated in Volume 2, Figure 6.11 Air quality monitoring locations. Table 6.6 presents NO_2 and PM_{10}, annual mean monitoring results for 2015 to 2017. Annual mean concentrations are well below the annual mean PM_{10} and NO_2 objective (40 $\mu g/m^3$) at the three sites across these years, where data is available.

Table 6.6: Hull annual mean automatic monitoring data for 2015-2017

Site ID	Site classification	National Grid Reference		Annual Mean Concentration $\mu g/m^3$					
				NO_2			PM_{10}		
		X	Y	2015	2016	2017	2015	2016	2017
Hull Freetown (AURN)	Urban Background	509482	429322	24	23	24	-(a)	-(a)	-(a)
Holderness Road (AURN)(b)	Roadside	511794	430511	31	30	29	16	17	20
Myton Centre (HCC)	Urban Traffic	509068	428270	23(b)	25	24	16(b)	17	18

Source: Hull City Council

Notes: (a) no data available

(b) Data capture <75%

Data capture was in excess of 95% for all sites and all years unless otherwise specified.

6.6.5 Table 6.7 shows that no exceedances of the 1-hour NO_2 or daily PM_{10} objective were monitored at the stations between 2015 and 2017.

Table 6.7: Hull 1-hour and 24-hour automatic monitoring data for 2015-2017

Site ID	Site classification	Number of hours NO_2 > 200 µg/m³			Number of days PM_{10} > 50 µg/m³		
		2015	2016	2017	2015	2016	2017
Hull Freetown (AURN)	Urban background	0	0	0	-(a)	-(a)	-(a)
Holderness Road (AURN)	Roadside	0	1	0	6	3	3
Myton Centre (HCC)	Urban traffic	0	0	0	0	3	2
Number of allowances within the AQO		18			35		

Source: Hull City Council and Defra UK-AIR
Notes: (a) no data available
Data capture was in excess of 95% for all sites and all years unless otherwise specified.

6.6.6 HCC also undertakes diffusion tube monitoring at 45 sites. Table 6.8 presents diffusion tube monitoring results at locations within the study area from 2013 to 2017 and the diffusion tube locations are shown in Volume 2, Figure 6.11 Air quality monitoring locations. Exceedances of the annual mean NO_2 objective have been monitored at the sites at Princes Dock Street and Castle Street, which are located within the AQMA and their locations is in line with the building facades. However, in 2017, concentrations at several of these locations reduced to below the annual mean NO_2 objective; only two sites recorded exceedances of this objective in 2017. The data shows there is a downward trend in annual NO_2 concentrations between 2013 and 2017 with the exception of the monitoring site at the Castle Street Hotel and North Road.

Table 6.8: HCC NO_2 diffusion tube data for 2014-2016

Site ID	Location	Site classification	Distance to relevant exposure (m)	National Grid reference		Annual mean NO_2 concentration µg/m^3				
				X	Y	2013	2014	2015	2016	2017
S1	Blanket Row Car Park	Roadside	3	509900	428419	32	31	31	29	28
S2	Humber Dock Street	Roadside	0	509753	428425	31	24	32	27	25
S3	Castle Street Hotel	Roadside	3	509502	428434	**49**	**44**	**46**	**46**	**47**
S4	Spruce Road	Roadside	3	509140	428244	**41**	38	38	35	33
S5	Tadman Street	Roadside	2	508536	427978	36	32	34	31	30
S6	Hessle Road	Roadside	3	508140	427802	37	33	30	31	29
S7	Ice House Road	Urban Background	4	508905	428502	25	21	22	21	20
S8	Myton (Trailer) a	Roadside	4	509068	428271	31	28	31	26	25
S9	Myton (Trailer) b	Roadside	4	509068	428271	30	29	30	24	24
S10	Myton (Trailer) c	Roadside	4	509068	428271	29	29	31	29	25
S11	Daltry St	Roadside	5	508565	428037	38	35	34	28	31
S12	Earl De Grey	Roadside	0	509513	428462	**43**	**41**	**41**	36	34
S13	Princes Dock Side	Roadside	0	509727	428473	**44**	**43**	**46**[(b)]	37	34
S14	Castle st (Road)	Kerbside	3	509922	428447	**54**	**47**	**46**	**48**	**47**
S15	Castle st (Wall)	Roadside	5	509913	428455	**42**	37	**40**	35	36
S16	Lowgate	Kerbside	3	510039	428687	**40**	37	38	35	36
S17	Francis Street (AQMS) a	Urban Background	3	509482	429322	27	25	25	22	25
S18	Francis Street (AQMS) b	Urban Background	3	509482	429322	27	25	26	23	25
S19	Francis Street (AQMS) c	Urban Background	3	509482	429322	26	26	26	22	25

Site ID	Location	Site classification	Distance to relevant exposure (m)	National Grid reference		Annual mean NO_2 concentration µg/m^3				
				X	Y	2013	2014	2015	2016	2017
S20	Spring Bank	Roadside	2	508817	429373	37	36	34	33	31
S29	Anlaby Road	Roadside	3	507345	428738	**40**	35	37	35	35
S30	Plimsoll Way	Roadside	5	510721	428732	29	25	27	26	24
S31	Hedon Road	Kerbside	5	512289	429284	27	26	25	25	26
S32	Southcoates Lane	Roadside	2	511676	430370	31	30	28	25	26
S49	North Road	Roadside	3	506395	427679	-	20	22	21	20

Source: Hull City Council

Notes: [a] No data available

[b] Data capture less than 75%

All results bias adjusted.

Exceedances of Annual Mean NO_2 Objective (40 µg/m^3) highlighted in bold

ERoYC air quality monitoring

6.6.7 There are no automatic stations operated by ERoYC. Instead, ERoYC monitors NO_2 through an extensive network of diffusion tube sites. None of the monitoring sites are located in the vicinity of the Scheme study area.

Scheme air quality monitoring

6.6.8 A twelve-month (January 2015 to December 2015) NO_2 diffusion tube monitoring survey was undertaken as part of the assessment to supplement the existing monitoring data described above. Monitoring has been undertaken at 42 locations within Hull, as indicated in Volume 2, Figure 6.11 Air quality monitoring locations. Monitoring results were bias adjusted as described in Volume 3, Appendix 6.4 Monitoring survey and the final results are summarised in Table 6.9.

Table 6.9: Scheme NO_2 diffusion tube data (2015)

Site ID	Location	Site classification	National Grid reference		2015 Annual mean NO_2 concentration µg/m^3
			X	Y	
P2	Corner of William Street and Cogan Street	Roadside	509216	428337	32.4
P3	Salvation Army William Booth House	Roadside	509244	428351	33.1
P5	Castle Street	Roadside	509803	428459	**56.4**
P6	Castle Street	Roadside	509841	428457	**42.9**
P7	Castle Street	Roadside	509894	428456	38.4
P9	South Bridge Road	Roadside	511448	428993	25.0
P10	Freetown Way	Roadside	509982	429198	31.7
P11	Freetown Way	Roadside	509370	429287	32.9
P14	Campbell Street, adjacent to A63 Clive Sullivan Way flyover	Roadside	508525	428019	29.8
P15	On lamp post in line with building façade adjacent to Clive Sullivan Way flyover	Roadside	508562	428036	32.5
P16	On Lamp post at back of properties on Redfern Close	Roadside	508672	428073	**40.0**
P17	Located on Lamp Post 5 in grass court area behind Neville Close	Urban Background	508822	428137	27.7
P18	On lamp post on footpath adjacent to A63 at the back of Quantock Close properties	Roadside	508738	428094	**46.2**

Site ID	Location	Site classification	National Grid reference		2015 Annual mean NO_2 concentration µg/m^3
			X	Y	
P19	Bottom of Porter Street, adjacent to A63. Close to pedestrian crossing.	Urban Background	508911	428177	26.1
P20	On lamp post along fence line to east of St James Street	Roadside	508917	428130	**40.2**
P21	On lamp post along fence line to west of Alfred Street	Roadside	508717	428056	**45.3**
P22	On lamp post between Alfred Street and Commerce Lane	Roadside	508793	428086	**52.4**
P23	Lamp post on western side of Porter Street (south of Brisbain Street junction)	Urban Background	508947	428231	22.1
P24	Campbell Street, adjacent to A63 Clive Sullivan Way flyover north of site 2	Roadside	508519	428031	34.3
P25	Lamp post outside 13 Redfern Close (Lamp Post 3)	Urban Background	508657	428114	25.9
P26	Lamp Post 2 outside 7 Quantock Close	Urban Background	508755	428137	25.4
P27	Lamp Post 3 on corner of 11 Neville Close	Urban Background	508825	428156	25.9
P28	North of Boothferry Road (South of Sports Ground)	Roadside	505099	427803	24.8
P29	North of Anlaby Road CCTV Mast, near Parkfield Drive	Roadside	506850	428701	22.3
P30	North of Hessle Road (off Wilshire Road)	Roadside	506606	427492	32.5
P31	East of Rawlings Way	Roadside	508312	428364	27.5
P32	South of Hassle Road and end of Madley Road	Roadside	508404	427927	34.0
P33	Corner of Linnaeus Street and Analby Road	Roadside	508411	428655	35.9
P34	East of Mount Pleasant	Roadside	511268	429338	**40.1**
P35	West of Mount Pleasant	Roadside	511262	429301	**40.9**
P36	North of Holderness	Roadside	511792	430510	31.5
P37	North of Spring Bank	Roadside	508983	429334	34.4
P38	Corner of Anlaby Road and Arcon Drive	Roadside	505818	428796	24.4

Site ID	Location	Site classification	National Grid reference		2015 Annual mean NO_2 concentration $\mu g/m^3$
			X	Y	
P39	East of Great Union Street near Church Street	Roadside	510546	428973	30.4
P40	West of Plimsoll Way	Roadside	510726	428733	27.6
P41	East of Plimsoll Way	Roadside	510753	428714	26.2
P42	A63 between Dagger Lane and Princes Dock Street	Roadside	509758	428462	**48.9**
P43	A63 adjacent to Market Place	Roadside	509990	428466	32.0
P44	Off A63 on Fish Street	Roadside	509837	428476	32.2
P45	Off A63 on Princes Dock Street	Roadside	509714	428483	32.6
P46	Off A63 on Vicar Lane	Roadside	509927	428454	39.0

Note: Exceedances of annual mean NO_2 Objective (40 $\mu g/m^3$) highlighted in bold

6.6.9 The Scheme monitoring data shows that concentrations exceed the annual mean NO_2 objective at ten roadside locations. Exceedances were monitored at sites P5, P6 and P42 along Castle Street (in Hull AQMA), sites P16, P18, P20, P21 and P22 on Clive Sullivan Way (in Hull AQMA) and P34 and P35 in close proximity to Mount Pleasant Road. Tubes P34 and P35 are outside of Hull AQMA, but are not representative of human exposure where the annual mean objectives apply as per Table 6.2 i.e. not near residential properties.

Defra background concentrations

6.6.10 Defra provides estimates of background pollution concentrations for NO_2 and PM_{10} across the UK for each 1km grid square, for every year from 2015 to 2030. Background pollutant concentrations are spatially and temporally variable throughout the UK and have been obtained from the Defra website[91].

6.6.11 Table 6.10 presents the maximum background annual mean NO_2 and PM_{10} concentrations predicted at any grid square across the model study area for the Base Year and Opening Year scenario. The maximum background NO_2 and PM_{10} concentrations are well below annual mean AQOs in the Base Year and Opening Year scenario.

[91] Background pollutant concentration data. Available online at: https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015

Table 6.10: Defra maximum background annual mean concentrations of PM_{10} and NO_2 (µg/m^3) for Study Area

Grid square location (OS grid reference)		2015		2025	
X	Y	PM_{10}	NO_2	PM_{10}	NO_2
510500	429500	16.2	27.0	15.4	20.3

6.6.12 A comparison between Defra background NO_2 and monitored NO_2 has been undertaken at the Defra Automatic Urban Rural Network (AURN) urban background monitoring station at Freetown, which is located within the model study area and is shown in Volume 2, Figure 6.11 Air quality monitoring locations. Table 6.11 shows that the Defra predicted NO_2 background was within 4.1% of that monitored in 2015 and slightly more conservative than the monitored concentration. The Defra background maps are therefore considered appropriate for use in this assessment as they represent a worst case.

Table 6.11: Defra and AURN background NO_2 concentrations (µg/m^3)

Defra Background NO_2 [A]	AURN Background NO_2 [B]	Difference [A-B]/B
25.4	24.4	4.1%

6.6.13 The background NO_x maps provide data for individual pollutant sectors. Therefore, the road traffic component has been removed for roads included in the dispersion model in order to avoid double counting the road traffic contribution to the background concentration. This included removing the contribution of the A63 trunk road and other A roads included in the dispersion model. A tool is available on the Defra website[92] to adjust the NO_2 backgrounds, allowing sector removal of NO_x from the total NO_x background. This tool (v6.0) was used to adjust the Base Year and Opening Year background NO_2 concentrations used in the assessment. The background NO_2 concentrations used at receptors are shown in Volume 3, Appendix 6.2 Local air quality receptor results.

Pollution climate mapping model

6.6.14 As described in Section 6.5.48, Defra uses the PCM model to report compliance with EU Directive on ambient air quality. In the Opening Year of the Scheme (2025), the maximum annual mean NO_2 concentration predicted in the PCM model is 31.7µg/m^3 (across the affected road network) which is below the EU limit value. The highest concentration is predicted on a section of the A63 along Hessle Road, east of the Clive Sullivan Way flyover (Defra Link Census ID: 48331), as shown in Volume 2, Figure 6.1 Air quality constraints.

[92] Defra (2017). NO_2 adjustment for NOx sector removal tool (version 6.0.1) Available online at: https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

Summary

6.6.15 The Scheme Site is located in an AQMA declared for exceedances of the annual mean NO_2 objective. Air quality monitoring data from HCC and from surveys undertaken for the Scheme indicates that NO_2 concentrations are currently above the annual mean NO_2 objective at roadside locations along the A63 within the AQMA. No exceedances of the annual mean NO_2 objective have been monitored outside of the AQMA, other than along Mount Pleasant Road.

6.6.16 HCC automatic monitoring data and Defra background PM_{10} concentrations indicate that concentrations of PM_{10} are well below AQOs in the study area.

6.7 Mitigation

Construction

6.7.1 It is expected that construction works would be carried out in accordance with the Best Practicable Means, as described in Section 79 (9) of the Environmental Protection Act (EPA) 1990, to reduce fumes or emissions which may impact upon air quality. As a minimum, the following measures are required to prevent significant effects during the construction phase. These measures would be included within the Outline Environmental Management Plan (OEMP) and would be implemented by the Contractor through a Construction Environment Management Plan (CEMP):

- Avoid double handling of materials
- Minimise height of stockpiles and profile to minimise wind-blown dust emissions and risk of pile collapse
- Locate stockpiles out of the wind (or cover, seed or fence) to minimise the potential for dust generation
- Ensure that all vehicles with open loads of potential dusty materials are securely sheeted or enclosed
- Provide a means of removing mud and other debris from wheels and chassis of vehicles leaving the site. This may involve a simple coarse gravel running surface or jet wash, or in the case of a heavily used exit point, wheel washers
- Maintain a low speed limit on site to prevent the generation of dust by fast moving vehicles
- Damp down surfaces in dry conditions
- Water should be sprayed during cutting / grinding operations (i.e. cutting kerbs)

- All vehicle engines and plant motors shall be switched off when not in use

Operation

6.7.2 Sections 5.14 and 5.15 of the NN NPS provide policy advice on mitigation:

> *"5.14 The Secretary of State should consider whether mitigation measures put forward by the applicant are acceptable. A management plan may help codify mitigation at this stage. The proposed mitigation measures should ensure that the net impact of a project does not delay the point at which a zone will meet compliance timescales."*
>
> *"5.15 Mitigation measures may affect the project design, layout, construction, operation and / or may comprise measures to improve air quality in pollution hotspots beyond the immediate locality of the scheme. Measures could include, but are not limited to, changes to the route of the new scheme, changes to the proximity of vehicles to local receptors in the existing route, physical means including barriers to trap or better disperse emissions and speed control. The implementation of mitigation measures may require working with partners to support their delivery."*

6.7.3 The results of the air quality assessment (Section 6.8) demonstrate that the Scheme would not have a significant air quality impact and would not affect reported compliance with the EU Directive on ambient air quality. Mitigation would therefore not be required.

6.8 Predicted environmental effects

Construction

6.8.1 A total of 68 sensitive receptors were considered for the Construction Phase assessment. These were located along the key roads which would be affected during the Construction Phase (as identified in Section 6.4) and were selected from the worst case locations used in the Operation Phase assessment. The location of the receptors considered in the Construction Phase assessment are shown in Volume 2, Figure 6.8 Construction Phase: Construction traffic receptors.

6.8.2 Total NO_2 concentrations were predicted for the Base Year, Do Minimum and Do Something construction scenarios for the year 2021. The receptors with the highest predicted concentrations and greatest change in NO_2 are presented and described in the section below. The concentrations predicted at all 68 receptors in the base year and Do Minimum and Do Something scenarios are presented in Volume 3, Appendix 6.2 Local air quality receptor results.

A63 Hessle Road

6.8.3 Table 6.12 shows the worst case NO_2 concentrations and change in concentrations at receptors along the A63 Hessle Road in the Do Minimum and Do Something scenarios for Phase 1 of the Construction Phase. Annual mean

NO_2 concentrations are predicted to be below the AQOs at all receptors on A63 Hessle Road in both scenarios.

6.8.4 The highest predicted annual mean NO_2 concentration in 2021 is predicted at receptors 74 and 75 where concentrations of 37.4µg/m^3 are predicted in the Do Something construction scenarios respectively. These receptors also experience the greatest increase in annual mean NO_2 concentrations of 3.0-3.1µg/m^3 between the Do Minimum and Do Something construction scenario. These receptors are located on the first floor of a building, approximately 6m south of the A63, adjacent to the WB carriageway between the Clive Sullivan Way exit road and Porter Street.

6.8.5 The increase in NO_2 concentrations at these receptors are the result of an increase in traffic flows of approximately 4,000 AADT on the EB carriageway during construction traffic management measures. There are also changes in speed bands from Free Flow to Light Congestion on the WB carriage in the PM period and change from Light to Heavy Congestion on the EB carriage in the AM period.

Table 6.12: Annual mean NO_2 at selected receptors - A63 Hessle Road

Sensitive Receptor ID	NO_2 Annual Mean Concentration (µg m^{-3})			
	2015 Base	Construction DM (2021)	Construction DS (2021)	Change
74	41.8	34.3	37.4	3.1
75	41.9	34.4	37.4	3.0

Note: Exceedance of annual mean NO_2 objective/EU limit value (40 µg m^{-3}) shown in bold.

DM = Do Minimum (without Scheme); DS = Do Something (with Scheme); Change = DS minus DM

A63 Castle Street

6.8.6 Table 6.13 shows the NO_2 concentrations and change in concentrations at the worst case receptors along the A63 Castle Street in the Do Minimum and Do Something scenarios for Phase 1 of the Construction Phase.

6.8.7 The highest predicted annual mean NO_2 concentrations in 2021 on the A63 Castle Street are predicted at receptors 11 and 12, where concentrations of 50.5µg/m^3 and 49.6µg/m^3 are predicted in the Do Minimum and Do Something scenarios respectively. These receptors are located approximately 5m north of the A63, on the corner of Dagger Lane. As a result of the closure of Ferensway South during the Construction Phase, a decrease in NO_2 of 0.9µg/m^3 is predicted at these locations because of a reduction of approximately 2,000 AADT along this section of the A63. There are 14 other receptors located in the same row of residential properties (between Dagger Lane and Fish Street) which are predicted to experience reductions in NO_2 of between 0.1 to 0.9µg/m^3. At ten receptors,

including receptor 11 and 12, there is a 'small' improvement in air quality above the AQO, as presented below in Table 6.13.

6.8.8 There are no receptors along A63 Castle Street which are expected to experience a new exceedance of the NO2 AQO or which would have an exceedance made worse as a result of the construction traffic management measures.

Table 6.13: Annual mean NO_2 at selected receptors - A63 Castle Street

Sensitive Receptor ID	NO_2 Annual mean concentration (µg m^{-3})			
	2015 Base	Construction DM (2021)	Construction DS (2021)	Change
6	**55.5**	**45.2**	**44.5**	-0.7
7	**58.3**	**47.6**	**46.8**	-0.8
8	**58.7**	**48.0**	**47.2**	-0.8
9	**59.2**	**48.4**	**47.6**	-0.8
10	**59.8**	**48.9**	**48.0**	-0.9
11	**61.6**	**50.5**	**49.6**	-0.9
12	**61.5**	**50.5**	**49.6**	-0.9
68	**56.1**	**45.7**	**45.0**	-0.7
69	**54.7**	**44.5**	**43.9**	-0.6
84	**52.0**	**42.3**	**41.7**	-0.6

Note: Exceedance of annual mean NO_2 objective (40 µg m^{-3}) shown in bold

DM = Do Minimum (without Scheme); DS = Do Something (with Scheme); Change = DS minus DM

Wider study area

6.8.9 Table 6.14 shows the worst case NO_2 concentrations and change in concentrations at receptors along the remaining local roads likely to be affected by the construction traffic management measures in the Do Minimum and Do Something scenarios. Annual mean NO_2 concentrations are predicted to be below the AQOs at all receptors in the wider study area in both scenarios.

6.8.10 The highest predicted annual mean NO_2 concentration in 2021 in the wider study area is predicted at receptor 61. This receptor is located on the A165 (George Street) where concentrations of 27.7µg/m^3 and 28.3µg/m^3 are predicted in the Do Minimum and Do Something construction scenarios respectively.

6.8.11 The greatest change in annual mean NO_2 concentrations in the wider study area is predicted at receptor 60, where there is predicted to be an increase in annual NO_2

concentrations of 0.7µg/m^3 between the Do Minimum and Do Something construction scenario. This receptor is located approximately 2m north of the A165 (George Street).

6.8.12 The increases in NO_2 at both of these locations is due to increases of approximately 2,000 AADT along this section of the A63 as traffic will redistribute on to local roads to avoid sections of the A63 during the construction period.

Table 6.14: Annual mean NO_2 at selected receptors – wider study area

Sensitive receptor ID	NO_2 Annual mean concentration (µg m^{-3})			
	2015 Base	Construction DM (2021)	Construction DS (2021)	Change
60	32.5	24.7	25.4	0.7
61	35.9	27.7	28.3	0.6

Note: Exceedance of annual mean NO_2 objective/EU limit value (40 µg m^{-3}) shown in bold.

DM = Do Minimum (without Scheme); DS = Do Something (with Scheme); Change = DS minus DM

6.8.13 The results of the detailed air quality model to assess the construction traffic management have been verified using local monitoring data and show there are no new exceedances or worsening of annual mean NO_2 concentrations at receptors above the objective. Therefore, considering these results, it can be concluded that the construction phase will not impact on compliance with the EU Directive on ambient air quality. In accordance with IAN 174/13, there are no significant air quality effects associated with the construction traffic management measures.

Operation

6.8.14 A total of 98 sensitive receptors were considered for the local air quality assessment. These were identified at worst case locations alongside the affected road network defined in Section 6.4. The location of the receptors considered in the assessment is shown in Volume 2, Figure 6.5 Operation Phase: Modelled receptor locations (human health).

6.8.15 Total NO_2 and PM_{10} concentrations were predicted for the Base Year, Opening Year Do Minimum and Opening Year Do Something scenarios. The total concentrations predicted in all scenarios and at all receptors for both NO_2 and PM_{10} are shown in Volume 3 Appendix 6.2 Local air quality receptor results.

6.8.16 For PM_{10}, Do-minimum and Do-something annual mean concentrations are well below 40µg/m^3. The greatest Do-something concentration is predicted at receptor 11, which has a predicted annual PM_{10} concentration in 2025 of 23.0µg/m^3.

6.8.17 The greatest increase in PM_{10} is predicted at receptor 14, which has a predicted change in annual PM_{10} concentration in 2025 of 2.3µg/m^3, resulting in a Do-something concentration at this receptor of 21.2µg/m^3.

6.8.18 As modelled PM_{10} concentrations at these worst case receptors are well below the annual PM_{10} objective, it can be concluded that there will be no significant PM_{10} effects at sensitive receptors as a result of the Scheme so no further discussion has been undertaken. The section below will instead focus on NO_2.

6.8.19 Air quality effects at the receptors with the highest predicted NO_2 concentrations and greatest change in NO_2 are presented and described in this section. An additional figure, Volume 2, Figure 6.12 Operation Phase: Key receptors, highlights the key receptors discussed below.

NO_2 results - A63 Clive Sullivan Way flyover to the Mytongate Junction

6.8.20 This section of the A63 encompasses the western extent of the Scheme and is located in the Hull AQMA, as shown in Volume 2, Figure 6.12 Operation Phase: Key receptors. The two-way traffic flow is predicted to increase by approximately 12,000 vehicles per day along some of this section of the A63 as a result of the Scheme.

6.8.21 On the eastbound (EB) section of A63:

- Traffic speed is expected to improve from ‘Heavy Congestion’ to ‘Light Congestion’ in the PM traffic period and from ‘Light Congestion’ to ‘Free Flow’ in the IP traffic period between Porter Street and the Mytongate Junction.
- Traffic speed is expected to worsen from ‘Free Flow’ to ‘Light Congestion’ in the IP traffic period and from ‘Light Congestion’ to ‘Heavy Congestion’ in the PM traffic period between the Clive Sullivan Way flyover and Porter Street.
- The speed improvements between Porter Street and Mytongate Junction are mainly associated with the removal of the signalised pedestrian crossing at Porter Street and the signals at Mytongate Junction while the speed worsening on the Clive Sullivan Way flyover is due to an increase in eastbound traffic on the existing road layout, resulting in increased congestion.

6.8.22 On the westbound (WB) section of the A63:

- Traffic speed is expected to change from ‘Free Flow’ to ‘Light Congestion’ in the AM, IP and PM traffic periods between Porter Street and the Clive Sullivan Way flyover.
- Traffic speed is expected to change from ‘Free Flow’ to ‘Light Congestion’ in the AM and PM period between the Mytongate Junction and Porter Street.
- Traffic speed is expected to change from ‘Free Flow’ to ‘Heavy Congestion’ in the PM period on the stretch of road where the Mytongate Junction slip road joins the A63.

- The increase in congestion and resulting decrease in speed is due to an increase in westbound traffic, whilst the road layout (with exception of removal of pedestrian crossing adjacent to Porter Street) remains as in the Do Minimum scenario.

6.8.23 Table 6.15 shows the receptors with the highest annual mean NO_2 concentration in the Opening Year and greatest change in annual mean NO_2 as a result of the Scheme for this section of the A63. The highest annual mean NO_2 concentration in the Opening Year is predicted at receptor 75 where concentrations of 31.9µg/m^3 and 33.4µg/m^3 are predicted in the Do Minimum and Do Something scenarios respectively. This receptor is located on the first floor of a building, approximately 6m south of the A63, adjacent to the WB carriageway between the Clive Sullivan Way exit road and Porter Street. The increase in NO_2 concentrations is the result of the increase in traffic flows of approximately 7,500 AADT on the WB carriage.

6.8.24 The greatest change in annual mean NO2 concentrations in the Opening Year for this section of the Scheme is predicted at receptor 25, where there is predicted to be an increase in annual NO_2 concentrations of 1.9µg/m^3 between the Do Minimum and Do Something scenarios. This receptor is located approximately 6m north of the slip road onto the A63. The increase in NO_2 is the result of the increase in traffic flows of approximately 3,000 AADT on the slip road and 1,600 AADT on the EB carriageway.

6.8.25 The greatest improvement in annual mean NO_2 concentrations in the Opening Year for this section of the Scheme is predicted at receptor 17, where there is estimated to be a decrease in annual NO_2 concentrations of 1.6µg/m^3 between the Do Minimum and Do Something scenarios. This receptor is located approximately 6m north of the Mytongate Junction slip road. The decrease in NO_2 concentrations are a result of improvements in PM and IP period speeds on the EB section of the A63 which offsets the emissions from the additional vehicles on the A63.

6.8.26 Annual mean NO_2 concentrations are predicted to be below the annual mean objective at all receptors between Clive Sullivan Way flyover and the Mytongate Junction in the Do Minimum and Do Something Opening Year scenarios.

Table 6.15: Annual mean NO_2 at selected receptors - Clive Sullivan Way flyover to the Mytongate Junction

Sensitive receptor ID	NO_2 Annual mean concentration (µg m^{-3})			
	2015 Base	2025 DM	2025 DS	Change
75	41.9	31.9	33.4	1.5
25	39.6	29.3	31.2	1.9
17	38.9	30.1	28.5	-1.6

Note: Exceedance of annual mean NO_2 objective (40 µg m^{-3}) shown in bold.

DM = Do Minimum (without Scheme); DS = Do Something (with Scheme); Change = DS minus DM

NO_2 results - A63 Mytongate Junction to Market Place

6.8.27 This section of the A63 encompasses the eastern extent of the Scheme and is located in the Hull AQMA. The two-way traffic flow is predicted to increase by 12,000 vehicles per day along some of this section of the A63 as a result of the Scheme.

6.8.28 On the EB section of the A63:

- Traffic speeds are expected to improve from 'Light Congestion' to 'Free Flow' in the IP period between Mytongate Junction and Dagger Lane.
- Traffic speed is expected to improve from 'Light Congestion' to 'Free Flow' in the AM, IP and PM period between Dagger Lane and Vicar Lane.
- Traffic speed is expected to worsen from 'Light Congestion' to 'Heavy Congestion' in the PM period between Vicar Lane and Market Place.

6.8.29 The speed improvements are the result of the widening of the existing carriageway to provide a third lane (increasing capacity on the road), restricting access to the A63 from side roads (e.g. Princes Dock Street and Dagger Lane) and the removal of the signalised pedestrian crossing near Dagger Lane. The speed worsening is the result of additional traffic accessing the new exit from the A63 on to Market Place.

6.8.30 On the WB section of the A63:

- Traffic speed is expected to improve from 'Light Congestion' to 'Free Flow' in the IP period between the Holiday Inn and Mytongate Junction.
- Traffic speed is expected to improve from 'Light Congestion' to 'Free Flow' in the AM period and from 'Heavy Congestion' to 'Free Flow' in the PM period between Market Place and the Holiday Inn.

6.8.31 These speed improvements are mainly the result of the removal of the traffic signals at Mytongate Junction and the removal of signalised pedestrian crossings.

6.8.32 As shown in Table 6.16, the highest annual mean NO_2 concentration in the Opening Year scenario between Mytongate Junction and Market Place is predicted at receptor 11, where concentrations of 45.8µg/m^3 and 41.7µg/m^3 are predicted in Do Minimum and Do Something scenarios. This receptor is located approximately 5m north of the A63, on the corner of Dagger Lane. As a result of the Scheme, there is a decrease in NO_2 of 4.1µg/m^3 at this location. This improvement is the result of a reduction in traffic congestion and increases in speed on the EB A63 (see Section 6.8.28) which decreases vehicle emissions. This speed improvement outweighs the increase in vehicle emissions caused by the increase in traffic flows of approximately 6,000 AADT on the EB A63. There

are eight other receptors located in the same row of residential properties (between Dagger Lane and Fish Street) where there is a reduction in NO_2 of between 1.8 to 4.2µg/m^3. At three of these receptors there is a removal of an exceedance of the annual NO_2 objective.

6.8.33 The greatest increase in NO_2 at receptors between Mytongate Junction and Market Place is at receptor 3, where there is predicted to be an increase in annual NO_2 concentrations of 1.9µg/m^3 between the Do Minimum and Do Something scenarios from 30.7µg/m^3 to 32.6µg/m^3. The receptor is located approximately 10m north of the A63, near the Market Place exit from the A63. The increase in NO_2 concentrations are the result of the increase in traffic flows of approximately 6,000 AADT on the EB carriage and a change in speed bands in the PM period from 'Light Congestion' to 'Heavy Congestion' due to vehicles exiting the A63.

6.8.34 There are no receptors between Mytongate Junction and Market Place which are expected to experience a new exceedance of the NO_2 air quality objectives or which would have an exceedance made worse as a result of the Operation Phase of the Scheme.

Table 6.16: Annual mean NO_2 at Mytongate Junction to Market Place receptors

Sensitive receptor ID	NO_2 Annual mean concentration (µg m^{-3})			
	2015 Base	2025 DM	2025 DS	Change
3	**41.6**	30.7	32.6	1.9
6	**55.5**	**41.2**	39.4	-1.8
7	**58.3**	**43.3**	**40.4**	-2.9
8	**58.7**	**43.6**	**40.5**	-3.1
9	**59.2**	**44**	**40.7**	-3.3
10	**59.8**	**44.4**	**40.8**	-3.6
11	**61.6**	**45.8**	**41.7**	-4.1
12	**61.5**	**45.8**	**41.6**	-4.2
68	**56.1**	**41.6**	39.3	-2.3
69	**54.7**	**40.6**	38.7	-1.9

Note: Exceedance of annual mean NO_2 objective (40 µg m^{-3}) shown in bold.

DM = Do Minimum (without Scheme); DS = Do Something (with Scheme); Change = DS minus DM

NO_2 results - wider study area

6.8.35 Air quality impacts across the wider study area (beyond the A63 between Daltry Street and Market Place) are presented in Table 6.17. Changes in annual NO_2 (both positive and negative) are predicted to be 0.4µg/m^3 or less (i.e. imperceptible) at the majority of these receptors as changes in traffic flows are smaller on the wider network compared to along the A63. In addition, these sensitive receptors are generally located further away from these roads compared to sensitive receptors located adjacent to the A63.

6.8.36 There are two receptors in the wider study area with a change in annual NO_2 concentrations greater than 0.4µg/m^3; receptor 42 and receptor 64, both of which had increases in concentrations of 0.5µg/m^3. Receptor 42 is approximately 15m north of Hessle Road, where there is an increase of approximately 1,000 AADT. Receptor 64 is located less than 5m east of High Street, where there is an increase of approximately 1,000 AADT and decreases in traffic speeds in the AM and PM periods from 'Light Congestion' to 'Heavy Congestion'. Annual NO_2 concentrations at both receptors in the Do Minimum and Do Something scenarios are well below the annual NO_2 objective.

6.8.37 The highest Opening Year annual mean NO_2 concentration in the wider study area is predicted at receptor 61 on the A165 (George Street), where concentrations of 26.2µg/m^3 and 26.0µg/m^3 are predicted in the Do Minimum and Do Something scenarios.

6.8.38 The greatest reductions in annual mean NO_2 are predicted at receptor 31 on Walker Street and receptors 54 and 57 on the A165 (Freetown Way), where annual mean NO_2 concentrations are predicted to decrease by 0.6µg/m^3. The decrease in NO_2 predicted here is the result of a decrease in traffic flow of approximately 4,000 vehicles per day on Freetown Way and 2,000 vehicles per day on Walker Street as a result of the Scheme.

Table 6.17: Annual mean NO_2 at wider study area receptors

Sensitive receptor ID	NO_2 Annual mean concentration (µg m^{-3})			
	2015 Base	2025 DM	2025 DS	Change
31	29.3	22	21.4	-0.6
42	24.7	17.8	18.3	0.5
54	31.6	23.3	22.7	-0.6
57	28.7	21.2	20.6	-0.6
61	35.9	26.2	26	-0.2

Sensitive receptor ID	NO_2 Annual mean concentration (µg m^{-3})			
	2015 Base	2025 DM	2025 DS	Change
64	30.2	21.9	22.4	0.5

Note: DM = Do Minimum (without Scheme); DS = Do Something (with Scheme); Change = DS minus DM

Compliance risk assessment

6.8.39 As discussed in Section 6.5.48, IAN 175/13 provides guidance on the assessment of Scheme impacts and compliance with the EU Directive on ambient air quality. There are several PCM links which intersect with the ARN (the CRRN), two of which have increases in NO_2 concentrations of more than 0.4µg/m^3 at nearby sensitive receptors. These links are presented in Table 6.18 Compliance Risk Analysis below.

6.8.40 All the other links in the CRRN are predicted to experience a decrease in NO_2 concentrations or experience no changes greater than 0.4µg/m^3 at the nearby worst affected receptors. In addition, these PCM links have NO_2 concentrations less than 40µg/m^3 in the Opening Year and therefore have not been discussed further within this compliance assessment.

6.8.41 The maximum PCM / Scheme equivalent PCM annual mean NO_2 concentration is predicted for the PCM link corresponding with Clive Sullivan Way (Defra Link Census ID: 48331). The Defra annual mean NO_2 concentration predicted for this link in the Scheme Opening Year is 32µg/m^3 and the Scheme leads to a maximum increase in NO_2 of 1.9µg/m^3 at the worst case adjacent receptor (receptor 25). This corresponds with a Scheme equivalent annual mean concentration of 33.9µg/m^3, which is below the EU Limit Value (40 µg/m^3). Therefore, there is a low risk of the Scheme affecting the UK's reported ability to comply with the EU Directive on ambient air quality. The Scheme is therefore considered to meet the policy tests set out in the NPS for NN.

Table 6.18: Compliance risk assessment

Inputs			Defra PCM model and compliance information				HE receptor results			
HA Receptor ID	Defra Link Census ID	Zone / Agglomeration Ref No	Is it a Compliant Zone in 2015?	Opening Year: Total NO_2 2025	Maximum Modelled Conc in Zone 2025	Projected Compliance Year	Annual Mean DM NO2 (µg/m^3)	Annual Mean DS NO_2 (µg/m^3)	Change in Annual Mean (µg/m^3) (DS-DM)	Equivalent PCM DS (µg/m^3)
25	48331	18	No	31.7	31.7	2021	29.3	31.2	1.9	33.6
3	27932	18	No	31.2	31.7	2021	30.7	32.6	1.9	33.1

Ecological designated sites - atmospheric NO_x concentrations

6.8.42 Table 6.19 shows the modelled NO_x concentrations for the three receptor transects in the Humber Estuary designated site. The location of these receptors is shown in Volume 2, Figure 6.6 Operation Phase: Modelled receptor locations (ecological) and the full set of results along the transects are shown in Volume 3, Appendix 6.2 Local air quality receptor results. Only receptor results within 50m of the A63 are described in this section, as Scheme impacts are 'imperceptible' beyond this distance, as described below.

6.8.43 In the Opening Year of the Scheme, the annual mean NO_x objective (30 μg/m^3) is predicted to be exceeded at the edge of the designated site. For Transect 1, only the first modelled point is predicted to exceed the objective as this is the closest point to the A63; concentrations are predicted to decrease to below the objective over the next 10m increment. Modelled NO_x concentrations are predicted to be below the annual mean objective at all receptors in Transect 2 and Transect 3 as they are further from the A63 main carriageway than Transect 1.

6.8.44 The Scheme is predicted to lead to increases in NO_x in the designated site (along all three transects), due to a predicted increase in traffic of between 1,000 to 2,000 vehicles per day on the adjacent section of the A63.

6.8.45 However, only the first modelled point of Transect 1 has a predicted change greater than 0.4μg/m^3 and total concentrations above 30μg/m^3. In accordance with IAN 174/13, nitrogen deposition at this location has been assessed and the results discussed with the Scheme Ecologist to determine significance of effects.

Table 6.19: Annual mean NO_x at ecological designated site receptors

Transect	Distance to the edge of A63 mainline (metres)	NO_x annual mean concentration (μg/m^3)			
		2015 Base	2025 DM	2025 DS	Change
Transect 1	3[(a)]	**66.5**	**44.7**	**45.6**	0.9
	13	**43.6**	28.6	29.0	0.4
	23	**36.9**	23.9	24.2	0.3
	33	**33.4**	21.5	21.7	0.2
	43	**31.2**	20.0	20.1	0.1
Transect 2	35[(a)]	**33.8**	21.4	21.6	0.2
	45	**30.4**	19.3	19.4	0.1
Transect 3	13[(a)]	**44.1**	29.6	29.9	0.3
	23	**36.2**	23.8	24.0	0.2
	33	**32.7**	21.3	21.5	0.2

Transect	Distance to the edge of A63 mainline (metres)	NO_x annual mean concentration (µg/m^3)			
		2015 Base	2025 DM	2025 DS	Change
	43	**30.6**	19.9	20.0	0.1

Notes: (a) indicates the closest point to the affected road

Exceedances of annual mean NO_x objective highlighted in bold

DM = Do Minimum (without Scheme); DS = Do Something (with Scheme); Change = DS minus DM

Ecological designated sites - Nitrogen deposition

6.8.46 Following discussions with the Scheme ecologist, the habitat classification which is applicable to the designated site is presented below. Total average nitrogen deposition rates and critical loads for this classification have been derived from APIS[93] and are presented in Table 6.20. It should be noted that United Nations Economic Commission for Europe (UNECE) estimates a critical load for coastal salt marsh of 30-40 kg(N)/ha/yr, as reported in DMRB Volume 11 Section 3, Part 1 – Air Quality (HA207/07). The APIS critical load is lower than this (20–30 kg(N)/ha/yr) and has been applied here as a worst case. The existing deposition rates are below the critical load range in the Base Year and Opening Year Do Minimum scenario.

Table 6.20: APIS total nitrogen deposition

Transect	APIS habitat classification	Total background Nitrogen deposition base year[1]	Total background Nitrogen deposition Scheme Opening Year[1]	APIS critical load range
		(kg (N) / ha / yr)	(kg (N) / ha / yr)	(kg (N) / ha / yr)
Transect 1	Coastal Saltmarsh	16.9	13.8	20-30

Notes: (1) Based on a 2% reduction in deposition per year from 2014 (APIS deposition is 17.2 kg (N) / ha / yr in 2014)

6.8.47 Using detailed dispersion modelling, concentrations of NO_2 have been determined at the first receptor in Transect 1. DMRB Volume 11 Section 3, Part 1 – Air Quality (HA207/07) requires that dry NO_2 deposition, which is a component of total nitrogen deposition, is calculated from the NO_2 concentration predicted (see Section 6.5.46). The road contribution to dry NO_2 deposition has been determined by subtracting the dry NO_2 deposition rate for the APIS square from the receptor dry NO_2 deposition rate. This provides the road contribution to dry NO_2 deposition and is presented in Table 6.21 for the Base, Do Minimum and Do Something scenario.

[93] Air Pollution Information System (APIS) Available online at www.apis.ac.uk

Table 6.21: Modelled road contribution to NO_2 dry deposition

Transect	Distance to 'Affected' road (metres)	Modelled road contribution to NO_2 dry deposition (kg (N) ha / yr)			
		2015 Base	2025 DM	2025 DS	Change
Transect 1	3[(a)]	2.11	1.68	1.72	0.04 (0.13-0.2% of critical load)

Note: [(a)] indicates the closest point to the affected road

DM = Do Minimum (without Scheme); DS = Do Something (with Scheme)

Results presented have been rounded to 2dp to indicate direction of change and is not a reflection of model accuracy.

6.8.48 The modelled road contribution to NO_2 dry deposition in Table 6.21 has been added to the APIS average total background nitrogen deposition rates shown in Table 6.20 to give the total nitrogen deposition rate at the receptor, as presented in Table 6.22.

6.8.49 Total nitrogen deposition is below the critical load range in all scenarios and the change in deposition associated with the Scheme is less than 1% of the critical load. These air quality effects have been discussed with the Scheme ecologist and the Scheme impacts are concluded to be not significant for ecological receptors based on the magnitude of increase and because the flushing action from tides is likely to reduce the input of atmospheric nitrogen (N) to the saltmarsh ecosystem.

Table 6.22: Modelled total nitrogen deposition

Transect	APIS Habitat Classification	Distance to 'Affected' road (metres)	Total N Deposition (kg (N) ha / yr)			APIS critical load range
			2015 Base	2025 DM	2025 DS	(kg (N) / ha / yr)
Transect 1	Coastal Saltmarsh	3[(a)]	18.99	15.46	15.51	20-30

Note: [(a)] indicates the closest point to the affected road

DM = Do Minimum (without Scheme); DS = Do Something (with Scheme)

Results presented have been rounded to 2dp to indicate direction of change and is not a reflection of model accuracy.

Assessment of significance – Local air quality

6.8.50 Table 6.23 presents the number of properties within each magnitude of change category for the Scheme. All sensitive receptors that could be experience an exceedance of the air quality objectives have been included within modelling.

Table 6.23: Local air quality receptors informing Scheme significance

Magnitude of change in annual mean ($\mu g/m^3$)	Number of receptors with:	
	Worsening of an air quality objective already above objective or creation of a new exceedance	Improvement of an air quality objective already above objective or the removal of an existing exceedance
Large (>4)	0	2
Medium (>2 to 4)	0	5
Small (>0.4 to 2)	0	2

6.8.51 As discussed in Section 6.8, there are nine receptors where the annual mean NO_2 objective is predicted to be exceeded in the Do Minimum scenario and three of these exceedances are removed as a result of the Scheme. Table 6.23 shows that the majority of these receptors are predicted to experience a 'medium' magnitude improvement in NO_2. The three receptors which have an exceedance removed experience either 'small' or 'medium' magnitudes of change. There are no receptors which are predicted to experience an exceedance of the annual mean PM_{10} objective or have an exceedance removed as a result of the Scheme.

6.8.52 Table 6.24 presents the overall evaluation of the significance of effect on local air quality. Overall it is concluded that there are no significant local air quality effects as a result of the Scheme.

Table 6.24: Overall evaluation of local air quality significance

Key criteria questions	Yes / No
Is there a risk that environmental standards will be breached?	Yes
Will there be a large change in environmental conditions?	No
Will the effect continue for a long time?	Yes
Will many people be affected?	No
Is there a risk that designated sites, areas, or features will be affected?	No
Will it be difficult to avoid, or reduce or repair or compensate for the effect?	No
On balance is the Overall Effect significant?	No
Evidence in support of professional judgement: - No adverse large, medium or small changes are predicted at receptors as a result of the Scheme	

Key criteria questions	Yes / No
- Beneficial changes are predicted at nine receptors as a result of the Scheme – two large, five medium and two small changes. - Exceedances of the annual NO_2 objective are removed at three receptors. - No exceedances of the annual PM_{10} objective at receptors. - There is 'Low Risk' of the Scheme causing non-compliance with the EU Directive on ambient air quality as the maximum NO_2 concentrations in the PCM model in the Opening Year is 31.7µg/m^3 and the greatest increase in NO_2 concentrations adjacent to this PCM link is 1.9µg/m^3. - There is a risk of an exceedance of the NOx annual mean objective at the Humber Estuary SSSI. However, the overall air quality impacts at this site are not considered to be significant.	

Regional air pollution

6.8.53 Results of the regional assessment are presented in Table 6.25. The Scheme is predicted to cause a reduction in emissions of NO_x and CO_2 and an increase in PM_{10} compared to the Do Minimum scenarios in 2025 and 2040. This is primarily due to the improvement in speeds as a result of the Scheme reducing congestion, which for NOx and CO_2 outweighs the overall increase in vehicle flows in the Do Something scenario. As PM_{10} has smaller emission factors, the improvement in speeds has limited effect relative to the increases in vehicles, resulting an overall increase in regional emissions.

Table 6.25: Regional air quality emissions

Pollutant	2015 Base Year	2025 DM	2025 DS	2025 Change	2040 DM	2040 DS	2040 Change
NO_x (t/yr)	76.0	42.4	41.5	-2.1%	36.8	35.4	-3.8%
PM_{10} (t/yr)	20.7	18.1	19.0	4.9%	20.5	22.4	9.7%
CO_2 (t/yr)	24820.2	33032.3	32718.8	-0.9%	39314.0	35810.7	-8.9%

Note: Emission factors are not available beyond 2030. 2030 emission factors have been assumed for 2040

6.9 Climate change effects

6.9.1 Changes in climate can affect the dilution and dispersion of air pollutants, exacerbating concentrations of pollutants generated during the Construction and Operation Phases. For example, windy and warm, dry conditions can combine to generate dust temporarily affecting local air quality. However, the Construction Phase is anticipated to be completed by 2024 and the worst case air quality effects during the Operation Phase are expected to occur in 2025. This is well before any notable changes in the UK's climate could occur so the potential for effects from climate change to exacerbate dust effects is concluded to be negligible.

6.10 Conclusions

6.10.1 This chapter provides an assessment of the potential air quality effects of the A63 Castle Street Improvements (the Scheme) in accordance with the DMRB Volume 11 Section 3, Part 1 - Air Quality (HA207/07) and IAN 170/12, IAN 174/13, IAN 175/13 and IAN185/15.

6.10.2 An air quality monitoring survey has been undertaken to measure existing concentrations of nitrogen dioxide (NO_2) across the study area, to complement the NO_2 and PM_{10} data from HCC and Defra. The monitoring survey has been used together with Defra air quality modelling to establish baseline concentrations of NO_2 at receptors. The Scheme Site is located in Hull AQMA and monitored and modelled baseline NO_2 concentrations in 2015 exceeded the annual mean NO_2 objective at several roadside locations adjacent to the section of the A63 encompassing the Scheme. There were no exceedances of the short or long term PM_{10} air quality objectives monitored.

6.10.3 A qualitative assessment of potential dust effects has been undertaken, based on a review of likely dust raising activities and identification of sensitive receptors within 200m of the Scheme Site. Potential dust effects would be suitably controlled using the best practice mitigation measures proposed and consequently are unlikely to cause statutory nuisance.

6.10.4 Quantitative assessments have been undertaken to assess the air quality impacts during the Construction and Operation Phase of the Scheme at key receptors, using an atmospheric dispersion model. These models have been verified against local air quality monitoring data and have been used to estimate the air quality impacts of changes in traffic associated with the Scheme.

6.10.5 As a result of traffic management measures during the Construction Phase, there is expected to be an increase in traffic flows on the A63 Hessle Road and surrounding local roads. These changes are not expected to result in any new exceedances of the AQOs or a worsening in air quality at receptors already above the NO_2 objective. The Construction Phase is also expected to result in a decrease in vehicle flows along the A63 Castle Street, resulting in some improvements in air quality at receptors currently exceeding the NO_2 objective. Overall, the air quality impact associated with the Construction Phase is considered not significant.

6.10.6 During the Operation Phase, the Scheme is expected to lead to an increase in vehicles along the A63 between Daltry Street and Market Place, which is located in the Hull AQMA. However, the Scheme reduces traffic congestion on several stretches of the A63 in the AQMA, including in areas where the annual mean NO_2 objective is currently exceeded and expected to be still be exceeding in the Opening Year Do Minimum scenario. The reduced congestion and therefore improved vehicle speeds is predicted to remove these exceedances of the NO_2 objective, despite the increases in traffic flows and no new exceedances of the AQOs are predicted as a result of the operation of the Scheme. Furthermore, the

Scheme is not expected to affect compliance with the EU Directive on ambient air quality. Therefore, the air quality impacts associated with the Operation Phase are considered not significant.

6.10.7 No exceedances of the PM_{10} air quality objectives are predicted as a result of the Scheme. However, the Scheme is predicted to cause an increase in regional emissions of PM_{10}.

6.10.8 Considering the results presented in this assessment the Scheme is consistent with national and local planning policy with respect to air quality.

Chapter 7. Noise and vibration

7.1 Executive summary

7.1.1 This chapter presents an assessment of the potential temporary and permanent changes in environmental noise and vibration as a result of the construction and operation of the A63 Castle Street Improvements (the Scheme).

Noise

Existing situation – Baseline

7.1.2 Noise measurement surveys have been undertaken to inform the existing baseline noise conditions. Surveys found that road traffic noise is currently a significant feature of the baseline noise climate in the area of receptors adjacent to the section of the A63 covered by the Scheme.

Construction

7.1.3 The assessment has indicated that there is potential for significant adverse effects where construction activities are carried out in close proximity to sensitive receptors adjacent to the works. Construction works along the Scheme extents during each phase which are in proximity to receptor locations would only occur for a relatively short period of time. The works would be at a greater distance for the majority of the construction period and resultant increases would be lower. Mitigation measures have been considered and should be implemented where practical to minimise noise level increases. These are mainly in the area of the Mytongate Junction, dwellings adjacent to the eastbound carriageway of A63 Castle Street and those adjacent to the westbound carriageway of Hessle Road. The daytime construction works would produce significant adverse effects where the works in the vicinity of receptors which exceed threshold values extend beyond a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any six consecutive months.

7.1.4 In the case of night time works, although limited in scope, there is a risk of temporary disturbance due to works at the closest receptors. It is expected that prior notice would be given to affected receptors and that mitigation measures will be implemented to minimise noise impacts to avoid disturbance.

Operation

7.1.5 The assessment is based on a comparison of predictions of the likely impacts with baseline conditions and / or the predicted conditions under the scenario of the Scheme not being implemented.

7.1.6 At all of the key receptors, predicted noise levels in the opening year without the Scheme are at or above the Significant Observed Adverse Effect Level (SOAEL) of 68dB$L_{A10,18hr}$ (equivalent to 63dB$L_{Aeq,16h}$). For key receptors, where increases

occur as a result of the Scheme, increases at these properties at Scheme opening would be negligible except for; Quantock Close, The Lodge Porter Street, Hessle Road (St Alfred Street to Ropery Street), A63 Castle Street: Dagger Lane to Fish Street, A63 Castle Street: Fish Street to Vicar Lane, Hull Magistrates, Holiday Inn, Marina Court, where a minor increase would occur. These receptors experience increases of 1dB or greater which are assessed in accordance the National Policy Statement (NPS) applicable to National Road and Rail Networks as significant adverse.

7.1.7 Long term increases with the Scheme at key receptors are all less than 3dB and therefore considered negligible. However, increases above 1dB for key receptors which exceed SOAEL are identified at; Quantock Close, Hessle Road (St Alfred Street to Ropery Street), Warehouse No. 6, A63 Castle St (Princes Dock Street to Dagger Lane), Castle Street (Dagger Lane to Fish Street), Castle Street (Fish Street to Vicar Lane), Hull Magistrates, Holiday Inn, Marina Court. Resulting effects at these key receptors are considered as significant adverse. Long term noise level decreases at residences at 61-71 William Street, William Street (east end) and Cogan Street are considered significant beneficial (i.e. a decrease of 3dB or more), whilst elsewhere where the SOAEL is exceeded and there is a decrease in noise level, these decreases are considered negligible.

7.1.8 In the long term the number of residences experiencing an increase with the Scheme (4,486) is lower than would experience an increase in the Do Minimum scenario (5,483). The Scheme therefore has a net benefit.

7.1.9 Significant adverse changes with the Scheme in the opening year (an increase of 1dB or greater) would occur at 693 residential dwellings and significant beneficial changes in noise levels (a decrease of 1dB or greater) would occur at 332 dwellings.

7.1.10 Significant adverse changes with the Scheme in the design year (an increase of 3dB or greater) would occur at 39 residential dwellings and significant beneficial changes (a decrease of 3dB or greater) would occur at 111 dwellings. Without the Scheme, 21 dwellings would experience significant adverse changes in the design year but no dwellings would experience significant benefits. Overall the Scheme in the long term provides a net benefit with respect to significant effects due to changes in noise level.

7.1.11 Significant adverse effects are expected where increases of 1dB or greater in road traffic noise levels and where noise levels also exceed SOAEL. This occurs for 141 residential properties in the opening year and 182 residential properties in the design year with the Scheme. No significant adverse effects are expected due to an increase in noise level and exceedance of SOAEL in the design year without the Scheme. This indicates a greater number of individual properties would experience significant adverse effects with the Scheme than without due to increases in noise level above SOAEL. However, whilst individual properties would experience significant adverse effects with the Scheme, overall fewer properties

would experience noise levels greater than SOAEL due to the Scheme compared to without. The Scheme therefore provides an overall net benefit.

7.1.12 Long term night time changes in road traffic noise levels with the Scheme would result in significant beneficial effects at 45 dwelling and significant adverse effects at one dwelling. Without the Scheme long term changes in night time noise levels would result in negligible increases but no beneficial changes. The Scheme therefore provides a benefit in decreasing night-time noise levels.

Noise Important Areas

7.1.13 Under EU requirements for noise mapping undertaken by Department for the Environment, Food and Rural Affairs (Defra) there are four Important Areas (IAs) within the study area. These extend along a significant length of the Scheme extents and would experience both benefits and dis-benefits. In general, noise effects within IAs are similar for both the short and long term with the Scheme and are summarised below.

- IA390: There would be negligible decreases in noise level in the short and long term
- IA400: There would be negligible increases in noise level in the short and long term
- IA10193: A mixture of increases and decrease would occur in the short and long term with an overall negligible benefit due to the Scheme
- IA10194: For the short and long term the western part would be subject to decreases in noise level due to the lowering of the carriageway into underpass. At the east end there will be small increases in noise level due to increased traffic flows.

Vibration

Construction

7.1.14 The prediction of groundborne vibration from construction works indicates there is potential for perceptible levels of vibration at receptors within 5m during vibratory roller activities and 25m during sheet piling activities. Mitigation has been proposed to minimise impacts of vibration. It is expected that these works would be relatively short lived with respect to nearby sensitive receptors and therefore the significance of any potential adverse effects would be reduced.

Operation

7.1.15 No adverse changes in groundborne vibration due to operational road traffic are expected because the carriageway surface would have no significant discontinuities and the Scheme is expected to improve upon the condition of existing carriageway.

7.2 Introduction

7.2.1 The Scheme has the potential to give rise to both temporary and permanent noise and vibration impacts that could affect sensitive receptors adjacent to the Scheme Site and along affected road links. Consequently, these impacts may generate effects, adverse or beneficial, at sensitive receptors.

7.2.2 This chapter identifies the key noise and vibration impacts, describes the study area and key sensitive receptors and assesses the potential effects to inform the scope for mitigation.

7.2.3 The Highways England's Standard, the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7 'Noise and Vibration (Revision 1)' HD 213/11 (2011)[94] (hereafter referred to as HD 213/11), provides guidance on the assessment of noise and vibration associated with road projects and the management of environmental effects.

7.2.4 In accordance with HD 213/11, the requirement for the assessment of noise and vibration associated with a road project is identified where the magnitude of potential noise or vibration impacts are expected to equal or exceed threshold criteria.

7.2.5 As a potential permanent change in magnitude of 1dB $L_{A10,18h}$ in the short term (i.e. on opening) was identified during scoping, this assessment has been undertaken in accordance with the methodology at the Detailed level of assessment as described in HD 213/11.

7.3 Legislative, regulatory and policy background

International / European

7.3.1 The Environmental Noise Directive (END) EU Directive 2002/49/EC[95] provides a common basis for European Member States to prioritise action and develop measures for the control of environmental noise with regards to annoyance and sleep disturbance. Initially, this required the development of Noise Action Plans based on strategic noise maps derived using calculated noise levels from rail, road, air and industrial noise sources. Within the Round 2 stage, the noise maps were used to identify Noise Important Areas (NIAs) as requiring consideration for mitigation.

[94] Highways Agency - Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7 'Noise and Vibration' HD 213/11 (Revision 1) November 2011

[95] Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise 2002. Available online at: http://ec.europa.eu/environment/noise/directive_en.htm

7.3.2 The World Health Organization's (WHO) 'Guidelines for Community Noise'[96] are intended to guide the long term management of community noise to help meet the WHO's core objective of "*the attainment by all peoples of the highest possible levels of health*". They set out various noise guide values for specific activities. These values represent the onset of specific effects such as annoyance or sleep disturbance.

7.3.3 For night time noise, WHO gives an annual average level of 45dB $L_{Aeq,8hours}$ and also recommends that for individual events *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night."* Allowing for a 15dB reduction through an open window gives an external level of 60dB L_{Amax} 10 to15 times per night. However, WHO also states: *"It is estimated that 80 – 90% of the reported cases of sleep disturbance in noisy environments are for reasons other than noise originating outdoors. For example sanitary needs; indoor noises from other occupants; worries; illness; and climate."*

7.3.4 The WHO 'Night Noise Guidelines for Europe' 2009[97] reviewed available evidence of health effects of night time noise across Europe, and derived health-based guideline values. The guidelines recommended an interim target of 55dB $L_{Night,outside}$ to protect the public. This target value is an annual average $L_{Aeq,8hours}$ from 23:00 to 07:00.

National

7.3.5 The government has produced a series of National Policy Statements (NPS), including one on National Road and Rail Networks. The National Policy Statement for National Networks (NN NPS)[98] sets out the government's vision and policy for the future development of nationally significant infrastructure projects on the national road and rail networks in England. The NN NPS provides guidance for promoters of Nationally Significant Infrastructure Projects (NSIP) and also provides the basis for examination by the examining authority and decision making by the Secretary of State (SoS) for Transport.

7.3.6 NN NPS requires that:

- Paragraph 5.193 *"Due regard must be given to the relevant sections of the Noise Policy Statement for England, National Planning Policy Framework and the Government's associated planning guidance on noise"*.

[96] World Health Organization 'Guidelines for Community Noise' 1999. Available online at: http://www.who.int/docstore/peh/noise/guidelines2.html

[97] World Health Organization 'Night Noise Guidelines for Europe' 2009. Available online at: http://www.euro.who.int/__data/assets/pdf_file/0017/43316/E92845.pdf

[98] The National Policy Statement for National Networks 2014. Available online at: https://www.gov.uk/government/publications/national-policy-statement-for-national-networks

Paragraph 5.195 "The Secretary of State should not grant development consent unless satisfied that the proposals will meet, the following aims, within the context of Government policy on sustainable development:

- avoid significant adverse impacts on health and quality of life from noise as a result of the new development;
- mitigate and minimise other adverse impacts on health and quality of life from noise from the new development; and
- contribute to improvements to health and quality life through the effective management and control of noise where possible."

Paragraph 5.200 *"Applicants should consider opportunities to address the noise issues associated with the Important Areas as identified through the noise action planning process".*

Paragraph 5.198 *"Mitigation measures for the project should be proportionate and reasonable and may include one or more of the following:*

- *engineering: containment of noise generated;*
- *materials: use of materials that reduce noise, (for example low noise road surfacing);*
- *lay-out: adequate distance between source and noise-sensitive receptors; incorporating good design to minimise noise transmission through screening by natural or purpose-built barriers;*
- *administration: specifying acceptable noise limits or times of use (e.g., in the case of railway station PA systems)*"

7.3.7 The Environmental Noise (England) Regulations 2006[99] implement European legislation requiring Noise Action Plans to be developed on a five-year rolling programme. Action Plans are required to be developed for the major noise sources and areas for which maps have been produced. The Action Plans seek to manage noise issues and effects including noise reduction if necessary, based on the results obtained through the mapping process. As a result of the process, the 'Noise Action Plan: Roads (Including Major Roads)' [100] was published.

[99] Environmental Noise (England) Regulations 2006. Available online at: http://www.legislation.gov.uk/uksi/2006/2238/contents/made

[100] Noise Action Plan: Roads (Including Major Roads). Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/276237/noise-action-plan-roads-201401.pdf

7.3.8 National Planning Policy Framework (NPPF)[101] came into force in March 2012 and forms the main national planning policy document within England. Paragraph 123 states that: "*Planning policies and decisions should aim to:*

- *Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of a new development*
- *Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions*
- *Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established*
- *Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

7.3.9 The Noise Policy Statement for England (NPSE)[102] was issued by Defra in 2010. Its purpose is to promote *"good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."* The three main aims are to:

- "*Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development*
- *Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development, and*
- *Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."*

7.3.10 The NPSE identifies that *"Unlike many other pollutants, noise pollution depends not just on the physical aspects of the sound itself, but also the human reaction to it"* (paragraph 2.9).

[101] NPPF. Available online at: http://webarchive.nationalarchives.gov.uk/20180608095821/https://www.gov.uk/government/publications/national-planning-policy-framework--2

[102] NPSE. Available online at: https://www.gov.uk/government/publications/noise-policy-statement-for-england

7.3.11 The NPSE introduces the concept of SOAEL as being *"the level above which significant adverse effects on health and quality of life occur"* and states at paragraph 2.21: *"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."*

7.3.12 The NPSE also states at paragraph. 2.24: *"The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL (Lowest Observed Adverse Effect Level) and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur."*

7.3.13 The NPSE provides guidance on setting values to be used to represent the LOAEL and SOAEL:

- LOAEL – this is the level above which adverse effects on health and quality of life can be detected
- SOAEL – this is the level above which significant adverse effects on health and quality of life occur

7.3.14 National Planning Practice Guidance (NPPG)[103] is the web-based 'home of the National Planning Policy Framework for England'. NPPG advises that:

"Local planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider:

- *Whether or not a significant adverse effect is occurring or likely to occur*
- *Whether or not an adverse effect is occurring or likely to occur*
- *Whether or not a good standard of amenity can be achieved*

In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during construction wherever applicable) is, or would be, above or below the significant observed adverse effect level..."

[103] NPPG. Available online at: https://www.gov.uk/government/collections/planning-practice-guidance

7.3.15 Local authorities have statutory controls on noise and vibration. Sections 60 and 61 of the Control of Pollution Act 1974[104] concern impacts relating to construction sites and the Environmental Protection Act 1990[105] places a duty on local authorities to serve abatement notices where noise from premises, vehicles and machinery is judged to constitute a statutory nuisance. Compliance with these controls is required although the requirements fall outside the planning system.

7.3.16 The Noise Insulation Regulations 1975 (amended 1988)[106] were made under Part 2 of the Land Compensation Act 1973 for the obligatory and discretionary provision of noise mitigation measures for dwellings adjacent to new highways.

7.3.17 British Standard BS 5228 '*Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise*' (2009+A1:2014) provides a methodology for calculating noise levels generated by fixed and mobile plant used for a range of typical construction operations. The Standard includes a database of equivalent continuous noise levels (L_{Aeq} dB) at a reference distance of 10m and a simple noise propagation model that can be used to make allowances for source-receiver distances, ground properties, utilisation time etc.

7.3.18 BS 5228 '*Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 2: Vibration*' (2009+A1:2014) provides guidance on the effects of vibration and the likelihood they will cause complaint and cosmetic damage to buildings. It also provides a methodology for the calculation of vibration impacts for a range of construction activities that generate vibration.

Local

7.3.19 Policy 49 of the Hull Local Plan 2016 to 2032[107] concerns Noise Pollution and requires that: *"Development which would site noise sensitive receptors in proximity to noisy uses or areas should demonstrate that there would be an acceptable level of amenity for end users. Where this has not been demonstrated, development will not be allowed."* and *"Development of noisy uses should demonstrate that adverse impacts of noise can be mitigated and that there would be an acceptable impact on the amenity of surrounding land uses, including the Humber Estuary International Site."*

[104] Control of Pollution Act – Part III Noise 1974. Available online at: http://www.legislation.gov.uk/ukpga/1974/40

[105] Environmental Protection Act 1990. Available online at: http://www.legislation.gov.uk/ukpga/1990/43/contents

[106] Noise Insulation Regulations. Available online at: http://www.legislation.gov.uk/uksi/1975/1763/contents/made

[107] Hull Local Plan 2016 to 2032. Available online at: http://www.hull.gov.uk/resident/planning-and-building-control/local-plan

7.3.20 The Noise Action Plan for the Hull Agglomeration[108] was prepared by Defra in 2010. It set out the general approach to managing noise from road traffic and the aims of the Plan.

7.4 Study area

7.4.1 HD 213/11 requires that impacts are assessed where sensitive receptors are identified within the study area. The assessment method considers the impacts at dwellings separately to other sensitive receptors such as hospitals, schools, community facilities, designated areas and public rights of way. Due to the urban nature of the Scheme Site and shielding created by buildings directly adjacent to the Scheme extents, the assessment of temporary noise and vibration impacts during construction is limited to the consideration of impacts on key sensitive receptors that are adjacent to the Scheme. These are generally within 50m of the centre line of the carriageway. Sensitive receptors that are further back from the Scheme may also be exposed to noise impacts from the works. However, baseline noise levels at these properties would be lower owing to less exposure to road traffic noise from the A63. They would also benefit from the screening offered by front line buildings which would reduce impacts from the works. Furthermore, it is anticipated that the application of measures to mitigate the impacts on receptors in front line buildings would also mitigate noise at the more remote receptors.

7.4.2 The study area for the assessment of permanent changes in road traffic noise and vibration during operation is defined within HD 213/11 to include:

- All dwellings within 600m from the carriageway edge of all affected routes within 1km of the Scheme Site. The affected routes are indicated on Volume 2, Figure 7.1 Study area for the assessment of permanent changes in road traffic noise.
- Dwellings within 50m of affected routes beyond 1km of the Scheme Site

7.4.3 The study area, which has been determined using the current design layout for the Scheme and the analysis of forecasted traffic data, includes 6,476 dwellings and 154 non-residential receptors. The study area is shown in Volume 2, Figure 7.1 Study area for the assessment of permanent changes in road traffic noise.

7.5 Approach and methodology

Overview

7.5.1 The main purpose of this chapter is to identify temporary and permanent noise and vibration impacts associated with the Scheme. Part of the assessment process is to identify measures to reduce and eliminate significant adverse effects.

[108] Noise Action Plan. Hull Agglomeration. Environmental Noise (England) Regulations 2006 as amended. DEFRA 2010

7.5.2 HD 213/11 paragraph 3.36 requires that operational impacts in terms of magnitude of change are reported. The following sections set out how magnitude of impact is assigned for the main types of noise and vibration impacts that are expected to arise, including:

- Temporary, short term airborne noise and groundborne vibration impacts due to activities during construction
- Permanent, long term noise and vibration impacts from road traffic after the Scheme opening

7.5.3 In accordance with HD 213/11, this assessment at Detailed level includes consultation with stakeholders and the results of a noise measurement survey conducted specifically to inform this assessment. The latter provides a reference against which an acoustic model of road traffic noise can be compared and used to predict noise levels under the assessment scenarios with and without the implemented Scheme. The noise measurement survey details can be found at Volume 3, Appendix 7.1 survey methodology and results.

7.5.4 An assessment of permanent nuisance impacts due to traffic noise and traffic-induced vibration has also been undertaken. Refer to paragraphs 7.8.73 to 7.8.75.

7.5.5 HD 213/11 references the British Standard (BS) 5228 'Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise and Part 2: Vibration' (2009)[109] for the evaluation of significance of temporary noise and vibration impacts generated by construction activities. Both parts of BS 5228 were revised in 2014[110].

Consultation

7.5.6 The Project Team consulted the Environmental Health department of Hull City Council (HCC) on the proposed approach of the baseline noise survey and assessment methodology in January 2013. Further consultation was conducted during preliminary baseline surveys in October 2013 and prior to renewed baseline noise measurements undertaken in March 2017 and February 2018. Consultation was undertaken again in January 2018.

7.5.7 The following points were agreed:

- HCC was content that the methodology set out in the DMRB HD 213/11 (revision 1) is appropriate for the assessment of noise and vibration associated with the Scheme.

[109] British Standards Institution (2009). British Standard 5228 'Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise and Part 2: Vibration'

[110] British Standards Institution (2009+A1:2014). British Standard 5228 'Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise and Part 2: Vibration'

- The assessment of noise and vibration impacts during the construction period should be undertaken in accordance with BS 5228-1 2009+A1:2014 Parts 1 and BS 5228-2 2009+A1:2014.

- Noise levels during construction are expected to be greater than baseline levels, especially for works carried out during the night time, which would present the risk of potential disturbance. Measures should be considered to minimise this and be implemented in consultation with HCC, providing information on the reason for, nature, timing and duration of any works that need to be undertaken at night.

- Permanent impacts due to groundborne vibration from road traffic can be scoped out of the assessment as the surface of the carriageway would be renewed and be constructed to be free of discontinuities. Section A5.26 of HD 213/11 states *"Significant groundborne vibrations may be generated by irregularities in the road surface. Such vibrations are unlikely to be important when considering disturbance from new roads and an assessment will only be necessary in exceptional circumstances."*

7.5.8 The approach of the baseline noise survey carried out in March 2017 and the selection of monitoring positions was discussed and agreed with HCC.

7.5.9 The opinion of the Planning Inspectorate (PINS) on the Scoping Report (see Section 5.4)[111] included comments with regard to the assessment of Noise and Vibration. These are provided in Volume 3, Appendix 4.1, along with the Project Team's response.

Magnitude of impact

7.5.10 HD 213/11 states that *"in terms of road traffic noise, a methodology has not yet been developed to assign significance according to both the value of a resource and the magnitude of the impact*." However as stated above the NPSE introduces the concept of SOAEL as being *"the level above which significant adverse effects on health and quality of life occur"* (paragraph 2.21). For road traffic noise sources an appropriate value for SOAEL is considered to be 68dB$L_{A10,18hr}$ façade level (equivalent to 63dB$L_{Aeq,16h}$ free field noise level). This is based upon guidance, legislation and values adopted for recent infrastructure schemes.

7.5.11 The magnitude of impact of the Scheme is the change in noise level which would occur at a sensitive receptor due to the development. This is applied within this assessment of the noise and vibration aspects of the Scheme, to be consistent with the methodology of HD 213/11.

7.5.12 Section 7.5.2 identifies the main sources of noise and vibration impacts that could occur in implementing the Scheme. The following sections describe the impacts in

[111] A63 Castle Street Improvements, Hull. Environmental Statement Scoping Report. Highways Agency. 112630/1 Rev 1. March 2013.

more detail and with reference to relevant standards and guidance, assign magnitudes of impact to the various temporary and permanent noise and vibration impacts that are identified.

Methodology for assessment of Construction Phase impacts

Scope of assessment

7.5.13 The scope of the assessment of temporary impacts during the Construction Phase includes:

- Airborne noise due to the use of construction equipment and mobile plant
- Groundborne vibration due to activities such as piling and vibratory compaction.

7.5.14 The construction of the Scheme is expected to generate additional traffic movements for the delivery and movement of materials and the attendance of site personnel.

7.5.15 Construction traffic would generally approach from the west on the A63 as the majority of suppliers and contractors would be from west of the city of Hull. Routes from the east are limited by the coastline and there are no significant urban settlements beyond Hull to the east. It would require an increase in heavy vehicles of 10% to 15% to result in a change in noise level of 1dB $L_{A10,18h}$. This would equate to around an extra 1,500 heavy vehicles per day. As the number of construction vehicles associated with the Scheme would not approach this number, construction vehicle movements are considered insignificant and not considered further in this assessment.

Methodology – Overview

7.5.16 HD 213/11 requires the following in reporting an assessment of temporary impacts within a Detailed level assessment:

- Identify receptors likely to be affected
- Identify activities that generate noise and vibration, their locations and durations
- Evaluate changes in noise and vibration
- Provide a general indication of changes in road traffic due to construction including any proposed diversion routes
- State any limitations and assumptions used to inform the assessment

7.5.17 Parts 1 and 2 of BS 5228-2009+A1:2014 provide a methodology for the prediction and assessment of noise and vibration impacts arising during construction. The application of the standards within this assessment is described below.

Methodology – Construction noise

7.5.18 Annex C of Part 1 of BS 5228 includes a database of equivalent continuous noise levels (L_{Aeq} dB) generated by a range of fixed and mobile plant used for typical construction activities, including a set of data for road construction works. Annex F of the standard describes a methodology that can be used with the database to predict noise impacts from works, taking into account variables such as the proximity of receptors to the works, plant utilisation, the degree of ground absorption and screening attenuation.

7.5.19 The standard does not define strict criteria to determine the significance of effects of noise impacts, although examples of how limits of acceptability have been applied historically and some examples of assessing significance are presented. 'Example Method 1 – The ABC method' (Annex E 'Significance of Noise Effects' Section E.3.2) has been adopted for the assessment of effects at residential receptors, as the approach considers the expected changes in ambient noise levels and better reflects conventional Environmental Impact Assessment (EIA) methodologies compared with the use of fixed / absolute noise limits.

7.5.20 The method is summarised in Table 7.1 below. The method uses threshold noise levels for daytimes, evenings and weekends and night-times which are derived from the baseline L_{Aeq} noise levels at the façade of receptors, rounded to the nearest 5dB(A).

Table 7.1: BS 5228–1:2014 ABC method for the assessment of construction noise impacts at dwellings

Assessment category threshold value	Threshold value L_{Aeq} dB(A)		
	Category A	Category B	Category C
Night time 23:00-07:00 every day	45	50	55
Evenings and weekend 19:00 to 23:00 Monday to Friday 13:00 to 23:00 on Saturdays 07:00 to 23:00 on Sundays	55	60	65
Daytime 07:00 to 19:00 Monday to Friday 07:00 to 13:00 Saturdays	65	70	75
- Category A: threshold values apply where baseline noise levels rounded to the nearest 5 dB are less than these values - Category B: threshold values apply where baseline noise levels rounded to the nearest 5 dB are the same as Category A values - Category C: threshold values apply where baseline noise levels rounded to the nearest 5 dB are higher than Category A values			

7.5.21 Using the above methodology in accordance with BS5228, exceedance of the threshold values is an indication of potential significant adverse effects. However, the duration of the works should also be considered. BS5228-1 does not set specific duration criteria for significance but Annex E.4 does set duration criteria in

the context of eligibility for noise insulation or temporary rehousing. These requirements are adopted here to determine significance so that a significant adverse effect due to construction noise arises when the levels set out in the ABC threshold level are exceeded for a period of 10 days or more of working in any 15 consecutive days or 40 days or more of working in any consecutive 6 months.

Methodology – Groundborne vibration during construction

7.5.22 BS 5228-2 provides comprehensive guidance on the assessment of vibration due to construction activity. The standard considers levels of vibration from construction in terms of Peak Particle Velocity (PPV).

7.5.23 BS 5228-2 indicates magnitudes of vibration corresponding with potential perception and complaint as follows:

- 0.14mm/s – Vibration might just be perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
- 0.3mm/s – Vibration might just be perceptible in residential environments.
- 1mm/s – It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation is given to residents.
- 10 mm/s – Vibration is likely to be intolerable for any more than a very brief exposure to this level.

7.5.24 A minimum of 2 weeks prior notice of the works would be given to the occupiers of affected properties. This would be undertaken as part of the public consultation with additional notice given to specific receptors before works commence. This would be set out within the Construction Environmental Management Plan (CEMP). An outline Environmental Management plan (OEMP) is provided as part of the Development Consent Order (DCO) application, see document reference TR010016/APP/7.3.

7.5.25 BS 5228-2 includes guidance on the levels of vibration that would be necessary to cause structural damage to different types of buildings. It states that low frequency vibration at a PPV of 15mm/s may cause cosmetic damage in un-reinforced or light framed structures e.g. for residential / light commercial use, and 50mm/s in heavy commercial buildings. These values apply to transient vibration which does not induce a resonant response in structures and low-rise buildings. A source of continuous low frequency vibration may induce a vibration response in buildings or structures at their resonant frequencies. The building would then be subject to additional dynamic forces arising from its own motion. Therefore, BS 5228-2 recommends that the values given should be reduced by 50% to take into account for dynamic magnification due to resonances. Applying a reduction of 50% to the lowest values in BS 5228-2 gives:

- 7.5mm/s for residential and light commercial buildings
- 25mm/s for industrial and commercial buildings

7.5.26 The standard also states: *"Important buildings which are difficult to repair might require special consideration on a case-by-case basis. A building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive."*

7.5.27 The German Standard DIN 4150 '*Structural Vibration – Part 3: Effect of Vibration on Structures*'[112] includes guideline values for the evaluation of short term vibration on buildings with regards to potential damage. The values are presented as a function of frequency and apply at the building foundation. The short term levels of vibration in the frequency bands having the most stringent levels are as follows:

- 3mm/s for particularly sensitive buildings
- 5mm/s for residential buildings
- 20mm/s for industrial and commercial buildings

7.5.28 The Association of Noise Consultants (ANC) Guidelines 'Measurement and Assessment of Groundborne Noise and Vibration'113 reviews the various criteria for building damage which concludes: "*To be below damage criteria, vibration in any direction should not exceed 3mm/s PPV for transient vibration and 2.5mm/s (below 2mm/s at 1Hz) for continuous vibration (anywhere in the structure). Higher vibration may not necessarily cause damage.*" These most stringent criteria are obtained from DIN 4150.

7.5.29 With respect to the above discussion it is considered that an appropriate value for the onset of significant adverse effects for occupied receptors would be 1mm/s. The onset of significant adverse effects for non-residential receptors, i.e. the potential for cosmetic damage, is considered to commence at 3mm/s for sensitive / susceptible buildings. For other non-residential receptors, e.g. commercial and industrial buildings, it is considered a continuous PPV of more than 7mm/s would be required to cause cosmetic damage.

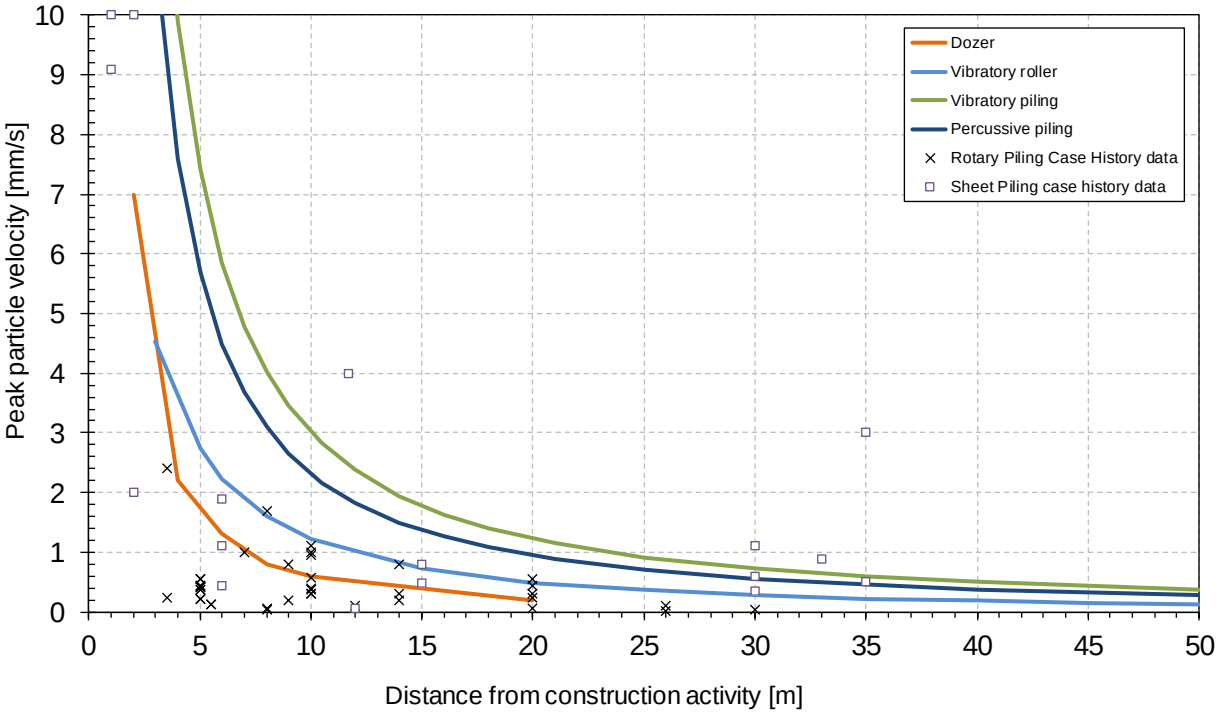
7.5.30 Annex E of BS 5228-2 presents case history data and empirical methods to estimate the levels of vibration generated by a range of construction activities at a given distance from the works. Predicted levels of vibration, expressed as PPV, for activities relevant to the construction of the Scheme are presented in Figure 7.2 below for distances up to 50m.

[112] DIN 4150 'Structural Vibration – Part 3: Effect of Vibration on Structures' 1999

[113] Association of Noise Consultants (ANC) Guidelines 'Measurement and Assessment of Groundborne Noise and Vibration'. 2nd Edition. 2012.

7.5.31 With reference to Figure 7.2 and the criteria for the assessment of magnitude of impact and significance, there is potential for significant adverse effects where dozer and vibratory roller activities that generate vibration are within approximately 5m of sensitive receptors.

Figure 7.2: Predicted levels of vibration from works with a dozer, vibratory compaction and rotary bored piling[114]



7.5.32 For sheet piling works, reference case history values indicate a wide range in vibration magnitude depending on the specific type of piling method and piling requirements (i.e. drop hammer or driven, direction, depth, ground conditions, duration of works). With reference to Figure 7.2 and the criteria for the assessment of magnitude of impact and significance, there is potential for significant adverse effects where sheet piling activities that generate vibration are within approximately 25m of sensitive receptors.

LOAEL and SOAEL summary

7.5.33 On the basis of the above, Table 7.2 summarises LOAEL and SOAEL values that are applied in the assessment of Construction and Operation Phase impacts.

Table 7.2: LOAEL and SOAEL threshold values

Source	Time Period	LOAEL	SOAEL
Construction noise	Daytime	Exceed the existing ambient noise level	Exceed the BS 5228 daytime threshold value

[114] British Standard 5228 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration' 2009+A1:2014 Annex E

Source	Time Period	LOAEL	SOAEL
	Night-time	Exceed the existing ambient noise level	Exceed the BS 5228 night-time threshold value
Construction vibration (disturbance of building occupants)	Daytime or night-time	0.3mm/s	1.0mm/s
Operational noise	Daytime	55dB$L_{A10,18hr}$ façade level (equivalent to 50dB$L_{Aeq,16h}$ free field noise level)	68dB$L_{A10,18hr}$ façade level (equivalent to 63dB$L_{Aeq,16h}$ free field noise level)
	Night-time	40dB $L_{Night,outside}$ (free-field)	55dB $L_{Night,outside}$ (free-field)

Assessment of Operation Phase impacts

Scope of assessment

7.5.34 The scope of the assessment of permanent impacts during the Operation Phase includes:

- Airborne noise due to short and long term changes in road traffic noise within the study area defined by HD 213/11, and in terms of noise change at dwellings and in terms of noise nuisance
- Nuisance due to airborne vibration

Methodology – Road traffic noise assessment

7.5.35 HD 213/11 describes the impacts of road traffic noise in terms of the noise descriptors conventionally used for assessing the impact of road traffic in the UK. The UK traffic noise index $L_{A10,18h}$ dB is a statistical description of the time-varying noise levels from road traffic and is defined as the arithmetic average of the values of hourly L_{A10} dB for each of the 18 one-hour intervals between 06:00 and 24:00. The DMRB assessment of noise impacts due to road traffic are calculated in accordance with the methodology described within the Calculation of Road Traffic Noise (CRTN)[115].

7.5.36 In order to predict the level of road traffic noise from the road network traffic, forecasted parameters have been provided in terms of 18-hour Annual Average Weekday Traffic (AAWT) flow between the hours of 06:00 to 24:00 along with average vehicle speed and the percentage of heavy goods vehicles (HGVs).

7.5.37 Night time road traffic noise levels have been determined using the Method 3 calculation procedure presented by the Transport Research Laboratory (TRL)[116].

[115] Calculation of Road Traffic Noise. Department of Transport and the Welsh Office 1988

[116] Transport Research Laboratory (2002). Converting the UK traffic noise index LA10,18h to EU noise indices for noise mapping. P.G. Abbott and P.M. Nelson. PR/SE/451/02

7.5.38 Calculations of the road traffic noise level have been carried out using CRTN (implemented within three-dimensional acoustic software DataKustik's CadnaA 2018) and forecasted traffic parameters under four scenarios:

- Do Minimum option in the Scheme Opening Year 2025
- Do Minimum option in the future assessment year 2040
- Do Something option in the Scheme Opening Year 2025
- Do Something option in the future assessment year 2040

7.5.39 Traffic parameters under the Do Minimum options take into account the expected traffic growth with committed development and without the Scheme in place. The parameters under Do Something scenarios account for expected traffic growth, committed development and changes attributed to the Scheme.

7.5.40 In accordance with HD 213/11, the assessment of permanent changes in road traffic noise requires that the following comparisons are presented:

- The short term change in road traffic noise upon the proposed Scheme opening (Do Minimum option versus Do Something option both in the baseline year)
- The long term change in road traffic noise assuming the Scheme is implemented (Do Minimum option in the baseline assessment year versus Do Something option in the future assessment year)
- The long term change in road traffic noise assuming the Scheme is not implemented (Do Minimum option in the baseline assessment year (2025) versus Do Minimum option in the future assessment year (2040)

7.5.41 For short term changes in road traffic noise, the smallest change in road traffic noise level that is considered perceptible is 1dB $L_{A10,18h}$. In the long term, a change of 3dB $L_{A10,18h}$ in road traffic noise is considered to the smallest perceptible change. Consequently, different scales are applied for assigning magnitude of impact for short and long term impacts due to changes in road traffic within HD 213/11. These are presented in Table 7.3 below and can be positive or negative.

Table 7.3: Classification of magnitude of short and long term noise impacts due to changes in road traffic noise

Magnitude of impact	Noise change, $L_{A10,18h}$	
	Short term	Long term
No change	0	0
Negligible	0.1 to 0.9	0.1 to 2.9
Minor	1 to 2.9	3 to 4.9
Moderate	3 to 4.9	5 to 9.9

Magnitude of impact	Noise change, $L_{A10,18h}$	
Major	5+	10+

7.5.42 Significant adverse effects are considered to occur where an increase of; 1dB $L_{A10,18h}$ or greater is predicted in the short term, 3dB $L_{A10,18h}$ or greater is predicted in the long term or 1dB $L_{A10,18h}$ or greater is predicted in the long term where noise levels also exceed SOAEL.

Methodology – Noise nuisance

7.5.43 HD 213/11 presents a methodology for the assessment of nuisance caused by road traffic noise. Nuisance is quantified in terms of the percentage of residents bothered by road traffic noise i.e. those bothered 'very much' or 'quite a lot'. HD 213/11 presents a relationship between steady levels of road traffic noise and the percentage of people bothered very much or quite a lot by traffic noise. A relationship is also presented between changes in road traffic noise and the changes in the percentage of people bothered very much or quite a lot by road traffic noise. For a given baseline noise level, the corresponding percentage of population bothered is derived – known as the 'steady state'. For subsequent changes, either the short term, step change in the percentage of people bothered 'very much' or 'quite a lot' is added to derive a total percentage of population bothered, or, for the long term case, the steady-state value is used.

7.5.44 Short term changes in the level of road traffic noise results in a greater increase in number of people bothered 'very much' or 'quite a lot' than the same degree of change in noise in the long term. The worst case (generally the short term effect immediately after opening) should be used for the assessment. Thus, where there are noise increases at Scheme opening, tabulated noise nuisance changes are dominated by the short term change, which can be relatively large as a result of a small increase in noise.

Methodology – Airborne vibration nuisance

7.5.45 HD 213/11 includes a requirement to assess nuisance due to airborne vibration. This type of impact occurs due to low frequency characteristics of road traffic noise particularly from heavy vehicles which can cause vibration in lightweight building elements such as windows and doors. The assessment considers all dwellings within the calculation area that are within 40m from the nearest edge of the affected routes. The same relationships used to calculate noise nuisance level are used to estimated vibration nuisance, except that the numbers of people annoyed by vibration are 10% lower than those annoyed by noise. This is based on the findings of the surveys used to derive the methodology noise nuisance given in HD 213/11.

Noise measurement survey

7.5.46 A noise measurement survey (see Volume 3, Appendix 7.1 Survey methodology and results) has been conducted to assist with the understanding of the existing

noise climate in the area of the Scheme in accordance with HD 213/11 requirements for a Detailed level of assessment. Baseline noise levels are also required in order to determine the appropriate threshold values for receptors within the assessment of construction noise impacts in accordance with BS 5228-1:2009+A1:2014.

7.5.47 The description of the baseline noise climate has been informed by the noise measurement survey. This was conducted during the period between Tuesday 28 February to Monday 6 March 2017. This comprised a combination of:

- Attended short term measurements at six positions which included three consecutive hourly periods in the period 10:00 to 17:00
- Unattended long term measurements at three positions which ran continuously over night-time periods and included three consecutive hourly periods in the period 10:00 to 17:00

7.5.48 Measurement locations were selected to represent the closest affected noise sensitive locations along the length of the Scheme. Long term measurement locations were selected to establish typical or average noise conditions which are considered representative of road traffic noise using the existing A63. Short term measurements were undertaken simultaneously with long term surveys to assist in establishing the variation in noise levels over the Scheme Site extents. Short term measurement locations were selected to represent intermediate locations along the Scheme Site extents at noise sensitive receptor locations. Survey locations are shown in Volume 2, Figure 7.3 Noise monitoring locations.

7.5.49 CRTN includes a shortened measurement procedure based on measurements of $L_{A10,1h}$ dB made over three consecutive hours to represent the UK traffic noise index $L_{A10,18h}$ dB as follows:

$$LA10_{18\,hour} = LA10_{3\,hour} - 1\,dB(A)$$

The three-hour value is defined within CRTN as the arithmetic mean of the three consecutive hourly values of the measured L_{A10} noise level between 10:00 and 17:00.

7.5.50 For this measurement survey, the attended measurements were conducted in three consecutive one-hour intervals. The road traffic noise index $L_{A10,18h}$ can then be estimated from the measurement results at each position. Details of the survey procedure and full sets of survey results are provided in Volume 3, Appendix 7.1 Survey methodology and results. Details of instrumentation used is in Volume 3, Appendix 7.2 Noise survey instrumentation calibration certificates.

7.6 Existing environment

General observations

7.6.1 The dominant source of ambient noise that was observed at survey positions was road traffic using the A63, which varied in nature due to the characteristics of idling, slow moving, braking and accelerating and free-flowing traffic conditions.

7.6.2 Other sources of noise included emergency vehicle sirens, vehicle horns, wind in the trees and pedestrian noise.

7.6.3 Weather conditions over the period of the surveys in late February / early March 2017 began with wet conditions (results discarded) becoming dry, overcast and with minimal wind. Over the remainder of the survey, daytime temperatures varied between 5 and 8°C, winds were generally westerly and up to ~3m/s with dry conditions and variable cloud cover.

Noise action plans

7.6.4 Sections of the A63 within the Scheme Site were identified as containing First Priority Locations within the first round of Noise Action Plans produced by Defra in 2011 in accordance with the European Noise Directive. The purpose of the Noise Action Plan for the Hull Agglomeration[117] was to identify and inform the management of noise issues in the area.

7.6.5 There are four IAs within the study area. These are IA390, IA400, IA10193 and IA10194 identified by Defra Noise mapping. IA390 encompasses a section of Anlaby Road between Saner Street and Convent Lane and is owned by HCC. IA400 encompasses all of the A63 within the study area west of Porter Street and is owned by Highways England. IA10193 primarily encompasses the A165 between Carroll Place and Ganstead Lane and is owned by HCC. IA10194 encompasses most of the section of the A63 Castle Street from Vicar Lane to Cogan Street and is owned by Highways England and HCC. These are shown in Volume 2, Figure 7.4 Important areas identified by Defra noise mapping.

Key receptors

7.6.6 The key sensitive receptors are those which are immediately adjacent to areas where physical works are expected to be undertaken and are described in Table 7.4 below.

7.6.7 For each receptor, the distance to the centre line of the carriageway and the distance to the closest point of the Scheme Site extents are given. For receptor locations identified by street name, the closest affected properties to the Scheme and physical works have been selected as representative for the identified location

[117] Noise Action Plan. Hull Agglomeration. Environmental Noise (England) Regulations 2006 as amended. DEFRA 2010

and distances referenced to these properties. Selected key sensitive receptor locations are shown in Volume 2, Figure 7.5.

Table 7.4: Key Sensitive receptors considered in the assessment of temporary noise and vibration impacts during construction

Receptor	Type	Distance to Scheme centre line (m)	Shortest distance to Scheme (m)	Number of sensitive receptors
Quantock Close, Neville Close, Lovat Close	Residential	25	18	121
The Lodge, Porter Street	Residential	35	30	95
Myton Centre	Office	35	20	7
61 to 71 William Street	Residential	45	20	6
William Street (east end)	Residential	45	20	38
Cogan Street	Residential	35	10	28
William Booth House	Residential	25	3	1
Hessle Road: St Alfred Street to Ropery Street	Commercial	15	5	1
Hessle Road: St James Street to Commerce Lane	Residential	16	6	12
The Whittington and Cat	Hotel and commercial	45	18	2
Warehouse No. 6	Office and commercial	15	2	2
A63 Castle Street: Princes Dock Street to Dagger Lane	Residential	25	5	19
A63 Castle Street: Dagger Lane to Fish Street	Residential	15	4	29
A63 Castle Street: Fish Street to Vicar Lane	Residential	15	5	39
Magistrates' Court	Institutional	35	20	4
Trinity Burial Ground	Recreational	25	0	1
Holiday Inn	Hotel	25	10	1
Marina Court	Commercial	15	6	15

Results of the noise survey

7.6.8 The results of the noise survey in terms of UK traffic noise index ($L_{A10,18h}$) are summarised in Table 7.5 and are presented in full within Volume 3, Appendix 7.1 Survey methodology and results. All results have been corrected where necessary to be presented as façade noise levels. The estimated traffic noise nuisance is also given using the curve for steady state noise that is presented in Figure A6.1 within Annex 6 of HD 213/11.

Table 7.5: Summary of the baseline daytime noise levels (façade) and estimated nuisance levels

Position	$L_{A10,18h}$ dB weekday	Distance (m) to centre of A63	Estimated nuisance level (% bothered very much or quite a lot by traffic noise)
ST1 – 5 / 6 Castle Street	77	15	54%
ST2 – Castle Street / Vicar Lane	77	15	54%
ST4 – Porter Street	75	20	48%
ST5 – Princes Dock	75	15	48%
ST6 – Marina Court	75	15	48%
ST7 – Whittington and Cat	77	65	54%
LT1 – Myton Centre (non-residential)	69	30	31%
LT2 – Holiday Inn	77	15	54%
LT3 – William Street / Cogan Street	72	45	39%

7.6.9 Night time noise levels from the LT1, LT2 and LT3 measurement positions are presented in Table 7.6 below. It should be noted that the value given for $L_{Aeq,8h}$ is based on the levels measured over a number of night-time periods at each location and not an annual average. Traffic conditions during the survey were however considered to be representative of typical weekday conditions.

Table 7.6: Summary of the baseline night time noise levels (façade)

Position	$L_{A10,1h}$ dB 23:00 to 07:00	$L_{Aeq,8h}$ dB 23:00 to 07:00
LT1 – Myton Centre	62 to 72	64
LT2 – Holiday Inn	68 to 79	71
LT3 – William Street / Cogan Street	65 to 74	65

7.6.10 The results of the night-time measurements of $L_{Aeq,8h(23:00-07:00)}$ indicate that the baseline noise levels during the measurement period were significantly above the Night Noise Guideline of 55dB L_{night}. It should be noted that L_{night} as defined by WHO Guidelines are an average across a whole year. Although there will be

nightly variation in $L_{Aeq,8h(23:00-07:00)}$ the degree of exceedance suggests that the L_{night} would at the measurement locations be significantly above 55dB(A).

7.7 Mitigation

Construction

7.7.1 BS 5228 – 2009+A1:2014 states that disturbance due to construction noise impacts can be mitigated by good public relations: "*Good relations with people living and working in the vicinity of site operations are of paramount importance. Early establishment and maintenance of these relations throughout the carrying out of site operations will go some way towards allaying people's fears*."

7.7.2 The effects of potential noise and vibration impacts on affected communities can be mitigated by effective communication between Highways England, contractors and the public. Specific provisions to notify affected residents ahead of noisy works and the arrangements for the investigation and remediation of noise issues that may arise during construction would also be required. Public relations would be managed throughout the Construction Phase. Information on the works would be disseminated to local residences via a letter drop and will include contact details which can be used for queries and in the event of disturbance. A press release providing the Scheme information would also be presented on the Highways England website.

7.7.3 Limits for normal working hours and levels of noise at nearby properties would be agreed in advance with Highways England and HCC and incorporated into the contract specification for the construction of the Scheme. The contract would also include a clause requiring that the best practicable means (BPM) for noise control be applied at all times. These should include the selection of the most appropriate method and plant for the job, adequate maintenance of plant, optimum siting of stationary plant, local screening and the education of the workforce. Restrictions may also be placed on early and late delivery times. Potentially affected residents would be kept informed in advance of the works and contacts details be provided for residents to request further information or to report disturbance.

7.7.4 Incorporated mitigation related to construction noise and vibration would be set out within the CEMP. The implementation of the mitigation would be the responsibility of the contractor and a contractual obligation which would be agreed during construction preparation. The CEMP would identify the series of measures to reduce the environmental effects during the construction period and cover environmental and safety aspects affecting the interests of residents, businesses, all road users and the general public in the vicinity of the works. Specific measures for the mitigation of noise and vibration would be discussed and agreed with HCC and described within the contractor method statements. Noise mitigation measures may include procurement of low noise plant options, time restrictions on certain noisy activities, temporary noise barriers and tool box briefings to operatives on quite working.

7.7.5 Where potentially significant construction noise and vibration effects are predicted, recommendations would be made to minimise the impacts to levels lower than those classed as significant impacts. Amongst others, it is recommended that, where practical, the erection of temporary noise barriers around working areas should be undertaken and that the quietest methods of working are prioritised and selected. Specific measures would be determined in agreement between HCC and the contractor for the works and detailed in the CEMP.

7.7.6 The requirements for the CEMP are currently set out in a the OEMP, see document reference TR010016/APP/7.3 and Section 7.5.4.

7.7.7 Other, more specific forms of construction mitigation are as follows:

- It is proposed that the A63 remain in use throughout the works in order that its capacity is maximised.
- Temporary acoustic barrier fencing to be provided along the northern carriageway edge between the Myton Centre and William Booth House when construction activities are programmed to occur along in this section of the Scheme.
- Monitoring of phases would be conducted in order to verify that noise levels associated with traffic flows during construction do not cause significant adverse effects at noise sensitive receptors.
- Proactive communication with local residents, businesses and road users to address their concerns and opinions on the traffic management (TM) phasing.
- Safe access and egress would be maintained to all businesses and residential properties. Emergency routes to be available throughout the Scheme construction programme of works at all times.
- Every effort would be made to ensure that there are no late removals of the TM after overnight lane closures. The overnight closures required are discussed below.

7.7.8 Night-time road closures would be required to install the main span of the deck of both the proposed footbridges. It is understood that each deck would be delivered and installed on a single night. In each instance the A63 traffic would be diverted via the A1105 Anlaby road and publicised well in advance of the works.

7.7.9 Overnight carriageway closures (traffic running in contraflow on the opposing carriageway to the lifting operation) would be used to enable installation of the ramp sections.

7.7.10 Where best practical means have been applied to mitigate noise from construction works but noise levels would still exceed threshold values for an extended period, it would be appropriate to provided noise insulation measures (e.g. secondary

glazing and alternative ventilation) or temporary re-housing to residents as set out in Annex E.4 of BS 5228 -1:2009+A1:2014. This would be the case where noise levels exceed the threshold for more than 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

Construction traffic

7.7.11 Measures would be set out in the CEMP to control potential noise impacts from site traffic. This may include the following:

- Vehicles should not wait or queue up with engines running on the site or on the public highway
- Manage deliveries to prevent queuing of site traffic at access points and the need for vehicles to reverse
- Use of adjustable or directional audible vehicle-reversing alarms or use of alternative warning systems, e.g. white noise alarms

Operation

Reducing road traffic noise at source

7.7.12 In considering the noise mitigation appropriate to the Scheme the stated aims of the NPSE as set out in Sections 7.3.8 to 7.3.12 have been considered.

7.7.13 Operational noise impacts would be mitigated by the treatment of the new carriageway and slip roads with a thin layer of stone mastic asphalt (thin surface course). This material reduces the generation of tyre noise relative to that for hot-rolled asphalt (HRA). However, it has little effect on sources such as engine / transmission / exhaust noise which are a greater contributor to vehicle noise at low speed. The beneficial effect from a thin surface course increases with traffic speed, due to the increasing influence of tyre noise, but its effectiveness reduces over time and with wear. HD 213/11 advises that for roads with a mean traffic speed of less than 75km/h, a surface correction of -1dB should be applied in the case of a low noise surface. As the upper speed limit is 40mph (64km/h) this correction has been applied within the acoustic model for road traffic noise under the Do Something scenario for all sections of the carriageways that fall within the areas of resurfacing.

Sound insulation

7.7.14 Any dwellings at which the predicted level of road traffic noise is found to satisfy the criteria for sound insulation measures in accordance with the Noise Insulation

Regulations 1975[118] would be offered either sound insulation measures or a grant instead.

7.7.15 Eligible dwellings are required to be shown on a map, or on a list produced by the highway authority, and made available for public inspection no later than six months after the opening of the Scheme[119].

Noise barriers

7.7.16 In urban situations where buildings are often very close to roads and access is often directly onto the road in question it is often difficult or impossible to utilise noise barriers for noise control. Noise barriers can also introduce shading, severance and road user line of sight issues. In the instance of A63 Castle Street noise barriers have been considered but found to be impractical for these reasons. However, the underpass and its retaining walls would act as a screen against traffic noise in the locality.

7.8 Predicted environmental effects

Impacts during construction

Overview of activities

7.8.1 The construction of the Scheme will be broken into eight phases (phase 0 to phase 7) as shown in Table 2.5 of Chapter 2, The Scheme. Noise associated with the Construction Phases has been considered and assessed at the identified receptor locations. The durations of the individual phases are also given in Table 2.5.

7.8.2 Operation of the construction compounds associated with the Scheme would be ongoing during relevant phases of the construction programme and noise sources associated with the compounds has the potential to impact nearby noise sensitive receptors. The proposed compound locations are shown at Volume 2, Figure 2.12 Construction site compound locations. They comprise the following seven sites:

- Arco site (preferred Option A) or Staples site (alternative Option B) - bentonite compound
- Wellington Street Island Wharf (Spencers) - main site offices
- A63 Eastbound Recovery Base (A63 layby eastbound to the north of St Andrews Quay) – vehicle recovery

[118] Noise Insulation Regulations. Statutory Instruments No. 1763. Building and Buildings. HMSO ISBN 0 11 051763 1975. Available online at: http://www.legislation.gov.uk/uksi/1975/1763/introduction/made

[119] Review of propagation modelling results indicate that approximately 216 properties in close proximity to the Scheme would satisfy the criteria for sound insulation in accordance with the Noise Insulation Regulations.

- Livingstone Road (South Humber Properties Ltd) - materials compound
- Land south east of Mytongate Junction - Trinity Burial Ground site compound
- Neptune Street Set Down - Princes Quay Bridge compound, vehicle recovery and traffic management
- A63 Westbound Recovery Base (A63 layby westbound to the west of Garrison Road roundabout) - vehicle recovery

7.8.3 Noise mitigation measures shall be employed to minimise associated noise impact from compound activities and plant items with respect to any nearby properties. Site hoarding around the compounds and compound structures (i.e. office and site cabins, etc.) will provide acoustic screening subject to the specific location of noise sources and nearby receptors. Appropriate compound layout arrangements of plant and machinery will be considered to minimise noise impact from all relevant noise sources.

7.8.4 The programme of work, methods of working and selection of construction equipment is still being determined. These factors influence the characteristics of the noise and vibration impacts. As construction planning is inevitably in an early stage it is necessary to make some assumptions in order to evaluate the potential impacts. The assumptions on construction activities, plant noise emissions and the utilisation of construction plant upon which the assessment is based, are stated in Volume 3, Appendix 7.3 Construction source noise levels. The predicted levels have been compared with threshold levels in order to establish potential significant adverse effects.

Noise during construction – Daytime works

7.8.5 Noise impacts during construction have been assessed for all the key receptors identified in Table 7.4 i.e. those immediately adjacent to the physical works, with reference to significance threshold levels shown at Table 7.1. Where adverse impacts are identified mitigation will be identified in the CEMP. Mitigation is discussed in more detail at Section 7.7.

7.8.6 Table 7.7 presents a summary of the magnitude of impacts due to daytime construction works at a group of residential receptors adjacent to the western end of the Scheme Site. The daytime threshold value of 75dB(A) is appropriate (Category C) based on the results of the baseline measurements made nearby at the end of Porter Street. The impacts given in Table 7.7 relate to the exceedance of the existing ambient L_{Aeq} level. Exceedance of the threshold value is also given and shows the effects on residential receptors with high sensitivity would potentially occur due to activities in Construction Phase 1.

7.8.7 Phase 1 works are programmed to occur for 9 months but the predicted impacts would only occur for a relatively short period of time at the assessed worst case

location with respect to receptors. The works would be at a greater distance for the majority of other times and resultant impacts would be lower.

7.8.8 Mitigation should be implemented by the contractor where practical and appropriate to control noise levels at this receptor to not exceed the threshold value. It is considered that the works would produce significant adverse effects if the works in the vicinity of the receptor which exceed the threshold value extend beyond a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

Table 7.7: Predicted magnitude of noise impact due to daytime construction works at Quantock Close, Neville Close and Lovat Close

Receptor(s)	Activities	Shortest distance to works (m)	Predicted worst case noise level from construction dB L_{Aeq} facade	Magnitude of impact relative to baseline $L_{Aeq,12h}$	Exceedance of daytime threshold 75dB(A)
Quantock Close, Neville Close and Lovat Close	Phase 0	18	74	1	-1
	Phase 1	25	78	5	3
	Phase 2	200	63	-10	-12
	Phase 3	270	60	-13	-15
	Phase 4	280	60	-13	-15
	Phase 5	280	60	-13	-15
	Phase 6	25	68	-5	-7
	Phase 7	18	72	-1	-3

7.8.9 Table 7.8 summarises the assessment of construction impacts at The Lodge, Porter Street for which has a daytime threshold value of 75dB(A) is appropriate (Category C) based on the results of the baseline measurements made at the adjacent position ST4. Exceedance of the threshold value is also given and shows the effects on residential receptors with high sensitivity would potentially occur due to activities in phase 1.

7.8.10 A large number of residential properties at The Lodge would be affected due to noise from phase 1 works. Phase 1 works are programmed to occur for 9 months, however, would only occur for a relatively short period of time at the assessed worst case location with respect to receptors. The works would be at a greater distance for the majority of other times and resultant impacts would be lower.

7.8.11 Mitigation should be implemented by the contractor where practical and appropriate to control noise levels at this receptor to not exceed the threshold value. It is considered that the works would produce significant adverse effects if the works in the vicinity of the receptor which exceed the threshold value extend beyond a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

Table 7.8: Predicted magnitude of noise impact due to daytime construction works at The Lodge, Porter Street

Receptor(s)	Activities	Shortest distance to works (m)	Predicted worst case noise level from construction dB L_{Aeq} facade	Magnitude of impact relative to baseline $L_{Aeq,12h}$	Exceedance of daytime threshold 75dB(A)
The Lodge, Porter Street	Phase 0	30	71	-2	-4
	Phase 1	25	77	4	2
	Phase 2	120	68	-5	-7
	Phase 3	230	61	-12	-14
	Phase 4	230	62	-11	-13
	Phase 5	230	62	-11	-13
	Phase 6	35	65	-8	-10
	Phase 7	30	69	-4	-6

7.8.12 Table 7.9 summarises the assessment of construction noise impacts on the residential building 61-71 William Street. The daytime threshold value of 70dB(A) is appropriate (Category B) based on the results of the baseline measurements made nearby at the Myton Centre. The results show that due to the close proximity of the carriageway, the construction impacts have a potential to exceed threshold values for during all phases except for phase 6.

7.8.13 A relatively small number of residential properties at 61-71 William Street would be potentially affected due to noise from construction activities. Construction works during each phase would only occur for a relatively short period of time at the assessed worst case locations with respect to receptors. The works would be at a greater distance for the majority of other times and resultant impacts would be lower. It is considered that a temporary noise barrier fence (approximately 250m to be located on the northern carriageway edge between the Myton Centre and William Booth House) would be practical and effective to mitigate noise from construction works at this receptor location and nearby properties.

7.8.14 Mitigation should be implemented by the contractor where practical and appropriate to control noise levels at this receptor to not exceed the threshold value. It is considered that the works would produce significant adverse effects if the works in the vicinity of the receptor which exceed the threshold value extend beyond a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

Table 7.9: Predicted magnitude of noise impact due to daytime construction works at 61-71 William Street

Receptor(s)	Activities	Shortest distance to works (m)	Predicted worst case noise level from construction dB L_{Aeq} facade	Magnitude of impact relative to baseline $L_{Aeq,12h}$	Exceedance of daytime threshold 70dB(A)
61-71 William Street	Phase 0	20	71	3	1
	Phase 1	20	80	12	10
	Phase 2	35	78	10	8
	Phase 3	45	75	7	5
	Phase 4	45	76	8	6
	Phase 5	45	76	8	6
	Phase 6	45	63	-5	-7
	Phase 7	20	74	6	4

7.8.15 Table 7.10 summarises the assessment of noise impacts due to daytime construction works at the residential receptors on William Street. The daytime threshold value of 70dB(A) is appropriate (Category B) based on the results of the baseline measurements made nearby at ST3 William Street. The results show that due to the close proximity of the carriageway, the construction impacts have a potential to exceed threshold values for during all phases.

7.8.16 Approximately 38 residential properties at William Street (east end) would be potentially affected due to noise from construction activities. Construction works during each phase would only occur for a relatively short period of time at the assessed worst case locations with respect to receptors. The works would be at a greater distance for the majority of other times and resultant impacts would be lower. It is considered that a temporary noise barrier fence (approximately 250m to be located on the northern carriageway edge between the Myton Centre and William Booth House) would be practical and effective to mitigate noise from construction works at this receptor location and nearby properties.

7.8.17 Mitigation should be implemented by the contractor where practical and appropriate to control noise levels at this receptor to not exceed the threshold value. It is considered that the works would produce significant adverse effects if the works in the vicinity of the receptor which exceed the threshold value extend beyond a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

Table 7.10: Predicted magnitude of noise impact due to daytime construction works at William Street (east end)

Receptor(s)	Activities	Shortest distance to works (m)	Predicted worst case noise level from construction dB L_{Aeq} facade	Magnitude of impact relative to baseline $L_{Aeq,12h}$ dB	Exceedance of daytime threshold 70dB(A)
William Street (east end)	Phase 0	20	71	0	1
	Phase 1	20	80	9	10
	Phase 2	50	72	1	2
	Phase 3	20	82	11	12
	Phase 4	45	76	5	6
	Phase 5	45	76	5	6
	Phase 6	45	76	5	6
	Phase 7	20	74	3	4

7.8.18 Table 7.11 summarises the assessment of noise impacts due to daytime construction works at the residential receptors on Cogan Street. The daytime threshold value of 70dB(A) is appropriate (Category B) based on the results of the baseline measurements made nearby at ST3 William Street. The results show that due to the close proximity of the carriageway, the construction impacts have a potential to exceed threshold values for during all phases.

7.8.19 Approximately 28 residential properties at Cogan Street would be potentially affected due to noise from construction activities. Construction works during each phase would only occur for a relatively short period of time at the assessed worst case locations with respect to receptors. The works would be at a greater distance for the majority of other times and resultant impacts would be lower. It is considered that a temporary noise barrier fence (approximately 250m to be located on the northern carriageway edge between the Myton Centre and William Booth House) would be practical and effective to mitigate noise from construction works at this receptor location and nearby properties.

7.8.20 Mitigation should be implemented by the contractor where practical and appropriate to control noise levels at this receptor to not exceed the threshold value. It is considered that the works would produce significant adverse effects if the works in the vicinity of the receptor which exceed the threshold value extend beyond a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

Table 7.11: Predicted magnitude of noise impact due to daytime construction works at Cogan Street

Receptor(s)	Activities	Shortest distance to works (m)	Predicted worst case noise level from construction dB L_{Aeq} façade	Magnitude of impact relative to baseline $L_{Aeq,12h}$ dB	Exceedance of daytime threshold 70dB(A)
Cogan Street	Phase 0	10	73	2	3
	Phase 1	10	86	15	16
	Phase 2	30	78	7	8
	Phase 3	12	87	16	17
	Phase 4	35	78	7	8
	Phase 5	35	78	7	8
	Phase 6	35	78	7	8
	Phase 7	12	79	8	9

7.8.21 Table 7.12 summarises the assessment of noise impacts due to daytime construction works at the residential receptors within William Booth House. The daytime threshold value of 70dB(A) is appropriate (Category B) based on the results of the baseline measurements made nearby at LT3 William Street. The results show that due to the close proximity of the carriageway, the construction impacts have a potential to exceed threshold values for during all phases.

7.8.22 Construction works during each phase would only occur for a relatively short period of time at the assessed worst case locations with respect to receptors. The works would be at a greater distance for the majority of other times and resultant impacts would be lower. It is considered that a temporary noise barrier fence (approximately 250m to be located on the northern carriageway edge between the Myton Centre and William Booth House) would be practical and effective to mitigate noise from construction works for some receptors at this location. The elevated location of some receptors at William Booth House would however not benefit from an acoustic barrier.

7.8.23 Mitigation should be implemented by the contractor where practical and appropriate to control noise levels at this receptor to not exceed the threshold value. It is considered that the works would produce significant adverse effects if the works in the vicinity of the receptor which exceed the threshold value extend beyond a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

Table 7.12: Predicted magnitude of noise impact due to daytime construction works at William Booth House

Receptor(s)	Activities	Shortest distance to works (m)	Predicted worst case noise level from construction dB L_{Aeq} façade	Magnitude of impact relative to baseline $L_{Aeq,12h}$	Exceedance of daytime threshold 75dB(A)
William Booth House	Phase 0	3	85	14	15
	Phase 1	10	88	17	18
	Phase 2	5	92	21	22
	Phase 3	10	88	17	18
	Phase 4	25	81	10	11
	Phase 5	25	81	10	11
	Phase 6	25	81	10	11
	Phase 7	5	86	15	16

7.8.24 Table 7.13 summarises the assessment of noise impacts due to daytime construction works at the residential receptors on A63 Castle Street between Princes Dock Street and Vicar Lane. The daytime threshold value of 75dB(A) is appropriate (Category C) based on the results of the baseline measurements made nearby at positions ST1 and ST2 on A63 Castle Street. The results show that due to the close proximity of the carriageway, the construction impacts have a potential to exceed threshold values for during all phases except phases 4, 5 and 6.

7.8.25 A relatively large number of residential properties at this location would be potentially affected due to noise from construction activities. Construction works during each phase would only occur for a relatively short period of time at the assessed worst case locations with respect to receptors. The works would be at a greater distance for the majority of other times and resultant impacts would be lower.

7.8.26 Mitigation should be implemented by the contractor where practical and appropriate to control noise levels at this receptor to not exceed the threshold value. It is considered that the works would produce significant adverse effects if the works in the vicinity of the receptor which exceed the threshold value extend beyond a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

Table 7.13 Predicted magnitude of noise impact due to daytime construction works at Castle Street: Princes Dock Street to Vicar Lane

Receptor(s)	Activities	Shortest distance to works (m)	Predicted worst case noise level from construction dB L_{Aeq} facade	Magnitude of impact relative to baseline $L_{Aeq,12h}$	Exceedance of daytime threshold 75dB(A)
	Phase 0	4	90	14	15

Receptor(s)	Activities	Shortest distance to works (m)	Predicted worst case noise level from construction dB L_{Aeq} facade	Magnitude of impact relative to baseline $L_{Aeq,12h}$	Exceedance of daytime threshold 75dB(A)
Castle Street: Princes Dock Street to Vicar Lane	Phase 1	4	94	18	19
	Phase 2	15	82	6	7
	Phase 3	10	86	10	11
	Phase 4	230	58	-18	-17
	Phase 5	15	75	-1	0
	Phase 6	15	72	-4	-3
	Phase 7	4	83	7	8

Construction – Night works

7.8.27 Table 7.14 presents the worst case levels of noise from activities that are expected to be undertaken during the night-time.

Table 7.14: Predicted noise levels from night works

	Calculated noise level from night works L_{Aeq} dB (worst case)		
Receptor	Removal of central reserve	Carriageway works	Construction of footbridges
Quantock Close	78	78	70
Neville Close	78	78	70
Lovat Close	78	78	70
The Lodge, Porter Street	75	75	67
61-71 William Street	73	73	65
William Street (east end)	73	73	65
Cogan Street	75	75	67
William Booth House	78	78	70
Hessle Road: Street Alfred Street to Ropery Street	82	82	75
Hessle Road: St James Street to Commerce Lane	82	82	75
A63 Castle Street: Princes Dock Street to Dagger Lane	78	78	70
A63 Castle Street: Dagger Lane to Fish Street	82	82	75
A63 Castle Street: Fish Street to Vicar Lane	82	82	75
Holiday Inn	78	78	70

7.8.28 The calculated construction noise levels during almost all of the above activities are more than 5dB above the highest night time threshold of 55dB(A) given in

Table 7.1 at all residential receptors and the hotel. These impacts are considered to have the potential to be significant adverse**,** however, represent worst case periods (i.e. where works would be at the closest extents to the relevant receptor).

7.8.29 Works would only be undertaken for a limited number of nights with respect to the scope of the construction works programme and it is therefore considered the significance of noise impact would be lower than indicated above. Mitigation should be implemented by the contractor where practical and appropriate to control noise levels at noise sensitive receptor locations in the vicinity of night time works to not exceed the threshold value. It is considered that works during night time periods would produce significant adverse effects if undertaken in the vicinity of the receptors which exceed the threshold value and extend beyond a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

7.8.30 Where best practical means have been applied to mitigate noise from construction works but noise levels are still expected to exceed threshold values for an extended period, it would be appropriate to provided noise insulation measures (e.g. secondary glazing and alternative ventilation) or temporary re-housing to residents as set out in Annex E.4 of BS 5228 -1:2009+A1:2014. This would be the case where noise levels exceed the threshold for more than 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

Construction – Compounds

7.8.31 The site compounds are listed at Section 7.8.2. Calculations have been undertaken in outline based on expected activities at each compound location. Common activities during operation of the compounds have been assumed for each compound location including delivery and movement of goods and materials (comprising delivery vehicles and all terrain forklift plant). Additional noise sources have been considered for the concrete production and bentonite batching plant at relevant compound locations which comprise mixing and pump plant. Table 7.15 and Table 7.16 present the worst case levels of noise from activities that will be undertaken at site compounds for day and night-time periods respectively.

7.8.32 Receptors have been selected to represent the closest noise sensitive properties at each compound location and are considered representative of other nearby noise sensitive properties.

Table 7.15: Predicted daytime noise levels from construction compounds

	Calculated noise level from construction compound L_{Aeq} dB (worst case)			
Compound Location	**Nearest Receptors**	**Shortest distance to compound (m)**	**Daytime threshold value**	**Exceedance of daytime threshold**
Preferred Option A: Arco (south west of Kingston Retail Park)	The Lodge, Bathurst Street (residential)	65	70	-2
Alternative Option B: Staples (north east of Mytongate roundabout)	Ferry Road (residential)	40	75	-2
Wellington Street Island Wharf	North of Wellington Street Road (residential)	78	65	-7
A63 Eastbound Recovery Base (layby north of St Andrews Quay	Goulton Street (commercial premises)	25	75	-8
Livingstone Road	Ferry Road (residential)	125	75	-21
Land south east of Mytongate Junction: (adjacent to Trinity Burial Ground)	The Whittington and Cat (residential)	15	75	-2
Neptune Street Set Down	Strickland Street (commercial premises)	110	70	-15
A63 Westbound Recovery Base (layby west of Garrison Road roundabout)	The Haven (residential)	45	75	-13

Table 7.16: Predicted night time noise levels from construction compounds

	Calculated noise level from construction compound L_{Aeq} dB (worst case)			
Compound Location	**Nearest Receptors**	**Shortest distance to compound (m)**	**Night-time threshold value**	**Exceedance of night time threshold**
Preferred Option A: Arco (south west of Kingston Retail Park)	The Lodge, Bathurst Street (residential)	65	55	13
Alternative Option B: Staples (north east of Mytongate roundabout)	Ferry Road (residential)	40	55	18
Wellington Street Island Wharf	North of Wellington Street Road (residential)	78	55	3
A63 Eastbound Recovery Base (layby north of St Andrews Quay)	Goulton Street (commercial premises)	25	55	12
Livingstone Road	Ferry Road (residential)	125	55	1

	Calculated noise level from construction compound L_{Aeq} dB (worst case)			
Compound Location	**Nearest Receptors**	**Shortest distance to compound (m)**	**Night-time threshold value**	**Exceedance of night time threshold**
Land south east of Mytongate Junction (adjacent to Trinity Burial Ground)	The Whittington and Cat (residential)	15	55	18
Neptune Street Set Down	Strickland Street (commercial premises)	110	55	0
A63 Westbound Recovery Base (layby west of Garrison Road roundabout)	The Haven (residential)	45	55	7

7.8.33 Calculations indicate that noise impact from construction compounds is unlikely to cause significant disturbance to nearby noise sensitive properties during daytime periods. Impacts have the potential, however, to be significant adverse during periods when night works are ongoing and compounds are in use to support ongoing works. These impacts**,** however, represent worst case periods (i.e. closest relevant receptors). Compound works will only be undertaken for a limited number of nights with respect to the scope of the construction works programme and therefore it is considered the significance of noise impact will be lower than indicated above.

7.8.34 Mitigation should therefore be carefully considered and implemented as appropriate using best practical means to minimise potential disturbance, especially during any night time works. Measures including compound layout, operations and vehicle movements should be considered during detailed design of relevant compounds. Acoustic barriers and enclosures located around significant noise sources of fixed plant items (e.g. pumps, mixers, generators, etc.) would also assist to minimise noise impact particularly during night time works. It is considered that noise from compounds has the potential to produce significant adverse effects if noise levels at receptors exceed the threshold value for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

7.8.35 Where best practical means have been applied to mitigate noise from construction compounds but noise levels would still exceed threshold values for an extended period, it would be appropriate to provided noise insulation measures (e.g. secondary glazing and alternative ventilation) or temporary re-housing to residents as set out in Annex E.4 of BS 5228 -1:2009+A1:2014. This would be the case where noise levels exceed the threshold for more than 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

Vibration during construction

7.8.36 With reference to Figure 7.2 and Sections 7.5.22 to 7.5.32, the impacts due to groundborne vibration from vibratory roller activities are predicted where sensitive receptors are 5m or less from the works and from sheet piling are predicted where sensitive receptors are 25m or less from the works. The results in terms of disturbance to building occupants are summarised in Table 7.17.

Table 7.17: Predicted worst case vibration levels due to construction

Receptor	Activities	Shortest distance to works (m)	Predicted worst case level of vibration PPV (mm/s)	Significance of Effect – disturbance to building occupants
William Booth House	Construction of slip roads, carriageway surfacing	3	5.0	Significant adverse
Hessle Road: St Alfred Street to Ropery Street	Carriageway surfacing	5	3.0	Significant adverse
Warehouse No. 6	Construction of slip roads, carriageway surfacing	3	5.0	Significant adverse
A63 Castle Street: Princes Dock Street. to Dagger Lane	Construction of slip roads, carriageway surfacing	5	3.0	Significant adverse
A63 Castle Street: Dagger Lane to Fish Street	Carriageway surfacing	4	3.5	Significant adverse
A63 Castle Street: Fish Street to Vicar Lane	Carriageway surfacing	5	3.0	Significant adverse
Holiday Inn	Sheet piling	15	1.8	Significant adverse

7.8.37 The assessment shows that on the basis of above worst case assumptions, impacts would be significant adverse at all receptors considered.

7.8.38 The specific locations and extents of proposed sheet piling works are not currently known. Therefore, distances to nearest sensitive properties and type of piling method and equipment may change and affect the magnitude and significance of impacts. It is worth noting that these works would be relatively short-term with respect to nearby sensitive dwellings and therefore the opportunity for associated impacts to occur would also be limited.

7.8.39 Mitigation to reduce the significance of adverse effects of vibration can include prior warning to occupants. Much of the disturbance resulting from vibration arises from the notion that if it can be felt then it is causing damage. This is not the case and thresholds of building damage are considerably higher than those of human

disturbance. Public relations warning of the onset, reason for and duration of vibration along with assurance that the potential for damage is being closely monitored can do much to mitigate the potential disturbance and significance of effect.

7.8.40 Mitigation may also include moderation of activities adjacent to buildings such that vibration levels are kept within prescribed limits. This will be subject to specific location of works and piling requirements. Where this cannot be done, then condition surveys prior to works taking place should be undertaken.

Road diversions and changes in traffic during construction

7.8.41 Road closures are planned during relevant Construction Phases which will affect road traffic flows and associated road traffic noise levels during the Scheme construction. Predicted traffic flow information has been provided relating to the road network within the vicinity of the Scheme with respect to each Construction Phase accounting for road closures, planned diversions and alterations to the road network due to the Scheme design. This peak daytime 18-hour (06:00 – 24:00) AAWT flow data has been reviewed with respect to baseline traffic flow values (i.e. representative prior to construction works). Baseline Noise Levels (BNL) have been calculated based on the traffic flow data during baseline and Construction Phases in accordance with CRTN calculation methodology. A comparative assessment has been undertaken using these calculated noise levels to determine the relative changes in noise level due to changes in traffic flow during the Construction Phases.

7.8.42 Table 7.18 presents results from the analysis. The analysis has excluded all results where changes were found to be less than +1dB. A change of +1dB in the short term is considered just perceptible and therefore not significant. Several road links do not have comparative data where it is understood links are changed or road closures are in place.

Table 7.18: Road traffic noise level changes during diversions and construction

Link ID	Road name	Calculated change in road traffic noise level, dB				
		Phase 1-2 (12 months)	Phase 3 (7 months)	Phase 4-5 (15 months)	Phase 6 (4 months)	Phase 7 (4 months)
3160_3159	A1165	-5.7	+3.4	+3.3	+3.3	+1.8
3159_1205	A165	-2.1	+6.1	+6.0	+6.0	+4.0
1142_8542	A63 Castle Street	+1.5	+0.1	+0.5	+0.5	N/A
1566_8895	A63 Castle Street	+1.3	N/A	N/A	N/A	N/A
1146_1566	A63 Garrison Road	+1.1	N/A	N/A	N/A	N/A

Link ID	Road name	Calculated change in road traffic noise level, dB				
		Phase 1-2 (12 months)	Phase 3 (7 months)	Phase 4-5 (15 months)	Phase 6 (4 months)	Phase 7 (4 months)
4327_1369	A63 Hessle Road	+3.9	+3.2	+3.3	+3.2	+1.3
8535_4327	A63 Hessle Road	+4.3	+3.7	+3.8	+3.8	+1.8
1542_1247	Anlaby Road	-4.8	+3.6	+3.6	+3.6	+3.5
4124_1248	Anlaby Road	-1.5	+3.9	+4.1	+4.0	+0.6
4124_4404	Anlaby Road	-2.9	+2.8	+2.8	+2.8	+2.3
4264_1233	Anlaby Road	-7.4	+0.6	+0.5	+0.5	+7.4
4404_1532	Anlaby Road	-2.9	+3.7	+3.7	+3.7	+3.2
1232_1233	Ferensway	+0.5	+6.1	+5.9	+6.0	+5.7
1233_1232	Ferensway	-5.9	-5.6	-5.8	-5.8	+2.9
4249_1233	Ferensway	-3.2	+2.4	+2.3	+2.2	+1.6
8791_1413	Ferensway	-8.3	+13.5	+13.2	+13.2	+9.3
8536_4003	Mytongate	+11.3	+10.5	+10.6	+10.5	N/A
8867_8536	Mytongate	+7.3	+6.7	+6.7	+6.7	N/A
8869_8870	Mytongate	+6.1	+5.4	+5.4	+5.4	N/A
8870_8538	Mytongate	+8.9	+8.4	+8.4	+8.4	N/A
2568_2557	Rawling Way	+1.1	+1.0	+1.0	+1.0	-1.0
8531_8530	Roundabout Hessle Road / Rawling Way / Daltry Street	+1.4	+0.9	+0.9	+0.9	+1.0
8533_8534	Roundabout Hessle Road / Rawling Way / Daltry Street	+2.7	+2.2	+2.3	+2.3	+1.3

7.8.43 Results in Table 7.18 show that several road links would have large increases in road traffic noise level (in the region of 10-13 dB) during construction works. These links refer to small road sections (circa 30m) which are unlikely to have a significant contribution to overall change in noise level at receptor locations due to their length.

7.8.44 Results indicate that receptors in the vicinity of route diversions would experience increases in noise levels, however, subject to specific locations may also benefit from decreases from road closures or decreases in traffic flow on other affected routes. The greatest increases however are identified around the Mytongate Junction. Where road closures are required for extended periods (i.e. greater than

40 days in any 6-month period) consideration should be given to vary the diversion routes to minimise the duration of potential disturbance in individual areas.

Impacts during operation

Road traffic noise during operation

7.8.45 The DMRB assessment summary tables are presented in Table 7.19 to Table 7.22. The corresponding noise contour plots for these calculations are presented within Volume 2, Figures 7.6 to 7.14.

7.8.46 Predicted levels at the key receptors are shown in Table 7.19. Several key receptors experience a change in noise level which exceeds 1dB in the Opening Year which have the potential to be considered significant adverse.

7.8.47 It is evident that at all of the key receptors, noise levels are above the SOAEL of 68dB $L_{A10,18h}$ (equivalent to 65dB L_{Aeq}). Noise increases of 1dB or greater arising from the Scheme at key receptors in the Opening Year or Design Year would also have the potential to be considered significant adverse.

Table 7.19: Predicted operational road traffic noise levels at key receptors

Receptor name	Do Min opening year	Do Something opening year	Do Min future assessment year	Do Something future assessment year	Opening Year change DS-DM	Long term without DMDY-DMOY	Long term with DSDY-DMDY
	$L_{A10,18h}$ Road freefield dB(A)	$L_{A10,18h}$ Road freefield dB(A)	$L_{A10,18h}$ Road freefield dB(A)	$L_{A10,18h}$ Road freefield dB(A)	dB(A)	dB(A)	dB(A)
Quantock Close	75.5	77.0	75.9	76.9	1.5	0.4	1.0
The Lodge, Porter Street	73.0	74.2	73.4	74.2	1.2	0.4	0.8
Myton Centre	73.4	71.9	73.7	72.3	-1.5	0.3	-1.4
61 - 71 William Street	72.1	68.0	72.5	68.4	-4.1	0.4	-4.1
William Street (east end)	71.9	67.4	72.3	67.7	-4.5	0.4	-4.6
Cogan Street	71.8	67.0	72.2	67.4	-4.8	0.4	-4.8
William Booth House	73.8	71.7	74.1	72.1	-2.1	0.3	-2.0
Hessle Road: St Alfred Street to Ropery Street	78.6	80.2	79.0	80.1	1.6	0.4	1.1
Hessle Road: St James Street to Commerce Lane	78.4	78.7	78.8	78.1	0.3	0.4	-0.7
Arco	72.2	72.3	72.6	72.5	0.1	0.4	-0.1

Receptor name	Do Min opening year	Do Something opening year	Do Min future assessment year	Do Something future assessment year	Opening Year change DS-DM	Long term without DMDY-DMOY	Long term with DSDY-DMDY
	$L_{A10,18h}$ Road freefield dB(A)	$L_{A10,18h}$ Road freefield dB(A)	$L_{A10,18h}$ Road freefield dB(A)	$L_{A10,18h}$ Road freefield dB(A)	dB(A)	dB(A)	dB(A)
Whittington and Cat	70.9	67.3	71.4	67.7	-3.6	0.5	-3.7
Warehouse No. 6	78.0	78.9	78.3	79.3	0.9	0.3	1.0
A63 Castle Street: Princes Dock Street to Dagger Lane	74.7	75.4	74.9	75.9	0.7	0.2	1.0
A63 Castle Street: Dagger Lane to Fish Street	78.3	79.6	78.5	80.0	1.3	0.2	1.5
A63 Castle Street: Fish Street to Vicar Lane	76.4	78.7	76.6	79.2	2.3	0.2	2.6
Magistrates' Court	73.6	76.4	74.0	76.8	2.8	0.4	2.8
Trinity Burial Ground	69.5	69.8	69.8	70.2	0.3	0.3	0.4
Holiday Inn	72.5	74.4	72.7	74.8	1.9	0.2	2.1
Marina Court	76.4	78.9	76.7	79.3	2.5	0.3	2.6

7.8.48 The changes in daytime road traffic noise in the Opening Year are shown in Table 7.20. This demonstrates that, overall, more residential properties would experience an increase in traffic noise (2,744 properties) than would experience a decrease (2,360 properties) in the Opening Year. Decreases are due to a significant portion of the road being in the underpass in the central area and elsewhere parapets and retaining walls which provide some acoustic screening.

7.8.49 The majority of receptors which experience increases in Opening Year noise levels would be below 1dB, which are assessed as negligible and not considered to be significant. However, increases of 1dB or greater in the Opening Year daytime traffic noise level would occur at 693 residential dwellings and 209 other noise sensitive properties. The resulting effects for these properties are assessed as significant adverse.

7.8.50 The majority of receptors which experience decreases in noise level would be below 1dB. Reductions in noise levels of 1dB or more as a result of the Scheme in the Opening Year are expected at 332 residential dwellings and 72 other noise sensitive properties, resulting in significant beneficial changes. 113 of these

residential receptors would experience a moderate beneficial change (decrease of between 3-4.9dB) and 2 would experience a major beneficial change (decrease of 5dB or more). These receptors are mainly in the area of the Mytongate Junction and to the east, and the benefit would be due to the lowering of the main carriageway into the underpass in this location and optimising screening provided by parapet / retaining walls.

7.8.51 It is predicted that in the short term there will be an increase in noise level at; Quantock Close, The Lodge Porter Street, Hessle Road (St Alfred Street to Ropery Street), Hessle Road (St James Street to Commerce Lane), Arco, Warehouse No. 6, A63 Castle St (Princes Dock Street to Dagger Lane), A63 Castle Street (Dagger Lane to Fish Street), A63 Castle Street (Fish Street to Vicar Lane), Magistrates' Court, Trinity Burial Ground, Holiday Inn and Marina Court. It is predicted that all other key receptors would experience a decrease in noise level in the short term.

7.8.52 Where increases occur in the short term, increases at these properties would be negligible except for; Quantock Close, The Lodge Porter Street, Hessle Road, A63 Castle Street: Dagger Lane to Fish Street, A63 Castle Street: Fish Street to Vicar Lane, Magistrates' Court, Holiday Inn, Marina Court, where a minor increase would occur. The resulting effects for these properties are assessed as significant adverse.

Table 7.20: Short term change in daytime road traffic noise levels with the Scheme: Do Something 2025 – Do Minimum 2025

Scheme / Option	A63 Castle Street Improvements, Hull		
Scenario / Comparison:	Short term change in noise levels in the Opening Year Do Something 2025 vs Do Minimum 2025		
		Daytime	
Change in noise level (dB)		Number of dwellings	Number of other sensitive receptors
Increase in noise level, $L_{A10,18h}$	0.1 – 0.9	2,051	358
	1 – 2.9	693	209
	3 – 4.9	0	0
	5+	0	0
Total with increases		**2,744**	**567**
No change	0	436	170
Decrease in noise level, $L_{A10,18h}$	0.1 – 0.9	2,028	454
	1 – 2.9	217	62
	3 – 4.9	113	10
	5+	2	0
Total with decreases		**2,360**	**526**

7.8.53 The long term, changes in road traffic noise without the Scheme are shown in Table 7.21. These changes correspond with expected traffic growth and

committed developments only. Details of the committed development allowed for are set out within the Uncertainty Log for the traffic data upon which the assessment has been based.

7.8.54 Increases in the long term daytime traffic noise levels are expected at 5,462 dwellings and 1,077 non-residential receptors, with decreases at 34 dwellings and 45 non-residential receptors. These long term changes in noise level (positive or negative) are below 3dB. The magnitudes of impact are assessed to be no more than negligible and the resulting effects are assessed as not significant. Long term increases above 3dB are expected at 21 dwellings which are assessed as significant adverse. There are no increases of 1dB or greater for residential receptors which also exceed SOAEL in the long term daytime traffic noise level without the Scheme.

7.8.55 In the long term without the Scheme, increases are found at all key receptors but will not exceed 1dB. Resulting effects at these receptors are not considered significant.

7.8.56 With respect to night time noise, a total of 1,421 residential properties would receive noise levels in excess of the World Health Organization's Interim Target level of 55 dB(A) and would be subject to an increase in noise level. There are no residential properties which would be subject to the World Health Organization's Interim Target level of 55 dB(A) and would be subject to a decrease in noise level.

Table 7.21: Long term change in road traffic noise levels without the Scheme: Do Minimum 2040 – Do Minimum 2025

Scheme / Option	**A63 Castle Street Improvements, Hull**			
Scenario / Comparison:	Long term change in noise levels **without** the Scheme Do Minimum 2040 vs Do Minimum 2025			
		Daytime		Night-time
Change in noise level		Number of dwellings	Number of other sensitive receptors	Number of dwellings
Increase in noise level, $L_{A10,18h}$	0.1 – 2.9	5,462	1,077	1,421
	3 – 4.9	21	0	0
	5 – 9.9	0	0	0
	10+	0	0	0
Total with increases		**5,483**	**1,077**	**1,421**
No change	0	23	141	14
Decrease in noise level, $L_{A10,18h}$	0.1 – 2.9	34	45	0
	3 – 4.9	0	0	0
	5 – 9.9	0	0	0
	10+	0	0	0
Total with decreases		**34**	**45**	**0**

7.8.57 The long term changes in traffic noise with the Scheme implemented are shown in Table 7.22 below. This shows that, overall, more properties would experience an increase in long term daytime traffic noise (4,486 properties) than would experience a decrease (725 properties). This is due to traffic growth over the 15 years.

7.8.58 The majority of properties would only experience changes in noise levels (increase or decrease) below 3dB, of which associated impacts are considered to be negligible. The number of dwellings experiencing an increase in the long term with the Scheme (4,486) is however lower than would experience an increase in the long term in the Do Minimum scenario (5,483). The Scheme therefore has a net benefit.

7.8.59 The greatest increase in noise levels would be between 3.0 to 4.9dB for 39 residential dwellings and 2 other noise sensitive properties, which is assessed as significant adverse. The majority of these receptors are remote from the Scheme extents and adjacent to minor road links away from the Scheme extents where the parameters are close to the limits of the validity of CRTN (low flow, low speed, etc.). This level of impact means that the Scheme would have no significant long term adverse effect.

7.8.60 Increases of 1dB or greater in the long term daytime traffic noise level with the Scheme, which also exceed SOAEL, would occur at 182 residential properties. The resulting effects for these properties are assessed as significant adverse.

7.8.61 There would be a significant beneficial impact for 111 residential and 13 non-residential receptors, where there would be a decrease in noise of between 3.0 and 4.9dB. These occur where the main carriageways have been lowered into the underpass and therefore residences benefit from increased screening.

7.8.62 In the long term with the Scheme, increases are found to occur at the following key receptors; Quantock Close, The Lodge Porter Street, Hessle Road (St Alfred Street to Ropery Street), Warehouse No. 6, A63 Castle St (Princes Dock Street to Dagger Lane), Castle Street (Dagger Lane to Fish Street), Castle Street (Fish Street to Vicar Lane), Hull Magistrates, Trinity Burial Ground, Holiday Inn, Marina Court.

7.8.63 Long term increases at key receptors are all less than 3dB and therefore considered negligible. Long term increases above 1dB for key receptors which exceed SOAEL are however identified at; Quantock Close, Hessle Road (St Alfred Street to Ropery Street), Warehouse No. 6, A63 Castle St (Princes Dock Street to Dagger Lane), Castle Street (Dagger Lane to Fish Street), Castle Street (Fish Street to Vicar Lane), Hull Magistrates, Holiday Inn, Marina Court. Resulting effects at these key receptors are considered as significant adverse.

7.8.64 Long term noise level decreases at residences at 61-71 William Street, William Street (east end), Cogan Street and Whittington and Cat are considered to be significant beneficial (i.e. a decrease of between 3dB and 4.9dB). Elsewhere

where the SOAEL is exceeded and there is a decrease in noise level, these decreases are considered negligible, however they are commensurate with the aims of the NPSE in reducing SOAEL.

7.8.65 With respect to night-time noise, a total of 762 residential properties would receive noise levels in excess of the World Health Organization's Interim Target level of 55 dB(A) and would be subject to an increase in noise level. Of these, 55 would increase from below 55dB(A) to above 55dB(A). Table 7.21 shows that almost all of these increases would be less 3dB and considered negligible. There are 506 residential properties which would be subject to the World Health Organization's Interim Target level of 55 dB(A) and would be subject to a decrease in noise level.

Table 7.22: Long term change in road traffic noise levels with the Scheme: Do Something 2040 – Do Minimum 2025

Scheme / Option		A63 Castle Street Improvements, Hull		
Scenario / Comparison:		Long term change in noise levels **with** the Scheme Do Something 2040 vs Do Minimum 2025		
		Daytime		Night time
Change in noise level		Number of dwellings	Number of other sensitive receptors	Number of dwellings
Increase in noise level, $L_{A10,18h}$	0.1 – 2.9	4,447	848	761
	3 – 4.9	39	2	1
	5 – 9.9	0	0	0
	10+	0	0	0
Total with increases		**4,486**	**850**	**762**
No change	0	329	206	144
Decrease in noise level, $L_{A10,18h}$	0.1 – 2.9	614	194	461
	3 – 4.9	111	13	45
	5 – 9.9	0	0	0
	10+	0	0	0
Total with decreases		**725**	**207**	**506**

Noise Important Areas

7.8.66 It is not possible to assign a single benefit or dis-benefit to NIAs since those within the Scheme extend along a significant length of the Scheme extents and therefore experience both benefits and dis-benefits as outlined in Sections 7.7.29 to 7.7.45.

7.8.67 Changes in noise levels as a result of the Scheme have been analysed with respect to the NIAs.

7.8.68 In general, as a result of the Scheme there would be negligible decreases in noise level due to a reduction in traffic flows at IA390.

7.8.69 In general, as a result of the Scheme there would be negligible increases in noise level due to increased traffic flows at IA400.

7.8.70 The western section of IA10193 would experience a mixture of negligible increases and decreases in noise level. Receptors located on the A165 would generally see small decreases in noise levels and Great Union Street would see small increases. A greater number of receptors on the A165 are included within the Scheme study area and therefore overall negligible benefits are expected in IA10193 due to the Scheme.

7.8.71 Long term noise levels in the western and northern sections of IA10194 (majority of Ferensway and Freetown Way) would be subject to decreases in noise level due to the lowering of the carriageway into underpass. At the east end of IA10194 (southern section of Ferensway and relevant extent of A63) there would be negligible increases in noise level due to increased traffic flows.

7.8.72 Reducing noise levels in NIAs is a KPI of Highways England. Negligible increases at individual receptors within NIAs are expected. In general, the implementation of the Scheme in predicted to result in smaller increases in road traffic noise within the NIAs than in the case that the Scheme is not implemented. The Scheme therefore offers a benefit to receptors in terms of changes in noise level within NIAs in comparison with the impacts in the case that the Scheme is not implemented.

LOAEL and SOAEL

7.8.73 The number of properties which are greater than SOAEL with and without the Scheme are shown in Table 7.23. This demonstrates that, overall, in the long term more properties would experience road traffic noise levels greater than SOAEL regardless of whether the Scheme is implemented. This is a result of increased traffic flows. Fewer properties would however experience noise levels greater than SOAEL with the Scheme compared to without the Scheme. The Scheme therefore provides a net benefit.

7.8.74 The Scheme aims to reduce congestion which in practice would result in an increase in overall traffic speed and traffic flow. The implications of increasing traffic speed and flow consequently increase noise levels. However, in general, design measures including low noise road surfacing and screening from the underpass would assist to offset these impacts.

7.8.75 In total 40 individual residences would change from less than SOAEL to greater than SOAEL in the Opening Year as a result of the Scheme. However, the number of individual residences which would change from greater than SOAEL to less than SOAEL in the Opening Year as a result of the Scheme would be 91. Noise levels would be reduced below the SOAEL threshold criteria for a greater number of individual properties than would experience increases above the threshold. This is in accordance with the first two aims of the NPSE in reducing the number of receptors above SOAEL.

Table 7.23: Long term changes in number of SOAEL properties due to road traffic noise levels

Scheme / Option	A63 Castle Street Improvements, Hull	
	Opening Year	Design Year
No. of properties greater than SOAEL in DM	1,931	2,076
No. of properties greater than SOAEL in DS	1,880	1,941

Non-traffic sources during operation

7.8.76 Noise from fixed plant such as water drainage pumps will be enclosed and is expected to be significantly lower than existing levels of road traffic noise.

Noise nuisance during operation

7.8.77 The assessment of traffic noise nuisance is shown in Table 7.24. This compares the nuisance level expected in the Do Minimum case where there are changes associated with long term gradual changes in traffic noise, with the Do Something case where there would be both a short term change on opening and the long term changes due to traffic growth. This shows that under the Do Minimum case there is a small increase in nuisance at dwellings but at the majority of dwellings the nuisance level is expected to remain the same. Under the Do Something case, a greater number of dwellings are expected to experience increases in nuisance level and to higher nuisance levels. However, the Do Something case also brings about decreases in nuisance level that are not seen under Do Minimum.

7.8.78 It should be noted that the methodology places greater emphasis on short term changes on Scheme opening, than those in the long term. Furthermore, traffic noise levels are already relatively high within the study area, and there is a high rate of change in the annoyance curve at these levels. The assessment is therefore sensitive to the relatively small changes in noise levels due to the changes brought about by implementing a road project.

Table 7.24: Road traffic noise nuisance

Scheme / Option		A63 Castle Street Improvements, Hull	
Scenario / Comparison:		Change nuisance due to road traffic noise	
		Do Minimum	Do Something
Change in noise nuisance level		Number of dwellings	Number of dwellings
Increase in nuisance level	< 10%	1,146	638
	10 < 20%	0	949
	20 < 30%	0	691
	30 < 40%	0	0
	> 40%	0	0
No change	0	3,599	1,938
Decrease in nuisance level	< 10%	0	457
	10 < 20%	0	72
	20 < 30%	0	0

Scheme / Option	A63 Castle Street Improvements, Hull		
	30 < 40%	0	0
	> 40%	0	0

Airborne vibration during operation

7.8.79 Table 7.25 presents the results of the airborne vibration nuisance assessment. This shows that there are 467 dwellings within 40m of affected routes. Under the Do Minimum scenario, all properties are expected to experience either no change or a negligible increase in nuisance due to airborne vibration. Under the Do Something scenario, 315 dwellings would experience an increase in vibration nuisance whereas 38 are expected to benefit from a reduction in nuisance and 3 would experience no change. As in the case of noise nuisance, the implementation of the Scheme creates a short term change that would not be apparent under the Do Minimum scenario and to which the estimation of nuisance is particularly sensitive. The assessment of the Do Minimum case is based on long term changes only which is predicted to result in lower levels of nuisance.

Table 7.25: Airborne vibration nuisance from road traffic at dwellings within 40m of affected routes

Scheme / Option	A63 Castle Street Improvements, Hull		
Scenario / Comparison:	Change nuisance due to airborne vibration from road traffic at dwellings within 40m from affected routes		
		Do Minimum	Do Something
Change in vibration nuisance level		Number of dwellings	Number of dwellings
Increase in nuisance level	< 10%	210	0
	10 < 20%	0	147
	20 < 30%	0	168
	30 < 40%	0	0
	> 40%	0	0
No change	0	201	3
Decrease in nuisance level	< 10%	0	55
	10 < 20%	0	38
	20 < 30%	0	0
	30 < 40%	0	0
	> 40%	0	0

7.9 Conclusion

7.9.1 This assessment has considered the temporary and permanent noise and vibration impacts that are expected to arise due to the proposed A63 Castle Street Improvements Scheme.

Noise

Existing situation – Baseline

7.9.2 Noise measurement surveys have been undertaken to inform the existing baseline noise conditions. Surveys found that road traffic noise is currently a significant feature of the baseline noise climate in the area of receptors adjacent to the section of the A63 covered by the Scheme.

Construction

7.9.3 The assessment has indicated that there is potential for significant adverse effects where construction activities are carried out in close proximity of sensitive receptors adjacent to the works. Construction works along the Scheme extents during each phase which are in proximity to receptor locations would only occur for a relatively short period of time. The works would be at a greater distance for the majority of other times and resultant impacts would be lower. Mitigation measures have been considered and will be implemented where practical to minimise noise impact. These are mainly in the area of the Mytongate Junction, dwellings adjacent to the eastbound carriageway of A63 Castle Street and those adjacent to the westbound carriageway of Hessle Road. The daytime construction works would produce significant adverse effects where the works in the vicinity of receptors which exceed the threshold values extend beyond a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

7.9.4 In the case of night time works, although limited in scope, there is also a risk of temporary disturbance due to works at the closest receptors. Prior notice will be given to affected receptors and mitigation measures will be implemented to minimise noise impacts to avoid disturbance.

Operation

7.9.5 The assessment has indicated that there is potential for significant adverse effects at 141 sensitive receptors due to the operation of the Scheme. The assessment is based on a comparison of predictions of the likely impacts with baseline conditions and / or the predicted conditions under the scenario of the Scheme not being implemented.

7.9.6 At all of the key receptors, predicted noise levels in the opening year without the Scheme are at or above the SOAEL of 68dB$L_{A10,18hr}$ (equivalent to 65dBL_{Aeq}). For key receptors, where increases occur in the short term as a result of the Scheme, increases at these properties would be negligible except for; Quantock Close, The Lodge Porter Street, Hessle Road (St Alfred Street to Ropery Street), A63 Castle Street: Dagger Lane to Fish Street, A63 Castle Street: Fish Street to Vicar Lane, Hull Magistrates, Holiday Inn, Marina Court, where a minor increase would occur. These receptors experience increases of 1dB or greater in the opening year which are assessed as significant adverse effects.

7.9.7 Long term increases with the Scheme at key receptors are all less than 3dB and therefore considered negligible. However, increases above 1dB for key receptors which exceed SOAEL are identified at; Quantock Close, Hessle Road (St Alfred Street to Ropery Street), Warehouse No. 6, A63 Castle St (Princes Dock Street to Dagger Lane), Castle Street (Dagger Lane to Fish Street), Castle Street (Fish Street to Vicar Lane), Hull Magistrates, Holiday Inn, Marina Court. Resulting effects at these key receptors are considered as significant adverse. Long term noise level decreases at residences at 61-71 William Street, William Street (east end) and Cogan Street are considered significant beneficial (i.e. a decrease of 3dB or more), whilst elsewhere where the SOAEL is exceeded and there is a decrease in noise level, these decreases are considered negligible.

7.9.8 In the long term the number of dwellings experiencing an increase with the Scheme (4,486) is lower than would experience and increase in the long term in the Do Minimum scenario (5,483). The Scheme therefore has a net benefit.

7.9.9 Significant adverse effects with the Scheme in the opening year (an increase of 1dB or greater) would occur at 693 residential dwellings and significant beneficial effects in noise levels (a decrease of 1dB or greater) would occur at 332 dwellings.

7.9.10 Significant adverse effects with the Scheme in the design year (an increase of 3dB or greater) would occur at 39 residential dwellings and significant beneficial effects (a decrease of 3dB or greater) would occur at 111 dwellings. Without the Scheme, 21 dwellings would experience significant adverse effects in the design year but no dwellings would experience significant benefits. Overall the Scheme in the long term provides a net benefit with respect to significant effects due to changes in noise level.

7.9.11 Significant adverse effects are expected where increases of 1dB or greater in road traffic noise levels and where noise levels also exceed SOAEL. This occurs for 141 residential properties in the opening year and 182 residential properties in the design year with the Scheme. No significant adverse effects are expected due to an increase in noise level and exceedance of SOAEL in the design year without the Scheme. A greater number of individual properties would experience significant adverse effects with the Scheme than without due to increases in noise level above SOAEL. However, whilst individual properties would experience significant adverse effects with the Scheme, overall fewer properties would experience noise levels greater than SOAEL due to the Scheme compared to without. The Scheme therefore provides an overall net benefit.

7.9.12 Long term night time changes in road traffic noise levels with the Scheme would result in significant beneficial effects at 45 dwelling and significant adverse effects at 1 dwelling. Without the Scheme long term changes in night time noise levels would result in negligible increases but no beneficial decreases. The Scheme therefore provides a benefit in decreasing night-time noise levels.

Noise Important Areas

7.9.13 Under EU requirements for noise mapping undertaken by Defra there are four IAs within the study area. These extend along a significant length of the Scheme extents and would experience both benefits and dis-benefits. In general, noise effects within IAs are similar for both short and long term with the Scheme and are summarised below.

- IA390: There would be negligible decreases in noise level in the short and long term
- IA400: There would be negligible increases in noise level in the short and long term
- IA10193: A mixture of increases and decreases would occur in the short and long term with an overall negligible benefit due to the Scheme
- IA10194: For the short and long term the western part would be subject to decreases in noise level due to the lowering of the carriageway into underpass. At the east end there will be negligible increases in noise level due to increased traffic flows.

Vibration

Construction

7.9.14 The prediction of groundborne vibration from construction works indicates there is potential for perceptible levels of vibration at receptors within 5m during vibratory roller activities and 25m during sheet piling activities. Mitigation has been proposed to minimise impacts of vibration. It is expected that these works would be relatively short lived with respect to nearby sensitive receptors and therefore the significance of any potential adverse effects would be reduced.

Operation

7.9.15 No adverse changes in groundborne vibration due to operational road traffic are expected because the carriageway surface would have no significant discontinuities and the Scheme is expected to improve upon the condition of existing carriageway.

NN NPS and significant effects

7.9.16 The assessment demonstrates that the Scheme meets the aims of NN NPS because:

- The implementation of the Scheme avoids significant adverse impacts on health and quality of life by reducing the total number of sensitive receptors exposed to levels of road traffic noise above SOAEL in the long term below that in the case where the Scheme is not implemented.

- Adverse impacts on health and quality of life from noise during construction will be minimised by controls of working hours and management of activities to limit the duration that receptors adjacent to the Scheme are exposed to noise from activities over the phases of work.

- The implementation of the Scheme contributes to improvements to health and quality of life from noise by reducing the elevation of the road thereby providing screening and reducing the exposure of receptors to road traffic noise in the long-term.

7.9.17 In terms of significance of residual environmental effects, a greater number of individual receptors are assessed as resulting in significant beneficial effects than those resulting in a significant adverse effect with the Scheme when compared to the scenario without the Scheme.

7.9.18 Table 7.26 presents a summary of where the assessment has found potential significant residual effects as a result of the Scheme.

Table 7.26: Summary of significant residual effects

Description of effect	Receptor or group of receptors	Magnitude of impact	Conclusion of significance of effect	Justification of significance conclusion
Operational road traffic noise	Long term: 39 dwellings and 2 other sensitive receptors	Increase of 3dB $L_{A10,18h}$ or greater in the long term	Significant adverse effect but 20 of these receptors would have been subject to such an increase even if the Scheme did not go ahead.	Perceptible permanent increase in road traffic noise
Operational road traffic noise	Long term: 182 dwellings	Increase of 1dB $L_{A10,18h}$ or greater in the long term where noise levels also exceed SOAEL	Fewer properties would experience noise levels greater than SOAEL due to the Scheme compared to without.	Perceptible permanent increase in road traffic noise where the receptor is exposed to levels above SOAEL
Operational road traffic noise	Long term: 111 dwellings and 13 other noise sensitive receptors	Decrease of 3dB $L_{A10,18h}$ or greater in the long term	Significant beneficial effect	Perceptible permanent decrease in road traffic noise

Chapter 8. Cultural heritage

8.1 Executive summary

8.1.1 This chapter outlines the impact and effects of the A63 Castle Street Improvements (the Scheme) on archaeological remains, historic buildings and historic landscapes referred to collectively as Cultural Heritage.

8.1.2 It identifies that during construction of the Scheme there would be a temporary significant adverse effect on the Trinity Burial Ground (MMS144)[120], Statue of King William III and Flanking Lamps (MMS600), Warehouse No. 6 (MMS602), Castle Buildings (MMS603), Princes Dock (MMS673), Humber Dock (MMS761) and the Old Town conservation area (in particular sub-zones A3, B2, B3 and C2).

8.1.3 As a result of the construction of the Scheme there would be a permanent significant adverse effect on the Trinity Burial Ground (MMS144), Castle Buildings (MMS603), and Earl de Grey public house (MMS604).

8.1.4 During operation of the Scheme there would be permanent significant adverse effect on the Trinity Burial Ground (MMS144).

8.2 Introduction

8.2.1 The assessment has considered the impact on all heritage assets from the Scheme, including designated scheduled monuments, listed buildings and conservation areas; and non-designated buried archaeological remains, historic buildings and historic landscapes.

8.2.2 The chapter describes the legislative, regulatory and policy background; the extent of the study area; the approach and methodology of the assessment; the existing environment of the Scheme established through desk-based research and field survey (detailed in Volume 3, Appendices 8.1, 8.2, 8.4, 8.5 and 8.6); the mitigation undertaken prior to and during the Scheme, including archaeological works (method statements for which are contained in Volume 3, Appendices 8.7 and 8.8); and the predicted environmental significant effects (full details of which are tabulated in Volume 3, Appendix 8.3 Impact assessment tables).

8.3 Legislative, regulatory and policy background

8.3.1 Full details of the legislative, regulatory and policy background are contained within Volume 3, Appendix 8.1 Baseline report.

8.3.2 International policy on the protection of cultural heritage is provided by:

[120] For the purpose of assessment each heritage asset has been assigned a unique identifier, or MMS number. A full list of heritage assets is provided in Volume 3, Appendix 8.2 Gazetteer of assets

- The European Convention of the Protection of the Archaeological Heritage (1992)
- UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage (1972)

8.3.3 The overarching legislation in relation to archaeology in England, Wales and Scotland is provided by:

- The Ancient Monuments and Archaeological Areas Act (1979)

8.3.4 Listed buildings and conservation areas in England and Wales are covered by:

- The Planning (Listed buildings and conservation areas) Act 1990

8.3.5 The National Planning Policy Framework (NPPF) provides a framework for the management of the historic environment. It describes policies relating to heritage assets which are buildings, monuments; places, or landscapes identified as having a degree of significance meriting consideration in planning decisions.

8.3.6 The National Policy Statement for National Networks (NN NPS) sets out the Government's vision and approach to development of nationally significant infrastructure projects. NN NPS paragraphs 5.120 to 5.142 provides the framework for the assessment of the historic environment.

8.3.7 Regional planning policy related to heritage is covered by the Saved Joint Structure Plan for Kingston Upon Hull and the East Riding of Yorkshire (Adopted June 2005). Policies ENV6 and ENV7 set out the requirements for heritage.

8.3.8 Local planning policy related to heritage is covered by the Hull Local Plan (adopted November 2017). The following policies refer to heritage:

- Policy 15 Local distinctiveness. This sets out that development should promote local distinctiveness with reference to the setting character and appearance of listed buildings, conservation areas and other heritage assets
- Policy 16 Heritage considerations. Setting out policy where development effects heritage assets.

8.4 Study area

8.4.1 The study area has been tailored for individual sub-topics but is based on the Scheme Site Boundary and has been applied for the identification of all designated and non-designated heritage assets. This has been expanded in accordance with the Scheme to include areas proposed for construction compounds, and areas potentially impacted by wider services and utilities (SU), and streetscape work as part of the Scheme. The size of the study area is considered sufficient to compile a comprehensive baseline, identifying designated and non-designated heritage assets.

8.4.2 The study area for each of the three topic areas has been considered in turn in accordance with Design Manual for Roads and Bridges (DMRB), Environmental Assessment (Volume 11, Section 3, Part 2 (HA208/07) Cultural Heritage 2007, Sections 5.4, 6.4 and 7.4) referred to forthwith as DMRB guidance:

- Assessment of archaeological remains within 200m of the Scheme Site Boundary in accordance with DMRB guidance. This has been further refined to include a detailed assessment of archaeological assets within the Scheme Site Boundary. See Volume 2, Figure 8.1 Overview Map - Sheet extents for Historic Landscape Character Units and events and monuments.

- Assessment of historic buildings within 500m of the Scheme Site Boundary including conservation areas, Grade II listed buildings, locally listed buildings and non-designated historic buildings. Historic buildings of high significance (Grade I and Grade II*) have been identified within 1km of the Scheme Site Boundary to assess for visual impact. See Volume 2, Figure 8.2 - Overview map - Sheet extents for historic buildings. A zone of theoretical visibility (ZTV) has been considered using professional judgement as opposed to a computer-generated model. This is in line with the zone of visual Influence (ZVI) considered in Chapter 9 Landscape.

- Assessment of the historic landscape has been undertaken within 200m of the Scheme Site Boundary. This is an updated version of the study undertaken in 2010 for the Highways Agency Environmental Assessment Report (EAR) that has been updated to take account of new data and expanded to include the increased area of the Scheme as defined above. See Volume 2, Figure 8.1 Overview Map - Sheet extents for Historic Landscape Character Units and events and monuments.

8.4.3 The study area has been divided into 10 zones in order to enable understanding of the individual areas of the Scheme. These reflect both the Scheme and the Historic Environment. These are in Table 8.1: Zones of cultural heritage assessment below and shown in Volume 2, Figures 8.1 and 8.2.

Table 8.1: Zones of cultural heritage assessment

Zone	Name	Scheme details
Zone 1	Old Town, A63 Castle Street	Main Route
Zone 2	The Docks, A63 Castle Street	Main Route
Zone 3	West of Humber Docks, A63 Castle Street	Main Route Staples site Compound Land South East of Mytongate Junction
Zone 4	West of Mytongate Junction, A63 Castle Street	Main Route Myton Centre Development Arco Compound

Zone	Name	Scheme details
Zone 5	Eastern Bank of the River Hull	A63 Westbound Recovery Base
Zone 6	Old Town North	Old Town Accommodation Works Service and Utility Diversions
Zone 7	Old Town South	Old Town Accommodation Works Service and Utility Diversions
Zone 8	West Hull	Service and Utility Diversions Wellington Street Island Wharf (Spencers) Compound Neptune Street Set Down Compound
Zone 9	A63 west of Hull	A63 Eastbound Recovery Base north of St Andrews Quay
Zone 10	Hessle	Livingston Road (South Humber Properties Ltd)

8.5 Approach and methodology

Scope of the assessment

8.5.1 The assessment methodology follows guidance contained within DMRB Volume 11, Section 3, Part 2 (HA208/07) Cultural Heritage. The work encompasses the following sub-topics:

- Archaeological remains
- Historic buildings
- Historic landscapes

8.5.2 The assessment was also undertaken in accordance with the published standards and guidance set out below:

- Historic England - Conservation Principles, Policies and Guidance 2008
- Historic England - Historic Environment Good Practice Advice in Planning note 2 – Managing significance in decision taking in the historic environment (GPA2) 2015a
- Historic England - Historic Environment Good Practice Advice in Planning note 3 – The setting of heritage assets (GPA3) 2017
- Chartered Institute for Archaeologists - Standard and Guidance for historic environment assessment 2014
- Historic England - Understanding Historic Buildings: A guide to good practice 2016

8.5.3 The method for determining and appraising baseline conditions involved desk study, walkover survey and intrusive investigation. Site walkovers were carried out in October and November 2016 to evaluate the heritage significance of heritage assets, identify the setting of the assets and identify any further visible heritage assets. Details of the works undertaken to create the baseline report are contained within Volume 3, Appendix 8.1 Baseline report and Appendix 8.2 Gazetteer of assets.

8.5.4 This has been supported by non-intrusive and intrusive archaeological investigation to determine the extent of the archaeological remains in advance of work. These are presented as Volume 3, Appendix 8.4 Assessment mitigation and deposit modelling, Appendix 8.5 Advance archaeological works report: Site investigation works and the town defences and Appendix 8.6 Advance archaeological works report: Holy Trinity Burial Ground.

8.5.5 This assessment considers all heritage assets, designated and non-designated. These include scheduled monuments, listed buildings, conservation areas, non-designated below-ground archaeological remains, locally listed and non-designated built heritage assets and historic landscapes. There are no world heritage sites, registered parks and gardens, or registered battlefields within the defined study area and therefore no assessment of such resources is required.

8.5.6 This assessment considers both temporary and permanent construction impacts on heritage assets. Temporary construction impacts would be impacts on the setting of assets through construction-related activities. They can be short-term impacts that would not last beyond the construction period, medium-term that would persist beyond the construction period but no more than 15 years and long-term that would persist for more than 15 years but are reversible. Permanent impacts are physical impacts that cannot be reversed, for example the removal of buried archaeological remains, or setting related, for example the introduction of the Scheme into the setting of an asset. All operational impacts are permanent and relate to the use of the road once built and include noise, pollution, vibration and the visual intrusion from the movement of vehicles and impacts of operational lighting. Impacts can be both positive and negative.

8.5.7 The temporal scope of the assessment assumes a baseline with current conditions as of the date of publication of the Environmental Statement (ES).

8.5.8 The methodology for assessing value / sensitivity, magnitude of impact and significance of effects is based on the methodology set out in DMRB but adapted to take into account changes in terminology.

Assessment of value

8.5.9 The value of historic environment receptors (heritage assets) is based on Table 8.2: Criteria for assessing value (heritage significance) below. Assessment of value is based on a combination of designated status and professional judgement based on the published standards and guidance listed above. The level of value

has been assessed on an individual basis, taking into account the particular nature of the heritage asset and the different types of heritage values.

8.5.10 Due to the size and complexity of the Old Town conservation area, assessment of value has been considered for the 19 conservation sub-zones detailed in the conservation area appraisals[121]. The impacts to the conservation area have then been considered as a whole.

Table 8.2: Criteria for assessing value (heritage significance)[122]

Value	Typical criteria
Very High	World heritage sites (including nominated sites). Assets of acknowledged international importance. Assets that can contribute significantly to acknowledged international research objectives.
High	Assets that can contribute significantly to national research objectives. Scheduled monuments, undesignated assets of schedulable quality, Grade I or II* listed buildings, Grade II listed buildings that can be shown to have exceptional qualities, conservation areas containing very important buildings, undesignated structures of clear national importance. Designated or undesignated landscapes of outstanding interest, high quality and importance of demonstrable national value, exhibiting considerable coherence, time-depth or other critical factors.
Medium	Designated or undesignated assets that contribute to regional research objectives. Most Grade II listed buildings, historic buildings of exceptional qualities in their fabric or historical associations, conservation areas containing buildings that contribute significantly to its historic character, historic townscapes or built-up areas with important historic integrity in their buildings or built setting. Designated special historic landscapes, undesignated historic landscapes that would justify special historic landscape designation. Landscapes of regional value, averagely well preserved historic landscapes with reasonable coherence, time-depth or other critical factor(s).
Low	Designated and undesignated assets important to local interest groups, limited by poor preservation or poor contextual association. Assets of limited value but with the potential to contribute to local research agendas. Locally listed buildings, unlisted historic buildings of modest quality in their fabric or historical association, historic townscapes of limited historic integrity in their buildings, or built settings.
Negligible	Assets with little or no surviving archaeological or historical interest,
Unknown	The importance of the resource has not been ascertained. Buildings with some hidden potential for historic significance.

[121] Hull City Council (1999) Old Town (Eastern and Northern part) Conservation Area Character Appraisal; Hull City Council (2004) Old Town (Western and Northern Part) Conservation Area Character Appraisal; Hull City Council (2005) Old Town (Southern Part) Conservation Area Character Appraisal

[122] Based on DMRB Volume 11, Section 3, Part 2 Tables 5.1, 6.1 & 7.1

Assessment of magnitude

8.5.11 The degree of impact to the asset from the introduction of the Scheme would be assessed in accordance with criteria in Table 8.3: Criteria for assessing the magnitude of impact below:

Table 8.3: Criteria for assessing the magnitude of impact[123]

Magnitude	Criteria
Major	Change to most or all key archaeological materials, or historic building elements, such that resource is totally altered. Comprehensive changes to setting. Change to most or all key historic landscape elements, parcels or components; extreme visual impacts; gross change of noise or change to sound quality; fundamental changes to use or access; resulting in total change to historic landscape character unit.
Moderate	Changes to many key archaeological materials, or historic building elements, such that the resource is clearly modified. Considerable changes to setting that affect the character of the asset. Changes to the setting of an historic building, such that it is significantly modified. Changes to many key historic landscape elements, parcels or components; visual change to many key aspects of the historic landscape, noticeable differences in noise or sound quality; considerable changes to use or access; resulting in moderate change to historic landscape character unit.
Minor	Changes to key archaeological materials, or historic building elements, such that the asset is slightly altered. Slight changes to setting. Changes to the setting of an historic building, such that it is noticeably changed. Changes to few key historic landscape elements, parcels or components; slight visual changes to few key aspects of the historic landscape; limited change of noise levels or sound quality; slight changes to use or access; resulting in limited changes to historic landscape character unit.
Negligible	Very minor changes to archaeological materials or setting. Slight changes to historic building elements or setting that hardly affect it. Very minor changes to key historic landscape elements, parcels or components; virtually unchanged visual impacts, very slight changes in noise levels or sound quality; very slight changes to use or access; resulting in a very small change to historic landscape character unit.
No Change	No change to the heritage asset.

Assessment of significance

8.5.12 Effects have been evaluated by combining the assessment of both magnitude of impact and value of the asset to predict the significance of effect, as shown in Table 8.4: Significance of effects below. These effects can be beneficial or adverse and temporary or permanent depending on the nature of the development and the mitigation and any enhancement measures proposed. A significant effect on the heritage asset is considered to be moderate and above.

[123] Based on DMRB Volume 11, Section 3, Part 2 Tables 5.3, 6.3 & 7.3

Table 8.4: Significance of effects[124]

Magnitude of impact	Value (heritage significance) of heritage asset			
	High	Medium	Low	Negligible
Major	Very Large / Large	Large / Moderate	Moderate / Slight	Slight
Moderate	Large / Moderate	Moderate	Slight	Neutral / Slight
Minor	Moderate / Slight	Slight	Neutral / Slight	Neutral / Slight
Negligible	Slight	Neutral / Slight	Neutral / Slight	Neutral
No Change	Neutral	Neutral	Neutral	Neutral

Consultation

8.5.13 In response to the scoping report produced in 2013[125] the Planning Inspectorate produced a Scoping Opinion (see document reference TR010016/APP/6.9). Letters in response to the Scoping Report were included in the Planning Inspectorate Scoping Opinion from Historic England (formerly English Heritage) and Hull City Council (HCC). The issues raised can be summarised as:

- The A63 Castle Street acts as a substantial barrier and creates severance between the north and south areas of the Old Town conservation areas and the Scheme should consider options to improve this situation. Of particular concern, was proposals for the linking of Princes Dock Street with Humber Dock Street, and Market Place with Queen Street.
- Setting should be integrated as a factor to be considered which contributes to the significance of a heritage asset, listed buildings and conservation areas and should be integrated into the assessment of visual impact.
- Grade II listed buildings have been defined as having a 'medium value' in the scoping opinion but it has been advised that the level of value should be assessed on an individual basis, considering the nature of the heritage asset and the different types of heritage values.
- Historic England would not support the dismantling of any Grade II listed building.
- Overall the archaeological assets are considered of high potential. Six buried archaeological assets are of high value, three sections of the town's defences, the remains of Myton Gate, the former course of Mytongate (the street), and the remains of the Augustinian Friary.

[124] Based on DMRB Volume 11, Section 3, Part 2 Table 5.1

[125] Highways Agency (2013) A63 Castle Street Improvements, Hull Environmental Statement Scoping Report

- The value of archaeological assets has the potential to go up or down. Enhanced understanding through further investigative work should form part of the ES.

8.5.14 Regular scheme Cultural Heritage Liaison Group meetings have been held with representatives from Historic England, HCC and Humber Archaeology Partnership from 2013 until the current time.

8.5.15 Continuing discussions regarding Trinity Burial Ground have also taken place with the vicar of Holy Trinity Parish Church Hull, the Parochial Church Council and the York Diocesan Office, as well as with relevant officers of HCC. It is envisaged that these discussions would continue for the duration of the Scheme.

8.5.16 A Statement of Common Ground (SoCG) is being formulated between Highways England and Historic England which covers the approach to excavation of the Trinity Burial Ground.

Limitations and assumptions

8.5.17 The assessment is based on the preliminary designs for the Scheme. Detailed Design may change impacts and would need to be reviewed at different design stages, as stated in Chapter 5, section 5.8.

8.5.18 The walkover surveys were restricted to external visual inspection from publicly accessible areas, which limit the ability to assess the impacts of visual intrusion and interruption of views from within property boundaries or interiors of historic buildings.

8.5.19 Archaeological watching briefs on ground investigation and archaeological trial trenching have been undertaken at available sites on the Scheme. The active nature of the A63 Castle Street has limited the available sites for investigation and results are therefore indicative of potential remains and cannot reflect entirely accurately the actual below ground archaeological remains.

8.5.20 An assumption has been made relating to the probable number of burials contained within Trinity Burial Ground. Estimates based on documentary and archaeological evidence range from 16,000-19,000 and an assumption has been made on approximately 17,000 burials existing in the burial ground[126].

8.5.21 It has been assumed that within the Trinity Burial Ground any temporary land take involved within the proposed scheme has the potential to impact on archaeological remains. The temporary land take will be required for the construction of the retaining wall for the Mytongate underpass. It has been assessed that 43% of the

[126] Based on documentary research and evaluation work undertaken by OAN HFA, contained in Appendix 8.6 and iterated in the Statement of Common Ground with Historic England

archaeological remains within the current boundary of the Trinity Burial Ground may be permanently impacted.

8.5.22 An assumption has been made that after completion of the proposed scheme the area required for the construction of the retaining wall will be returned to amenity use as part of the Trinity Burial Ground. It has been assessed that approximately one third of the above ground remains of the Trinity Burial Ground including elements of the Old Town Conservation Area may be permanently impacted. This is described in more detail in Chapter 9 Landscape and Chapter 10 Ecology and nature Conservation.

8.5.23 Limitations described in Chapter 6 Air quality apply to cultural heritage. Assessment has focused on nitrogen dioxide (NO_2) emissions as opposed to particulate matter (PM10) because background PM10 concentrations and vehicle emission factors for PM10 are low and the Scheme is unlikely to result in an exceedance of the PM10 air quality objectives or limit values (which determines significance).

8.5.24 Limitations and assumptions described in Chapter 7 Noise and vibration also apply to cultural heritage. Impacts on built heritage assets in the proximity to the Scheme are not expected as construction activities will be temporal and transient.

8.5.25 Limitations and assumptions described in Chapter 9 Landscape with relation to the extent of existing tree removal during construction and the extent and standard of lighting required by the Scheme also apply to cultural heritage.

8.5.26 Future groundwater conditions have been modelled for the area around Mytongate underpass (see Chapter 11 Road drainage and the water environment). Beyond the immediate area of the underpass the model shows limited changes to groundwater levels during construction or operation (+/- 0.13m). It is assumed that these limited impacts can be extrapolated beyond the area modelled to establish that the Scheme has limited potential to impact on waterlogged archaeological remains.

8.6 Existing environment

8.6.1 A full description of the archaeological remains, historic buildings and historic landscapes contained within the study area of the Scheme can be found in Volume 3, Appendix 8.1 Baseline report. This contains a detailed description of the key heritage assets and assessment of their value. Key heritage assets have been selected due to their proximity and visibility to the Scheme, their heritage value and group value. Assets have been grouped together where they relate to each other and where the impact is the same.

8.6.2 Each individual archaeological event, heritage asset or group has been attributed an MMS number (e.g. MMS001, MMS002) throughout the report. Conservation areas have been named, and alpha-numeric numbering (e.g. A1, A2 etc…) given consistent with existing conservation area appraisals.

8.6.3 There are two scheduled monuments in the study area; the Blockhouses, Curtain Wall and Citadel of the eastern town defences (MMS493) and the Beverley Gate of the Hull town defences (MMS494).

8.6.4 The A63 passes through the Hull Old Town conservation area. Such is the extent of the conservation area it has been split into three areas (Southern, Western and Northern, and Central and Eastern) and 19 sub-zones during a character appraisal by HCC. In addition, 10 further conservation areas lie within the study area.

8.6.5 Six Grade I, 13 Grade II* and 242 Grade II listed buildings lie within the wider study area. A further 128 locally listed and non-designated historic buildings are within the study area. A single Grade I listed building, located beyond the study area, has been assessed for the impact caused by long distance views of the Scheme.

8.6.6 There are no registered parks and gardens in the study area. There are no world heritage sites or registered battlefields in the study area.

8.6.7 Full details of the heritage assets that have been identified by the Scheme are listed in Volume 3, Appendix 8.2 Gazetteer of assets.

Geology and topography

8.6.8 The underlying bedrock geology of the area is Burnham Chalk Formation, a sedimentary bedrock formed 84 to 94 million years ago during the Cretaceous Period. It was overlain by superficial geology of Tidal Flat Deposits of clay and silt formed up to 2 million years ago during the Quaternary period[127].

8.6.9 Holocene deposition after the last ice age has resulted in superficial peat and alluvial formations throughout the lower reaches of the River Hull and the Humber Estuary. Localised palaeo-channels associated with the shifting course of the River Hull are believed to run across the study area.

8.6.10 Further superficial deposits have formed through historic land reclamation starting in the medieval period after *c.* 1300 AD and increasing during the 19th century. These deposits are particularly prevalent along either side of the River Hull and south towards the Humber Estuary in line with Humber Street and English Street.

8.6.11 The topography of the study area slopes very gently from north to south. The old town to the north of Princes Dock sits on marginally higher ground than the area to the south towards the Humber. The original topographic slope of the land has been reduced in the land south of the A63.

[127] British Geological Survey (2016) Available online at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html

Summary of the archaeological and historic background

8.6.12 A full discussion of the archaeological and historical background of the study area is presented in Volume 3, Appendix 8.1 Baseline report. The timescales used in the ES are based on the DMRB periods list for Cultural Heritage included in Volume 3, Appendix 8.1.

Palaeo-environmental remains (all periods)

8.6.13 There is a medium potential for palaeo-environmental remains potentially dating from the Mesolithic (12,000 – 4,000 BC) until the medieval period (AD 1450) associated with the former course of the River Hull (known as the Auld Hull). The course of the River Hull originally split in two north of the old town. The eastern course is believed to have broadly followed the current existing course of the River Hull. The western course broadly followed the line of Waterhouse Lane and Commercial Road (MMS486) and bisects the proposed route of the Scheme in Zone 3. The remains of the former course have been identified during examination of the ground investigations carried out as part of the Scheme. The results of these investigations are presented as Volume 3, Appendix 8.4 Assessment, mitigation and deposit modelling.

Prehistoric, Romano-British and early medieval

8.6.14 No archaeological sites from the prehistoric, or Romano-British periods have been identified within the study area. There is negligible to low potential for prehistoric and Romano-British period remains in the study area.

8.6.15 No archaeological sites from the early medieval period have been identified within the study area. There is negligible to low potential for early medieval period remains in the study area.

Medieval

8.6.16 Evidence for permanent settlement first occurred in the study area from the medieval period. A series of small settlements existed prior to the formation of the town of Hull, including Myton and Wick in the study area. The site of Myton (MMS400), Myton Grange (MMS401) and an associated burial ground and chapel (MMS402) may also have been in the location of Wick and were probably located in the area of the Mytongate Junction (Zones 3 and 8). Archaeological remains have been uncovered during evaluation in a parcel of land west of the Trinity Burial Ground (MMS544, Zone 3, see Volume 3, Appendix 8.5 Advance archaeological works report: Holy Trinity Burial Ground) that may relate to this settlement.

8.6.17 The town of Hull (Zones 1, 6 and 7) was formally established as a new town in 1293 by Edward I. It has been suggested that the course of the Auld Hull was diverted to run in its current course at this time. The town was surrounded by a ditch and palisade built in AD 1321-1324. This was replaced gradually between

1330 to 1406 by brick town walls, a series of gates and 30 interval towers. Within the study area (Zone 2) these include the site of Myton Gate (MMS128), the site of Postern Gate (MMS221), the scheduled monument of Beverley Gate (MMS494) and two sections of medieval town defences including Humber Dock Street (MMS130) and Princes Dock Street (MMS129).

8.6.18 Continuing east from the Myton Gate, was the street of Mytongate (MMS105, Zone 1). The former line of the street and possible remains of the houses on the southern street frontage, lie beneath the current route of the A63 Castle Street. The northern street frontage is preserved at the eastern end, corresponding with Nos. 65 to 83 Castle Street (discussed below in Historic Buildings, MMS857, MMS858, MMS859, MMS860). At the eastern end of the street was the site of an Augustine Friary (MMS101), which has been almost entirely excavated during previous construction phases. Further potential medieval and post-medieval sites along the street include the Charity Hall (MMS104), the Guildhall (MMS107), the Town Gaol (MMS108), the Butchery Meat Market (MMS109), 85 Queen Street (MMS111) 44 Mytongate, Barber's Shop (MMS135) and the Carmelite Friary on Monkgate (MMS288).

8.6.19 To the north of the study area (Zone 6) lies the core of the medieval town. The oldest surviving building within the study area are the Church of the Holy Trinity (MMS618, discussed in Historic Buildings below). The archaeological remains of a 14th-century boundary wall possibly relating to the churchyard of Holy Trinity were uncovered in 1974 south of the church (MMS027). The streets around the church adopt the medieval street plan and include Dagger Lane, Fish Street, Vicar Lane and Market Place (west to east) and North Church Side, South Church Side, and Posterngate. Located on these streets were the potential sites of several important medieval buildings including Crouched Friary (MMS195), Bishops' Palace, Lowgate (MMS200), Selby's Hospital (MMS213), Gregg's Hospital (MMS219) and Glover Maison Dieu (MMS220).

8.6.20 To the south of the A63 Castle Street (Zone 7) the town defences continued along Humber Dock Street, before turning to the east where the Hessle Gate (MMS286) and the Watergate (MMS291) enclosed the southern side. Inside the pattern of medieval streets continued. Archaeological remains of the medieval town have been identified during evaluation on the site of Blackfriargate (MMS015).

8.6.21 The potential for medieval period archaeological remains is considered medium to high in Zones 1, 2, 6 and 7 of the Old Town. There is low-medium potential for medieval period archaeological remains in Zone 3. In all other zones the potential is considered low for this time period.

Post medieval

8.6.22 The town defences were reinforced in the post medieval period. New ditches were excavated on the western side and the gates were reinforced with further walls known as 'hornwork' (MMS131, Zone 3). Elements of this may survive west of Princes Dock Street and Humber Dock Street. The partial remains of the ditch

were excavated during an archaeological evaluation undertaken as part of the Scheme by Oxford Archaeology North and Humber Field Archaeology (see Volume 3, Appendix 8.4 Assessment, mitigation and deposit modelling).

8.6.23 In the later post-medieval period the town defences were dismantled and the former location of the town ditch was excavated to create a series of docks. These include the Humber Dock (MMS761, built 1809), Princes Dock (MMS673, 1829) and the Railway Dock built (MMS602, 1846). These are discussed in more detail below under historic buildings.

8.6.24 The Trinity Burial Ground was built to accommodate the expanding population of Hull. It was consecrated in 1783 and continued in use until 1861. Documentary research has shown that 18,938 burials were undertaken in this time, and it has been estimated that approximately 17,000 may exist in the burial ground. The burial ground has been subject to evaluation and is discussed in greater detail in Volume 3, Appendix 8.3 Impact assessment tables, Appendix 8.6 Advance archaeological works report: Holy Trinity Burial Ground and Appendix 8.7 Holy Trinity Burial Ground – Project design for main phase clearance of burial remains and archaeological works.

8.6.25 The potential for post-medieval period archaeological remains is considered medium to high in all zones excepting Zones 8 and 9, which lie outside the medieval core of Hull and were not developed until the later 19th century.

Archaeological remains

8.6.26 A total of 435 archaeological assets have been identified in the 200m buffer of the Scheme. Of these 121 are located within the Scheme Site Boundary. These are depicted on Volume 2, Figure 8.3 Archaeological Events and Monuments. The value of these assets is listed fully in the Cultural Heritage baseline in Volume 3, Appendix 8.1 Baseline report and 8.2 Gazetteer of assets. Key assets are summarised below at Table 8.6.

8.6.27 The list of archaeological assets is based on information contained with the Humber Sites and Monuments Record (HSMR), supplemented with information ascertained by deposit modelling, (Volume 3, Appendix 8.4 Assessment, mitigation and deposition modelling), and archaeological evaluation undertaken in advance of the Scheme (Volume 3, Appendix 8.5 Advance archaeological works report: Site investigation works and the town defences and Appendix 8.6 Advance archaeological works report: Holy Trinity Burial Ground).

8.6.28 Table 8.5 below summarises the archaeological potential by zone. The archaeological potential is highest in Zone 1 associated with the medieval and post-medieval town, Zone 2 associated with the former defences and docks, and Zone 3 where the Trinity Burial Ground is located. The main course of the A63 Castle Street Scheme passes through Zones 1, 2, 3 and 4. There is also potential for archaeological remains in Zone 5 associated with the post-medieval defences, and in Zone 6 and 7 associated with the old town.

Table 8.5: Archaeological potential by zone

Zone	Palaeo-environmental (all periods)	Prehistoric / Romano-British	Early medieval	Medieval	Post-medieval
Zone 1	low	low	low	high	high
Zone 2	low	low	low	high	medium
Zone 3	medium	low	low	low-medium	high
Zone 4	low	low	low	low	low
Zone 5	low	low	low	low	high
Zone 6	low	low	low	medium-high	medium-high
Zone 7	low	low	low	medium-high	medium-high
Zone 8	low	low	low	low	low
Zone 9	low	low	low	low	low
Zone 10	low	low	low	low	high

8.6.29 Table 8.6: Key archaeological assets in the Scheme details the key archaeological assets that would be impacted by the Scheme. Full details and assessment of value are provided in Volume 3, Appendix 8.1 Baseline report.

Table 8.6: Key archaeological assets in the Scheme

Zone	MMS No	Name	Value
1	MMS101	Site of Augustine Friary	High
	MMS105	The former course of Mytongate and street frontage	High
	MMS107	Site of Medieval Guildhall	High
	MMS108	Site of Medieval Town Gaol	High
	MMS111	Site of 85 Queen Street	High
2	MMS128	Site of Myton Gate	High
	MMS129	Section of medieval town defences (remains of) Princes Dock Street	High
	MMS130	Section of medieval town defences (remains of) Humber Dock Street	High
3	MMS144	Site of Trinity Burial Ground	High
	MMS486	Course of the Old Hull, River Bank, Streams and Ditches	Medium
	MMS544	Medieval remains equivalent to the site of the medieval settlement of Wyke or Myton, including the site of Myton Grange and Chapel	Medium

Historic buildings

8.6.30 Six Grade I, 13 Grade II* and 242 Grade II listed buildings, and 128 locally listed and non-designated historic buildings lie within the 500m buffer study area of the Scheme. A single Grade I listed building located beyond the study area has been assessed for the impact caused by long distance views of the Scheme. Within the

500m buffer are the Old Town conservation area and a further 10 conservation areas. These are depicted on Volume 2, Figure 8.4 Historic Buildings and conservation areas. Detailed appraisal of the setting and value of the historic buildings and conservation areas is provided in the Cultural Heritage baseline in Volume 3, Appendix 8.1 Baseline report. Key assets are summarised below in Table 8.7: Key sub-zones of the Old Town conservation area impacted by the Scheme and Table 8.8: Zones and key historic buildings impacted by the Scheme.

8.6.31 The list of built heritage assets is based on information contained in National Historic List (NHL) and the HSMR, supplemented by information from field appraisal. These are contained in Volume 3, Appendix 8.1 Baseline report and Appendix 8.2 Gazetteer of assets.

8.6.32 The Scheme intersects the Old Town conservation area which contains 158 listed buildings (about 35% of Hull's total stock of listed buildings). Only the most significant of these buildings or those most likely to be impacted by the Scheme have been individually assessed. Instead an overall value for areas of the town have been established by examining individual sub-zones of the conservation area (as defined in the Conservation Area Appraisals, A1-4, B1-10 and C1-5).

Table 8.7: Key sub-zones of the Old Town conservation area impacted by the Scheme

OTCA sub-zone	HLCU	Name	Zone	Value
A1	HLCU20	Old Town, Central and Eastern, Zone 1, High Street Lanes and Staithes	1, 6	High
A3	HLCU19	Old Town, Central and Eastern, Zone 3, Lowgate / Market Place	1, 6	High
B1	HLCU26	Old Town, Western and Northern Part, Zone 1 Queen Victoria Square	6	High
B2	HLCU14 HLCU17	Old Town, Western and Northern Part, Zone 2, Princes Dock Street	2, 6	Medium
B3	HLCU15	Old Town, Western and Northern Part, Zone 3, Castle Street, Dagger Lane to Vicar Lane	1, 6	Medium
B4	HLCU9	Old Town, Western and Northern Part, Zone 4, Trinity Square, North and South Church Side	6	High
B5	HLCU18	Old Town, Western and Northern Part, Zone 5 Posterngate	6	High
C1	HLCU16	Old Town Southern Part, Zone 1 Trinity Burial Ground,	3, 7	Medium
C2	HLCU10 HLCU11 HLCU12 HLCU13	Old Town Southern Part, Zone 2 Docklands	2, 7	Medium
C3	HLCU24	Old Town Southern Part, Zone 3 Riverfront	7	Medium

OTCA sub-zone	HLCU	Name	Zone	Value
C4	HLCU23	Old Town Southern Part, Zone 4 Fruit Market and 'Forelands'	7	Medium
C5	HLCU21 HLCU22	Old Town Southern Part, Zone 5 Oldgates	1, 7	Medium

Table 8.8: Zones and key historic buildings impacted by the Scheme

Zone	Description	MMS No	Name	Value
1	Old Town conservation area (A1, A3, B3 and C5). It contains a group of two listed buildings located at the southern end of Market Place and a group of six locally listed buildings at the junction of Market Place and the A63 Castle Street and along the northern side of the A63 Castle Street.	MMS600	Statue of King William III and Flanking Lamps	High
		MMS601	Market Place Toilets	Medium
		MMS241	King William Hotel, Market Place	Low
		MMS861	No. 65 Castle Street, Hull Telephone Exchange;	Low
		MMS857, MMS858, MMS859	Nos 74, 75 and 76 Castle Street; No 80 Castle Street;	Low
		MMS860	No 82-83 Castle Street, Burnett House	Low
2	Old Town conservation area (B2 and C2) Defined by the former 18th and 19th century docks and warehouses.	MMS602	Warehouse No. 6	Medium
		MMS673	Princes Dock	Medium
		MMS761	Humber Dock	Medium
3	Old Town conservation area (C1 and C2). Includes the Castle Buildings (MMS603) and the Earl de Grey public house (MMS604) on the A63 Castle Street and the Trinity Burial Ground (MMS144).	MMS603	Castle Buildings	Medium
		MMS604	Earl de Grey public house	Medium
4	Lies outside the conservation area, and is defined by modern estates to the north and a former area of mixed industrial buildings to the south.	MMS605	Vauxhall Tavern public house	Medium
5	Lies east of the River Hull	MMS606 MMS607	Trinity House workshop and Buoy Shed / Tubular Crane to North East of Former Trinity House Buoy Shed	Medium
6	Northern half of the Old Town conservation area (sub-zones A1 to A4, and B1 to B6, see Table 8.7). Contains a large proportion of the historic buildings of the Old Town conservation area including Grade I,	MMS618	Parish Church of the Holy Trinity and Churchyard Wall	High

Zone	Description	MMS No	Name	Value
	Grade II* and Grade II listed buildings and several locally listed and non-designated historic buildings.			
7	Southern half of the Old Town conservation area (sub-zones C1 to C5, see Table 8.7).	MMS764	Warehouse No. 13	Medium
		MMS765	Shipping Line Office, the Former Railway Dock Warehouse	Medium
		MMS767	Railway Dock	Medium
8	West and north of the Old Town includes the Jameson Street and Georgian New Town conservation areas. At the western edge of Hull are four conservation areas: Coltman Street, Hessle Road, Boulevard and Alexander Dock.		*No key buildings in this zone*	
9	*No historic buildings*			
10	*No historic buildings*			

Historic landscapes

8.6.33 A total of 30 historic landscape units have been identified in the 200m buffer of the Scheme. Of these, 16 form part of the Old Town conservation area and a further one part of the Jameson Street conservation area and are considered in historic buildings above. Two further significant areas have been identified. Of these two neither would be physically impacted but both would see an impact to their setting by the Scheme. These are depicted on Volume 2, Figure 8.5 Historic Landscape Characterisation Units. The Historic Landscape Character Units (HLCU) are defined in Volume 3, Appendix 8.1 Baseline report.

8.6.34 They are based on a combination of three sources, the landscape character units defined in the Environmental Assessment Report (EAR), the individual conservation areas and sub-zones defined in the Conservation Area Appraisals (discussed above), and the provisional HLCU provided by Humber Field Archaeology in advance of the final report on historic landscape characterisation undertaken for HCC.

Zones 1, 2, and 3

8.6.35 The historic landscapes in Zones 1, 2 and 3 correspond with the Old Town conservation area and are discussed in detail above (referred to in Table 8.7).

Zone 4

8.6.36 Further to the east in Zone 4, the Historic Landscape Characterisation has identified that the landscape is of generally low value. However, two HLCU have been identified adjacent to the Scheme. These are:

- English Town (HLCU2)
- Australia Houses (HLCU6)

8.6.37 The English Town is an area of former industrial streetscape with some survival of 19th century industrial buildings and street lines. The Australia House flats on William Street is a block of surviving 1930s buildings, with an adjacent public house from the same period on the corner of William Street and Porter Street.

Zones 5, 6, 7, 8, 9, and 10

8.6.38 Zone 5 east of the River Hull has lost much of its historic character and now contains warehouses and new housing estates. Its setting continues to be influenced by the HLCU of the eastern area of the Old Town conservation area, notably the Wharves and River (HLCU20; A2). Zone 6 and 7 contain the remainder of the HLCU associated with the Old Town conservation area (see Table 8.7 above for details). Zone 8 includes a series of conservation areas discussed in Historic Buildings above as well as the remaining areas of English Town (HLCU2) and Australia Houses (HLCU6). Zone 9 and 10 contain no significant HLCUs.

8.7 Potential impacts

8.7.1 The potential impacts of the proposed Scheme on heritage assets were identified during scoping of the Scheme based on the EAR report. These potential impacts are considered below.

8.7.2 Direct and permanent impacts would arise from the extent of site clearance works, depth of excavations for the road sub-base or structures, the position and placement of pedestrian bridge supports, the scope and alignments of drainage and other service works, any statutory undertaker's diversions, and changes in traffic volume noise, vibration or dust / pollution, and any changes to lighting levels and / or landscape enhancement works. Temporary impacts may arise from the location of construction works compounds, traffic diversions and changes in the water table.

8.7.3 Construction has the potential for direct and permanent adverse impacts to archaeological remains. In terms of area, 43% of the archaeological remains in the Trinity Burial Ground would be potentially impacted by the construction of the Mytongate Junction, including temporary land take required for the construction of the retaining wall.

8.7.4 There would be potential impacts caused by the construction of the Scheme to other archaeological remains including the former course of the River Hull and associated palaeo-environmental remains, the medieval settlement of Myton or Wyke, and the archaeological remains of a former the 18th century gaol, former timber yards, saw mills, warehouses and a former brass and copper works. Potential impacts would also occur to the archaeological remains of the Myton

Gate, the town walls and Civil War defences, and archaeological remains dating from the medieval and post-medieval period within the Old Town.

8.7.5 In terms of built heritage there is the potential for direct and permanent adverse impacts would arise from the dismantling of the Grade II listed Earl de Grey public house as part of the Scheme. There would be potential direct impacts to the Grade II listed Humber Dock resulting from dismantling the northern wall to build the Princes Quay Bridge. There would be potential direct and permanent adverse impacts to approximately one third of the Trinity Burial Ground after construction of the Mytongate Junction and the land has been returned to amenity use.

8.7.6 There would be potential impacts to the setting of the Old Town conservation area, and several listed buildings contained within the Old Town conservation area. Of concern would be potential impacts to the setting of the Grade I listed Statue of King William; the Grade II listed Public Toilets, Warehouse No 6, Humber Dock, Princes Dock and Castle Buildings; and non-designated Nos 65, 74, 75, 76, 80 and 82-83 Castle Street. In addition, there would be potential impacts to the setting of the surviving built heritage elements of the Trinity Burial Ground. There would be potential impacts to the setting of other listed buildings outside the Old Town conservation area including three public houses on the A63 Castle Street i.e. the Grade II listed Vauxhall Tavern and Alexander Hotel and the non-designated Cat and Whittington public house.

8.7.7 There would be the potential for indirect impacts caused during and after construction by a reduction in connectivity between the north and south of the Old Town conservation area where existing at-grade crossings over the A63 Castle Street would be removed.

8.7.8 Two HLCU i.e. the English Town and Australia Houses may see potential impacts to their setting.

8.8 Mitigation

8.8.1 DMRB, Volume 11, Section 3, Part 2 states in paragraph 4.33 that "*Mitigation avoids or reduces the potential adverse effects of the scheme"*. This section describes the measures that have been taken (through design to date), or that would be taken, to mitigate the impacts upon archaeological features, the built heritage and historic landscape features.

Construction

8.8.2 Construction would be carried out using industry best practice and in accordance with the Outline Environmental Management Plan (OEMP, TR010016/APP/7.3) to mitigate any temporary adverse effects. Mitigation measures for the historic environment have been incorporated throughout the design and construction stages. These fall into two categories:

- Type 1: controls imposed on construction activities, e.g. through the Code of Construction Practice (CoCP) or OEMP

- Type 2: further mitigation, such as compensatory measures or enhancement measures. This includes retaining aesthetics of the current (historic environment) landscape by reducing the impact on the setting of assets (listed buildings etc) and incorporating landscaping features and design features at the detailed design stage.

8.8.3 In paragraph 4.35 of DMRB it states 'mitigation measures should be identified on a case-by-case basis, and can include, for instance: avoidance, burial or excavation in the case of archaeological remains; relocation, photography or measured surveys in the case of historic buildings; and information panels, or landscaping works in the case of impacts on historic landscapes'. Professional judgement has been used to assess the degree to which archaeological investigation and recording would reduce the impact the Scheme has on individual heritage assets.

Archaeology

8.8.4 Pre-construction archaeological investigation would be undertaken where complexity, extent of remains, programme-critical construction issues, or ability to access the site precludes investigation during work. This would include a combination of detailed excavation and recording of sites for which no more appropriate mitigation can be proposed.

8.8.5 The following archaeological investigations have been undertaken or would be undertaken in advance of work and have been agreed on consultation with Historic England and HCC:

- Watching brief on ground investigation and modelling (route-wide, completed, see Volume 3, Appendix 8.4)

- Humber Dock Street excavation (southern defence trench – off line work, completed, see Volume 3, Appendix 8.5)

- Princes Dock Street excavation (northern defence trench – off line work, proposed)

- Trinity Burial Ground excavation (addressed by Scheme Design, see Volume 3, Appendix 8.7 Holy Trinity Burial Ground, Method Statement for Exhumation and Archaeological Removal of Burials)

- Archaeological excavation proposed in the land plots west and east of the Trinity Burial Ground

8.8.6 The following archaeological investigation and recording might need to be undertaken during work and have been agreed on consultation with Historic England and HCC:

- Princes Quay Pedestrian, Cycle and Disabled User Bridge watching brief (addressed by Scheme Design, see Volume 3, Appendix 8.8 Princes Quay Footbridge, Interim Project Design for Site Clearance Archaeological Works)
- Archaeological watching brief on the A63 carriageway from Princes Quay / Humber Quay to the eastern end of the Scheme at Myton Bridge
- Archaeological watching brief on Humber Dock Street works
- Archaeological watching brief on Old Town Accommodation Works including Princes Dock Street
- Archaeological watching brief on service and utility diversions and Yorkshire Water Sewer Diversion

8.8.7 Archaeological investigation would not be undertaken in the following areas as the method of construction is not conducive to successful recording:

- The Mytongate reconfiguration and underpass excavation. The approved method involves grout injection of soil to enable excavation to depth.

8.8.8 A Scheme design would be produced for all archaeological investigations conducted in advance of work or under a watching brief during work. This would include details of post-excavation analysis, appropriate dissemination of the results and archive deposition.

Historic buildings

8.8.9 The following mitigation has been undertaken to compensate the impacts to built heritage assets which includes historic buildings and conservation areas:

- The Princes Quay pedestrian, cycle and disabled user bridge (referred to as Princes Quay Bridge) has been designed to complement the historic relationship between the Princes Dock, Humber Dock and Warehouse No. 6. The footway has been diverted to the north of Warehouse No. 6 as part of this work, creating accentuated views of the dockside. The Princes Quay Bridge should create a positive townscape feature within the Old Town conservation area.
- Landscaping of the Old Town including new lighting, high quality landscaping and appropriate use of tree-planting to replace tree loss as described in Chapter 9 Landscape.
- The Trinity Burial Ground would see positive landscape enhancement to the surviving built heritage, and the movement of the gates and pillars from the Holy Trinity Church to the new landscaped space. This should create a positive landscape space from the surviving elements of the Trinity Burial Ground within the Old Town conservation area.

- Connectivity between the north and south of the Old Town conservation area: consideration has been given to improved connections where existing connections are removed. The construction of the Porter Street pedestrian, cycle and disabled user bridge (referred to as Porter Street Bridge), the Mytongate overbridge, the Princes Quay Bridge and improvements to the underpass beneath Myton Bridge adjacent to High Street, would replace a series of at-grade crossings which respond slowly and change infrequently due to traffic volume. This responds to concerns raised by Historic England in response to the scoping opinion which highlighted that the A63 Castle Street acts as a substantial barrier and creates severance between the north and south areas of the Old Town conservation areas.

- The Earl de Grey public house would be dismantled as part of the Scheme. The buildings would be archaeologically recorded prior to and during the dismantling process in line with Historic England guidance. The southern façade would be dismantled but the future use of the dismantled building elements has not been finalised at this stage of the Scheme. No additional mitigation has been proposed.

Historic landscape

8.8.10 Mitigation associated with the conservation areas are considered above. The following mitigation would improve specific Historic Landscape Character Units (HLCU).

- The construction of the Porter Street Bridge may improve connectivity between the area north of the A63 Castle Street and the English Street HLCU.

- The area south west of the Australia House HLCU contains poor quality low-rise modern building stock. Replanting of the Millennium Garden, the stopping-off of Cogan Street and the creation of area of public realm could provide screening from the visual impact of the road for heritage assets and improve the setting of the Australia House HLCU.

8.9 Predicted environmental effects

8.9.1 This section identifies typical and specific impacts from the construction and operation of the road, taking mitigation measures into account and their effect on heritage assets. As detailed in DMRB 11 Annex 5, Table 5.2, impacts are generally considered as either construction impacts (to include ground investigation and site clearance), or operation impacts.

8.9.2 The archaeological resource may be affected by both:

- negative impacts caused by the removal of archaeological levels, sensitive deposits or the alteration of stable ground conditions which may lead to degradation of the quality and survival of buried archaeological remains.

- positive impacts caused by the cessation of erosion or damage that would continue without the Scheme.

8.9.3 The built heritage may be affected by both:

- negative impacts caused by required dismantling or loss of part of a structure or its grounds, increased visual intrusion, noise, dust / pollution and vibration, economic impacts caused by the severance or degradation of an asset.
- positive impacts caused by the removal of heavy traffic adjacent to an asset that would slow down deterioration or increase economic viability.

8.9.4 The historic landscape may be affected by both:

- negative impacts caused by severance or loss of historic features, increased visual intrusion, or changes to historic landscape character.
- positive impacts caused by the removal of intrusive traffic, roads or street furniture.

8.9.5 In addition to impacts on heritage assets within areas of land required for the construction of the Scheme, additional temporary and permanent impacts may arise in areas of service and utility (SU) diversions, the Old Town Accommodation Works and temporary construction site compounds beyond these areas.

8.9.6 Most impacts on archaeological deposits take place during construction and are permanent. There may also be additional impacts through the use of heavy plant from noise, pollution and vibration. Permanent impacts on archaeology and the historic environment can also be caused by changes to groundwater levels.

8.9.7 Impacts on the built heritage and historic landscapes during construction can include temporary impacts on setting brought about by hoardings and safety fencing, noise and vibration from piling and other construction machinery. Impacts to the visual and landscape amenity of these assets are considered in Chapter 9 Landscape.

8.9.8 During operation permanent impacts on historic buildings and landscapes and their setting, arise from increased traffic movement, traffic noise and lighting.

Temporary construction impacts

8.9.9 Temporary construction impacts would not affect the majority of buried archaeological remains. The exception would be the scheduled monument of Beverley Gate where the buried remains form part of a sunken display at the northern end of Princes Dock Street in Queen Victoria Square. However, the Scheme would not change the setting of the scheduled monument to the extent that would produce a significant effect.

8.9.10 There would be a temporary negative impact to the setting of the Statue of King William III and Flanking Lamps (MMS600) and Warehouse No. 6 (MMS602) during construction, resulting in a moderate significant adverse effect.

8.9.11 There would be a temporary negative impact to the setting of the Trinity Burial Ground (MMS144) included in sub-zone C1 of the Old Town conservation area, and the Castle Buildings (MMS603) during construction. This would cause a temporary large significant adverse effect.

8.9.12 Overall there would be a temporary negative impact on the setting of the Old Town conservation area that would be most acute along the line of the A63 Castle Street between the Mytongate Junction and the eastern end of the Scheme (Zones 1-3). The impact would be greatest in the area of the Trinity Burial Ground (C1) and the Docklands (C2). Impacts to the visual and landscape amenity of these assets is considered in Chapter 9 Landscape. In addition, the Scheme would cause temporary negative impact due to severance between the northern (A1-4, B1-10) and southern (C1-5) parts of the Old Town conservation area. This may have indirect negative impacts on the conservation area and historic buildings within the conservation area caused by the reduction in footfall from north to south of the A63 Castle Street and subsequent economic deterioration. Overall this would have a temporary moderate significant adverse effect.

8.9.13 Full assessment of the impacts are as described in Volume 3, Appendix 8.3 Impact assessment tables 1.1 to 1.4.

Permanent construction impacts

8.9.14 The responses to the scoping report identified five high value archaeological assets in the Old Town: notably the remains of the Augustine Friary (MMS101); the former course of Mytongate and street frontage including the Medieval Guildhall, the Medieval Town Gaol and 85 Queen Street (MMS105, MMS107, MMS108, MMS111); and the remains of the town defences including the Mytongate (MMS128), those on Princes Dock Street (MMS129) and on Humber Dock Street (MMS130). These assets have been subject to archaeological excavation in the 1970s and previous negative impacts from the construction of the A63 Castle Street. The Scheme would result in negative impacts where deep excavation may occur in the location of services and would not be continuous across the extent of the Scheme. In the case of the town defences off line excavation has been or would be conducted as a compensatory act for any damage caused by the Scheme. Given these factors taken together, it has been assessed that there would be no significant effect on these archaeological assets.

8.9.15 There would be a permanent major negative impact on the Trinity Burial Ground. Around 43% of the archaeological remains within the Trinity Burial Ground would be impacted by the Scheme. The survival of archaeological remains, notably burials has been evaluated (see Volume 3, Appendix 8.3 Impact assessment tables and Appendix 8.6 Advance archaeological works report: Holy Trinity Burial Ground). It would be subject to archaeological excavation as detailed in the

method statement (see Volume 3, Appendix 8.7 Holy Trinity Burial Ground – Project design for main phase clearance of burial remains and archaeological works). In addition, there would be permanent negative impacts on above ground remains including built heritage assets. Permanent impacts would involve the removal of two lamp posts outside the Trinity Burial Ground (MMS866; non-designated) and the wall of the burial ground on its western, eastern and northern sides which would be removed by construction work to the A63 Castle Street. Landscaping of the burial ground would return some of the burial ground to amenity use. This would mean only approximately one third of the burial ground being permanently removed by the Scheme. However, there would also be a permanent negative impact to setting of the remaining 70% of the burial ground caused by the presence of the realigned road. Overall these impacts would have a permanent large significant adverse effect.

8.9.16 The medium value Grade II listed Castle Buildings (MMS603) would see a permanent moderate negative impact caused by changes to its setting resultant from the dismantling of the adjacent Earl de Grey public house, and changes to the layout of the Mytongate Junction. All these would result in changes to the historic setting of the building and further degrade the historic street layout of Castle Street. This would have a permanent moderate significant adverse effect.

8.9.17 The medium value Grade II listed Earl de Grey public house (MMS604) would see a major negative impact caused by its dismantling. This would result in the entire loss of the building and constitutes a permanent large significant adverse effect.

8.9.18 The permanent major negative impact to the Trinity Burial Ground would also impact sub-zone C1 of the Old Town conservation area. This represents one of 19 sub-zones and a small proportion of the land area of the Old Town conservation area. Other permanent negative impacts have been caused by severance between the northern (A1-4, B1-10) and southern (C1-5) parts of the conservation area caused by the reduction in at-grade crossings. This has been mitigated to an extent by the creation of new traffic-free connections between the northern and southern areas through the construction of the Porter Street Bridge and the Princes Quay Bridge, and improvements to the at-grade crossing at the Mytongate Junction and underpass at High Street. Overall it has been assessed that there will be no significant effect on the Old Town conservation area.

8.9.19 Permanent construction impacts to heritage assets are contained in Volume 3, Appendix 8.3 Impacts assessment tables 1.5 to 1.8.

Operation Phase

8.9.20 There will be no operational effects on archaeological remains due to the Scheme.

8.9.21 There would be a permanent negative impact on the Trinity Burial Ground caused by the operation of the Scheme. The construction of the Mytongate Junction would result in permanent loss of approximately one third of the above ground remains of the Trinity Burial Ground. This would move noise, pollution and visual impacts

arising from the new road alignment closer to the remainder of the burial ground. In addition, a reduction in the number of trees in the burial ground would be most pronounced on a short-term basis as replacement trees mature. However, there would also be a permanent reduction in the number of trees that would reduce the quality of visual screening. This would negatively impact upon the sense of enclosure in the burial ground and introduce additional noise, pollution, and visual impacts. The landscape amenity of the burial ground is considered in Chapter 9 Landscape. This would have a permanent moderate significant adverse effect.

8.9.22 There would be permanent negative impact to some areas of the Old Town conservation area caused by the operation of the Scheme. The permanent moderate negative impact to the Trinity Burial Ground would also impact sub-zone C1 of the Old Town conservation area. This represents one of 19 sub-zones and a small proportion of the land area of the Old Town conservation area. There would be both positive and negative impacts caused by the operation of the Scheme. These include an increase in traffic flow of around 20% in the opening year (2025) combined with a reduction in standing traffic and improvement in the standard of lighting. When compared with the existing baseline it is envisaged that overall the conservation area would see neutral or negligible operational impacts. Overall there would be no significant effect on the Old Town conservation area.

8.9.23 Operational impacts to heritage assets are contained in Volume 3, Appendix 8.3 Impact assessment tables 1.9 and 1.11.

8.10 Conclusion

8.10.1 In conclusion, mitigation measures include the use of construction methods in alignment with best industry practice and the OEMP (document reference TR010016/APP/7.3) to avoid or limit damage to heritage assets. Prior and during construction archaeological investigation has been or will be undertaken route-wide. This includes modelling of palaeo-deposits, investigation on Humber and Princes Dock Street into the town defences and investigation of the Trinity Burial Ground. An archaeological watching brief will be maintained during work on archaeological remains in the Old Town. An archaeological mitigation strategy would be produced including the implementation of a programme of archaeological works to investigate, analyse, report and record these assets. Impacts to the setting of historic buildings and the Old Town conservation area has been undertaken by sympathetic design of the Prince Quay Bridge, positive landscape design in the Trinity Burial Ground and upgrading of the existing crossing points at Mytongate Overbridge and the underpass beneath Myton Bridge between the northern and southern parts of the Old Town conservation area. The Earl de Grey public house would be archaeologically recorded in advance of dismantling.

8.10.2 Following implementation of the mitigation measures, during construction of the Scheme there would be a temporary significant adverse effect on the setting of the Trinity Burial Ground (MMS144); Statue of King William III and Flanking Lamps

(MMS600); Warehouse No. 6 (MMS602); Castle Buildings (MMS603); and the Old Town conservation area (sub-zones C1, A3, B2, B3 and C2).

8.10.3 On the completion of construction of the Scheme there would be a permanent significant adverse effect on the setting of the Trinity Burial Ground (MMS144) and the Castle Buildings (MMS603). There will be a permanent significant adverse effect on the Earl de Grey public house (MMS604), caused by the dismantling of the buildings.

8.10.4 During operation of the Scheme there would be permanent significant adverse effect on the setting of the Trinity Burial Ground (MMS144).

Chapter 9. Landscape

9.1 Executive summary

9.1.1 A landscape and visual impact assessment of the five year construction and then Operation Phases of the Scheme has been undertaken. The assessment comprises this chapter of the Environmental Statement (ES) plus a series of appendices (Volume 3, Appendices 9.1. to 9.6). The scope of the assessment reflects the requirements of local planning policy set out in Volume 3, Appendix 9.1 Local planning policy context, and the method statement for the assessment is set out in Volume 3, Appendix 9.2 Landscape and visual method statement. Detailed assessments of the effects of the Scheme on various landscape and visual receptors are set out in Volume 3, Appendices 9.3 Quantification if impacts on landscape features to 9.6 Effects on visual receptors.

9.1.2 Significant landscape and visual effects have been identified during both the construction and Operation Phases of the Scheme. The significant residual Construction Phase effects are considered to be largely unavoidable for a large scale infrastructure project within a city centre location. Further mitigation of these effects is not considered practicable. A large adverse and significant Construction Phase effect on trees within the Trinity Burial Ground would occur as a result of tree removal required to enable the disinterment of graves.

9.1.3 The proposed mitigation (the landscape proposals) would lessen the residual Operation Phase landscape and visual effects of the Scheme over time. The proposed green space improvements at the former Myton Centre would result in significant beneficial residual visual effects after 15 years on residential receptor RR10 (numbers 25-35 Brisbane Street and numbers 176-198 Porter Street). However, the assessment also identifies that some long term, significant and adverse effects would persist beyond 15 years after completion (see paragraph 9.8.78). A large adverse and significant residual landscape effect of the Scheme would be caused by the loss of approximately one third of the Trinity Burial Ground open space and the loss of valued mature trees here and elsewhere along the highway corridor. This change would be to the significant and permanent detriment of landscape character to the south east of Mytongate within the Old Town conservation area.

9.1.4 Major visual change would also arise as a consequence of the introduction of the strikingly designed Princes Quay pedestrian, cycle and disabled user bridge. It is not possible to professionally and objectively categorise this major visual change within a sensitive location as either adverse or beneficial. Given that the proposed bridge has been designed in collaboration with key stakeholders and has already been awarded planning consent by Hull City Council (HCC), and its design therefore judged satisfactory, the visual effect of the bridge is judged by this assessment to be not significant (i.e. that its visual effect should weigh neither positively nor negatively within the overall planning balance).

9.2 Introduction

9.2.1 This report documents the assessment of the landscape and visual effects of the A63 Castle Street Improvements (the Scheme). It comprises this chapter of the ES plus a series of appendices (Volume 3, Appendices 9.1 to 9.6). The appendices provide:

- a review of the local planning policy context
- a method statement for the landscape and visual assessment
- detailed assessments of the effects of the Scheme on different categories of landscape and visual receptor

9.2.2 The Scheme is in an urban area. The assessment considers its effect on the surrounding townscape character including its effect on existing trees, vegetation and other landscape features located either side of the existing highway. The term ‘landscape’ is used throughout the assessment to refer to both ‘landscape’ and ‘townscape’ effects.

9.2.3 Landscape and visual effects are interrelated but distinct. Landscape effects relate to changes in the character of the area irrespective of their visibility (effects on the landscape or townscape resource) while visual effects refer to the change in view experienced by people in specific locations.

9.2.4 The landscape and visual assessment has been undertaken using a combination of published guidance and reasoned professional judgement. The assessment has been undertaken in line with the following published guidance:

- Highways England Interim Advice Note 135/10 'Landscape and Visual Effects Assessment' (IAN 135/10, 2010)
- Landscape Institute and Institute of Environmental Management and Assessment ‘Guidelines for Landscape and Visual Impact Assessment’, 3rd Edition (GLVIA3, 2013)

9.3 Legislative and planning policy context

International / European

9.3.1 The UK is a signatory to the European Landscape Convention (ELC) which seeks to achieve improved approaches to the planning, management and protection of landscapes throughout Europe. The ELC and its definition of landscape underpins the Guidelines for Landscape and Visual Impact Assessment (GLVIA3, 2013) which have informed the approach to the assessment (see Volume 3, Appendix 9.2 Landscape and visual method statement).

National

National Networks National Policy Statement

9.3.1 The National Networks National Policy Statement (NN NPS)[128] sets out the government's policies to deliver development of Nationally Significant Infrastructure Projects (NSIPs) on the national road network in England. The Secretary of State (SoS) uses the NN NPS as the primary basis for making decisions on such development consent applications.

9.3.2 The NN NPS requires that where a development is subject to an EIA an assessment of any likely significant landscape and visual impacts should be undertaken (paragraph 5.144). The assessment should consider any relevant local development plan policies, significant effects during construction and operation, and visibility and conspicuousness (paragraphs 5.146-148). The NN NPS states that where a local development document in England has policies based on landscape character assessment, these will be given particular consideration (no such assessment is in place in Hull). More specifically, local designations will be given consideration in decision making by the SoS but not be used in themselves to refuse consent (paragraph 5.156) (no such designations apply to the Scheme). In taking decisions, the SoS will consider whether the Scheme has been designed carefully, taking account of environmental effects on the landscape and siting, operational and other relevant constraints, to avoid adverse effects on landscape or to minimise harm to the landscape, including by reasonable mitigation (paragraph 5.157). The SoS will also judge whether visual effects on sensitive receptors outweigh the benefits of the development (paragraph 5.158).

9.3.3 This assessment of the Scheme considers the matters raised by the NN NPS and provides the relevant landscape and visual information that is required by it to enable appropriate decision making.

National Planning Policy Framework

9.3.4 The National Planning Policy Framework (NPPF) sets out the government's planning policies for England and how these are expected to be applied. Part 11 of the NPPF sets out the framework with respect to conserving the natural environment. Paragraph 109 states that the planning system should contribute to and enhance the natural and local environment by protecting and enhancing valued landscapes.

Local

9.3.5 Volume 3, Appendix 9.1 Local planning policy context and Volume 2, Figure 9.1 Planning policy provide a summary of the relevant local planning policy context.

[128] National Policy Statement for National Networks December 2014 Department for Transport. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387222/npsnn-print.pdf

The Scheme falls under the authority of HCC. Volume 3, Appendix 9.1 considers aspects of the following local planning policy documents:

- the adopted Hull Local Plan 2016-2032[129]
- the draft Thornton Neighbourhood Plan, 2017 (not adopted)[130]

9.3.6 Policy 42 of the adopted Hull Local Plan titled 'Open space' is of relevance to the landscape and visual assessment of the Scheme. It applies to the Trinity Burial Ground and states that "*open space, sports and recreational buildings and land, including playing fields, should not be built on unless…the loss resulting from the proposed development would be replaced by equivalent or better provision in terms of quantity and quality in a suitable location*".

9.3.7 The west of the scheme falls into the Thornton Neighbourhood Area, which comprises the residential area to the north of Hessle Road and east of Ferensway. This is the only part of the Scheme with a Neighbourhood Plan or draft Neighbourhood Plan in place. Policy TNP4.4 of the un-adopted Draft Thornton Neighbourhood Plan titled 'Local urban greenspace provision' is of relevance to the landscape mitigation proposal for the site of the former Myton Centre. The draft policy states that *"should the Myton Centre become vacant / be demolished (perhaps along with the former Darley Arms Public House) the resulting urban greenspace will be used for play provision to serve local needs and / or tree planting and / or wall / earth mound to minimise noise impacts from the A63 trunk road traffic".*

9.4 Study area

9.4.1 The Scheme comprises a linear highway largely at existing or below existing grade within a low lying and essentially flat urban context that follows the alignment of the existing A63. The urban area lying immediately around the Scheme comprises: residential areas to the north west; the historic town centre ('Old Town') to the north east; modern retail parks and commercial and light industrial buildings to the south west; and historic dockland and river front areas located to the south east.

9.4.2 The townscape is often densely built with frequent tree cover. Street frontages typically comprise buildings of between two and five storeys with occasional taller structures. This urban grain is interrupted by areas of open space, car parking associated with large scale retail outlets and by areas of open water at Princes Quay, Humber Dock Marina and Railway Dock.

[129] Hull Local Plan 2016-2032 Adopted November 2017 Hull City Council. Available online at: http://www.hull.gov.uk/resident/planning-and-building-control/local-plan

[130] Draft Thornton Neighbourhood Plan, May 2017. Available online at: http://thorntonplan.org.uk/site-map/draft-thornton-neighbourhood-plan/

9.4.3 The most substantial new vertical elements associated with the Scheme would comprise two pedestrian, cycle and disabled user bridges reaching a maximum height of approximately 13m above surrounding street level. One of these bridges, at Princes Quay, would be located between two areas of open dock.

9.4.4 Within this context the study area for the landscape and visual assessment has been determined by the likely zone of visual influence (ZVI) of the Scheme elements. The ZVI of the Scheme would be largely determined by the likely extent of visibility of the two proposed pedestrian bridges that extend above existing grade. In the absence of substantial topographical variation and in the context of reasonably densely built townscape the ZVI of the Scheme has been determined using professional observation in the field rather than being computer-generated based on a digitised terrain model. The likely ZVI of the Scheme (excluding remote construction compounds) is illustrated by Volume 2, Figure 9.2.

9.4.5 As a consequence, the study area for the landscape and visual assessment typically extends to no more than 100m around the Scheme (including any land temporarily required during construction) extending to approximately 200m north and south of Mytongate (to allow for views along Ferensway and Commercial Road) and to approximately 300m at Princes Quay and Humber Dock Marina (north and south of the proposed Princes Quay Bridge to allow for longer views across areas of open water).

9.4.6 It is considered that any glimpsed visibility of the Scheme from outside of this study area (perhaps from the upper storeys of taller buildings) would not have the potential to result in significant visual effects, and as such has not been assessed further.

9.5 Approach and methodology

Method statement

9.5.1 A method statement for the landscape and visual assessment including assessment criteria is provided in Volume 3, Appendix 9.2 Landscape and visual method statement.

Scope of the assessment

9.5.2 The scope of the assessment comprises the following:

- landscape effects (used also to refer to townscape effects)
- visual effects

9.5.3 The ‘receptors’ of the landscape changes that would be caused by the Scheme comprise landscape features (see Volume 3, Appendix 9.3 Quantification of effects on landscape features) and landscape character areas referred to as Project Landscape Character Areas (PLCAs) (see Volume 3, Appendix 9.4 Effects on landscape character). The quantification of the effects of the Scheme on

landscape features in Volume 3, Appendix 9.3 Quantification of effects on landscape features informs the overall assessment of the significance of the effects on PLCAs in Volume 3, Appendix 9.4 Effects on landscape character. Volume 3, Appendix 9.3 Quantification of effects on landscape features, quantifies the removal of features that are considered to contribute to the landscape character of the nine PLCAs assessed in Volume 3, Appendix 9.4 Effects on landscape character, with a focus on tree removal.

9.5.4 The 'receptors' of the visual changes that would be caused by the Scheme comprise 12 representative viewpoints (see Volume 3, Appendix 9.5 Effects on representative viewpoints) and schedules of various categories of visual receptor (i.e. people in specific locations such as their homes, public areas or places of work) (see Volume 3, Appendix 9.6 Effects on visual receptors). The assessment of the effects on representative viewpoints contained in Volume 3, Appendix 9.5 Effects on representative viewpoints, informs the individual assessment of the significance of the effects on the detailed schedules of visual receptor contained in Volume 3, Appendix 9.6 Effects on visual receptors.

9.5.5 The assessment of landscape and visual effects includes consideration of the following elements:

- landscape features that would be removed (e.g. loss of existing trees or valued built features)
- the effects of temporary construction activity (the five year (medium term) presence of plant, temporary buildings, materials storage, and construction traffic parking and movements)
- introduction of the new highway infrastructure (including bridges and other associated development)
- the effects associated with both temporary (medium term) and permanent signage and lighting

9.5.6 The assessment of visual effects also takes account of the appearance of vehicles using the new highway and how this might differ from current traffic flows.

9.5.7 The temporal scope of the assessment includes the following periods of time:

- Construction Phase effects - a 'medium term' construction period of five years
- Operation Phase effects (year of opening in winter) - the effects of the completed Scheme when the absence of leaves on the trees illustrates the worst case scenario before mitigation planting has taken effect
- Operation Phase effects (year 15 in summer) - the effects of the completed scheme once mitigation planting has largely matured

9.5.8 Any cumulative landscape and visual effects of the Scheme are considered alongside other environmental parameters in Chapter 16 Combined and cumulative effects.

9.5.9 The assessment considers the temporary effects arising from the use of construction compounds. Two alternative locations are being considered for a required bentonite compound i.e. the preferred Option A at the Arco site and the alternative Option B at the Staples site, the approach to the assessment of compounds focuses on generally assessing Arco as the preferred Option A. Section 9.10 of this chapter then sets out any identified significant effects arising from the use of the Staples site compound as alternative Option B.

Structure adopted to report landscape and visual effects

9.5.10 Guidance recommends that the process of assessing effects is clearly laid out to include the following:

- identification of landscape and visual receptors and a description of current baseline conditions
- an assessment of the sensitivity of the receptors to the changes likely to arise because of the Scheme (taking account of both receptor susceptibility and receptor value)
- an assessment of the change to the receptor that would be caused by the Scheme (the magnitude of change)
- identification of mitigation
- an assessment of the significance of the effect on the receptor (including an assessment of the effect during the Construction and Operation Phases of the Scheme and the residual effect after 15 years when any landscape mitigation in the form of new planting would have begun to mature)

9.5.11 These stages of the assessment are brought together for each landscape or visual receptor within Volume 3, Appendices 9.3 to 9.6 which respectively consider:

- effects on landscape features (Volume 3, Appendix 9.3)
- effects on PLCAs (Volume 3, Appendix 9.4)
- visual effects at agreed representative viewpoints (Volume 3, Appendix 9.5)
- visual effects on different categories of visual receptor along the route (detailed schedules) (Volume 3, Appendix 9.6)

9.5.12 Summaries of the assessments within each appendix are provided within this chapter.

Consultation

9.5.13 Consultations with HCC took place during earlier stages of the development of the Scheme and have been reviewed and incorporated within the design as the Scheme has progressed. Representative viewpoint locations were discussed with the Council in 2013 and agreed in 2018. Further details can be found at Volume 3, Appendix 4.1 Response to the Planning Inspectorate and stakeholder Scoping Opinion comments and in the Consultation Report (document reference TR010016/APP/5.1).

9.5.14 Consultation has also been undertaken with the Diocese of York regarding the potential effects of the Scheme on the Trinity Burial Ground. The Diocese is broadly happy with the proposals. However, some minor matters remain to be resolved relating to detailed design and ongoing maintenance.

9.5.15 In terms of the design, the Diocese require further consultation at the Detailed Design phase regarding the relocation of the memorials and protection of the character of the burial ground. In addition, consultation will take place regarding the provision of benches, bins, interpretation, disabled access, the re use of gate piers and the design of railings. The current proposals include the provision of benches and disabled access. However, further details will be provided during the Detailed Design phase, with proposals for the above to be developed in consultation with the Diocese of York.

9.5.16 Management and ownership issues were raised by the Diocese in relation to the walls and pathways. HCC currently have maintenance responsibility for TBG under existing arrangements and it will be important to ensure that they recognise their additional responsibilities given the improvement / landscaping to the burial ground, with specific responsibilities for maintaining paths and historic features. HCC already have maintenance responsibilities for other adopted areas of the scheme (e.g. areas of hard / soft landscaping and replacement area of Public Open Space). Specific maintenance requirements for the burial ground will be added to the Handover Maintenance Schedules and HCC's responsibilities for the care of the closed burial ground will be clearly established.

Limitations and assumptions

9.5.17 As noted in Volume 1, Chapter 2 The Scheme, the EIA has been carried out during the Preliminary Design stage of the Scheme. This means that the design of the Scheme has not been absolutely finalised, and there are some elements that are still uncertain. The assessments therefore assume a worst case scenario in line. At the time of writing the following elements of the Scheme relevant to the landscape and visual assessments are yet to be finalised but a worst case has been assumed in the assessment:

- full details of the location of plant and the removal of existing vegetation within construction compounds

- full details of the proposed phasing of tree removal during construction
- full and precise details of the proposed construction activities and programme
- the precise extent of the required tree removal within Trinity Burial Ground cannot be known until disinterment activity begins and is dependent upon conditions on site (it is possible that some large trees that have been assessed as being removed may remain)
- the location of the main sewer is yet to be finalised (the location of sewer option located on the Mytongate Junction slip road to the north of Trinity Burial Ground would not result in additional tree loss, however the location of sewer option at the Holiday Inn would result in the worst case removal of four trees in PLCA 4: Trinity Burial Ground)
- full details of the lighting proposals during both Construction Phase and Operation Phase

9.5.18 The landscape and visual assessments make the following worst case scenario assumptions for the above elements:

- all vegetation would be removed from within the construction compounds except for vegetation located on the boundary
- all existing trees to be removed would be removed at the same time and during the first year of construction
- all trees not shown as retained on the Landscape Proposals Plan (Volume 2, Figure 9.8 Landscape Proposals) would be removed
- the sewer would be located within the grounds of Holiday Inn leading to the removal of four trees
- the assessment of Construction Phase effects is based upon the worst case scenario of all construction activity within each Construction Phase occurring at the same time, as described in Volume 1, Chapter 2 The scheme, Table 2.5 Construction Phases and traffic management.

9.5.19 The following broad, worst case assumptions have been made to address the uncertainty regarding the construction lighting and the proposed operational lighting scheme:

- construction compounds would be lit twenty-four hours a day for seven days a week
- the effects of additional compound and construction lighting would be minimised due to the installation of SMART LED lighting with some on movement sensors

- given the proximity of compound and construction lighting to the highway, increases in light are not considered to be of significance due to the relatively high baseline levels of night-time light

- the Operation Phase of the Scheme would be lit to contemporary highway standards

- given the extended highway footprint and additional slip roads the Operation Phase lighting is likely to represent a slight net increase in overall lighting along the highway corridor and within adjacent car parking at the Kingston Retail Park, but the quantity and extent of lighting would be broadly comparable to current conditions

- the Operation Phase lighting would comprise modern LED lamps using the latest technology and designs to direct light to the carriageway and minimise spillage to surrounding areas (flat glass lanterns with appropriate directional shading) and is likely to be more directional than that which currently exists

- the Operation Phase main highway lighting columns would generally be positioned at back of footway directed towards the carriageway

- the Operation Phase lamps would generally be single-sided at back of footway and 9.6m in height, but with some 12m high double sided lamps positioned between the main carriageway and slip roads immediately to the west of Mytongate Junction

- from Mytongate Junction to the west of the scheme the main Operation Phase highway lighting would in some cases be located closer to the surrounding plots, which include residential properties to the north west, but residential properties are generally set back a considerable distance from the highway in this area and the repositioning of lighting columns would not result in noticeable change

- Operation Phase lamp standards would be positioned slightly closer to residential properties at William Booth House, the southern end of William Street and at The Lodge

- appropriate micro-siting and design of the new lamps would at Detailed Design phase would prevent significant adverse visual effects on properties which are already located within a highly illuminated urban context and highway corridor

- the colour of Operation Phase street lighting would change from the slight orange hue of the existing lighting to a cleaner white light

- the proposed Operation Phase lighting on the Princes Quay Bridge would comprise functional and decorative LED lighting to achieve acceptable night time levels as follows:

- lighting of the approach ramps and stairs would be lit by low level lighting bollards, integrated into handrail stanchions and independent bollards
- bollard lighting would be positioned along the road side of each ramp to delineate the ramped access for visually impaired users and limit visibility of light sources by road users
- fittings would be chosen to limit glare
- decorative lighting would be provided primarily to the underside of the bridge canopy
- the soffit would have an even wash of colour with separate lighting to highlight the porthole openings along the ridge
- the canopy lighting would have the capability to change colour
- all dynamic lighting effects would be slow so that users of the A63 experience no noticeable change as they drive past
- the landscaped approaches would be lit subtly and unobtrusively by bollards as well as lighting integrated in the bench seating and up lights to trees
- the bridge deck would be predominantly lit by downward light from the canopy to deliver a uniform distribution of white light over the bridge deck while limiting visibility of the light source from off the bridge deck and from the A63
- lighting proposals would avoid adversely impacting on sensitive receptors such as residential properties through the positioning and angling of lighting fixtures

- the Porter Street pedestrian, cycle and disabled user bridge would be lit to achieve acceptable night time light levels by integral lighting within the bridge parapet at Operation Phase
- additional Operation Phase wall mounted lighting within the Mytongate underpass would have very limited visibility from surrounding areas

9.5.20 Landscape and visual assessments have only been carried out from publicly accessible locations. This has therefore limited the ability to assess the effects on views from within properties.

9.5.21 Where groups of trees have been identified within the tree survey the number of trees within the group have been assumed based on National Tree Mapping data and by eye from publicly accessible locations.

9.5.22 The proposed landscape mitigation draws upon recommendations provided within Volume 1, Chapter 10 Ecology and nature conservation. The assumptions and limitations of the ecological assessment are provided within Volume 1, Chapter 10 Ecology and nature conservation, Section 10.5.

9.6 Existing environment

Introduction

9.6.1 The Scheme is located close to the centre of the city of Hull and follows the alignment of the existing A63 which runs through the city in a broadly west to east direction. There are historic dockland areas located on both sides of the road to the north and south with the historic core of the city mainly located just to the north. The study area is low lying; the city developed on flat estuarine land located on the banks of the River Humber, at approximately 5m AOD. The study area lies to the north of the banks of the River Humber (a tidal estuary), and the eastern extent of the study area borders the River Hull crossing at Myton Bridge. Water, with its associated historic and current use, plays an important role in the setting of the city in the area around the A63 (refer to Volume 2 Appendix 9.4 Effects on landscape character for further details).

9.6.2 The Scheme is partially located within the Old Town conservation area and there are several listed buildings and features located within the study area which are referenced in Volume 2 Appendix 9.3 Quantification of impacts on landscape features, and Volume 2 Appendix 9.4 Effects on landscape character, and described in detail within Chapter 8 Cultural Heritage.

9.6.3 In very general terms the landscape context of the Scheme can be summarised as:

- residential areas (a mix of both low and high rise) to the north west
- the historic town centre located to the north east (‘Old Town’)
- modern retail parks and commercial and light industrial buildings to the south west
- historic dockland with dockside promenades and river front areas located to the south east (including areas subject to wholesale regeneration)
- areas of recent or planned regeneration (including The Fruit Market, the River Hull riverside and land to the north east of the Mytongate Junction)

Landscape features

9.6.4 Consideration has been given to the direct, physical loss of existing landscape features because of the Scheme. Affected features predominantly comprise existing trees along the highway corridor and within adjacent landholdings but also include built features which contribute to landscape character such as brick

boundary treatments, buildings of note and features such as commemorative flagpoles and the Spurn Lightship which is moored in Humber Dock Marina. A description of the principal features is provided in Volume 3, Appendix 9.3 Quantification of impacts on landscape features, and an illustration of the location of these existing features is provided in Volume 2, Figure 9.3 Landscape features. The impacts of the Scheme on these features is described and, where helpful, quantified within Volume 3, Appendix 9.3 Quantification of impacts on landscape features (focusing principally on the effects of the Scheme on tree cover) as well as being carried forward into the overall assessment of the significance of the effects of the Scheme on landscape character contained in Volume 3, Appendix 9.4 Effects on landscape character. The following provides a summary of the principal existing landscape features that would potentially be affected by the Scheme.

Trees

9.6.5 The existing A63 highway corridor contains many existing trees. These have been the subject of an arboricultural survey to British Standard BS5837:2012 Trees in relation to design, demolition and construction recommendations (MMS Arboricultural Survey March 2017 provided as Volume 3, Appendix 9.7 Tree survey). The survey identifies approximately 293 individual tree specimens (tree ID numbers 211 to 504) and 10 groups (tree ID G1 to G10).

9.6.6 BS5837 provides definitions for trees categorised from A to C and U:

- Category A trees are defined as "*being of high quality with an estimated remaining life expectancy of at least 40 years*". These trees are "*particularly good examples of their species, especially if rare or unusual; or those that are essential components of groups of formal or semi formal arboricultural features*".

- Category B trees are defined as, "*being of moderate quality with an estimated remaining life expectancy of at least 20 years*". These trees, "*may be included in category A, but are downgraded due to impaired quality such that they are unlikely to be suitable for retention in 20 years; or trees lacking the special quality necessary to merit the category A designation*."

- Category C trees are defined as, "*being of low quality with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter of less than 150mm*". These are, "*unremarkable trees of limited merit or impaired condition that they do not qualify in higher categories*".

- Category U trees are, "*those in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years*".

9.6.7 Many of the existing trees along the highway corridor and within the wider study area are relatively juvenile and / or small (less than 10m in height) and are

categorised under BS5837:2012 as Category B or C. These are summarised below in table 9.1.

Table 9.1: Summary of numbers of tree specimens and groups identified within the tree survey

BS5837:2012 Tree category	Number of individual tree specimens	Number of tree groups
Category A	13	1
Category B	148	5
Category C	110	4
Category U	22	0

9.6.8 Important trees identified by the Arboricultural Survey as Category A or considered by this assessment to be visually notable are summarised in table 9.2.

Table 9.2: Summary of (BS5937:2012) category A and other visually notable trees not identified as category A

Tree survey number	BS5837:2012 Tree category	Location	Description
378	A	In the vicinity of the Myton Centre	Sycamore, 13m high
380	A	In the vicinity of the Myton Centre	Sycamore, 14m high
418	A	Trinity Burial Ground	Norway Maple, 22m high
423	A	Trinity Burial Ground	Norway Maple, 20m high
424	A	Trinity Burial Ground	London Plane, 22m high
432	A	Trinity Burial Ground	Common Ash, 20m high
434	A	Trinity Burial Ground	Norway Maple, 16m high
437	A	Trinity Burial Ground	Common Ash, 20m high
438	A	Trinity Burial Ground	London Plane, 22m high
441	A	Trinity Burial Ground	Norway Maple, 20m high
442	A	Trinity Burial Ground	Common Horse Chestnut, 20m high
453	A	Trinity Burial Ground	Norway Maple, 18m high
458	A	Trinity Burial Ground	Sycamore, 18m high
373-377	C	In the vicinity of the Myton Centre	Group of Lombardy Poplars, 16-18m high
G2	B	Mytongate roundabout	London Plane, Poplar and birch, 6-15m high
G3	B	Mytongate roundabout	Alder, Sycamore, Poplar, Horse Chestnut, hawthorn, 10-15m high

Other soft landscape areas

9.6.9 Public green spaces in the following locations along the highway corridor contribute to the local landscape (refer to Volume 2, Figure 9.3 Landscape features):

- area of juvenile 'arboretum' tree planting west of the Myton Centre between the A63 and Porter Street (Jubilee Arboretum)
- William Oak Park
- Great Passage Street pocket park
- Trinity Burial Ground
- the general presence of grass verges either side of the highway – most notably around the Mytongate Junction and along the southern fringe of residential areas to the north west

9.6.10 There are also several areas of existing ornamental and shrub planting along the highway corridor. Notable areas are located at:

- areas of shrub planting along the northern boundary of the Kingston Retail Park
- between the A63 and Princes Quay including shrub planting which softens the appearance of the Princes Quay shopping centre multi-storey car park
- the raised grass verge with floral displays and commemorative flagpoles between the highway and Humber Dock Marina
- planting between the existing A63 and the Magistrates' Court building (comprising a mix of small trees with an understorey of mature ornamental shrubs)
- areas of mature shrub planting located towards the eastern end of the Scheme near High Street

Built features

9.6.11 Built landscape features along the highway corridor that make a notable contribution to the landscape character of the area include:

- historic brick boundary treatments such as along the northern and western boundaries of the Trinity Burial Ground including stone copings
- other red brick walls that enclose and help to define the highway corridor such as that along the northern boundary of the Holiday Inn site and around residential plots to the north west

- low brick retaining walls forming low edges to grassed and planted areas between Princes Quay and Humber Dock Marina
- the historic built features including walling, moorings, bridges and elements of surviving rail associated with the Grade II listed Humber Dock and the Grade II listed Princes Dock
- notable buildings such as the Grade I listed Holy Trinity Church, and the Grade II listed: Castle Buildings (currently covered in hoardings); Earl de Grey public house (currently covered in hoardings); Warehouse No. 6 (at the southern end of Princes Quay); Alexandra Hotel and Vauxhall Tavern public house (located on Hessle Road at the west of the Scheme)
- the approximately 31 no. commemorative flagpoles positioned to the north of Humber Dock Marina
- King William III statue and lamps (Grade I listed) at the southern end of Market Place

9.6.12 The Spurn Lightship is located at the northern end of Humber Dock Marina and is open to the public. The effects of the Scheme on the location of the Lightship have been considered within the landscape character assessment but limited weight has been placed on the implications of its movement due to it being a mobile rather than permanent feature.

Landscape character

National landscape character context

9.6.13 The Scheme is located within Natural England's National Character Area (NCA) 41: Humber Estuary. Effects on the national landscape character area have not been assessed due to the urban context of the Scheme. The character area description nevertheless provides an introductory context for understanding local landscape character within the urban extent of Hull.

9.6.14 NCA 41: Humber Estuary is characterised by expansive, flat, low lying, sometimes remote estuarine landscape dominated by the Humber and its ever changing character due to tidal influences. The low tide exposes extensive mudflats, which are of international importance, as well as coastal habitats and salt marshes. There are many urban and industrial influences especially around Hull and on the south bank.

Project Landscape Character Areas

9.6.15 The city of Hull falls under the jurisdiction of HCC. The East Riding of Yorkshire Council unitary authority is responsible for the area surrounding the city. Neither local authority has undertaken a local landscape or townscape character assessment of the Scheme area.

9.6.16 Twenty-three fine grained local landscape character areas were identified in the vicinity of the Scheme options during earlier stages of the Scheme development and route selection. These have been amalgamated in this assessment into nine local PLCAs for the assessment of the landscape effects of the final Scheme. PLCAs have been identified by this assessment based on a combination of desktop and field work (refer to Volume 2, Figure 9.4 Project Landscape Area). The following were used to define the PLCAs:

- Land use
- Urban grain
- Scale, massing and density
- Blocks
- Building height
- Building type
- Relationships between buildings
- Architecture
- Materials
- Condition
- Enclosure
- Colour and texture
- Heritage assets
- Green infrastructure and public realm such as parks, river corridors etc.

9.6.17 The highway corridor itself has not been identified as a separate PLCA to enable the assessment to focus on the interface between the highway corridor and its surrounding landscape context. The boundaries of several of the PLCAs follow the highway reflecting differences in the predominant land use and character on each side of the road. A baseline description of each of the nine PLCAs is provided in Volume 3, Appendix 9.4 Effects on landscape character, and a plan of each PLCA is provided in Volume 2, Figure 9.4 Project landscape character areas. The effect of the Scheme on each has been assessed. The PLCAs comprise:

- PLCA 1: North West Residential
- PLCA 2: South West Commercial
- PLCA 3: Myton Street Commercial

- PLCA 4: Trinity Burial Ground
- PLCA 5: Princes Quay
- PLCA 6: Humber Dock Marina and Railway Dock
- PLCA 7: Old Town
- PLCA 8: Fruit Market
- PLCA 9: River Hull

9.6.18 Of the nine PLCAs the following are identified as the most sensitive (a combined assessment of both their susceptibility and value) to the effects of the Scheme (further explanatory details provided in Volume 3, Appendix 9.4 Effects on landscape character):

- PLCA 4: Trinity Burial Ground - an historic public open space (diocesan land) within the Old Town conservation area containing many large, mature trees and surrounded by historic brick boundaries. The character of this heavily treed open space is in stark contrast to its immediate surrounding which include the A63 highway corridor, commercial areas, residential areas and docks.
- PLCA 5: Princes Quay – dockside area with dockside promenade allowing pedestrian access to the city centre. A number of historic listed buildings are located within this area along with the historic Princes Dock. It is acknowledged that the Princes Quay shopping centre forms a detracting element within the PLCA eroding its historic landscape character.
- PLCA 6: Humber Dock Marina and Railway Dock - dockside areas with dockside promenades allowing pedestrian access to the south of the existing A63. These docks are now used as marinas. They contain large numbers of pleasure craft with reasonably high quality public realm, seating and lighting surrounded by historic dockside and modern buildings.
- PLCA 7: Old Town - the dense network of narrow streets and historic buildings to the north of the A63 highway corridor which mark the original centre of the city and which form the main parts of the Old Town conservation area.

Visual amenity

Representative viewpoints

9.6.19 The 12 representative viewpoint locations have been agreed with HCC to assist in understanding the appearance and visual effects of the Scheme. Locations are shown on Volume 2, Figure 9.5 Project ZVI boundary. A description of the existing view at each location is provided in Volume 3, Appendix 9.5 Effects on

representative viewpoints with baseline photographs of each location presented by Volume 2, Figure 9.6 Representative viewpoints.

9.6.20 The representative viewpoints located towards the western end of the Scheme at Porter Street, the Myton Centre and William Street (viewpoints 1 to 4) capture visually sensitive locations in the vicinity of residential properties. Many of those properties are within tall buildings that provide more elevated views.

9.6.21 The representative viewpoints around Mytongate (viewpoints 4 to 6) sit at the interface between residential and commercial areas adjacent to the existing highway infrastructure including the existing Mytongate Junction. These are therefore sometimes of slightly lower value and less sensitive.

9.6.22 More highly valued views are associated with eastern parts of the Scheme such as the representative viewpoints located in the vicinity of the Princes Quay and Humber Dock Marina and within Old Town (viewpoints 7 to 11).

Visual receptors

9.6.23 Volume 3, Appendix 9.6 Effects on visual receptors, schedules the various categories of visual receptor whose views are likely to be affected by the Scheme. The detailed assessments contained within this appendix describe the nature of existing views for people in the following locations:

- 38 residential receptor locations (private views from people's homes)
- 24 business receptor locations (views from people's places of work)
- 9 public open space receptor locations (the public views of users of the principal open spaces within the study area including both greenspaces and dockside and riverside public realm)
- 31 footpath or street receptor locations (the public views of people walking in surrounding streets including identified Public Rights of Way (PRoW) and long distance paths)

9.6.24 The 'on line' nature of the Scheme means that most of the visual receptors already experience views of the existing highway infrastructure and associated traffic movements. This will moderate the degree of visual change that would be experienced as a consequence of the Scheme.

9.6.25 The following receptor locations are identified as having some of the more sensitive views in the area:

- residential properties – the majority of these are located to the north west within PLCA 1: North West Residential, and include some high rise buildings with more elevated views (see Volume 2, Figure 9.6 Representative viewpoints, viewpoints 1, 2, 3 and 4) and to the north east on the fringes of the PLCA 7: Old Town (viewpoints 9 and 10)

- the principal public open spaces (especially Trinity Burial Ground and the dockside promenades, see viewpoints 7, 8 and 9)

9.6.26 Less sensitive views are associated with:

- commercial areas to the south west including the Kingston Retail Park and businesses around Waverley Street and St James Street (see viewpoints 6)
- the current baseline conditions within the Fruit Market area in the vicinity of Blanket Row and Blackfriargate - it is nevertheless acknowledged that future redevelopment of this area is likely to result in greater visual sensitivity and appropriate design measures to mitigate potential future visual effects have been considered (see viewpoint 11)

Highway lighting - baseline conditions

9.6.27 Existing highway lighting within the vicinity of the Scheme is typical of major highway infrastructure within a city centre location. Current lighting of the highway comprises high pressure sodium luminaires giving a yellow hue to existing night time views. The existing highway lighting along the main A63 carriageway comprises two elements:

- Single lamps are located on each side of the road at back of footway to the east of Mytongate as the highway passes Princes Quay, Humber Dock Marina and Railway Dock and through Old Town.
- Double lamps are located within the central reserve at and to the west of the Mytongate Junction extending between the Kingston Retail Park and Arco site to the south west and residential neighbourhood to the north west.

Temporary construction compounds – baseline conditions

9.6.28 Seven temporary compounds are to be used during the five year (medium term) Construction Phase of the Scheme details of which can be found in the A63 Castle Street Compound Options Report[131]. The locations of the temporary compounds are given on Volume, 2, Figure 2.12 Construction site compound locations.

9.6.29 Three compounds would be located within or close to the main Scheme areas around the Mytongate Junction:

- The preferred site at Arco (Option A) is located within a commercial and light industrial area to the west of the Scheme. The site comprises a cluster of approximately six commercial buildings (approximately between one and six storeys) which would be demolished to create space for large scale bentonite

[131] Balfour Beatty A63 Castle Street Improvements Compound Option Report August 2017 HE514508-BAL-GEN-S0-RP-WM-000001.

and jet grouting equipment to be located within the compound and car parking. A row of semi mature trees are located along the car park boundary to the north, six semi mature trees are located to the west of the car park and a group of semi mature trees are located to the east of the car park at the junction between Waverly Street and Spruce Road. Pockets of shrub planting are located in the vicinity of the trees along with an areas of amenity grass along the north west boundary, and at Waverley Street and Spruce Road junction. Residential properties on William Street and Porter Street are located at a relatively close proximity and would overlook the compound beyond the intervening greenspace and A63 Hessle Road highway corridor. The three storey Vauxhall Tavern located immediately adjacent to the compound, directly overlooks the site.

- Land immediately to the south east of Mytongate Junction (immediately to the west of the Trinity Burial Ground and the proposed site of the pumping station). This space currently comprises amenity grassland with a small number of trees. No residential properties overlook this site at close proximity. However, the three-storey Wittington & Cat public house is located immediately adjacent to Commercial Road and directly overlooks the site at close proximity.

- Wellington Street Island Wharf is an extensive River Humber side area of largely open ground a short distance to the south of the main Mytongate Junction. The north western areas of this site currently contain scrubby vegetation and small self-seeded trees. Two storey residential properties and a five storey block of residential flats face towards the site from the north but potential views are partially obstructed by street trees located outside of the proposed compound boundary and close board fencing surrounding the site. Views from the upper storeys of the flats would be oblique.

9.6.30 In addition, four more isolated areas of land would be used which lie some way to the west and east of the main Scheme areas:

- Livingstone Road is a site adjacent to the Humber (approximately 1km east of the Humber Bridge). The slightly elevated site is adjacent to the Estuary and currently comprises a raised area of bare ground and gravel of which the steeply sloping bank sides of the raised area are vegetated with ephemeral / short perennials, rough grasses and scattered scrub. A species poor hedgerow is located on the eastern boundary of the site. Commercial and industrial land uses are located to the north and east. Partial views of this construction compound site would be available from the upper storey rear windows of the Railway Cottages on Ferry Road beyond the intervening railway track and A63. Land immediately to the west (on the opposite side of the narrow Fleet Drain / Hessle Haven) is the focus of a range of recreational activities associated with the Hessle Cliff waterfront. These include car parking provision, the route of the Yorkshire Wolds Way and the Ferry Boat Inn (the latter faces towards the proposed compound). The site is in a very

open position adjacent to the Estuary with a largely 'natural' beach, low cliff and vegetated coastline with the main Estuary to the south.

- The A63 Eastbound Recovery Base is an existing layby immediately to the north of the existing A63 carriageway that would be extended to enable vehicle recovery activities during construction. An informal double row of mature, unmanaged hedgerow located on either side of a ditch with a small group of semi mature trees abuts the existing layby. There are no residential properties in the immediate vicinity. The route of the Yorkshire Wolds Way passes nearby but on the opposite side of the existing A63.

- The A63 Westbound Recovery Base is an existing layby located to the east of the Scheme on Garrison Road (now known as Roger Millard Way) just to the East of Garrison Road Roundabout (now known as Roger Millard Way Roundabout). There are no residential properties or public rights of way in the immediate vicinity.

- Neptune Street compound site is located in the industrial / commercial area between Albert Dock and the A63. The site largely consists of semi improved neutral grassland covered with tall ruderal species and a strip of scrub habitat located to the south and west. Scattered immature silver birch trees are present within the scrub habitat. There are no residential properties in the immediate vicinity. However, public right of way route 4 lies to the west of the site immediately adjacent to Onedin House on the west boundary and public right of way route 26 lies follows the southern boundary of the site.

The Myton Centre temporary car parking site – baseline conditions

9.6.31 The site of the Myton Centre would be used for parking for a period of up to five years between demolition of the Myton Centre buildings and the development of the site as a compensatory public open space. The majority of the site is currently covered by the footprint of the single storey Myton Centre buildings with some peripheral areas of car parking and lawns. Some large mature trees are located to the frontage with the A63 highway corridor. The site is overlooked by residential properties ranging from five storeys to the north east, three storeys to the north west and twelve storeys to the west.

9.7 Mitigation

Construction

9.7.1 Mitigation of the landscape and visual effects of the temporary but nevertheless medium term Construction Phase of the Scheme (five years between March 2020 and Spring 2025) would principally comprise best practice for construction projects within an urban area. Standard best practice construction techniques would be used in accordance with the Construction Environmental Management Plan (CEMP). The CEMP is described in Chapter 5 Environmental Impact Assessment process, Section 5.10.

9.7.2 Reduction of visual intrusion and effects on townscape character throughout the Construction Phase of the Scheme would include but not be limited to:

- a well-managed and tidy Scheme Site
- limited stockpiles of materials and deliveries on an as needed basis wherever possible
- large scale construction plant to be positioned in the least visually intrusive locations within construction compounds as far as practicable
- welfare units, temporary site offices, plant and hoarding in a colour that would aid integration with the surrounding townscape where possible
- tree felling to be carried out in stages as required wherever practicable to maintain existing visual screening of the highway for as long as practicable
- limited use of lighting wherever possible to restrict night time impacts (the effects of additional lighting would be minimised due to the installation of SMART LED lighting with some on movement sensors)

9.7.3 Works would be undertaken to limit impacts upon existing vegetation on Scheme Site. This would:

- prevent damage to roots, stem and branches of existing trees to be retained
- provide tree protection fencing in line with BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations.
- follow prohibitions applied within the area enclosed by the tree protection fencing

Operation

9.7.4 Landscape proposals for the Scheme have been prepared and would be implemented by the year of opening currently anticipated in 2025 (refer to Volume 2, Figure 9.8 Landscape proposals). The landscape proposals extend to the highway corridor within the permanent land take as well as to several adjacent parcels of land within the temporary (medium term) land take.

9.7.5 The landscape proposals (refer to Volume 2, Figure 9.8 Landscape proposals) principally seek to mitigate the adverse effects of the Scheme by compensating for the large number of trees lost both because of construction methods used during the disinterment process of graves within the Trinity Burial Ground and as a result of the footprint of the Scheme. In addition to this the landscape proposals aim to soften the overall appearance of the Scheme and integrate it with the character of its surroundings.

9.7.6 The Scheme would lead to the removal of approximately 317 trees (detailed in Volume 2 Appendix 9.3 Quantification of effects upon landscape features). The existing levels of tree cover make an important contribution to overall landscape character and in particular to the character of PLCA 1: North West Residential and PLCA 4: Trinity Burial Ground (detailed in Volume 2, Appendix 9.4 Effects on landscape character). Semi mature and mature tree canopy cover in both these PLCAs provides an important role in filtering views of the existing A63 highway corridor from the surrounding residential properties.

9.7.7 The landscape proposals provide compensation for tree loss through the planting of approximately 362 new trees, the majority of which would be planted as semi mature, standard, nursery stock. Key areas of tree planting are located within the proposed green space on the site of the former Myton Centre (PLCA 1: North West Residential) and the Trinity Burial Ground (PLCA 4: Trinity Burial Ground), which when mature, would replace key elements of baseline landscape character and provide filtering to views of the highway from the surrounding residential properties such as those located on William Street, Porter Street and Kingston Wharf (refer to Volume 2, Figure 9.7 Visual receptors and Volume 3 Appendix 9.6 Effects on visual receptors).

9.7.8 The Scheme would result in the loss of approximately 0.26ha of green space within the Trinity Burial Ground including the loss of the historic north boundary wall along with 72 mature and semi mature trees (within and immediately adjacent to the burial ground). The landscape proposals seek to compensate for the loss of the boundary wall by rebuilding and enhancing it using the reclaimed brick and stone copings from the original wall. The wall would be enhanced through the addition of historic gates and pillars from the Church of the Holy Trinity at both north boundary entrances and contemporary railings to match the gates. Approximately 55 new trees are proposed within the space, the majority of which would be planted as semi mature standard nursery stock. Tree planting is designed to both retain landscape character and ecological value along with balancing the requirement for user safety by providing clear lines of sight through the use of clear stem trees. Additional enhancement of the space is proposed by the planting of native hedgerow and native wildflower meadow in line with ecological mitigation recommendations (refer to Volume 1, Chapter 10 Ecology and nature conservation). In addition to this the amenity value of the space will be enhanced through: the introduction of a network of paths surfaced in self-binding gravel ensuring the space is accessible to all; an interpretation panel; and new seating.

9.7.9 The Scheme seeks to offset the loss of green space within the Trinity Burial Ground through the addition of approximately 0.44ha of landscaped green space on the site of the former Myton Centre. A further approximately 0.25ha of hard and soft landscape is proposed on Porter Street, Cogan Street and William Street to integrate the surrounding area with the proposed green space. The landscape proposals assimilate the existing Jubilee Arboretum and William Oak Park within the new area of green space to create one combined green space. Soft landscape

enhancements include the planting of native hedgerow and wildflower meadow (in line with ecological mitigation recommendations refer to Volume 1, Chapter 10 Ecology and nature conservation), and amenity shrub, herbaceous and bulb planting. Proposed additional tree planting and landform provides a buffer to the highway corridor assisting in filtering views of the highway from within the greenspace. Compensatory hard landscape works comprise the rebuilding of the southern brick boundary wall of William Oak Park. Further hard landscape works enhancement includes the introduction of a new network of paths using high quality materials and lighting; the relocation of the existing playground to a location further away from the highway; the improvement of entrances through the introduction of low walling; the introduction of seating; and the introduction of new surfacing and planting along Porter Street, Cogan Street and William Street.

9.7.10 Other key areas of compensatory tree planting include the central reserves of the Mytongate Junction; the Arco and Kingston Retail Park car parks; and the Magistrates' Court in order to restore current levels of tree cover. The proposed evergreen tree species ensure that current levels of visual screening for the magistrate's court would be maintained (refer to Volume 2, Figure 9.7 Visual receptors and Volume 3 Appendix 9.6 Effects on visual receptors). The introduction of a new landform with tree planting to the south east of Great Passage Street pocket park would assist in filtering views of the Mytongate Junction from within the greenspace. The proposed tree planting (including large, semi mature trees) within the Mytongate Junction central reserve forms a bat feeding corridor between Trinity Burial Ground and Great Passage Street pocket park in line with ecological mitigation measures set out in Chapter 10 Ecology and nature conservation.

9.7.11 The introduction of the proposed Princes Quay Bridge would result in a major magnitude of change to views from many of the surrounding visual receptors (refer to Volume 2, Figure 9.7 Visual receptors, and Volume 3 Appendix 9.6 Effects on visual receptors). The landscape scheme seeks to soften the appearance of the structure and enhance the surrounding landscape character through the introduction of high quality trees and amenity planting (refer to Volume 3 Appendix 9.4 Effects on landscape character).

9.7.12 Further enhancements include environmental and lighting improvements at the High Street underpass and the use of natural stone paving to areas within the Old Town conservation area and at key crossing points at the Porter Street Bridge and the High Street underpass. These improvements are designed to enhance landscape character and improve the streetscape.

9.8 Predicted environmental effects

Introduction

9.8.1 This section assesses the significance of the likely residual landscape and visual effects of the Scheme taking account of the proposed mitigation. It considers the effects of the Scheme at three points in time:

- during the Construction Phase (a five year period)
- at the opening year in winter to illustrate the worst case scenario when leaves are absent from the trees
- 15 years later in summer when landscape planting would have begun to take full effect

Construction Phase effects

9.8.2 Construction would be undertaken in eight phases between March 2020 and May 2025. These are referred to as phases 0 to 7 (phase 0 principally comprising the enabling works in areas surrounding the main proposed Scheme infrastructure). Full details of the Construction Phases and traffic management including the duration of each phase are provided in Volume 1, Chapter 2 The Scheme, Table 2.5 Construction Phases and traffic management. The following table highlights the likely sequence and duration of the construction activities most likely to give rise to landscape and visual effects.

Table 9.3: Construction Phases

Phase	Key construction activities	Landscape and visual implications
0	• Trinity Burial Ground enabling works. • Retail park enabling works. • Service diversions.	• Tree removal at Trinity Burial Ground. • General accommodation works in areas surrounding the main Scheme. • Establishment of the construction compound on land to the south east of Mytongate
1	• Completion of Trinity Burial Ground works.	• General tree removal along the highway corridor. • Demolition of the Myton Centre and Arco buildings • Establishment of a further 6 construction compounds at Arco site (including introduction of bentonite farm structures), Wellington Street Island Wharf, A63 Eastbound Recovery Base, A63 Westbound Recovery Base, , Livingstone Road and Neptune Street. • Establishment of a temporary car park on the site of the former Myton Centre • General ground level construction activities throughout the Scheme.
2	• Construction and opening of Porter Street Bridge.	• Visual effects of construction of Porter Street Bridge. • General ground level construction activities throughout the Scheme.
3	• Pumping station piling.	• Visual effects of construction of Princes Quay Bridge.

Phase	Key construction activities	Landscape and visual implications
	• Construction of Princes Quay Bridge (start).	• General ground level construction activities throughout the Scheme.
4	• Construction of Princes Quay Bridge (complete). • Mytongate Bridge and underpass.	• Visual effects of construction of Princes Quay Bridge. • Visual effects of Mytongate cutting excavation. • General ground level construction activities throughout the Scheme.
5	• Opening of Princes Quay Bridge • Mytongate Bridge and underpass	• Visual effects of Mytongate cutting excavation and bridge construction. • General ground level construction activities throughout the Scheme.
6	• Completion of Mytongate Junction	• Visual effects of Mytongate cutting excavation and bridge construction. • General ground level construction activities throughout the Scheme.
7	• Signage etc	• General ground level construction activities throughout the Scheme Site. • Erection of signage and lighting.

9.8.3 Large scale Construction Phase activities with the potential to give rise to landscape and visual effects would comprise:

- the five year (medium term) presence of and activities associated with temporary construction compounds including a substantial bentonite facility (these comprise seven sites, three located within the city centre in close proximity to the main Scheme and four within more isolated positions along the A63 corridor to the east and west)
- the use of the Myton Centre site as a temporary car park for construction staff
- demolition of several buildings (Myton Centre and the Arco buildings)
- dismantling of the Earl de Grey public house
- tree removal (the assessment differentiates between those trees that would need to be removed to make way for the physical extent of the proposed infrastructure and those additional trees that would need to be removed specifically to allow for construction activities to take place – e.g. the chosen approach to the disinterment of graves within the Trinity Burial Ground)
- the general extent of the works within a city centre context
- excavation and construction of the Mytongate Junction
- construction of the Porter Street Bridge
- construction of the Princes Quay Bridge
- implementation of the hard and soft landscape scheme

- relocation of the Spurn Lightship to the south east of Humber Dock Marina

Construction Phase impacts on landscape features

9.8.4 Volume 3, Appendix 9.3 Quantification of impacts on landscape features, includes consideration of those trees that would be removed specifically and additionally as a consequence of the proposed construction activities and methodology as opposed to the physical extent of the proposed infrastructure. The MMS Arboricultural Survey March 2017 included at Volume 3, Appendix 9.7 Tree survey, and Volume 2, Figure 9.9 Trees removed provide additional detail regarding the trees that would be affected.

9.8.5 A significant large adverse residual Construction Phase effect on landscape features is identified due to the removal of trees from within the Trinity Burial Ground which do not lie within the footprint of the proposed infrastructure but which would be removed to enable the chosen approach to the disinterment of graves prior to the construction of the Scheme to be undertaken. These trees include a number of BS5837 Category A trees such as tree ID nos. 438 (approximately 22m high mature London plane) and some of the Category A trees within tree group G4.

9.8.6 Approximately 12 trees (not surveyed but attributed category C grading) and the surrounding mature, scrubby, shrub planting would be removed within the grounds of the Magistrates' Court to enable the construction of the regraded High Street underpass ramp. These trees and shrubs are not considered to be of high value and their removal would not result in significant adverse residual Construction Phase effect on landscape features. Compensatory tree (semi mature, standards) and shrub planting in the proposed landscape scheme would replace this vegetation.

Construction Phase effects on landscape character

9.8.7 The detailed assessment of Construction Phase effects on landscape character is set out within Volume 3, Appendix 9.4. These assessments take account of the medium term duration of the five year construction period. The conclusions of the assessment are summarised in the table below.

Table 9.4: Construction Phase effects on landscape character

Project Landscape Character Area (PLCA)	Sensitivity (combining susceptibility of character and the value of the landscape)	Magnitude of change (including duration)	Significance of Construction Phase landscape effect
1. North West Residential	Moderate	Moderate	Moderate adverse (significant)
2. South West Commercial	Low	Moderate	Slight adverse (not significant)
3. Myton Street Commercial	Low	Moderate	Slight adverse (not significant)

Project Landscape Character Area (PLCA)	Sensitivity (combining susceptibility of character and the value of the landscape)	Magnitude of change (including duration)	Significance of Construction Phase landscape effect
4. Trinity Burial Ground	High	Major	Large adverse (significant)
5. Princes Quay	High	Moderate	Moderate adverse (significant)
6. Humber Dock Marina and Railway Dock	High	Moderate	Moderate adverse (significant)
7. Old Town	High	Minor	Slight adverse (not significant)
8. Fruit Market	Moderate	Minor	Slight adverse (not significant)
9 River Hull	Moderate	Minor	Slight adverse (not significant)

9.8.8 The disinterment of graves within the Trinity Burial Ground (a temporary activity proposed during the early part of the construction programme) including the need to remove additional mature and high value trees to make room for this temporary activity, combined with the general adjacent construction activity associated with the new Mytongate Junction, bridge and retaining structures, would have a significant large adverse effect on the landscape character of this area during and specifically as a consequence of the proposed Construction Phases, activity and chosen disinterment methodology (refer to Volume 3, Appendix 9.4 Effects on landscape character).

9.8.9 A temporary (medium term) but significant moderate adverse Construction Phase effect on landscape character would occur within the PLCA 5: Princes Quay as a consequence of the presence of construction activity (including the construction of the substantial Princes Quay Bridge) at the southern fringes of this visually open and high sensitivity character area.

9.8.10 A temporary (medium term) but significant moderate adverse Construction Phase effect on landscape character would occur within the PLCA 6: Humber Dock Marina and Railway Dock as a consequence of the presence of construction activity (including the construction of the substantial Princes Quay Bridge, realignment of the dock wall and new retaining structures north of the Holiday Inn) at the northern fringes of this visually open and high sensitivity character area.

9.8.11 The Spurn Lightship within the PLCA 6: Humber Dock Marina and Railway Dock would be temporarily relocated from the north eastern wall of the Humber Dock Marina to the south eastern wall of Humber Dock Marina. The relocation of this feature (in any case mobile and not necessarily permanent) would have a negligible effect on landscape character during the five year construction period.

9.8.12 A temporary (medium term) but significant moderate adverse Construction Phase effect on landscape character would occur within PLCA 1: North West Residential due the following proposals:

- the removal of a large number of mostly semi mature trees from along the road corridor (including adjacent visibility to those in the central reserves of the Mytongate Junction)
- the demolition of the Myton Centre
- the introduction of car parking on the site of the former Myton Centre
- the excavation of the proposed Mytongate Junction at the south east of the PLCA
- the construction of a new public open space at the Myton Centre which will encompass the Jubilee Arboretum and William Oak Park site with associated street enhancements
- the construction of the Porter Street Bridge at the south west of the PLCA
- the location of the Arco site bentonite compound adjacent to the southern boundary of this PLCA which would introduce an industrial element at the periphery of the area within PLCA 2: South West Commerical.

Construction Phase visual effects at representative viewpoints

9.8.13 This section presents a summary of the detailed assessment of the Construction Phase visual effects at the 12 selected representative viewpoints as set out in full within Volume 3, Appendix 9.5 Effects on representative viewpoints. The assessment assumes that the Construction Phase of the Scheme would include winter months during which very little visual screening would be provided by any intervening retained tree cover. It also assumes the most intensive period of construction activity for each viewpoint over a five year period.

9.8.14 Significant adverse Construction Phase visual effects are identified for the duration of the five year construction works at all the representative viewpoint locations (large adverse for viewpoints 1 to 10 and moderate adverse for viewpoints 11 and 12). This reflects the selection of viewpoints within an urban area that are very close to the existing highway corridor and that will be very close to large scale highway construction activity. Significant but temporary (medium term) visual effects at these locations along the highway corridor are considered to be unavoidable and none of the viewpoints is considered to require any specific additional measures during the Construction Phase to mitigate such effects. Mitigation would take the form of recognised best practice in construction.

Construction Phase visual effects on visual receptors

9.8.15 The detailed assessment of Construction Phase visual effects on individual receptors is set out in Volume 3, Appendix 9.6 Effects on visual receptors. These assessments assume that the Construction Phase of the Scheme would include winter months during which very little visual screening would be provided by any intervening retained tree cover. They also assume the most intensive period of construction activity for each receptor location.

9.8.16 The most substantial Construction Phase visual effects would be associated with the following aspects of the Scheme:

- demolition of the Myton Centre and Arco buildings which are overlooked on by residential properties along Porter Street and William Street
- the construction of the Porter Street Bridge close to residential properties located a short distance to the north
- construction of the Princes Quay Bridge in an open position with views from sensitive dockside areas and promenades (principally Princes Quay and Humber Dock Marina and Railway Dock) including the fringes of Old Town both to the north and south
- the construction of the main Mytongate Junction including an extensive length of cutting and the introduction of a new at grade road bridge close to Melbourne House; Sydney House, William Booth House; open spaces at William Oak Park, Great Passage Street pocket park, Trinity Burial Ground; and adjacent to the Holiday Inn Hotel
- general carriageway construction (including the introduction of 900mm high central concrete step barriers at the edge of Old Town with views from the south facing Castle Street frontage and framed vistas along narrow streets and lanes such as Dagger Lane, Fish Street and Vicar Lane)
- visual effects of temporary (medium term) construction compounds and car parking (see assessment of each site provided below)

9.8.17 In summary, significant Construction Phase visual effects would occur for the following visual receptors:

- residential properties, businesses and open spaces located along the route of the existing A63 - particularly those that are sited close to the carriageway (e.g. properties at Lovat Close, William Booth House, Arco and Kingston Retail Park) and those with slightly elevated views along the carriageway coincident with the location of larger scale construction activities (e.g. ‘The Lodge’ high rise flats and William Booth House which would be located immediately adjacent the main Mytongate Junction works and cutting)

- residential properties, businesses and open spaces located close to the Princes Quay Bridge (e.g. properties at Lisle Court, Trinity Court, and Warehouse No. 6)

- residential properties, businesses and open spaces located close to the Arco site construction compound (e.g. The Vauxhall Tavern, The Manor and The Lodge residential flats, Jubilee Arboretum, Armstrong Hydraulic and businesses on Lister Street)

- hotels located in close proximity to the Trinity Burial Ground (e.g. Holiday Inn and The Whittington Cat public house)

- road receptors that would directly experience construction work (e.g. Hessle Road and Castle Street)

9.8.18 The following residential and hotel visual receptors would experience significant large adverse Construction Phase visual effects: RR8 The Lodge; RR9 The Manor; RR10 numbers 25-35 Brisbane Street and numbers 176-198 Porter Street; RR12 Auckland House, William Street; RR14 numbers 2-76 Melbourne House Flats, William Street; RR16 William Booth House windows to frontage; RR22 Lisle Court (properties facing onto Princes Dock Street); RR23 Lisle Court (properties facing on to Castle Street); RR24 Trinity Court (south side - numbers 19, 21-38, 52-58 Trinity Court); RR34 Kingston Wharf; RR35 Holiday Inn; RR36 The Wittington & Cat public house; RR38 The Ellerman Wilson Warehouse, Kingston Street (refer to Volume 2, Figure 9.7 Visual receptors for locations).

9.8.19 The following residential visual receptors would experience significant moderate adverse Construction Phase visual effects: RR5 numbers 7, 9, 11 Neville Close; RR7 numbers 2-8, 12-16 Lovat Close; RR11 numbers 152-174 Porter Street; RR13 numbers 61-71 William Street; RR15 Sydney House, Cogan Street; RR18 Amy Johnson Court, Great Passage Street; RR26 Buildings fronting on to Castle Street between Fish Street and Vicar Lane including numbers 60-64 Vicar Lane; RR28 Number 80-83 Castle Street; RR31 Warehouse No. 13 ‘residential flats’ (refer to Volume 2, Figure 9.7).

9.8.20 The following business visual receptors would experience significant moderate adverse Construction Phase visual effects: BR1 listed Warehouse No. 6 (ASK Restaurant); BR3 Magistrates’ Court; BR8 Marina Court; BR13 Broadcasting Station, Commercial Road; BR14 Kingston Retail Park; BR15 Armstrong Hydraulic, Waverley Street; BR16 Lister Street businesses; and BR17 Vauxhall Tavern and Hull Daily Mail (refer to Volume 2, Figure 9.7).

9.8.21 The following open space visual receptors would experience significant large adverse Construction Phase visual effects: OSR1 Jubilee Arboretum; OSR2 William Oak Park; OSR5 Railway Dock; OSR6 Princes Quay; OSR7 Humber Dock Marina (refer to Volume 2, Figure 9.7). The Trinity Burial Ground would be closed during construction therefore a visual assessment at Construction Phase has not been carried out for this receptor.

9.8.22 The following open space visual receptor would experience significant moderate adverse Construction Phase visual effects: OSR3 Great Passage Street pocket park, OSR8 Hull Riverside (refer to Volume 2, Figure 9.7).

9.8.23 The following road visual receptors would experience significant moderate adverse Construction Phase visual effects: FRR1 Hessle Road (A63 west of Mytongate); FRR2 Castle Street (A63 east of Mytongate); FRR3 Porter Street; FRR4 William Street; FRR5 Cogan Street; FRR7 Ferensway; FRR10 Princes Dock Street (PROW Route 25); FRR22 Humber Dock Street (PRoW Route 23 and Route 24); FRR23 Railway Street; FRR24 Commercial Road; FRR25 Spruce Road; FRR26 St James Street; and FRR31 Lister Street (refer to Volume 2, Figure 9.7).

9.8.24 Significant but temporary (medium term) visual effects for these receptors are considered to be unavoidable and none of the views is considered to require any specific additional measures to mitigate such effects. This is due to the close proximity of visual receptors in relation to the large scale construction works making temporary screening ineffectual in mitigating the temporary visual effects of construction. Mitigation would take the form of recognised best practice in construction.

Landscape and visual effects of temporary construction compounds

9.8.25 The following summarises the principal landscape and visual effects of each of the proposed compounds and provides an overall assessment of whether, despite their temporary (medium term) nature, these might be significant. The summaries below provide an assessment of all of the construction compounds including the compounds and visual receptors that would be located further away from the principal area of works (Wellington Street Wharf, Livingstone Road, A63 Eastbound Recovery Base, A63 Westbound Recovery Base and Neptune Street Set Down Compound).

Arco site

9.8.26 The Arco site includes the large scale Arco buildings (approximately six) ranging from one to six storeys in height. All buildings would be demolished on the site which combined with the surrounding car parking would form a large compound immediately adjacent to the A63 highway corridor. Spruce Road would be stopped up at its junction with the A63 and a new access road would be constructed to the east of the site forming a link between Lister Street and Spruce Road. A variety of construction facilities and activities would be provided for on this site which would include a bentonite and jet grouting plant of 13.5m in height and 3m in diameter; a number of temporary accommodation buildings (some twin-stacked); material handling and storage; and regular vehicular movements through the site for the deposition and collection of a range of materials. Trees located along the northern boundary with the A63 highway corridor would be removed as part of the construction of the Scheme. All but one of the group of category B and C semi mature trees located on the junction between Spruce Road and Waverley Street would be removed to enable the construction of the access road between Spruce

Road and Lister Street. It is assumed that semi mature trees on the south and west boundary of the site would be retained.

9.8.27 The treatment of site frontages to the east of would be consistent with best practice in construction and would screen low level views into the compound. The immediately surrounding neighbourhood within PLCA 2: South West Commercial is substantially commercial and light industrial in land use, so the temporary (medium term) presence of this compound means that its landscape effect over the five year construction period would not be significant. The compound would have an indirect impact upon the landscape character of the adjacent PLCA 1: North West Residential. However, PLCA 1 would experience significant moderate adverse effects anyway due to the proposed demolition work, large scale tree loss, and highway and bridge construction.

9.8.28 The proximity of residential properties to the north and a hotel to west along with the limited screening that would be afforded by tree cover, would mean that the compound would have a significant large adverse visual effect over the five year construction period.

Land south east of Mytongate Junction

9.8.29 The land to the south east of Mytongate would be used as the basis of all archaeological fieldwork. It would be the location of accommodation needed to support the disinterment activity within the adjacent Trinity Burial Ground. These would comprise a number of single storey pitched roof buildings whose footprint would cover approximately 50% of the site.

9.8.30 This site and the required temporary accommodation buildings would be located immediately adjacent to the construction works associated with the excavation works required for the new junction at Mytongate and to the major disinterment works proposed within the Trinity Burial Ground. There are no residential properties overlooking the site and use of the adjacent public open space would be curtailed by the disinterment activities. There are generally no significant landscape and visual effects associated with the temporary (medium term) presence of this compound except for The Wittington & Cat public house and hotel, which is located across Commercial Road immediately opposite the site with main views from hotel rooms overlooking the compound. This receptor is assessed as experiencing significant large adverse effects refer to Volume 3, Appendix 9.6 Effects on visual receptors.

Wellington Street Island Wharf

9.8.31 This would be the main construction compound providing accommodation for construction personnel. A footprint of single storey pitched roof temporary buildings would extend over approximately one third of the site. Additional areas would be provided for car parking. Not all the site would be required with some areas towards the northern boundary left unused (refer to Volume 2, Figure 9.9

Trees removed). The site would not be used for stockpiling materials or for the storage of plant in excess of 4m in height.

9.8.32 The required facilities would not extend over the whole site and none would rise to a height of more than 4m. Existing scrub vegetation towards the northern boundary of the site would be retained to maintain a visual buffer between the temporary buildings and residential properties to the north. The limited extent and height of the required uses and temporary (medium term) presence of this compounds means that its landscape and visual effects would not be significant.

A63 Eastbound Recovery Base

9.8.33 The existing layby adjacent the A63 would be extended in length and width to accommodate traffic management operations. These would include some limited, simple, single storey temporary buildings to provide accommodation for personnel.

9.8.34 Some existing roadside vegetation would require removal to increase the size of the layby. This vegetation is of limited significance and does not contain mature trees of landscape value. There are no residential properties that overlook this compound site. Although the Yorkshire Wolds Way passes nearby the visual effect upon its users would be negligible in the context of the existing A63 highway corridor and traffic movements. The limited loss of vegetation and temporary (medium term) presence of this compound adjacent to the existing highway means that its landscape and visual effects would not be significant.

A63 Westbound Recovery Base

9.8.35 The existing layby adjacent to the A63 and to the south west of the Garrison Road Roundabout would accommodate traffic management operations. These would include some limited, simple, single storey temporary buildings to provide accommodation for personnel.

9.8.36 All vehicle recovery operations will be limited to the existing layby extents and would not result in the loss of any landscape features or affect the surrounding landscape character which is dominated by the highway. There are no residential or footpath receptors overlooking the compound site. The temporary (medium term) presence of this compound adjacent to the existing highway means that its landscape and visual effects would not be significant.

Livingstone Road

9.8.37 This site would be used for general construction activity including materials storage and handling and single storey temporary accommodation buildings. Its use may require levelling for use as a materials compound.

9.8.38 The regrading of the southern part of this site and its interface with the semi natural coastline of the Humber Estuary would result in a significant moderate adverse landscape effect. The temporary (medium term) presence of this compound and the existing industrial context of the view, means that its visual

effects in views from the residential properties to the north and recreational areas to the west would not be significant.

Neptune Street Set Down Area

9.8.39 The Neptune Street site would be used as a base for vehicle recovery. During the five year construction period, the site would house single storey temporary accommodation buildings and areas of vehicle circulation and car parking. The site would be cleared of vegetation, leading to a loss of self set immature birch trees and scrub along with a large area of semi improved neutral grassland and tall ruderal species. The loss of vegetation would not result in a significant effect on landscape features. Given the commercial / industrial context of the site located adjacent to the Albert Dock to the south and large scale commercial sheds to the north and west the landscape effect over the five year Construction Phase would not be significant. Similarly, the commercial context and low level proposed uses of the site mean that the visual effect, in particular upon the public rights of way adjacent to the site would not be significant.

Landscape and visual effects of the Myton Centre temporary car parking site

9.8.40 The Myton Centre site would be used for construction staff car parking between the demolition of the buildings and the site's redevelopment as a public open space. The detailed landscape and visual assessments contained in Volume 3, Appendices 9.3 to 9.6 refers to the Construction Phase effects of the temporary (medium term) car park due to its proximity to the main Scheme areas.

9.8.41 This site is surrounded on its northern and western sides by residential buildings of various heights. The site is overlooked by a large number of individual apartments. In combination with the proposed demolition works the Construction Phase visual effects associated with this compound would be significant large adverse.

Effects of utility diversions

9.8.42 The temporary landscape and visual effects of utility diversions would not be significant.

Effects of Construction Phase (temporary) lighting

9.8.43 Lighting provision for all construction compounds would be required to allow for security and access 24 hours a day and seven days a week. This would comprise modern LED lamps with many controlled by sensors meaning that illumination would be only occasional outside of working hours. All temporary lighting would be carefully positioned and designed to orientate light to where it would be required and to avoid light spillage beyond the compound boundaries. While the compound lighting might be visible from any surrounding residential properties, those properties would not themselves be illuminated by it (i.e. any light spillage beyond the compound boundaries would be carefully controlled and limited). Where practicable, existing vegetation and tree cover would be retained on the periphery

of construction compounds to limit such visual effects (e.g. the northern boundary of the Wellington Street Island Wharf compound site opposite residential properties along Wellington Street West). The temporary (medium term) visual effects of construction lighting during the five year construction period would not be significant.

Operation Phase effects

9.8.44 Once operational, the completed Scheme would comprise numerous changes and Scheme components that would affect the landscape and views in a variety of different ways. The principal permanent changes and components of the Scheme that could potentially give rise to significant Operation Phase landscape and visual effects comprise:

- the removal of a large number of mature and semi mature trees from along the highway verges, roundabout and Trinity Burial Ground and their replacement with a similar number of new plantings in different locations nearby due to the requirement of the Scheme footprint
- the absence of several buildings (Myton Centre, the Arco buildings, and Earl de Grey public house)
- removal or relocation of various boundary walls (of various heights) with relocated and extended structures (both horizontally and vertically) sometimes formed using reclaimed bricks
- introduction of substantial new retaining walls to the north of the Holiday Inn site and Trinity Burial Ground (the new highway would sit above existing ground levels with a drop of up to 2m down into the Holiday Inn and Trinity Burial Ground sites)
- absence of commemorative flagpoles at the northern end of Humber Dock Marina
- new changes in level around the Mytongate Junction, northern boundary of Trinity Burial Ground, northern boundary of the Holiday Inn site and new ramp structures in the vicinity of both the Porter Street and Princes Quay Bridges
- presence of the major new cutting and split level junction at Mytongate with associated railings
- general widening of the highway corridor with additional slip roads and connections
- the presence of the new Porter Street Bridge
- the presence of the new strikingly designed Princes Quay Bridge

- presence of new above ground structures at the pumping station
- presence of a new 900mm high concrete step barrier (CSB) along the length of the central reserve between the new carriageways
- replacement and new areas of ornamental and semi ornamental planting and changes to paving treatments
- replacement and new signage, lighting, vehicle barriers and CCTV cameras
- replacement and new street furniture including retractable bollards
- slightly altered position of the Spurn Lightship within Humber Dock Marina
- changes in traffic flows along the new highway

Operation Phase impacts on landscape features

9.8.45 Detailed quantification of the Operation Phase impacts of the Scheme on landscape features is set out within Volume 3, Appendix 9.3 Quantification of effects on landscape features. It includes an assessment in year one only as there would be no changes in impacts on landscape features between the year of opening and 15 years later. Volume 3, Appendix 9.7 Tree survey, comprises the MMS Arboricultural Survey 2017, which gives further details of the trees that would be removed to make way for the Scheme infrastructure. The assessment differentiates between trees that would be removed as a consequence of the footprint of the proposed infrastructure (i.e. treated as an Operation Phase effect of the Scheme) as opposed to those additional trees that would also be removed as a specific and additional consequence of the Construction Phase and its proposed activities and selected methodologies.

9.8.46 The principal impact of the Scheme on landscape features would be the removal of existing trees along the A63 road corridor. The widening of much of the highway, the major reconfiguration of the Mytongate Junction and the introduction of two new bridges would all require the removal of existing trees within the junction, central reserves, and along verges and adjacent areas on either side of the road. Approximately 317 trees would need to be removed including approximately 39 no. removed (in the worst case) for Construction Phase purposes at the Trinity Burial Ground. Efforts would be made to retain additional trees within the burial ground where possible dependent upon the conditions on site during construction. The greater number of the trees to be removed would be those located along both sides of the road to the west of Mytongate, within the two central reserves at the existing Mytongate Junction and at the Trinity Burial Ground (i.e. the additional trees affected by the footprint of the infrastructure rather than the disinterment activity during construction). These include approximately four trees identified as BS5837 Category A specimens by the MMS Arboricultural Survey March 2017 (refer to Volume 3, Appendix 9.7 Tree survey). That the Scheme follows the alignment of the existing highway through the centre of the

city of Hull means that these trees make a visible and prominent contribution to amenity along the road corridor and at its interface with surrounding urban landscape character areas. The removal of trees results in a significant large adverse effect of the Scheme. The removal of trees is also factored into the assessment of the Operation Phase effects of the Scheme on landscape character contained in Volume 3, Appendix 9.4 and summarised below.

9.8.47 Other impacts of the Scheme on landscape features include:

- the loss of approximately 3.56ha of amenity planting principally: along the frontage of the Kingston Retail Park; to the south of the Magistrates' Court; immediately to the south of William Oak Park adjacent to the existing brick wall; to the south of Princes Quay; and to the north of Humber Dock Marina
- the loss of approximately 0.26ha of green space within Trinity Burial Ground
- the loss of approximately 58m^2 of green space within William Oak Park
- the removal of a section of the northern boundary wall of the Trinity Burial Ground
- the removal of the boundary wall to the north of the Holiday Inn site
- the demolition of the Myton Centre and Arco buildings
- the dismantling of the historic Earl de Grey public house
- the loss of the original north wall of the Humber Dock (Grade II listed) and adjacent landscaping to allow for the construction of the Princes Quay Bridge and surrounding ramps
- the loss of approximately 30 celebratory flag poles to the north of Humber Dock Marina
- the loss of a low brick wall and area of ornamental planting immediately to the south of Princes Quay to allow for the construction of the Princes Quay Bridge and surrounding ramp
- the loss of ornamental planting adjacent to the Magistrates' Court to enable the construction of the underpass

Operation Phase effects on landscape character

9.8.48 The detailed assessment of Operation Phase effects on PLCAs is set out within Volume 3, Appendix 9.4 Effects on landscape character, and includes an assessment of significance at the year of opening (year one) and residual effects after 15 years (year 15). The table below provides a summary of the operation effects on landscape character identified in Appendix 9.4.

Table 9.5: Operation Phase effects on landscape character

Project Character Area (PLCA)	Sensitivity (combining value and susceptibility)	Year of opening		Year 15	
		Magnitude of change	Significance of Operation Phase landscape effect	Magnitude of change	Significance of Operation Phase landscape effect
1. North West Residential	Moderate	Minor	Slight adverse (not significant)	Minor	Slight beneficial (not significant)
2. South West Commercial	Low	Moderate	Slight adverse (not significant)	Minor	Negligible (not significant)
3. Myton Street Commercial	Low	Moderate	Slight adverse (not significant)	Minor	Slight adverse (not significant)
4. Trinity Burial Ground	High	Major	Large adverse (significant)	Major	Large adverse (significant)
5. Princes Quay	High	Moderate	Slight beneficial (not significant)	Moderate	Slight beneficial (not Significant)
6. Humber Dock Marina and Railway Dock	High	Moderate	Slight beneficial (not significant)	Moderate	Slight beneficial (not significant)
7. Old Town	High	Minor	Slight beneficial (not significant)	Minor	Slight adverse (not significant)
8. Fruit Market	Moderate	Minor	Slight adverse (not significant)	Minor	Slight adverse (not significant)
9 River Hull	Moderate	Negligible	Negligible (not significant)	Negligible	Negligible (not significant)

9.8.49 Significant large adverse long term residual Operation Phase effects on landscape character are identified at PLCA 4: Trinity Burial Ground due to the reduction in its area and loss of valuable trees.

9.8.50 No other significant residual effects on landscape character after 15 years have been identified.

9.8.51 The Spurn Lightship within PLCA 6: Humber Dock Marina and Railway Dock would be relocated to the north west corner of Humber Dock Marina on completion of the works. The slight relocation of this feature from its original position slightly further east (in any case mobile and not necessarily permanent) would have a negligible effect on landscape character.

9.8.52 Long term slight beneficial (but not significant) residual Operation Phase effects are identified at four landscape character area:

- PLCA 1: North West Residential – this is due to the creation of a new public open space in place of the Myton Centre and streetscape enhancements at adjacent William Street and Cogan Street.

- PLCA 5: Princes Quay – this is due to the enclosure and environmental improvements caused by the addition of the Princes Quay Bridge (partially offset by some adverse effects).

- PLCA 6: Humber Dock Marina and Railway Dock – this is due to the enclosure and environmental improvements caused by the addition of the Princes Quay Bridge (partially offset by some adverse effects).

- PLCA 7: Old Town – this is due to improvements in the public realm and the quality of paving materials on the southern fringes of the historic core.

9.8.53 The combined slight beneficial effects of the Scheme on these PLCAs is not considered to be significant.

Operation Phase effects at representative viewpoints

9.8.54 The detailed assessment of the Operation Phase visual effects at the 12 agreed representative viewpoints is set out within Volume 3, Appendix 9.5 Effects on representative viewpoints. It provides an assessment in Winter at year of opening and in summer after 15 years when new planting would have largely matured.

Principal sources of visual change

9.8.55 Given that the Scheme comprises a highway scheme largely located within an existing highway corridor (i.e. the land use remains essentially the same), the focus of the viewpoint assessment has been to determine whether visual conditions would be materially altered and adversely affected by the extended and additional highway infrastructure and its impact on nearby features within the highway corridor such as trees and surrounding boundary treatments. Despite the largely 'on line' nature of the new highway, substantial Operation Phase visual changes could arise as a consequence of the following key components of the Scheme:

- the presence of the proposed landmark Princes Quay Bridge including its canopy and the substantial solid ramp structures that are proposed to the north west (at the south western end of Princes Quay) and to the south east (at the north eastern end of Humber Dock Marina)

- the presence of the new, more simply designed Porter Street Bridge including the ramps and earth mounding required either side of the new carriageway

- the comprehensive reconfiguration of the Mytongate Junction, the introduction of a substantial new section of highway cutting (enclosed by close to vertical walls) and the road widening required to form the four slip

lanes (the levels associated with this junction would also change the visibility of traffic flows in the area)

- other sections of highway widening – especially as a consequence of the new slip roads around the new Mytongate Junction but also at other junctions including those at Market Place and High Street
- increased visual openness between the highway and surrounding areas as a consequence of tree removal (this would be most extensive to the west of the Mytongate Junction, along the Kingston Retail Park frontage and at the Trinity Burial Ground) and the greater visual openness between Ferensway and Commercial Road as a consequence of the absence of a tree-covered roundabout central reserve
- the introduction of a 900mm high central solid concrete step barrier (CSB)
- changes to the appearance of the Trinity Burial Ground and Holiday Inn frontage with new changes in level and the introduction of a more substantial boundary wall
- the introduction of new signage and lighting
- the removal of the Myton Centre building and the creation of a new area of public open space
- the dismantling of the Grade II listed Earl de Grey public house
- the introduction of the proposed new pumping station close to the vehicular entrance of the Holiday Inn

9.8.56 Where it is possible to do so with an appropriate degree of professional objectivity, the viewpoint assessment provided in Volume 3, Appendix 9.5 identifies the significance of the visual effect at each viewpoint at year of opening and 15 years later and states whether the visual effect at the viewpoint would be adverse or beneficial. To judge whether visual change is adverse or beneficial will always involve some degree of subjectivity and the professional assessment undertaken here seeks to reflect what is likely to be the majority or consensus view. For some viewpoints, however, particularly those within which the new Princes Quay Bridge would be prominently positioned, a judgement on whether the visual change would be adverse or beneficial has not been given (see further explanation below).

Visual effects at representative viewpoints in year of opening

9.8.57 In the year of opening significant adverse visual effects would occur at representative viewpoints 1 to 6 at the western end of the Scheme and at the main Mytongate Junction. This reflects the loss of mature tree cover that would occur throughout the western part of the Scheme area, the introduction of the Porter Street Bridge and the scale and raised elevation of the proposed new split level highway infrastructure at Mytongate Junction. The effects would be as follows:

- Viewpoint 01: Porter Street - significant moderate adverse visual effect due to loss of tree cover and introduction of the new Porter Street Bridge.
- Viewpoint 02: Myton Centre - significant moderate adverse visual effect due to loss of tree cover and introduction of the new Porter Street Bridge (new planting at the replacement public open space would not yet have taken effect).
- Viewpoint 03: William Street - significant large adverse visual effect due to loss of mature tree cover and new highway infrastructure.
- Viewpoint 04: West of Mytongate - significant large adverse visual effect due to loss of mature tree cover and new highway infrastructure.
- Viewpoint 05: North of Mytongate - significant large adverse visual effect due to extensive loss of large, mature tree cover and new split level highway infrastructure at Mytongate.
- Viewpoint 06: South of Mytongate – significant large adverse visual effect due to extensive loss of large, mature tree cover and new split level highway infrastructure at Mytongate.

9.8.58 The assessment of visual effects at representative viewpoints contained in Volume 3, Appendix 9.5 Effects on representative viewpoints, also identifies a large and therefore potentially significant visual effect at viewpoints 7, 8 and 9 within which the new Princes Quay Bridge would feature prominently. These areas of dockside public realm are of high sensitivity and the introduction of the new bridge would clearly result in a major change to the views. The bridge has been designed in consultation with key stakeholders to be a landmark addition to the locality rather than to subtly blend in with its landscape context. The soft landscaping adjacent to the bridge ramps has been designed to soften the appearance of the structure. Given that there can be no absolute consensus on whether the contemporary bridge design would improve or detract from the character of these historic dockside areas the assessments of viewpoints 7, 8 and 9 do not state whether the consequent change in visual amenity would be adverse or beneficial. In this context, it is noted that the bridge design has been given planning permission by HCC. The conclusion of this assessment is therefore that the visual effect of the new Princes Quay Bridge at viewpoints 7, 8 and 9 should be treated as being not significant – i.e. it should neither be treated as a significant adverse effect of the Scheme that requires further mitigation nor should it be identified as a significant benefit of the Scheme to be used to weigh against any other adverse environmental effects of the Scheme within the overall planning balance. It should be noted that this approach has not been taken to the assessment of the Porter Street Bridge due to its standard design (typical of highways infrastructure). Visibility of the Porter Street Bridge is generally considered to result in an adverse visual effect.

9.8.59 In the year of opening the visual effects of the Scheme at representative viewpoints 10 to 12 at the eastern end of the Scheme (and to the east of the Princes Quay Bridge) would be not significant. This reflects the presence of fewer large mature trees at the eastern end of the Scheme and the smaller scale of the proposed highway infrastructure changes. The highway would be extended in various ways but the visual effects would be limited to slight adverse.

Residual visual effects at representative viewpoints after 15 years

9.8.60 The detailed assessments of representative viewpoints contained in Volume 3, Appendix 9.5 Effects on representative viewpoints, identify that residual adverse and significant visual effects would persist beyond 15 years at representative viewpoint 6, located close to Mytongate Junction. Although visual effects in the vicinity of Mytongate would be ameliorated over time as a consequence of the maturing landscape scheme, the loss of mature tree cover (extensive area of large trees in excess of 15 years old at the Mytongate roundabout and within the adjacent Trinity Burial Ground) and the scale of new highway infrastructure (at slightly higher elevation) means that significant visual effects would persist. At Viewpoint 6: South of Mytongate there would be significant moderate adverse and residual visual effect due to extensive loss of large, mature tree cover and new and slightly more elevated split level highway infrastructure at Mytongate.

9.8.61 In addition to adverse effects, the detailed assessments of representative viewpoints contained in Volume 3, Appendix 9.5 identifies that residual beneficial and significant visual effects would persist beyond 15 years at Viewpoint 2: Myton Centre. Significant moderate beneficial residual visual effects would be due to the replacement of the Myton Centre building with a view dominated by the new planting associated with the new public open space

9.8.62 Large visual effects would persist at representative viewpoints 7, 8 and 9 beyond 15 years due to the presence of the Princes Quay Bridge and its associated ramp structures. However, these are not considered to be significant for the reasons given in paragraph 9.8.58.

9.8.63 The findings of the assessment of visual effect at representative viewpoints has informed the following assessment of effects on individual visual receptors.

Operation Phase effects on individual visual receptors

9.8.64 The detailed assessment of the Operation Phase visual effects of the Scheme on individual visual receptors within the study area is set out within Volume 3, Appendix 9.6. These detailed schedules individually assess the visual effects of the Scheme on specific groups of residential properties, places of work, streets and other areas of public realm within the city. These assessments draw on the findings of the representative viewpoint assessment contained in Volume 3, Appendix 9.5. An assessment in Winter in the year of opening and the long-term residual effect in summer after 15 years is provided.

Significant visual effects on individual receptors in the year of opening

9.8.65 Significant adverse Operation Phase visual effects are identified in the year of opening for many receptors and would occur for visual receptors located in close proximity to areas where substantial mature tree removal would be carried out. As noted in paragraph 9.8.58, the nature of the effect (whether it be adverse or beneficial) for visual receptors experiencing a large or moderate visual effect in the vicinity of the Princes Quay Bridge has not been provided.

Residential receptors

9.8.66 The following residential visual receptors would experience a significant large adverse visual effect: RR14 numbers 2-76 Melbourne House Flats, William Street; RR16 William Booth House windows to frontage; RR36 The Wittington & Cat public house; RR34 Kingston Wharf; RR38 The Ellerman Wilson Warehouse, Kingston Street (refer to Volume 2, Figure 9.7 Visual receptors for locations).

9.8.67 The following residential visual receptors would experience a significant moderate adverse visual effect: RR5 numbers 7, 9, 11 Neville Close; RR8 'The Lodge' High Rise Block, RR9 'The Manor' High Rise Block; RR10 numbers 25-35 Brisbane Street and numbers 176-198 Porter Street; RR12 Auckland House, William Street; RR15 Sydney House, Cogan Street; RR18 Amy Johnson Court, Great Passage Street (refer to Volume 2, Figure 9.7).

Business receptors

9.8.68 The following business visual receptors would experience a significant moderate adverse visual effect: BR13 Broadcasting Station, Commercial Road; BR14 Kingston Retail Park; and BR15 Armstrong Hydraulic (refer to Volume 2, Figure 9.7 for locations).

Open space receptors

9.8.69 The following open space visual receptors would experience a significant large adverse visual effect: OSR2 William Oak Park; OSR4 Trinity Burial Ground; and OSR5 Railway Dock (refer to Volume 2, Figure 9.7 for locations).

9.8.70 The following open space visual receptors would experience a significant moderate adverse visual effect: OSR1 Jubilee Arboretum and OSR3 Great Passage Street pocket park (refer to Volume 2, Figure 9.7).

Footpath and road receptors

9.8.71 The following footpath and road visual receptors would experience a significant moderate adverse visual effect due to the significant loss of tree canopy cover: FRR1 Hessle Road; FRR7 Ferensway; and FRR24 Commercial Road (refer to Volume 2, Figure 9.7 for locations).

Visual effects arising from the Princes Quay Bridge in the year of opening

9.8.72 The assessment of visual effects of individual receptors in Volume 3, Appendix 9.6 identifies a both large and moderate therefore potentially significant visual effects at a number of individual visual receptors with views in which the new Princes Quay Bridge would feature prominently. These receptors include residential properties and areas of dockside public realm that are high sensitivity and the introduction of the new bridge would clearly result in a major change to the views. However, as outlined in paragraph 9.8.58, the bridge has been designed to be a landmark addition to the locality rather than to subtly blend in with its landscape context. Given that there can be no absolute consensus on whether the contemporary bridge design would improve or detract from the character of these views the consequent change in visual amenity would be adverse or beneficial. In this context, it is noted that the bridge design has been given planning permission by HCC. The conclusion of this assessment is therefore that the visual effect of the new Princes Quay Bridge should be treated as being not significant – i.e. it should neither be treated as a significant adverse effect of the Scheme that requires further mitigation nor should it be identified as a significant benefit of the Scheme to be used to weigh against any other adverse environmental effects of the Scheme within the overall planning balance.

Residential receptors

9.8.73 The following residential visual receptor would experience a not significant large visual effect which is not considered to be either beneficial or adverse for the reasons given in paragraph 9.8.58 (views of Princes Quay Bridge): RR22 Lisle Court (properties facing onto Princes Dock Street); and RR23 Lisle Court (properties facing on to Castle Street.

9.8.74 The following residential visual receptors would experience a not significant moderate visual effect which is not considered to be either beneficial or adverse for the reasons given in paragraph 9.8.53 (views of Princes Quay Bridge): RR31 Warehouse No. 13 ‘residential flats’; and RR35 Holiday Inn (refer to Volume 2, Figure 9.7 2 for locations).

Business receptors

9.8.75 The following business visual receptors would experience a not significant moderate visual effect which is not considered to be either beneficial or adverse for the reasons given in paragraph 9.8.53 (views of Princes Quay Bridge): BR1 Warehouse No. 6 Ask Restaurant and BR8 Marina Court (refer to Volume 2, Figure 9.7 for locations).

Open space receptors

9.8.76 The following open space visual receptors would experience a not significant large visual effect which is not considered to be either beneficial or adverse for the

reasons given in paragraph 9.8.53 (views of Princes Quay Bridge): OSR6 Princes Quay; OSR7 Humber Dock Marina (refer to Volume 2, Figure 9.7 for locations).

Footpath and road receptors

9.8.77 The following footpath and road visual receptors would experience a not significant moderate visual effect which is not considered to be either beneficial or adverse for the reasons given in paragraph 9.8.53 (views of Princes Quay Bridge): FRR2 Castle Street; FRR10 Princes Dock Street; FRR22 Humber Dock Street and Promenade (PRoW Route 23 and PRoW Route 24); FRR23 Railway Street and dockside Promenade (refer to Volume 2, Figure 9.7 for locations).

Significant residual visual effects on individual receptors after 15 years

9.8.78 Effects on many visual receptors would be ameliorated over time because of the maturing landscape scheme. The assessment has concluded that no significant large adverse visual effects would persist beyond 15 years.

9.8.79 It is considered that significant moderate adverse residual Operation Phase visual effects would persist to beyond 15 years for the following receptors. The significance of the effect on the receptors below has decreased from year one due to the maturing landscape scheme within the Trinity Burial Ground (refer to Volume 2, Figure 9.7 for locations):

- RRR34: Kingston Wharf due to the considerable loss of mature tree cover within the Trinity Burial Ground
- RR36: The Whittington & Cat public house due to the considerable loss of mature tree cover within the Trinity Burial Ground
- RR38: The Ellerman Wilson Warehouse, Kingston Street due to the considerable loss of mature tree cover within the Trinity Burial Ground
- OSR4: Users of the reduced extent of the Trinity Burial Ground - the landscape scheme for this site has been designed to minimise any such adverse effect by creating a strong northern boundary which would balance the need for visual screening with the need to maintain informal surveillance of activities taking place within the open space to reduce anti-social behaviour (with the exception of the Holiday Inn the open space is not overlooked by inhabited buildings and is associated with anti-social behaviour)
- OSR5: Railway Dock due to the considerable loss of mature tree cover within the Trinity Burial Ground

9.8.80 It is considered that no further practicable mitigation is possible to reduce these significant adverse visual effects of the Scheme within 15 years. These visual effects would however slowly reduce over subsequent years as new tree planting

gains further maturity and height (many of the existing trees being removed are in excess of 50 years in age).

9.8.81 Significant moderate beneficial residual visual effects would be experienced at the following locations due to the maturity of planting within the Myton Centre public open space (refer to Volume 2, Figure 9.7 for location).

- RR9 'The Manor' High Rise Block, Bathurst Street
- RR10 numbers 25-35 Brisbane Street
- OSR1 Jubilee Arboretum

9.8.82 Visual effects arising from the Princes Quay Bridge after 15 years The assessment has concluded that the Scheme would result in not significant large residual visual effects at the following locations due to the introduction of Princes Quay Bridge and its associated ramp structures (the assessment has not been able to objectively categorise this change as either adverse or beneficial and has therefore categorised the effect as not significant, refer to paragraph 9.8.58 for explanatory text and Volume 2, Figure 9.7 for locations):

- RR22: Lisle Court (properties facing onto Princes Dock Street)
- RR23: Lisle Court (properties facing on to Castle Street)
- OSR6: Princes Quay due to the introduction of the bridge and its associated ramp structures that would enclose views towards the Humber Dock Marina
- OSR7: Humber Dock Marina due to the introduction of the bridge and its associated ramp structures that would enclose views towards Princes Quay

9.8.83 Not significant, moderate residual visual effects would also be experienced at the following locations due to the introduction of the Princes Quay Bridge (the assessment has not been able to objectively categorise this change as either adverse or beneficial and has therefore categorised the effect as not significant, refer to paragraph 9.8.67 for explanatory text and Volume 2, Figure 9.7 for locations):

- RR31: Warehouse No. 13 'residential flats'
- RR35: Holiday Inn.
- BR1: Warehouse No. 6 'Ask Restaurant'
- BR8: Marina Court
- FRR2 Castle Street
- FRR10 Princes Dock Street

- FRR22 Humber Dock Street and Promenade (PRoW Route 23 and Route 24)
- FRR23 Railway Street and dockside promenade

Effects of Operation Phase (permanent) lighting

9.8.84 Full details of the proposed lighting for the Scheme have yet to be finalised but the approximate location and height (typically 12m for double sided lamps and 9.6m high for single sided lamps) of the main highway lighting columns are known. A number of broad assumptions have been made in relation to the proposed lighting (refer to paragraph 9.5.19).

9.8.85 The Scheme is located within an urban city centre location. Residential neighbourhoods are limited to areas to the north west and properties are generally set back. The overall levels of lighting would be similar to current provision and appropriate to the urban context of the Scheme.

9.8.86 Replacement tree planting would mature over time and help to reduce any limited light spillage into adjacent residential areas.

9.8.87 With appropriate detailed design, the residual Operation Phase effect of the lighting of the Scheme would not give rise to significant adverse landscape or visual effects measured against existing baseline conditions of an already illuminated highway corridor.

9.9 Effects of climate change

9.9.1 Increases in temperatures and changes in rainfall could result in adverse landscape and visual effects due to potential impacts upon the planting scheme. Changes in climate pose a threat to plant species due to increases in pests and diseases both present in the UK and those which may be introduced, the impact of which is difficult to predict. Changes in rainfall could create drought conditions in summer and increase the likelihood of winter flooding, which could alter soil conditions. There is a great deal of uncertainty in determining the likelihood and severity of potential effects upon receptors due to the unpredictable nature of climate change effects.

9.9.2 A range of plant species has been selected for the planting scheme including both native and non native species to reflect the character of the surrounding townscape and ensure diversity, which is key to managing risk. Species include Norway Maple (Acer platanoides), Field Maple (Acer campestre), Lime (Tilia cordata and Tilla europeaus), Callery Pear (Pyrus Chanticeller) and Pine (Pinus sylvestris and Pinus nigra), which have high drought tolerance.

9.9.3 The potential impacts of climate change can be mitigated against through the monitoring of the landscape scheme and suitable replacement planting or the introduction of changes to the maintenance regime should plant species fail.

9.10 Conclusion

9.10.1 An assessment of the landscape and visual effects of the Scheme has been undertaken. As part of the iterative assessment and design process a comprehensive landscape scheme has been prepared to respond to the landscape character context, to accommodate the Scheme within its landscape setting and to mitigate identified adverse effects.

9.10.2 Taking account of this mitigation, the significant adverse residual landscape and visual effects of the Scheme have been identified as:

Construction Phase

- a significant large adverse Construction Phase landscape effect on trees within PLCA 4: Trinity Burial Ground due to a group of Category A and other trees being felled to enable disinterment to take place (rather than because of the footprint of the Scheme infrastructure)
- frequent significant adverse visual effects along the highway corridor (on all representative viewpoints and many individual receptors) during the five year Construction Phase (these significant but localised visual effects are considered unavoidable for a large scale infrastructure project within an urban location)
- a significant moderate (albeit temporary) adverse Construction Phase landscape effect on the character of PLCA 6: Humber Dock Marina and Railway Dock
- a significant moderate (albeit temporary) adverse Construction Phase landscape effect on the character of PLCA 1: North West Residential

Operation Phase (residual effects after 15 years)

- a permanent and significant large adverse landscape effect on the PLCA 4: Trinity Burial Ground because of its significant reduction in size and significant loss of high value trees
- significant moderate adverse visual effects due to the removal of many trees from along the highway corridor including many large, specimens, the screening and / or visually softening effect of this tree cover along the corridor would not be fully reinstated within 15 years of completion of construction
- significant moderate adverse visual effects on residential receptors: RR34 Kingston Wharf; RR36 The Wittington & Cat public house; RR38 The Ellerman Wilson Warehouse
- significant moderate adverse visual effects on representative viewpoint 6 south of Mytongate Junction

- not significant visual effects (both large and moderate) on some areas of dockside public realm surrounding the Scheme (the visual effects in these locations have not been categorised as either beneficial or adverse for the reasons given in paragraph 9.8.58)

- significant moderate beneficial residual visual effects on representative viewpoint 2 due to the maturity of planting within the Myton Centre public open space

- significant moderate beneficial residual visual effects on residential receptors: RR9 The Manor High rise block, Bathurst Street; RR10 numbers 25-35 Brisbane Street and numbers 176-198 Porter Street also due to the maturity of planting within the Myton Centre public open space

- significant moderate beneficial residual visual effects on open space receptor OSR1 Jubilee Arboretum also due to the maturity of planting within the Myton Centre public open space

9.11 Summary of changes to the assessment of significant effects for the preferred Option A site compound at Arco and the alternative Option B site compound at Staples

Effects on landscape features

9.11.1 There would be very little difference to the impact on landscape features should alternative Option B be taken forward. Under both options 317 trees would be removed. Under preferred Option A 114 trees would be removed from PLCA 2: South West Commerical, whereas 113 trees would be removed from this PLCA under alternative Option B. This is due to the requirement of the removal of an additional category B tree to allow for the construction of the link road between Lister Street and Spruce Road. Under Option B this category B tree would be retained but a category U tree would be removed within the tree line located to the south of American Golf and Maplin. Therefore, there would be no change to the assessment of significance upon landscape features.

Effects on landscape character

9.11.2 Should the alternative Option B be taken forward the significance of Construction Phase effects would increase from not significant slight adverse effects under Option A to significant moderate adverse within PLCA 3; Myton Street Commercial. This is due to the required demolition of the Staples, American Golf and Maplin buildings to make way for an extensive construction compound resulting in a large scale loss of buildings. The Staples site compound would consist of construction plant including a 13.5m high bentonite plant and ancillary equipment; jet grouting plant and ancillary equipment; silos and a concrete batching plant. The compound would occupy a large extent of PLCA 3 and introduce an industrial element to this commercial area close to the city centre,

which would result in a significant moderate adverse effect on landscape character during the Construction Phase.

9.11.3 There would be no change in the assessment of Operation Phase effects (at the year of opening and 15 years hence) upon the landscape character of PLCA 3 at should the preferred Option B be taken forward. This is due to the Staples, American Golf and Maplin buildings not being considered to be of high value or making an important contribution to landscape character due to their low quality, standard, commercial design.

9.11.4 There would be no changes to the significance of effects on the landscape character of PLCA 2: South West Commercial under alternative Option B as this PLCA is considered to have a greater capacity to accommodate a construction compound due to the existing nature of the commercial / light industrial landscape character. The extensive removal of vegetation within this PLCA associated with both options is considered to lead to a moderate magnitude of change during Construction Phase and at year one resulting in a not significant slight adverse effect upon landscape character.

9.11.5 Indirect effects upon PLCA 1: North West Residential from the Arco construction compound under the preferred Option A would not reduce the assessment of the significance of Construction Phase effects on PLCA 1, which would remain significant large and adverse.

Effects on representative viewpoints

9.11.6 The Arco site preferred Option A construction compound is visible in representative viewpoints 1, 2, 3, and 4 all of which are considered to experience significant large adverse visual effects during the Construction Phase due to the extensive amount of construction work taking place within the views including: the demolition of the Myton Centre; the construction of the Mytongate Junction cutting, the extensive removal of trees; utilities diversions; the realignment of the highway; and the construction of the Porter Street Bridge. Therefore, should the Staples site alternative Option B construction compound go ahead, Construction Phase effects would remain large, adverse and significant at these viewpoints. However, despite the magnitude of change remaining major in all of these viewpoints adverse visual effects would be lessened due to the absence of demolition work associated with the Arco buildings and large scale construction equipment within the view. There would be no change to the assessments of these viewpoints at years one and 15 should the Arco building be retained due to same loss of mature and semi mature trees in both options, the introduction of Porter Street Bridge and the increased prominence of the highway due to the solid central barrier.

9.11.7 Should the Staples site alternative Option B construction compound be taken forward it would be visible from representative viewpoints 5, 6 and 7. All of these viewpoints are located in close proximity to the Mytongate Junction and would already experience large, adverse and significant effects under the preferred Option A. This would result from construction work carried out along the highway

including: utilities diversions; the construction of the split level junction; significant removal of trees within Trinity Burial Ground; the construction of Princes Quay Bridge (seen in viewpoint 7); the dismantling of the Earl de Grey public house (seen in viewpoint 7); and the laying out of the new landscape scheme. The demolition of Staples, Maplin and American Golf would add to the already large adverse Construction Phase effects. In addition to this there would be no change visual effects experienced at viewpoints at the year of opening and 15 years hence should alternative Option B be taken forward. This is due to the assessment of visual effects being largely determined by the presence of Princes Quay Bridge and the loss of mature tree canopy cover. The Staples, American Golf and Maplin buildings are not considered to be of high value and their removal from the townscape is not considered to be of visual significance. Views of hoarding along the site boundary would be partially filtered by the surrounding vegetation.

Effects on visual receptors

9.11.8 Should the Staples site alternative Option B be taken forward, there would be an increase in the Construction Phase effects experienced by the adjacent receptors. Consequentially visual receptors adjacent to the Arco site preferred Option A would experience a reduction in Construction Phase visual effects. The visual effects on receptors to the north of Hessle Road that experience views of the Arco site preferred Option A would not change should the alternative Option B be taken forward due to the remaining large scale construction works taking place within views. Table 9.5 provides a summary of the changes to effects upon visual receptors experienced under both options.

Table 9.5: Summary of changes to Construction Phase effects on visual receptors for Option A and Option B site compounds

Visual Receptor	Significance of Construction Phase landscape effect (Arco site preferred Option A)	Significance of Construction Phase landscape effect (Staples site alternative Option B)
RR18 Amy Johnson Court, Great Passage Street	Moderate adverse	Large adverse
RR19 Hanover Court, Ferensway	Slight adverse	Large adverse
RR21 Ibis Hotel, Ferensway	Slight adverse	Large adverse
BR16 Lister Street businesses	Moderate adverse	Negligible
BR17 Vauxhall Tavern and Hull Daily Mail	Moderate adverse	Slight adverse
BR20	Slight adverse	Large adverse

Visual Receptor	Significance of Construction Phase landscape effect (Arco site preferred Option A)	Significance of Construction Phase landscape effect (Staples site alternative Option B)
Businesses on Myton Street including Monster Supplements		
BR23 Maplin and American Golf	Slight adverse	Demolished
BR24 Staples	Slight adverse	Demolished

Chapter 10. Ecology and nature conservation

10.1 Executive summary

10.1.1 The impact of the Scheme on ecology and nature conservation has been assessed in accordance with Highways England guidance within the Design Manual for Roads and Bridges (DMRB) (as updated by IAN 130/10[132]). Baseline information on ecological receptors was gathered through desk based studies, survey reports from earlier stages of Scheme development, updated field surveys in 2013, 2014, 2015, 2016, 2017 and 2018 and consultation with relevant organisations.

10.1.2 Ecological receptors of value relevant to the Scheme include the Humber Estuary (Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar and Site of Special Scientific Interest (SSSI) - international and national statutory designated site), Trinity Burial Ground Site of Nature Conservation Interest (Site of Nature Conservation Interest (SNCI) - local non-statutory designated site), mature amenity trees, bats and birds.

10.1.3 An Assessment of Implications on European Sites (AIES) is being undertaken separately as part of the application by Highways England to the Planning Inspectorate for the proposed Scheme. Noise, dust, sedimentation, contamination and vibration from piling operations, surface water run off, pollution spills and the re-siting of the Spurn Lightship during construction of the Princes Quay pedestrian, cycle and disabled user bridge have also been assessed in the AIES. The AIES for the Scheme is based on the findings of the Habitat Regulations Assessment (HRA) Screening Report for Princes Quay Bridge produced in August 2018 for Hull City Council (HCC) and the Marine Management Organisation (MMO) as the Competent Authority. This is currently undergoing consultation with the MMO and Natural England. The findings in the HRA Screening Report concluded that there would be no significant effects to the Humber Estuary designated sites, as did the subsequent AIES Screening Report for the Scheme. The document reference for the AIES is TR010016/APP/6.13).

10.1.4 36 mature trees are to be removed from Trinity Burial Ground SNCI to accommodate the Scheme, resulting in a significant adverse residual impact to this site during Construction and Operation Phases. A further 36 trees will be removed to facilitate the disinterment of graves. There are no opportunities to fully compensate for the reduction in area of this non-statutory designated site. At least 55 native mature and semi-mature trees would be planted as compensation and further large, semi-mature trees would be planted within the Mytongate Junction central reserve to create bat hop-overs. The understorey of the SNCI is to include

[132] Design Manual for Roads and Bridges, Interim Advice Note **130/10** Ecology and Nature **Conservation**. Available online at: http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian130.pdf

native shrubs and plants to attract invertebrates. The significance of the effect on this receptor would be moderate adverse during both construction and operation, as the receptor is of county value and significant major adverse during construction and operation as it is UK Biodiversity Action Plan (UKBAP) and Natural Environment and Rural Communities (NERC) Act 2006 Section 41 priority habitat.

10.1.5 Approximately 245 amenity trees along the length of the rest of the Scheme Site would need to be removed during construction. The effect would be slight adverse, as this receptor is valued at a local level. Amenity trees would be replaced with new tree planting of a further approximately 307 trees additional to the replacement trees in Trinity Burial ground SNCI, mostly within the Scheme Site extents. The residual impact is not predicted to be significant during the Operation Phase.

10.1.6 No significant adverse residual impacts to bats or birds are predicted during the Construction or Operation Phases of the Scheme. Mitigation measures would include sensitive timing of habitat clearance, erection of bat and bird boxes in Trinity Burial Ground SNCI and new tree and shrub planting, including within the improved road to restore habitat connectivity across the carriageway at Mytongate Junction.

10.2 Introduction

10.2.1 This chapter presents the baseline ecological and nature conservation aspects of the Scheme Site and its environs and assesses the likely impacts of the proposed A63 Castle Street Improvements development upon them. Where required, mitigation measures are presented and discussed to reduce identified significant effects of the proposed development during construction and operation.

10.2.2 The key findings of up to date ecological surveys completed by Mott Macdonald Sweco JV (MMSJV) in 2013, 2014, 2015, 2016, 2017 and 2018 are detailed, as well as relevant results of previous surveys undertaken at earlier stages of the Scheme's development and the outcome of consultations, in particular with Natural England.

10.2.3 The assessment undertaken is in accordance with the most recently published Highways England guidance, as detailed in Section 10.5.

10.2.4 The Scheme Site, comprising the Scheme footprint and all temporary site compounds, is shown in Volume 2, Figure 2.3 Scheme Site. Field and desk based study areas in relation to the application site are described in Section 10.4.

10.2.5 Appendices to this chapter consist of:

- Appendix 10.1: Preliminary ecological appraisal
- Appendix 10.2: Bat survey report

- Appendix 10.3: Breeding bird survey report
- Appendix 10.4: Wintering bird report

10.3 Legislative, regulatory and policy background

International and European legislation

10.3.1 The following legislation has been taken into account. Further explanation of the content of the identified legislation in relation to designated sites, habitats and fauna is provided in Volume 3, Appendices 10.1, 10.2, 10.3 and 10.4. Additionally, Appendix 10.1 contains detailed information on the baseline studies and survey undertaken to inform this assessment.

The Habitats Directive (Council Directive 92/43/EEC1992) [133]

10.3.2 On the conservation of natural habitats and wild flora and fauna. The directive protects over 1000 animal and plant species and over 200 'habitat types' which are of European importance.

The Birds Directive (Council Directive 2009/147/EC2009) [134]

10.3.3 On the conservation of wild birds. The directive is a comprehensive scheme of protection for all wild bird species occurring in the European Union, many of which are migratory throughout the Member States.

National legislation

The Wildlife and Countryside Act 1981 (as amended) [135]

10.3.4 The principal mechanism for the protection of wildlife in Great Britain. This legislation is the means by which the Convention on the Conservation of European Wildlife and Natural Habitats (the 'Bern Convention') and the European Union Directives on the Conservation of Wild Birds (2009/147/EC) and Natural Habitats and Wild Fauna and Flora (92/43/EEC) are implemented in Great Britain. Part I of the Act provides for the protection of birds, other wild animals and specified plants. It also makes it an offence to plant or otherwise cause to grow non-native invasive plant species.

[133] The Habitats Directive (Council Directive 92/43/EEC1992). Available online at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31992L0043:EN:HTML

[134] The Birds Directive (Council Directive 2009/147/EC2009). Available online at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32009L0147

[135] Wildlife and Countryside Act. Available online at: http://www.legislation.gov.uk/ukpga/1981/69

The Countryside and Rights of Way Act 2000[136]

10.3.5 The CROW Act covers access to open country, public rights of way, the designation of Areas of Outstanding Natural Beauty (AONB) and nature conservation, by strengthening the protection given to Sites of Special Scientific Interest (SSSI) and threatened species.

The Protection of Badgers Act 1992[137]

10.3.6 Provides special measures for protection of badgers and their setts in Great Britain.

Hedgerows Regulations 1997[138]

10.3.7 Under the regulations it is against the law to remove or destroy certain hedgerows classed as 'important hedgerows' without permission from the local planning authority.

The Natural Environment and Rural Communities Act 2006[139]

10.3.8 Defines a list of species of flora and fauna and habitats of principal importance for the purpose of conserving biodiversity, ('UK Biodiversity Action Plan' (UKBAP) Habitats and Species). The act provides that any public body or statutory undertaker in England and Wales must have regard to the purpose of conservation of biological diversity in the exercise of their functions with regard to the species and habitats on this list.

Highways England Biodiversity Action Plan 2015[140]

10.3.9 The HEBAP is Highways England's plan to protect and increase biodiversity on the roads networks as one component part of their forthcoming Environment Strategy. Highways England *"expect management to be guided by the principles of Natural England's The Mosaic Approach: Managing Habitats for Species."* In addition, they *"expect efforts to target Priority habitats and species (as identified under the Natural Environment and Rural Communities Act 2006, Section 41) however it is understood that in certain environments, for example in urban areas with few protected species, other habitats and species may be more suitable."*

[136] The Countryside and Rights of Way Act 2000. Available online at: http://www.legislation.gov.uk/ukpga/2000/37/contents http://www.legislation.gov.uk/ukpga/2000/37/contents

[137] The Protection of Badgers Act 1992. Available online at: http://www.legislation.gov.uk/ukpga/1992/51/contents

[138] Hedgerows Regulations 1997. Available online at: http://www.legislation.gov.uk/uksi/1997/1160/contents/made

[139] The Natural Environment and Rural Communities Act 2006. Available online at: http://www.legislation.gov.uk/ukpga/2006/16/contents

[140] Highways England Biodiversity Action Plan 2015. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/441300/N150146_-_Highways_England_Biodiversity_Plan3lo.pdf

National policy

National Planning Policy Framework 2012

10.3.10 Following the publication of the National Planning Policy Framework (NPPF) in March 2012[141], Planning Policy Statement 9 (PPS9): Biodiversity and Geological Conservation (2005) has been withdrawn. However, Office of the Deputy Prime Minister (ODPM) 06/2005: Biodiversity and Geological Conservation - Statutory Obligations[142] and their impact within the Planning System (the guidance document that accompanied PPS9) has not been withdrawn. Where more detailed guidance is required than is given within the NPPF, local planning authorities will continue to rely on ODPM 06/2005.

10.3.11 The specific policies reaffirm the contents and protection previously accorded to designated sites, species and habitats in PPS9. Additional emphasis is given to the creation of ecological networks and a net gain for biodiversity wherever possible.

10.3.12 Paragraph 117 of the NPPF states that *"To minimise impacts on biodiversity and geodiversity, planning policies should:*

- *Plan for biodiversity at a landscape-scale across local authority boundaries.*
- *Identify and map components of the local ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity, wildlife corridors and stepping stones that connect them and areas identified by local partnerships for habitat restoration or creation.*
- *Promote the preservation, restoration and re-creation of priority habitats, ecological networks and the protection and recovery of priority species populations, linked to national and local targets, and identify suitable indicators for monitoring biodiversity in the plan.*
- *Aim to prevent harm to geological conservation interests.*
- *Where Nature Improvement Areas are identified in Local Plans, consider specifying the types of development that may be appropriate in these areas.*"

10.3.13 Paragraph 118 of the NPPF states that *"When determining planning applications, local planning authorities should aim to conserve and enhance biodiversity by applying the following principles:*

[141] National Planning Policy Framework (NPPF) in March 2012. Available online at: h http://webarchive.nationalarchives.gov.uk/20180608213715/https://www.gov.uk/guidance/national-planning-policy-framework

[142] Office of the Deputy Prime Minister (ODPM) 06/2005: Biodiversity and Geological Conservation - Statutory Obligations. Available online at: https://www.gov.uk/government/publications/biodiversity-and-geological-conservation-circular-06-2005

- *If significant harm resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused.*

- *Proposed development on land within or outside a Site of Special Scientific Interest likely to have an adverse effect on a Site of Special Scientific Interest (either individually or in combination with other developments) should not normally be permitted. Where an adverse effect on the site's notified special interest features is likely, an exception should only be made where the benefits of the development, at this site, clearly outweigh both the impacts that it is likely to have on the features of the site that make it of special scientific interest and any broader impacts on the national network of Sites of Special Scientific Interest.*

- *Development proposals where the primary objective is to conserve or enhance biodiversity should be permitted.*

- *Opportunities to incorporate biodiversity in and around developments should be encouraged.*

- *Planning permission should be refused for development resulting in the loss or deterioration of irreplaceable habitats, including ancient woodland and the loss of aged or veteran trees found outside ancient woodland, unless the need for, and benefits of, the development in that location clearly outweigh the loss.*

- *The following wildlife sites should be given the same protection as European sites:- potential Special Protection Areas and possible Special Areas of Conservation;- listed or proposed Ramsar sites; and - sites identified, or required, as compensatory measures for adverse effects on European sites, potential Special Protection Areas, possible Special Areas of Conservation, and listed or proposed Ramsar sites".*

Regional policy

East Inshore and East Offshore Marine Plans 2014[143]

10.3.14 The aim of marine plans is to help ensure the sustainable development of the marine area. Marine plans will contribute to economic growth in a way that benefits society whilst respecting the needs of local communities and protecting the marine ecosystem.

[143] East Inshore and East Offshore Marine Plans 2014. Available online at: https://www.gov.uk/government/publications/east-inshore-and-east-offshore-marine-plans

Local policy

Hull Local Plan 2016 to 2032[144]

10.3.15 The new Hull Local Plan was submitted to the Planning Inspectorate in December 2016. The Planning Inspectorate responded to the plan in October 2017 with further consultation by HCC ending on 31 January 2017. The Hull Local Plan 2016-2032 was adopted on 23 November 2017 and supersedes the previous version which was adopted in 2000 and expired in 2006. The new Local Plan will guide development in the city up to 2032.

10.3.16 There were a number of policies from the superseded Hull Local Plan which related to SNCIs, development in relation to the Humber Estuary Sites, the protection of trees, species and green infrastructure - i.e. NE14, NE16, NE17, NE18, NE20 and NE21. These have since been replaced with new policies 43, 44 and 45 as follows:

Policy 43 Green Infrastructure and the Green Environment

1. *"Development that adversely affects the continuity and value of the Green Network, as designated on the Policies Map and Table 12.4, will not be permitted.*

2. *Development within or in close proximity to the Green Network should seek to protect and / or enhance the functionality and connectivity of the corridor.*

3. *Development adjacent to the River Hull should include a minimum of 8 metre space (unless otherwise agreed) to allow for:*

    a. *a north-south pedestrian and cycle way;*

    b. *flood defences as required to protect the city;*

    c. *contractors to access and maintain existing and proposed flood defences; and*

    d. *protection of wildlife corridors.*

4. *Development should incorporate and enhance existing and / or new green infrastructure features within their design, proportionate to their scale.*

5. *The Policies Map shows Green Network in the Kingswood area. The detailed allocations are made within the Kingswood Area Action Plan."*

[144] Hull Local Plan (2016 to 2032). Available online at: http://www.hull.gov.uk/resident/planning-and-building-control/local-plan

Policy 44 Biodiversity and wildlife

"*Policies Map*

1. *Wildlife designations within the city boundary are shown on the Policies Map. This includes the Humber Estuary International Site (Ramsar, SPA, SAC and SSSI), Local Nature Reserves (LNR), and sites likely to qualify as Local Wildlife Sites (LWS). Allocations within the Kingswood area are made within the Kingswood Area Action Plan.*

European sites (Ramsar, SPA, SAC)

2. *Development that may affect an existing or proposed European or Ramsar site should demonstrate through a Habitats Regulations Assessment that any impact will be acceptable. This will need to consider the impact of the scheme both on its own and in combination with other schemes that already have planning permission. Development will not be permitted if it is likely to result in a significant adverse impact unless there is an imperative reason of over-riding public interest.*

National sites (SSSI)

3. *Natural England will be consulted on proposals for development that are likely to have an effect on a SSSI. Development that will have a negative effect will not normally be permitted, except where the benefits of development substantially outweigh both the impact on the site and any broader impacts on the wider network of National Sites. In such cases, compensation for the harm will be required.*

Local sites (LNR, LWS)

4. *Development resulting in the loss or significant harm to a Local Wildlife Site or Local Nature Reserve will only be permitted if it can be clearly demonstrated there is a strong need for the development, and that there are no other appropriate locations for the development. Where loss or harm cannot be prevented or adequately mitigated, as a last resort, appropriate compensation for the loss / harm must be agreed.*

5. *Until formally reviewed, an open space site will be afforded the same level of protection as a Local Wildlife Site if it meets the Council's LWS selection criteria.*

Protected species

6. *Development adversely affecting a species protected by legislation will not be allowed.*

Promoting biodiversity improvements

7. *Development should seek to achieve a net gain in biodiversity habitat commensurate with the scale of the development, and schemes will be supported where they:*

a. *Conserve, restore, enhance or re-create biodiversity interests, particularly national Priority Habitats and Species and locally important habitat and species identified in the Hull Biodiversity Action Plan.*

b. Safeguard, enhance, create and connect identified habitat networks in order to:

i. protect, strengthen and reduce fragmentation of habitats;

ii. create a coherent ecological network that is resilient to current and future pressures;

iii. conserve and increase populations of species; and

iv. promote and enhance green infrastructure."

Policy 45 Trees

"Residential and commercial development and new trees

1. *Three new trees of native species and local provenance will be required to be planted for each new dwelling (this excludes conversions and changes of use). A presumption that the trees will be planted as part of the development rather than off-site will apply when appropriate. The planting of new trees will be encouraged in new commercial developments in appropriate places or within landscaping schemes wherever possible.*

Tree protection and replacement

2. *Hull City Council will make Tree Preservation Orders when necessary, in order to protect specific trees, groups of trees, or woodlands, in the interests of amenity and biodiversity.*

3. *The Council will not grant permission for the loss of or damage to a tree, group of trees or areas of woodland of significant amenity, biodiversity or historic value unless there is deemed to be an immediate hazard to public safety.*

4. *Trees protected by Tree Preservation Orders should be retained whenever possible, unless:*

a. They are dead, dying, diseased, or represent a hazard to public safety; or

b. The Council's arboricultural officer deems the felling to be acceptable with regards to the Council's policy on urban forestry and tree management; or

c. The benefit of the proposed development outweighs the benefit of their retention.

5. If felling is deemed acceptable by parts (3) or (4), then the planting of two replacement trees in an appropriate location will be required."

Joint Structure Plan for Kingston upon Hull and the East Riding of Yorkshire (Adopted June 2005) [145]

10.3.17 The Joint Structure Plan (JSP) was adopted on 29 June 2005. The JSP set out the framework for the development and use of land up to 2016 in the combined area of Hull and the East Riding of Yorkshire. The plan includes policies on the general location of land for new homes, businesses, shops and leisure facilities. It also gives guidance on encouraging more sustainable forms of movement (for both people and goods), protecting the natural and build environment, respecting and improving the character of the area and managing the risk from flooding and coastal erosion. A number of policies within the JSP have expired. Those that remain are called 'saved' policies as below:

Policy ENV 2

- *"Sites of strategic nature conservation importance will be protected from development likely to have a significant adverse effect. The level of protection afforded to these sites and any necessary mitigation and / or compensation measures should reflect their relative international, national or local importance."*

Policy ENV 3

- *"Development that is likely to have an adverse effect on species identified through UK Wildlife Acts, Regulations and Biodiversity Action Plans, will not be allowed unless it can be demonstrated that there is an overriding need for the development and / or appropriate mitigating compensation measures are provided. The level of protection afforded to species and any necessary mitigation / compensation measures should reflect their species and any necessary mitigation / compensation measures should reflect their relative international, national or local importance."*

[145] Joint Structure Plan for Kingston upon Hull and the East Riding of Yorkshire (Adopted June 2005). Available online at: http://www.hullcc.gov.uk/pls/portal/docs/PAGE/HOME/PLANNING/PLANNING%20POLICY/STRUCTURE%20PLAN/ADOPTED_JSP.PDF

Policy ENV 4

- *"The integrity of strategic habitat corridors along the River Derwent, River Hull, Humber Estuary, the coastline and within Hull should be maintained through habitat restoration, creation, and improvement. Further fragmentation of these corridors should be avoided."*

Hull Biodiversity Action Plan[146]

10.3.18 The Hull Biodiversity Action Plan (Hull BAP) includes a list of national and local priority habitats and species which are present in Hull. The Hull BAP outlines biodiversity objectives, key issues opportunities and current projects for each habitat type and species. Habitat Action Plans which have been included within the Hull BAP (HBP, 2002), and which are relevant to the study area include: Estuarine Habitats, Gardens and Allotments, Industrial Land, Parks, Golf Course and Cemeteries, The Built Environment, Trees, Scrub and Hedgerows and Grassland. Species Action Plans included within the Hull BAP and which are relevant to the study area include: Elm Trees, Pipistrelle Bats, Song Thrush and Lichens.

10.4 Study area

10.4.1 The study area is shown in Volume 2: Figure 2.1: Site Map and Volume 3: Appendix 10.1: Figure A: Extended Phase 1 Habitat Map. The Scheme would improve a 1.5km stretch of the A63 from Ropery Street to the Market Place and Queen Street junctions. The realigned A63 and the westbound exit slip road to Commercial Road would pass through the northern part of Trinity Burial Ground SNCI, resulting in the permanent loss of one third of its footprint. 72 mature trees within the SNCI would be lost to accommodate the works and the excavation of remains. Currently, a further 245 roadside trees across the Scheme Site footprint would also need to be felled to accommodate construction works. This chapter has been assessed during the Preliminary Design Stage of the Scheme when some elements of the design are not yet finalised. The difficulties encountered during preparation are described in Chapter 5: Environmental Impact Assessment process at Section 5.8 of this ES.

10.4.2 Buildings to be demolished include the Myton Centre, Arco buildings and the Holiday Inn substation. The former Earl de Grey public house is to be dismantled.

10.4.3 New structures include a two-span precast concrete overbridge at Mytongate Junction; retaining walls for the underpass at Mytongate Junction; a pumping station to the south east of Mytongate roundabout; retaining walls at the Holiday

[146] Hull Biodiversity Action Plan. Available online at: http://www.hullcc.gov.uk/pls/portal/docs/PAGE/HOME/PLANNING/PLANNING%20POLICY/ENVIRONMENTAL%20PLANNING%20POLICIES/BIODIVERSITY%20ACTION%20PLAN.PDF

Inn; pedestrian, cycle and disabled user bridges over the A63 at Porter Street and Princes Quay and the re-siting of Spurn Lightship.

10.4.4 A rising main downstream of the pumping station would transfer flow to a receiving network or watercourse. At present, it is proposed to outfall (discharge) directly to the Yorkshire Water sewer however if consent is not granted the outfall would discharge to the Humber Estuary through an existing sheet piled wall. The location of this is undecided.

10.4.5 Potential temporary construction site compounds and their locations are shown on drawings (Volume 2, Figure 2.12: Construction site compound locations and listed below:

8. Arco site (preferred Option A) or Staples site (alternative Option B) – bentonite compound (see Sections 10.6.21 to 10.6.22)
9. Wellington Street Island Wharf (Spencers) - main site offices
10. A63 Eastbound Recovery Base (A63 layby eastbound to the north of St Andrews Quay) - vehicle recovery
11. Livingstone Road (South Humber Properties Ltd) - materials compound
12. Land south east of Mytongate Junction - Trinity Burial Ground compound
13. Neptune Street Set Down – Princes Quay Bridge compound, vehicle recovery and traffic management
14. A63 westbound recovery base (A63 layby westbound to the west of Garrison Road roundabout) – vehicle recovery

10.4.6 The Myton Centre is proposed as replacement public open space for loss of green space incurred at Trinity Burial Ground. Prior to the landscaping of this area, the Myton Centre would be demolished and the site used for the duration of the works (5 years), as a temporary car park for contractor staff working on either the Arco or Staples sites. Parking provision would be limited to cars and small vans with disabled spaces provided. The area of the Myton Centre temporary car park is shown at Volume 2, Figure 2.12.

10.5 Approach and methodology

10.5.1 The assessment of impacts on ecology and nature conservation follows the most recent Highways England guidance DMRB, Volume 11, Section 3, Part 4 Ecology and Nature Conservation[147]) and supplementary advice (Interim Advice Note

[147] Design Manual for Roads and Bridges, Volume 11, Section 3, Part 4 'Ecology and Nature Conservation. Available online at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/11s3p04.pdf

130/10 Ecology and Nature Conservation: Criteria for Impact Assessment[148]). The assessment has also followed the Chartered Institute of Ecological and Environmental Management's (CIEEM) Ecological Impact Assessment (EcIA) guidance (2016[149]).

10.5.2 The following key stages are involved in the impact assessment:

- Description of the baseline conditions at the site with regard to ecology
- Valuation of each individual ecological receptor
- Identification and characterisation of development activities that may impact upon ecological receptors
- Identification of mitigation measures to avoid or reduce the impact, as well as compensation measures where impacts cannot be avoided
- Characterisation of predicted ecological impacts during Construction and Operation Phases, taking into account mitigation measures
- Evaluation of the significance of residual impacts

10.5.3 Ecological receptors are valued based upon their importance at a geographical scale as detailed in Table 10.1: Receptor valuations which is taken from IAN 130/10: Table 1. Receptors valued at lower than Local value were defined as having negligible value. Only ecological receptors of value (Local value or higher) were taken forward in the impact assessment process.

Table 10.1: Receptor valuations

Valuation	Criteria
International or European	Habitats Natura 2000 sites including: Sites of Community Importance (SCIs); Special Protection Areas (SPAs); potential SPAs (pSPAs); Special Areas of Conservation (SACs); candidate or possible SACs (cSACs or pSACs); and Wetlands of International Importance (Ramsar sites). Biogenetic Reserves, World Heritage Sites and Biosphere Reserves. Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Species Resident, or regularly occurring, populations of species which may be considered at an International or European level where: • the loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; or • the population forms a critical part of a wider population at this scale; or

[148] Design Manual for Roads and Bridges. Interim Advice Note 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment. Available online at: http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian130.pdf

[149] CIEEM (2016). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd Edition. Chartered Institute of Ecology and Environmental Management, Winchester

Valuation	Criteria
	• the species is at a critical phase of its life cycle at this scale.
UK or National	Habitats Designated sites including: Sites of Special Scientific Interest (SSSIs); Marine Protected Areas (MPAs) including Marine Conservation Zones (MCZs); and National Nature Reserves (NNRs). Areas which meet the published selection criteria eg JNCC (1998) for those sites listed above but which are not themselves designated as such. Areas of key / priority habitats identified in the UK Biodiversity Action Plan (BAP), including those published in accordance with Section 41 of the Natural Environment and Rural Communities Act (2006) and those considered to be of principal importance for the conservation of biodiversity. Areas of Ancient Woodland e.g. woodland listed within the Ancient Woodland Inventory. Species Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where: • the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or • the population forms a critical part of a wider population at this scale; or • the species is at a critical phase of its life cycle at this scale.
Regional	Habitats Areas of key / priority habitats identified in the Regional BAP (where available); areas of key / priority habitat identified as being of Regional value in the appropriate Natural Area Profile (or equivalent); areas that have been identified by regional plans or strategies as areas for restoration or re-creation of priority habitats (for example, South West Nature Map); and areas of key/priority habitat listed within the Highways Agency's BAP. Species Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level and key / priority species listed within the HABAP where: • the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or • the population forms a critical part of a wider population; or • the species is at a critical phase of its life cycle.
County or Unitary Authority Area	Habitats Designated sites including: Sites of Nature Conservation Importance (SNCIs); County Wildlife Sites (CWSs); and Local Nature Reserves (LNRs) designated in the county or unitary authority area context. Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Areas of key / priority habitats identified in the Local BAP; and areas of habitat identified in the appropriate Natural Area Profile (or equivalent). Species Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where: • the loss of these populations would adversely affect the conservation status or distribution of the species across the County or Unitary Authority Area; or • the population forms a critical part of a wider population; or • the species is at a critical phase of its life cycle.

Valuation	Criteria
Local	Designated sites including: Local Nature Reserves (LNRs) designated in the local context. Trees that are protected by Tree Preservation Orders (TPOs). Areas of habitat; or populations / communities of species considered to appreciably enrich the habitat resource within the local context (such as veteran trees), including features of value for migration, dispersal or genetic exchange.

10.5.4 The characterisation of ecological impact uses a range of factors as detailed in IAN 130/10 Table 2. Impacts are characterised at both the Construction and Operation Phases and take into account proposed mitigation measures. The factors include:

- SI (Sign) Positive (beneficial (+ve) or Negative (adverse (-ve))
- PO (Probability of Occurring): Certain, Probable, Unlikely
- CO (Complexity): Direct, Indirect, Cumulative
- EC (Extent): Area measures and percentage of total (e.g. area of habitat / territory lost)
- SZ (Size): Description of level of severity of influence (e.g. complete loss, number of animals affected)
- RE (Reversibility): Reversible or Not Reversible (can the effect be reversed, whether or not this is planned)
- DU (Duration): Permanent (P) or Temporary (T) in ecological terms. Where differing timescales are determined in relation to the life cycle of the receptor, these should be defined
- TF (Timing and Frequency): Important seasonal and / or life cycle constraints and any relationship with frequency considered

10.5.5 Measures to avoid or reduce the impact on ecological resources have been considered throughout the development of the Scheme as part of an iterative process. Mitigation measures have been developed to reduce impacts at both the Construction and Operation Phases as detailed within this ES chapter.

10.5.6 Where significant residual impacts to ecological receptors were predicted, the significance of the effect was evaluated, based on the descriptors within Table 10.2: Significance of effects (reproduced from IAN 130/10[148] Table 3). The significance of the effect is dependent on the level at which the resource is valued. Assignment of impacts to overall significance categories allows ecological impacts to be related to impacts in other topic areas.

Table 10.2: Significance of effects

Significance category	Typical descriptors of effect
Very large	An impact on one or more receptor(s) of International, European, UK or National Value. NOTE: only adverse effects are normally assigned this level of significance. They should be considered to represent key factors in the decision-making process.
Large	An impact on one or more receptor(s) of Regional Value. NOTE: these effects are considered to be very important considerations and are likely to be material in the decision-making process.
Moderate	An impact on one or more receptor(s) of County or Unitary Authority Area Value. NOTE: these effects may be important, but are not likely to be key decision-making factors.
Slight	An impact on one or more receptor(s) of Local Value. NOTE: these effects are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the Scheme.
Neutral	No significant impacts on key nature conservation receptors. NOTE: absence of effects, or those that are beneath levels of perception.

10.5.7 The following Scheme dates have been assumed for the purposes of the assessment:

- Construction Phase and start of works on site commences in March 2020
- Operation Phase and open to traffic (opening date) is May 2025

Scope of assessment

10.5.7 Information on ecological receptors was gathered through both desk based studies and field surveys.

10.5.8 The desk study assessed the area within a 2km radius of the application site. The field survey study area covered the application site and any adjacent features or habitats within 30m that had potential to support protected or notable species.

10.5.9 The desk study included a search for statutory and non-statutory designated wildlife sites and historical records of protected or notable species within the study area. The information was obtained through a search of local record centre data sets (North and East Yorkshire Ecological Data Centre), as well as online sources such as the government Multi-Agency Geographic Information for the Countryside (MAGIC) website.

10.5.10 Ordnance Survey maps at a scale of 1:25,000 were also used to search for ponds within 500m of the application site to assess whether the development could potentially impact on great crested newt breeding (aquatic) or terrestrial habitat.

10.5.11 Further desk based information was derived from an appraisal of previous ecological survey reports completed at earlier stages of Scheme development, as

well as other relevant reports of ecological surveys completed in the area. These are summarised below in Table 10.3: Previous ecological reports for the Scheme, and relevant findings are discussed in Section 10.6.

Table 10.3: Previous ecological reports for the Scheme

Report	Date	Author	Key Evaluation Results
Environmental Survey	2003	Smeeden Foreman	Identification of principal ecological receptors.
An Environmental Building Assessment, Bat Emergence and Dawn Swarming Survey for Castle Buildings, Quay West	2005	WSP 2005	Presence of a single common pipistrelle bat roosting behind a boarded up window in the Castle Buildings.
Phase 1 Ecological Survey, A63 Castle Street, Hull, Ecological Assessment Stage 2. Report Reference 06588242.501 Rev B0	2007	Golder Associates	Presence of non-statutory site of nature conservation importance (Trinity Burial Ground SNCI).
A63 Improvements – Hull, Environmental Assessment Report (Options Identification Stage). Report Reference W11189/VAA/03	2008	Pell Frischmann	Overall limited impact for the Scheme with no significant differences in ecological impact between Scheme options.
Kingston-upon-Hull Open Space Assessment. Sites of Nature Conservation Importance (SNCI).	October 2008	Penny Anderson Associates	Audit of habitats and species within Trinity Burial Ground SNCI.
Environmental Scoping Report (Options Selection Stage) W11189/T13/01	2009	Pell Frischmann	No significant differences in ecological impact between Scheme options.
Initial Screening Report for Appropriate Assessment (options selection stage). W11189/T13/06	2010	Pell Frischmann	Initial Scheme screening of potential impacts to European protected site. Drainage design needed before final assessment can be completed.
Scheme Assessment Report (W11189/T11/05)	2010	Pell Frischmann	Overground Scheme option has less impact on wildlife and biodiversity.

10.5.12 In February, June and August 2013, Extended Phase 1 habitat surveys were undertaken by MMSJV ecologists of the Scheme Site Boundary and the potential compound sites that were available at the time. Additional compound sites were surveyed in March 2014. Since then, the Scheme Site Boundary and the potential compound sites have changed and the area within the current Scheme Site Boundary and potential compound sites was re-surveyed on 24 May and 07 September 2016. In 2017 and 2018, potential compound sites were again changed and new sites were surveyed on 14 September 2017 and 28 March 2018. These were standard preliminary ecological surveys which record the main habitat types present, including dominant plant species in accordance with the categories specified for a Phase 1 Vegetation and Habitat Survey (Joint Nature

Conservation Committee, 2010[150]). They also assess the potential for the presence of protected or notable species and inform the need for further surveys. Full details are provided in Volume 3, Appendix 10.1.

10.5.13 All trees within the site and nine buildings were subject to an assessment of bat roost potential and Trinity Burial Ground SNCI was assessed to be a potential foraging resource during the 2013 Extended Phase 1 habitat surveys. Detailed visual inspections of buildings and trees were undertaken to look for physical evidence of bat roosting, such as droppings. Between June and September 2013, where bat roost presence within buildings and trees could not be ruled out from visual inspections, dusk emergence and dawn re-entry surveys were completed to confirm whether any roosts were present. In addition, bat activity transects and commuting route surveys were completed and automated detectors were deployed to monitor the level and pattern of bat activity within and adjacent to the application site. Further surveys for bat roosts and bat activity surveys were undertaken in August and September 2015 and July, August and September 2016 and September 2017 (Volume 3, Appendix 10.2). All surveys conducted in 2013 and 2015 followed methodologies outlined in Bat Surveys: Good Practice Guidelines 2nd Edition (L Hundt 2012[151]). The surveys conducted in 2016 and 2017 followed methodologies outlined in Bat Surveys: Good Practice Guidelines 3rd Edition (J Collins 2016[152]) and full details are provided in Volume 3, Appendix 10.2.

10.5.14 Two temporary site compounds (Livingstone Road and Wellington Street Island Wharf) that are located adjacent to the Humber Estuary SAC, SPA, Ramsar and SSSI and contained habitats (potentially suitable to support foraging, roosting and ground-nesting waterfowl that the Humber Estuary is designated for) were subject to breeding bird surveys in May and June 2016. Wintering bird surveys have been undertaken in January and February 2017 of three potential site compounds (Livingstone Road, Wellington Street Island Wharf and Neptune Street) as the latter only became available after the breeding bird surveys were completed. These surveys were to establish the birds' presence or likely absence and use of the site compounds and the adjacent designated sites. Another site compound that has since been removed from the Scheme (Tower Street) also had both surveys. The results of these surveys have been left in the reports as birds are highly mobile and the results provide a wider picture of their movements. The surveys referred to guidelines in Bibby *et al.* (1992)[153], Bibby *et al* (2000)[154], British

[150] JNCC (2010) Handbook for Phase 1 Habitat Survey: A technique for environmental audit

[151] L Hundt (2012) Bat Surveys: Good Practice Guidelines, 2nd Edition

[152] J Collins (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines, 3rd Edition

[153] C Bibby, N Burgess & D Hill (1992) Bird Census Techniques

[154] C Bibby, N Burgess, D Hill and S Mustoe (2000) Bird Census Techniques, 2nd Edition

Trust of Ornithology *et al* (2016)[155] and Gilbert *et al.* (1998)[156] and full details are provided in Volume 3, Appendices 10.3 and 10.4.

10.5.15 No targeted surveys for other protected species or further botanical surveys were necessary to inform the assessment of impacts on ecological receptors. Detailed botanical information from the Open Space Assessment of SNCIs was already available for the most extensive and valuable area of habitat within the application site, that is Trinity Burial Ground SNCI.

10.5.16 A separate Habitats Regulations Assessment (HRA) (termed an Assessment of Implications on European Sites (AIES) for Highways England schemes) Screening Report has also been produced to assess the potential impacts of the Scheme on the nearby European Sites. This is in accordance with the Conservation of Habitats and Species Regulations 2017. The document reference for the AIES is TR010016/APP/6.13. More details about this process can be found at Section 10.5.23.

Assumptions and limitations

10.5.17 The optimum time of year for completing Extended Phase 1 habitat surveys is between April and September, as many plant species have a seasonal expression in spring and summer only. However, it is possible outside of this season for experienced ecologists to identify habitat types to the JNCC (2010[150]) descriptions, determine their biodiversity value and potential for protected species and recommend further surveys within the season if required. One of the three survey visits in 2013 was on 26 February and the 2014 visit was on 14 March outside of the optimum season, although the habitats recorded did not require further specialist plant survey. Given the surveys in 2016 and 2017 were both within the optimum survey season on 23 May 2016, 07 September 2016 and 14 September 2017, the timing of the 2013 and 2014 surveys is not considered to be a limitation to the assessment.

10.5.18 Two buildings directly adjacent to the application site with high bat roost potential (Castle Buildings and former Earl de Grey public house) were unsafe to enter and an internal inspection for evidence of roosting bats could not be completed. To account for this limitation the number of subsequent dusk emergence surveys completed at these buildings was increased above the number recommended in the best practice guidance (L Hundt 2012[20] superseded by J Collins[21] 2016).

10.5.19 Buildings to the west of the temporary site compound at Wellington Street Island Wharf have not been assessed as the buildings are not to be demolished.

[155] British Trust of Ornithology, Joint Nature Conservancy Committee and the Royal Society for the Protection of Birds. (2016). Breeding Bird Survey Methodology. Available online at: https://www.bto.org/

[156] Gilbert et. al. (1998) Bird Monitoring Methods. RSPB

10.5.20 It has been assumed as a worst case scenario, that the Earl de Grey public house would be dismantled. For details see Chapter 8 Cultural heritage Section 8.8.

Consultation

Scoping

10.5.21 Natural England was consulted in March 2013 with regard to the scope of the Environmental Statement as detailed in the Scoping Report (A63 Castle Street Improvements, Hull Environmental Statement Scoping Report 112630/AE/01 Rev 1 March 2013). Natural England commented that they agreed with the proposed scope of the assessment. See Volume 3, Appendix 4.1 Response to the Planning Inspectorate and stakeholder Scoping Opinion comments for more details.

Bats

10.5.22 The Scheme was registered with Natural England's Discretionary Advice Service (DAS) in May 2013, principally to seek advice regarding the assessment of impacts upon bats. The Regulation team advised that increased survey effort should be applied at the buildings with high bat roost potential which were unsafe to enter, as noted in Section 10.5.18 above.

AIES

10.5.23 An AIES Screening Report was completed on behalf of Highways England (Highways Agency) in September 2014 for a preliminary design of the Scheme which included the construction of Princes Quay Bridge. This Screening Report underwent required consultation with Natural England over potential pollution pathways. At the time, it was concluded that there would be no significant effects as a result of the Scheme.

10.5.24 In the years between 2014 and 2017, the Scheme underwent design and environmental updates but was delayed as there were concerns over the potential disruption from construction to the UK City of Culture events which were to start in January 2017. Princes Quay Bridge is now being delivered as an early phase of the A63 Castle Street Improvements Scheme, subject to planning approval of conditions of an approved full planning consent from HCC. As the location remains within 2km of a European Site, a separate AIES is required, however for planning applications (which are not Highways England Schemes) this is known as a Habitats Regulations Assessment (HRA).

10.5.25 The HRA Screening Report for Princes Quay Bridge has therefore drawn upon the previous AIES for the full A63 Castle Street Improvements Scheme. In the years between 2014 and 2017, the Scheme underwent design and environmental updates but was delayed as there were concerns over the potential disruption from construction to the UK City of Culture events which were to start in January 2017.

10.5.26 An initial HRA Screening Report for Princes Quay Bridge was issued to Natural England for comment on 21 March 2018. This Report contained measures

proposed to mitigate impacts. A response from Natural England was received on 20 April 2018. This stated ". . . *due to the location of the proposed Princes Quay Bridge and the scale of works, we agree with the conclusion that the proposal is not likely to have a significant effect on the interest features of the Humber Estuary designated site and an Appropriate Assessment is therefore not required*."

10.5.27 On the 12 April 2018, a precedent was set by a decision made by the Court of Justice of the European Union (CJEU) People Over Wind and Sweetman v Coillte Teoranta (C-323/17)[157]. The CJEU issued a judgement which ruled that Article 6(3) of the Habitats Directive must be interpreted as meaning that mitigation measures (referred to in the judgment as measures which are intended to avoid or reduce effects) should be assessed within the framework of AA. As such it is now not permissible to take account of measures intended to avoid or reduce the harmful effects of the plan or project on a European Site at the screening stage.

10.5.28 The HRA Screening Report for Princes Quay Bridge was re-written based on the revised requirements of the CJEU and issued on behalf of HCC and MMO as the Competent Authority in August 2018. The findings of the HRA Screening Report concluded that there would be no significant effects to the Humber Estuary designated sites. This report is currently undergoing consultation with the MMO and Natural England. The AIES Screening Report for the Scheme is based on the findings of the HRA Screening Report for Princes Quay Bridge and will be submitted separately as part of the DCO application (see application reference for TR010016/APP/6.13).

SSSI

10.5.29 The SSSI designation of the Humber Estuary would normally require a separate consultation with Natural England as this is a national designation legislated by the Wildlife and Countryside Act 1981 (as amended) and not EU law. Natural England were satisfied that the Princes Quay Bridge works would not require a separate consultation regarding impacts to the Humber Estuary SSSI if the works are carried out in accordance with the planning application. If Natural England require a separate consultation for the SSSI regarding the A63 Castle Street Improvements Scheme, one will be undertaken.

Trinity Burial Ground

10.5.30 In 2017, Hull City Council (HCC) was consulted regarding the impacts to Trinity Burial Ground SNCI. It was accepted that the 28 mature trees that are located under the road site boundary would be lost, but that further assessment of the trees to be lost to accommodate the tent screening archaeological excavation works with the burial ground from view, would need to be undertaken. Mitigation was proposed by HCC including pruning and pollarding of some trees to avoid

[157] Court of Justice of the European Union (CJEU) People Over Wind and Sweetman v Coillte Teoranta (C-323/17). Available online at: http://curia.europa.eu/juris/document/document.jsf?docid=200970&doclang=EN

felling. A further consultation was undertaken in January 2018, in which HCC accepted that a further 12 trees would be removed to accommodate the archaeology tent and new entrance, totalling the likely loss of 40 trees. Compensation would include replanting semi mature trees on a like for like number with a possible gain in numbers close to Trinity Burial Ground as space within it is limited.

10.6 Existing environment

Desk study

Statutory designated sites

10.6.1 The Scheme Site Boundary is located adjacent to (in parts) the Humber Estuary which is a SAC, a SPA and a Ramsar site which are all international designations. The Humber Estuary is also designated as a Site of Special Scientific Interest (SSSI) which is a national designation. All designations share the same boundary (see Volume 2, Figure 10.1 Statutory designated sites).

10.6.2 The Estuary contains a number of habitats listed in Annex 1 of the Habitats Directive which are the primary reason for its designation as a SAC. These include: Atlantic salt meadows, shallow submerged sandbanks, partially covered mudflats and sandbanks, glasswort beds and coastal lagoons. Extensive intertidal mudflats which are not covered at low tide are also of primary importance. Significant species include river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus*. Other Annex 1 habitats which are present as a qualifying feature, but are not primary reasons for site selection include: Fixed dunes, dunes with sea buckthorn *Hippophae rhamnoides*, dunes with European marram grass *Ammophila arenaria* and embryonic shifting dunes. The presence of grey seals *Halichoerus grypus* is another qualifying feature. The SAC has been assessed as of very high biodiversity value at an international level.

10.6.3 The Humber Estuary is designated as a SPA for a range of bird species which are designated on Annex 1 of the Wild Birds Directive. The site supports very significant populations of bittern *Botaurus stellaris*, golden plover *Pluvialis apricaria*, avocet *Recurvirostra avosetta*, marsh harrier *Circus aeruginosus*, bar tailed godwit *Limosa lapponica*, ruff *Philomachus pugnax* and little tern *Sternula albifrons*, which breed and overwinter on the Estuary. Important migratory species include knot *Calidris canutus*, dunlin *Calidris alpina*, black tailed godwit *Limosa limosa*, redshank *Tringa tetanus* and shelduck *Tadorna tadorna*. The SPA has been assessed as of very high biodiversity value at an international level.

10.6.4 The Humber Estuary Ramsar site is designated as a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons. It supports a breeding colony of grey seals and natterjack toad *Bufo calamita*. The Humber Estuary Ramsar site supports a waterfowl assemblage of international importance and twelve bird species

populations occur at international importance levels. The Humber Estuary acts as an important migration route for both river lamprey and sea lamprey between coastal waters and their spawning areas. The Ramsar site has been assessed as of very high biodiversity value at an international level.

10.6.5 The Humber Estuary is designated as a SSSI as it has a series of nationally important habitats. These are the Estuary itself (with its component habitats of intertidal mudflats and sandflats and coastal saltmarsh) and the associated saline lagoons, sand dunes and standing waters. The Estuary supports nationally important numbers of 22 species of wintering waterfowl and nine passage waders, and a nationally important assemblage of breeding birds of lowland open waters and their margins. It is also nationally important for a breeding colony of grey seals, river lamprey and sea lamprey, a vascular plant assemblage and an invertebrate assemblage. The SSSI has been assessed as of high biodiversity value at a national level.

Non-statutory designated sites

10.6.6 Details of 15 non-statutory sites received from North and East Yorkshire Ecological Data Centre (NEYEDC) within or partly within a 2km radius of the site are provided in Table 10.4: Non-statutory designated sites and Volume 2, Figure 10.2 Non-statutory designated sites. SNCIs are non-statutory designated wildlife sites notified by HCC for habitats and / or species of nature conservation value within the city. They receive a level of protection through local planning policies. All SNCIs have been assessed as of medium biodiversity value at county level.

Table 10.4: Non-statutory designated sites

Designation	Name and site code	Description	Nearest distance to Scheme
SNCI	Trinity Burial Ground (369)	An old cemetery comprising an area of urban parkland with many mature trees, shrubs and scrub in the understorey and amenity grassland.	Within Scheme Site footprint
SNCI	River Hull (including banks; 168)	Fresh water tributary to the Humber Estuary. The vegetation present along the river is highly representative of the changes between freshwater, brackish and estuarine environments. Supports a wide range of flora and fauna along its entire length, including protected and / or UKBAP species.	150m east of main site
SNCI	Mudflats to south of Sammy's Point (255)	No information provided	250m south of main site
SNCI	Land to the East of Cricket Ground (86)	No information provided	1.1km northwest
SNCI	Land to the east of Hymers College grounds (373)	No information provided	1.2km northwest

Designation	Name and site code	Description	Nearest distance to Scheme
SNCI	Land to the west of Northumberland Avenue almhouses (364)	No information provided	1.25km north
SNCI	Foredyke Stream cycle track - south of Chapman Street (167)	No information provided	1.35km northeast
SNCI	West Park (84)	No information provided	1.4km northwest
SNCI	Strip of land north of Circle cricket ground (87)	No information provided	1.4km northwest
SNCI	Hymers College grounds (88)	No information provided	1.5km northwest
SNCI	Land to rear of Hymas Avenue (89)	No information provided	1.5km northwest
SNCI	Dismantled low level railway line (111)	No information provided	1.6km north
SNCI	Foredyke stream cycle track - south of Chamberlain Road (177)	No information provided	1.6km northeast
SNCI	General Cemetery, Spring Bank West (100)	No information provided	1.65km northwest
Yorkshire Wildlife Trust Reserve and SNCI	Pearson Park Wildlife Garden (108)	Though small in size this reserve contains a wide variety of habitats including ponds, hedgerows, woodland and a meadow, as well as a horticultural display and agricultural sections. The reserve is of importance due to its urban surroundings and supports a wide variety of birds, invertebrates and amphibians.	1.9km north

10.6.7 Trinity Burial Ground SNCI, lies partly within the application site. Located directly to the east of Mytongate Junction, it comprises a small area of urban parkland with mature broad-leaved trees and amenity grassland, covering an area of 8052m² (0.8ha). Species include ash *Fraxinus excelsior*, hybrid poplar *Populus* spp, lime *Tilia europaea*, pedunculate oak *Quercus robur*, wych elm *Ulmus glabra* and sycamore *Acer pseudoplatanus*.

10.6.8 The River Hull SNCI lies approximately 150m east of the site.

UKBAP (NERC Act 2006 Section 41) Priority habitats

10.6.9 The MAGIC website revealed that within a 2km radius of the site there were the following UKBAP Priority habitats which have been assessed as of high biodiversity value in the national area:

- Two parcels of 'Wood-pasture and Parkland', the closest being approximately 1.97km to the north west.
- 31 areas of 'Mudflats' habitat with the closest being adjacent to the Scheme Site Boundary (within site compounds at Wellington Street Island Wharf and Livingstone Road and in Humber Dock basin adjacent to Humber Dock Marina).
- Four areas of Broad habitats 'Intertidal substrate foreshore - mud' habitat with the closest being in the Humber Estuary (within site compounds Wellington Street Island Wharf and Livingstone Road and in Humber Dock basin).
- Four areas of Broad habitats 'Intertidal substrate foreshore – man-made ground' habitat with the closest being within the Scheme Site Boundary in Humber Dock Marina and Princes Dock. (This habitat has been assessed separately in Section 10.6.17 Standing Water)
- One area of Broad habitats 'Intertidal substrate foreshore - sand and gravel' habitat with the closest being approximately 656m to the east at Victoria Dock.
- 31 areas of 'Deciduous woodland' habitat with the closest being within the Scheme Site Boundary at Trinity Burial Ground.
- Eight areas of 'Broad-leaved woodland' habitat with the closest being within the Scheme Site Boundary at Trinity Burial Ground.
- One area of 'No main habitat but additional habitat exists - saltmarsh' approximately 60m to the south of A63 eastbound recovery base.

10.6.10 In terms of species, the MAGIC search revealed:

- There were two granted European Protected Species (EPS) licence applications within the search area. Both applications allowed for damage to and destruction of resting places used by common pipistrelle bat *Pipistrellus pipistrellus*.

Protected species

10.6.11 The records received from NEYEDC within 2km of the site were checked against the species included in the UKBAP and Hull Local Biodiversity Action Plans (LBAP). Records before the year 2000 were excluded.

- Flora – Two records of LBAP bee orchid *Ophrys apifera* 89m west of site; one record of UKBAP cornflower *Centaurea cyanus* 1.1km north of site and one record of UKBAP garden asparagus *Asparagus officinalis* 1.1km north of site.

- Invertebrates – One record of UKBAP August thorn moth *Ennomos quercinaria* 1.9km north west of site; four records of UKBAP cinnabar moth *Tyria jacobaea* 1km north west of site.

- Amphibians - No records of great crested newt *Triturus cristatus*. One record of UKBAP and LBAP common toad *Bufo bufo* was returned 1.9km to the north west.

- Fish – No records returned

- Reptiles – One record of Wildlife and Countryside Act 1981 (as amended) (WCA), UKBAP and LBAP common lizard *Zootoca vivipara* 1.2km to north west.

- Birds - There were records returned of nine protected / notable bird species in the search. This data comprised:

Table 10.5: Bird records received from NEYEDC

Scientific name	Common name	Designation	Date recorded	Number of records	Direction and distance from site (m)
Carduelis cannabina	Common linnet	UKBAP LBAP	2008	1	1.5 km SE
Larus argentatus	Herring gull	UKBAP	2008	1	1.9 km NW
Passer domesticus	House sparrow	UKBAP LBAP	2008	8	1 km NW
Passer montanus	Tree sparrow	UKBAP LBAP	2009	Not supplied	Not supplied
Perdix perdix	Grey partridge	UKBAP	2011	Not supplied	Not supplied
Prunella modularis	Hedge accentor	UKBAP	2008	4	On site
Sturnus vulgaris	Common starling	UKBAP	2014	12	929 m NE
Turdus philomelos	Song Thrush	UKBAP LBAP	2008	4	948 m NE
Turdus pilaris	Fieldfare	WCA Sch 1 UKBAP	2010	Not supplied	Not supplied

- NEYEDC also returned dated records for Eurasian sparrow hawk *Accipiter nisus*, common sandpiper *Actitis hypoleucos*, northern pintail *Anas acuta*,

northern shoveler *Anas clypeata*, Eurasian teal *Anas crecca*, Eurasian wigeon *Anas Penelope*, mallard *Anas platyrhyncho*, gadwall *Anas strepera*, greater white-fronted goose *Anser albifrons subsp. Albifrons*, greylag goose *Anser anser*, greater scaup *Aythya fuligula*, bohemian waxwing *Bombycilla garrulus*, brent goose *Branta bernicla subsp. Bernicla*, common goldeneye *Bucephala clangula*, purple sandpiper *Calidris maritima*, black-headed gull *Chroicocephalus ridibundus,* long-tailed duck *Clangula hyemalis*, tundra swan *Cygnus columbianus*, whooper swan *Cygnus cygnus*, peregrine falcon *Falco peregrinus*, black-tailed godwit, common scoter *Melanitta nigra*, grey wagtail *Motacilla cinerea,* Eurasian curlew *Numenius arquata*, bearded tit *Panurus biarmicus*, ruff *Philomachus pugnax*, avocet *Recurvirosira avosetta*, woodcock *Scolopax rusticola,* little tern *Sternula albifrons,* mistle thrush *Turdus viscivorus* and northern lapwing *Vanellus vanellus*.

- Bats – There were eight records returned of bats *Chiroptera* (order) as below.

Table 10.6: Bat records received from NEYEDC

Scientific name	Common name	Designation	Number of records	Latest date recorded	Direction and distance from site (m)
Pipistrellus sp.	Pipistrelle bat	EPS UKBAP LBAP WCA Sch 5	8	1994	775m N

Key:
EPS: European Protected Species: Species listed under the Conservation of Habitats and Species Regulations 2010 as amended.
WCA: Wildlife and Countryside Act 1981 (as amended)
UKBAP: UK Biodiversity Action Plan
LBAP: Hull Biodiversity Action Plan

- Badger - No records returned of badger *Meles meles*
- Otter - No records returned of otter *Lutra lutra*
- Water vole - No records of water voles *Arvicola amphibius*
- Other notable species - Two records returned of West European hedgehog *Erinaceus europaeus*, 1km to the north east of the site.
- Invasive species - One record of Budgerigar *Melopsittacus undulates* 300m north. Eighteen records of Japanese knotweed *Fallopia japonica* 300m north. Seven records of giant hogweed *Heracleum mantegazzianum* 979m north west. Six records of eastern grey squirrel *Sciurus carolinensis* 1073m north west.

10.6.12 A previous survey of buildings conducted in 2005 in the area revealed a common pipistrelle bat roost within the Castle Buildings, which is located directly adjacent to

the Scheme Site Boundary (WSP, 2005). A single bat was found during a daytime survey roosting behind a boarded up window in this derelict building.

10.6.13 No ponds or other suitable watercourses for great crested newts were identified on OS maps or aerial imagery within 500m of the Scheme footprint.

Field survey

10.6.14 This section provides a description of the habitats within the Scheme Site Boundary (excluding the designated sites described above), as well as an assessment of their value. The information is based upon the results of the extended Phase 1 habitat surveys undertaken by MMGJV in 2013 and 2014 and MMSJV in 2016, 2017 and 2018. Phase 1 habitat maps showing the locations of the habitats present are shown in Volume 3, Appendix 10.1 Preliminary ecological appraisal, Figure 10.1A sheets 1 to 9.

10.6.15 The Scheme Site Boundary has been assessed first and the potential compound sites, recovery options, potential accommodation works site and potential car parking have each been assessed separately.

Scheme Site description

10.6.16 The survey area is centred on a 1.5km section of the A63 Castle Street dual carriageway extending from Ropery Street in the west to the Market Place and Queen Street junction in the east. A large traffic island known as Mytongate Junction is located near the centre of the survey area. The survey area also extends southwards from this junction along Commercial Road, terminating adjacent to Wellington Street West on the northern bank of the Humber Estuary.

10.6.17 Residential and commercial properties are located on all sides of the survey area, with frequent amenity planting and areas of hard standing. Trinity Burial Ground SNCI, an area of urban parkland, is located at the centre of the Scheme Site Boundary and has been assessed separately – see Section 10.6.20.

Scheme Site habitats

- Scattered scrub - A small amount of scattered scrub was present adjacent to Waverley Street and around the substation in the Holiday Inn car park. The species it contained were bramble *Rubus fruticosus* agg. and ivy *Hedera helix*. Although scrub habitat is included in Hull BAP ‘Trees, scrub and hedgerow’ plan, the scattered scrub on site is not diverse and occurs in small, isolated pockets. It is not considered a good example of scrub and as such this habitat has been assessed as of negligible biodiversity value within the survey area only.

- Scattered trees - Occur frequently within the Scheme Site Boundary in association with amenity planted areas and include sycamore *Acer pseudoplatanus*, hybrid poplar *Populus* spp. and silver birch *Betula pendula* with occasional specimens of Norway maple *Acer platanoides*, snake-bark

maple *Acer rufinerve*, false acacia *Robinia pseudoacacia* and lime *Tilia* x *europaea*. Several semi mature or mature specimens of cherry *Prunus* spp. and sycamore are located in the west and centre of the survey area respectively. These trees stand between 5m and 8m in height and are in good condition. Trees are a Hull LBAP habitat and this habitat has been assessed as of medium biodiversity value within the county area.

- Standing water - Humber Dock Marina contains standing water habitat. The marina is connected to the Humber Estuary SAC, SPA, Ramsar and SSSI by two sets of gates (lock) crossing Wellington Street. Railway Dock is connected to Humber Dock Marina by a lock on the eastern side of Railway Dock. As both of these docks are man-made they do not contain habitats (sandbanks, mudflats, dunes) that the Humber Estuary is designated for. They may support some species that are designated, in particular grey seals, birds and sea and river lamprey. These two docks, because of their likely importance to these species and connectivity to the Humber Estuary have been assessed as of high / medium biodiversity value within the regional area as areas of standing water habitat (IAN 130/10: Table 1. Resource valuation states "*regularly occurring populations of species which may be considered at an International, European, UK or National level*"). In addition, they may support common fish and aquatic invertebrate species. Humber Dock Marina and Princes Dock are also UKBAP (NERC Act 2006 S41) Broad habitat 'Intertidal substrate foreshore - man made' habitats.

- Standing water – Princes Dock, to the north of the A63 is man-made, with no visible vegetation and contains fountains that re-circulate the water. It has a hydraulic connection to Humber Dock Marina, but the condition is unknown. It is believed to be a closed connection because of the difference in water colour to Humber Dock Marina. Princes Dock is considered unlikely to support species that are designated as part of the Humber Estuary. Princes Dock has been assessed as of negligible biodiversity value within the survey area only as standing water. (Humber Dock Marina and Princes Dock have been valued at national level as a UKBAP (NERC Act 2006 S41) Broad habitat, Section 10.6.9).

- Amenity grassland - This habitat occurs adjacent to the road verges and consists of regularly mown grass species including perennial ryegrass *Lolium perenne* and few common herbs dandelion *Taraxacum* spp and white clover *Trifolium repens*. Although this habitat is listed in the Hull BAP, the amenity grassland on site is of low biodiversity and is a poor, intensively managed example of the habitat. It has been assessed as of negligible biodiversity value within the survey area only.

- Introduced shrub - Areas of introduced shrub contain horticultural varieties including rose Rosa spp., cotoneaster *Cotoneaster* sp., Oregon grape *Mahonia aquifolium*, garden privet *Ligustrum ovalifolium*, burberry *Berberis* spp., lavender *Lavandula angustifolia*, dogwood *Cornus sanguinea*, cherry

laurel *Prunus laurocerasus*, dwarf reed *Phragmites* spp. and tufted grass *Deschampsia* spp. It has been assessed as of negligible biodiversity value within the survey area only.

Buildings

10.6.18 Nine buildings were assessed within the Scheme survey area and additional potential compound sites during surveys in 2013. They comprised the Earl de Grey public house, the Castle Buildings, the Myton Centre, the Arco Ltd Garage, the Holiday Inn, the ARC Building and three electric / gas substations. The ARC Building had been demolished by the time the update survey was undertaken in 2016. The buildings being considered have been assessed for bat roost potential in accordance with J Collins 2016[20]. The results of which are provided in the MMSJV bat report (Volume 3, Appendix 10.2 Bat survey report). Buildings to the west of the site compound at Wellington Street Island Wharf have not been assessed as they are not to be demolished.

10.6.19 All buildings have been assessed as of negligible biodiversity value within the survey area only although they can have potential to support wall ferns, lichens, invertebrates, nesting birds and bats**.**

- The Earl de Grey public house is located near the centre of the survey area. The building is unoccupied and will be dismantled as part of the Scheme. This building contains numerous features that offer potential refuge for wildlife (particularly bats).

- The Castle Buildings are unoccupied and derelict and located approximately 25m to the west of the Earl de Grey public house. Scaffolding is present on all sides of the building, which also contain a corrugated roof above. At the time of the assessment, the building contained a wide variety of features that could have been used by local wildlife (particularly bats).

- The Myton Centre is located in the west of the survey area and is to be demolished to make way for a temporary car park for construction staff. This building is in reasonably good condition, but has gaps under the roof felt that could potentially be used by bats.

- The Arco Ltd garage consists of a small single-storey building located in the west of the survey area. This building was in good condition at the time of the survey and had negligible bat roost potential. Two smaller buildings were surveyed with an endoscope in 2018 and also had negligible bat roost potential.

- The Trinity Burial Ground site compound is located to the land south east of Mytongate Junction adjacent to the westbound carriageway. The Holiday Inn building was in good condition at the time of the survey and had negligible bat roost potential.

- A number of power substations are located within the Scheme Site Boundary. These are small brick / concrete structures, some with flat roofs. One of these - the Holiday Inn substation – is still relevant to the Scheme and will be demolished. It was in good condition and had negligible bat roost potential.

Trinity Burial Ground SNCI

10.6.20 Trinity Burial Ground SNCI is located near the centre of the survey area. This local wildlife site comprises short, well maintained amenity grassland with noted emerging spring bulbs snowdrop *Galanthus* spp. and daffodil *Narcissus* spp. Frequent stands of wild privet *Ligustrum vulgare*, cherry laurel and bramble occur across the park which contains many headstones and burial tombs. Numerous semi mature and mature broadleaved trees occur in the burial ground including poplar, ash *Fraxinus excelsior*, weeping ash *Fraxinus excelsior subsp. pendula*, oak *Quercus robur*, sycamore, London plane *Platanus* x *hispanica,* wych elm *Ulmus glabra* and lime. These trees range between approximately 8m and 20m in height and vary in condition with woodpecker holes, peeling bark, scars and natural cavities frequently recorded. Dense ivy growth was recorded on the trunks and major limbs of several individual trees. A brick wall, approximately 2m in height, is located on the northern, eastern and western boundaries of the burial ground. A large crack and several holes were recorded in this wall which has also been colonised by dense ivy. As an SNCI this site has been assessed as of medium biodiversity value at county level.

Construction site compounds

Arco - preferred Option A

10.6.21 The site is located adjacent to the south of the A63 and the majority of the site is currently used as industrial buildings and car parking. Amenity trees and grassland occur along the A63 verge and a small area to the east of the site. The buildings are assessed as not having bat roost potential. The site has been assessed as of negligible biodiversity value within the survey area only.

Staples – alternative Option B

10.6.22 The site is located adjacent to the Mytongate Junction on the northern aspect bounded by and accessed off Myton Street to the east. The site is used as a retail park for Maplins, American Golf and Monster and is the former site of Staples. The site consists of a retail park containing three buildings in the north and west and a car park in the south. Scattered trees are present along the southern and eastern boundary of the car park including beech, sycamore and rowan. Areas of introduced shrub are present in the south west of the site, adjacent to the Maplins building, and in areas in the car park consisting of the non-native invasive cotoneaster sp., dog-rose *Rosa canina,* senecio, *Mahonia* sp. and ornamental cultivar species. A species-poor hedgerow and trees comprising introduced cultivars with planted beech and sycamore is present along the southern boundary

adjacent to the A63. The scattered trees and hedgerow on site have the potential to support breeding birds and provide foraging habitat for bats, but the urban location, lack of connectivity and non-native species composition of the hedgerow indicates a low value for biodiversity. The trees and buildings are assessed as not having bat roost potential. This site has been assessed as of negligible biodiversity value within the survey area only.

Wellington Street Island Wharf

10.6.23 Wellington Street Island Wharf is located adjacent to the Humber Estuary SAC, SPA, Ramsar and SSSI site. The habitats adjacent to the site include intertidal mud and sand (UKBAP Priority habitat 'intertidal mudflats' and Hull BAP 'Estuary') and intertidal boulders and rocks associated with the rock armour of the sea defences. This site is a disused, unmanaged area that was previously industrial developed dockland and has a Hull LBAP habitat plan. The site is largely ephemeral / short perennial habitat over gravel containing red fescue *Festuca rubra*, ribwort plantain *Plantago lanceolata*, white clover *Trifolium repens*, scarlet pimpernel *Anagallis arvensis*, evening primrose *Oenothera biennis*, perforate St.John's wort *Hypericum perforatum*, curled dock *Rumex crispus*, black medick *Medicago lupulina* and smooth hawk's-beard *Crepis capillaris*. This habitat is succeeding to tall ruderal species common nettle *Urtica dioica*, broad-leaved willowherb *Epilobium montanum*, hairy willowherb *Epilobium hirsutum*, rosebay willowherb *Chamerion angustifolium* and mugwort *Artemisia vulgaris*. Around the perimeters of the site, the vegetation has succeeded into scrub which consisted of buddleia *Buddleja davidii*, bramble and field bindweed *Convolvulus arvensis*. Immature scattered broad-leaved silver birch *Betula pendula* trees are present on the north and east boundaries. The site could potentially support invertebrates, breeding birds and small mammals. The ephemeral / short perennial habitat on the site has been assessed as being of low value for biodiversity at a local level.

A63 eastbound recovery base (A63 layby eastbound to the north of St Andrew's Quay)

10.6.24 The Eastbound recovery options is located adjacent to the existing layby in the eastbound carriageway of the A63 approximately 3.7km west of Mytongate roundabout. To the north of the hardstanding of the layby is an unmanaged hedgerow of blackthorn *Prunus spinosa* and hawthorn *Crataegus monogyna*. Behind this, the habitat is dense scrub as far as the rail line and contains dogwood, hazel *Corylus avellana*, occasional field maple *Acer campestre* and hawthorn. The dry ditch was also covered in these species and appeared permanently dry. A thin strip of tall ruderal species was present between the hardstanding and the hedgerow that had false oat-grass, rosebay willowherb, mugwort, scentless mayweed *Tripleurospermum inodorum*, broad-leaved dock *Rumex obtusifolius* and common toadflax *Linaria vulgaris*. The site has potential for breeding birds, reptiles, small mammals, foraging bats and invertebrates. The hedgerow on site has been assessed as of low biodiversity value in the local area.

Livingstone Road

10.6.25 This is located approximately 5.6km to the west of the Scheme Site Boundary, adjacent to Livingstone Road which is adjacent to the westbound carriageway of the A63. To the west of the site is the outfall of Fleet Drain which is also part of the Humber Estuary SAC, SPA, Ramsar and SSSI site which is also adjacent to the southern boundary of the Livingstone Road Site. Adjacent to the west and south of the site are also UKBAP Priority habitats 'intertidal substrate foreshore – mud' and 'mudflats', Hull BAP 'Estuary' and intertidal boulders and rocks associated with the rock armour of the sea defences. The section of the site to the west and north is hardstanding and currently in use as a car and lorry park and for container storage. A thin strip of amenity grassland is located on the northern boundary and is frequently mown. The section of the site to the south and east has a raised area of bare ground and gravel of which the bank sides of the raised area are vegetated. The vegetated habitat present on the banks is ephemeral / short perennial which is scattered on the bare ground on top of the raised area and on intertidal boulders and rocks on the southern boundary. Species present were groundsel *Senecio vulgaris*, red valerian *Centranthus rubur*, common ragwort, hawkweed *Hieracium* spp. oxford ragwort *Senecio squalidus* and poppy *Papaver* spp. Tall ruderal species teasel *Dipsacus fullonum* and scattered scrub species bramble, gorse *Ulex europaeus* and buddleia are also present on the banks of the raised area. A species-poor hedgerow consisting of mainly buddleia and elder *Sambucus nigra* is located on the eastern boundary of the site but it has a lack of connectivity to other hedgerows. The site has potential to support invertebrates, breeding birds and small mammals. The section of the site to the north and west has been assessed as of negligible biodiversity value in the survey area only and the section containing ephemeral / short perennial and hedgerow habitats to the south and east of the site is of low value for biodiversity in the local area.

Land south east of Mytongate Junction (Holiday Inn)

10.6.26 The compound is located on the approach to the Holiday Inn, south east of Mytongate Junction. The habitats in the grounds of the hotel were mainly the hardstanding of the car parking facilities. Around the main hotel building and separating car park spaces were areas of intensely managed amenity grassland and introduced shrub planting. The shrubs included cultivars of box *Buxus* spp., cherry laurel, senecio *Brachyglottis greyi*, weigela *Weigela* spp., rose *Rosa* spp. and *Cotoneaster* spp. (Schedule 9 of the Wildlife and Countryside Act 1981 (as amended). To the west of the site, the introduced shrubs had been planted to form hedgerows and were spaced with semi mature broad-leaved trees sycamore, rowan *Sorbus aucuparia*, hornbeam *Carpinus betulus*, silver birch and willow *Salix* spp.. Behind the substation, were a mature ivy-covered lime and a wild cherry *Prunus avium* tree that bordered the SNCI. The trees and introduced shrub on site have potential to support breeding birds and small mammals and the two mature trees have low bat roost potential. The site has been assessed as of negligible biodiversity value in the survey area only, with the scattered trees assessed as of low value in the local area.

Neptune Street

10.6.27 The Neptune Street compound site is located between Albert Dock and the A63. Approximately 18 months ago the site was bare ground but has now been colonised by vegetation. Semi-improved neutral grassland covered most of the site at the time of the survey. Species present were false oat-grass *Arrhenatherum elatius*, cocksfoot *Dactylis glomerata*, crested dog's-tail *Cynocurus cristatus,* red clover *Trifolium pratense* and melilot *Melilotus* spp. The northern and south eastern perimeters of the site contained tall ruderal species and a strip of scrub habitat. Species present were bramble, hedge bindweed *Calystegia sepium,* mugwort, buddleia, rosebay willowherb and field rose *Rosa arvensis.* There were scattered immature silver birch trees within the scrub habitat. An area of ephemeral / short perennial habitat occurred on and around a track to the east of the site with coltsfoot *Tussilago farfara*, scentless mayweed, teasel and black knapweed *Centaurea nigra*. These habitats can support invertebrates, birds, small mammals and provide forage for bats and is listed on the UKBAP (NERC Act 2006 S41) Priority Habitat descriptions as 'Open Mosaic habitats on Previously Developed Land'' and on the Hull LBAP as industrial land. As such, the ephemeral / short perennial habitat in Neptune Street is assessed as being of low value for biodiversity in the local area.

A63 westbound recovery base (A63 bus layby westbound, west of Garrison Road roundabout)

10.6.28 This site consists of a hard standing layby and footpath and a strip of amenity grassland. The site has been assessed as of negligible biodiversity value within the survey area only.

Myton Centre temporary car park

10.6.29 The site is located to the north west of Mytongate roundabout. The habitats around the Myton Centre buildings are regularly mown amenity grassland containing daisy *Bellis perennis*, greater plantain *Plantago major* and white clover with scattered semi mature trees of hornbeam *Carpinus betulus* and sycamore. Bare ground under the trees is being succeeded by occasional ruderal species common nettle, creeping thistle *Cirsium arvense* and rosebay willowherb. To the west of the Myton Centre buildings is an area that is currently used as public open space and contains an arboretum of scattered mixed trees that are non-native. A species-poor intact hedgerow containing mainly elder is present adjacent to the A63 footpath. To the east of the Myton Centre buildings is a children's play area and public seating area. This contains amenity grassland, scattered Lombardy poplar *Populus nigra* 'italica' and sycamore trees and introduced shrubs. A managed cherry laurel (non-native) hedgerow is present adjacent to William Street. The hedgerows within the compound site are isolated and do not provide a habitat connectivity function within the local landscape. They do not meet the criteria to be classed as important under the Hedgerow Regulations 1997. They have little wildlife value, other than providing some potential bird nesting habitat, although all

hedgerows over 20m long consisting of at least 80% cover of one native woody species are UKBAP (NERC Act 2006 S41) Priority Habitats. The compound site has potential for breeding birds, foraging bats, small mammals and invertebrates. The site has been assessed as of negligible biodiversity value in the survey area only, with the scattered trees and elder hedgerow assessed as of low value in the local area.

Protected and notable species

10.6.30 Although many species are afforded protection under the Wildlife and Countryside Act 1981 (as amended) and / or the Conservation of Habitats and Species Regulations 2017, only those considered relevant to the habitats identified within the field surveys are assessed below.

10.6.31 There is no suitable habitat within the survey area or temporary site compounds for water vole or white-clawed crayfish. In addition, no potential great crested newt breeding ponds or other suitable water bodies were identified within 500m of the Scheme Site Boundary and no suitable habitat was found during the field surveys. Therefore, there is a negligible risk of impacting on these species and they are not considered further in the assessment.

Terrestrial invertebrates

10.6.32 The habitats within the Scheme Site Boundary were all common nationally with the exception of Trinity Burial Ground SNCI. They are likely to support common or widespread species of terrestrial invertebrates. Similarly, the majority of the temporary site compounds are likely to support common or widespread terrestrial invertebrates with the exception of Wellington Street Island Wharf site compound, Neptune Street site compound and south east of Livingstone Road site compound. These areas were all assessed as being LBAP 'Industrial Land' habitat and contained diverse ephemeral / short perennial habitats that are suitable to support less common species of invertebrates. The southern part of the Livingstone Road site compound also contains black medick which is a larval food plant of the LBAP invertebrate species common blue *Polyommatus icarus*. Invertebrate species assemblages on the main site and temporary site compounds north west of Livingstone Road, land south east of Mytongate Junction, A63 westbound recovery base, Arco site and Staples site have been assessed as of negligible biodiversity value in the survey area only. Potential site compounds at Wellington Street Island Wharf, land south east of Mytongate Junction, Livingstone Road, A63 eastbound recovery base along with Trinity Burial Ground SNCI and the temporary car park site at Myton Centre have the potential to support LBAP invertebrate species and have been assessed as of low value for biodiversity in the local area.

Aquatic invertebrates

10.6.33 The mudflats and water of the Humber Estuary which are adjacent to site compounds at Wellington Street Island Wharf, Livingstone Road and Neptune Street, although lacking in vegetation at these points, have potential to support

fully aquatic invertebrate assemblages as notified in the Humber Estuary SSSI citation which include water beetles *Agabus conspersus* and *Helophorus fulgidicollis*. These have been assessed as of high value for biodiversity at the national level. Humber Dock Marina, Railway Dock and Princes Dock are unlikely to have important aquatic invertebrate assemblages present due to the man-made structure of the docks and regular disturbance from boat traffic. These have been assessed as of negligible biodiversity value in the survey area only. The River Hull SNCI is likely to have UKBAP aquatic invertebrates present which would be assessed as of low value for biodiversity in the local area as the SNCI site is not designated for aquatic invertebrate species.

Fish

10.6.34 Common fish species known to be present in the lower River Hull are bream *Abramis brama*, pike *Esox lucius*, roach *Rutilus rutilus*, dace *Leuciscus leuciscus*, chub *Squalius cephalus* (East Yorkshire Rivers Trust, 2017)[158]. Common fish species present in the Humber Estuary are flounder *Paralichthys dentatus,* cod *Gadus morhua*, whiting *Merlangius merlangus* and mullet *Mugilidae* spp. (British Sea Fishing[159]. UKBAP (NERC Act 2006 S41) species European eel *Anguilla Anguilla,* salmon *Salmo salar,* sea trout *Salmo trutta* and river lamprey *Lampetra fluviatilis* are also known to be present in both the Humber Estuary and the River Hull and river lamprey are a species that the Humber Estuary SAC / Ramsar and SSSI is designated for. In addition, the Humber Estuary is designated for sea lamprey *Petromyzon marinus.* Lamprey populations in the River Hull and the Humber Estuary (adjacent to Humber Dock Marina and the connecting Railway Dock) have been assessed as of very high value for biodiversity at an international level. European eel, salmon and sea trout populations in the River Hull and the Humber Estuary (adjacent to Humber Dock Marina and the connecting Railway Dock) have been assessed as of low biodiversity value at a local level.

Reptiles

10.6.35 One record of common lizard was received from NEYEDC, but it is considered unlikely that any reptile species would be present within the Scheme Site Boundary, site compounds at land south east of Mytongate Junction, A63 westbound recovery base, Arco site, Staples site and the temporary car park site at Myton Centre due to the unsuitable habitats present within them and their highly urban locations. Some of the site compounds, i.e. Wellington Street Island Wharf, Neptune Street and Livingstone Road provide some potentially suitable grassland basking habitats. These areas were recently developed and due to their urban location, there are no connecting semi-natural habitats from which reptiles could have re-populated the sites. Reptiles are not considered a constraint in these sites

[158] East Yorkshire Rivers Trust (2017). River Hull. Available online at: http://www.eastyorkshireriverstrust.org.uk/derwent-catchment-partnership.html

[159] British Sea Fishing. Yorkshire and Humberside. Available online at: http://britishseafishing.co.uk/yorkshire-and-humberside/

and they are not mentioned further in this report. The A63 eastbound recovery base site compound has suitable habitats for reptiles and connectivity to the wider countryside via the rail line that is adjacent to the site. However, it is small and therefore is not considered to be enough habitat to sustain a significant population of reptiles. Should reptiles be found present in the A63 eastbound recovery base they would be assessed as of low biodiversity value at a local level.

Birds

10.6.36 Buildings, scattered broad-leaved trees, areas of introduced shrub, scrub and hedgerows located within the Scheme Site and site compounds / temporary car park – land south east of Mytongate Junction, Myton Centre, A63 eastbound recovery base, Arco site and Staples site - offer a variety of nesting opportunities and foraging habitat for common, UKBAP and LBAP birds. During the field surveys several old bird nests were identified within the canopies of broad-leaved trees. Of these sites, Trinity Burial Ground SNCI at the centre of the Scheme area offers the highest potential for use by nesting and foraging birds and song thrush (a species of Principal Importance under Section 41 of the NERC Act 2006 is recorded as breeding there). Breeding birds in these sites have been assessed as of low biodiversity value in the local area.

10.6.37 Site compounds at Wellington Street Island Wharf and Livingstone Road are adjacent to the Humber Estuary SAC / SPA / Ramsar and SSSI and have suitable habitats for bird species that the Humber Estuary has been designated for to breed, roost or forage in. A suite of four breeding bird surveys was undertaken by MMSJV between May and June 2016 at sites which included Wellington Street Island Wharf and Livingstone Road. This was to identify existing breeding bird territories at or near the compounds and in the adjacent designated sites. Each survey comprised a late afternoon visit followed by a morning visit with two surveys at high tide and two at low tide for each site. As all sites are coastal and close to estuarine habitat, high tide surveys were carried out to see if birds also used the sites for roosting or foraging. Low tide surveys were undertaken and focused on bird foraging potential on exposed mud, sand or shingle habitat that was adjacent to each site when the tide was out. All sites were walked along a pre-determined transect route at a steady pace and all birds seen or heard were recorded. The surveyor stopped at various vantage points along transects to observe potential breeding behaviour.

10.6.38 The site compound at Wellington Street Island Wharf had 12 species in total with two species probably breeding one of which was UKBAP dunnock, with a further species possibly breeding. The site compound at Livingstone Road had 15 species recorded with two species confirmed breeding one of which was the UKBAP and Hull BAP species linnet. One of the species recorded in the mudflats adjacent to the site compound at Livingstone Road was mallard. This is a species that the Humber Estuary SPA is designated for, although it was not breeding within the site compounds. Curlew, a SPA and SSSI designated species and UKBAP was recorded on mudflats adjacent to Livingstone Road site compound,

again not breeding within the site compounds. Table 10.7 below provides a summary of the results each bird species recorded at each site during all four surveys. ✓*** indicates confirmed breeding, ✓** probably breeding, ✓* possibly breeding, ✓ in flight or on ground (not breeding). Full results are provided in Volume 3, Appendix 10.1.

Table 10.7: Summary of birds and breeding status recorded at site compounds at Wellington Street Island Wharf and Livingstone Road

Scientific name	Common name	Designation	Wellington Street	Livingstone Road
Anas platyrhynchos	Mallard	SPA		✓
Ardea cinerea	Grey heron			✓
Arenaria interpres	Turnstone			✓
Carduelis cannabina	Linnet	UKBAP Hull BAP	✓	✓***
Cardiulis carduelis	Goldfinch		✓	✓
Carduelis chloris	Greenfinch			
Columba livia	Feral pigeon			
Columba palumbus	Wood pigeon		✓	✓
Corvus corone	Carrion crow		✓	
Erithacus rubecula	Robin		✓*	
Falco tinnunculus	Kestrel			✓
Larus argentatus	Herring gull	UKBAP	✓	✓
Larus fuscus	Lesser black backed gull			✓
Larus marinus	Great black backed gull		✓	
Larus ridibundus	Black headed gull		✓	✓
Numenius arquata	Curlew	SPA SSSI UKBAP		✓
Passer domesticus	House sparrow	UKBAP	✓	✓
Prunella modularis	Dunnock	UKBAP	✓**	✓
Sturnus vulgaris	Starling	UKBAP	✓	✓
Sylvia communis	Whitethroat			✓ ***
Turdus merula	Blackbird		✓**	
Turdus philomelos	Song thrush	UKBAP Hull BAP		

10.6.39 Four wintering bird surveys were undertaken on the same site compounds in January and February 2017 and also at Neptune Street site compound which had

been added to the Scheme to establish birds' presence / likely absence and use of the site compounds and the adjacent designated sites. The survey results also informed the AIES process. Pre-determined transect routes were walked so birds could be located, identified and recorded using standard British Trust for Ornithology (BTO) notation. One vantage point was located and a period of time was spent recording bird activity in the viewable areas of site compounds at Neptune Street and Wellington Street Island Wharf, with two hours spent at Livingstone Road site compound.

10.6.40 The site compound at Wellington Street Island Wharf had 24 species recorded, with one species, mallard a qualifying species for the SPA. It was observed flying over and around the site. Four other UKBAP species were observed herring gull, dunnock, starling and house sparrow. The birds were all observed flying over and around the site.

10.6.41 The site compound at Neptune Street had 23 species recorded, with one species, mallard a qualifying species for the SPA. A pair was observed flying over and around the site. A peregrine (Schedule 1 of the Wildlife and Countryside Act (WCA) 1981 (as amended)) was recorded flying over the site and redwing (Schedule 1 (WCA) 1981 (as amended)) was recorded foraging within the site. Four other UKBAP species were observed herring gull flying over and around the site, dunnock within the site, linnet flying over the site (Hull BAP) and song thrush singing within the site (Hull BAP).

10.6.42 The site compound ay Livingstone Road had 24 species recorded, with six of those being qualifying species for the SPA which were mallard, redshank, grey plover, curlew (UKBAP), knot and oystercatcher. All these species except the mallard are also qualifying species for the Ramsar and SSSI and were observed feeding on the mudflats of Fleet drain and the Humber Estuary. Mallard sightings were of them flying over the site. Six other UKBAP species were recorded; linnet flying over the site (Hull BAP), song thrush perched singing within the site (Hull BAP), herring gull flying over and around the site, dunnock, bullfinch flying over the site and starling flying over the site. Full details are provided in Volume 3, Appendix 10.4.

10.6.43 Species found within / adjacent to these three site compounds within the Scheme that the Humber Estuary is designated for are assessed as of very high biodiversity value within the international / national level. All other bird species have been assessed as of low biodiversity value in the local area.

Aquatic marine mammals

10.6.44 The Humber Estuary SAC / Ramsar and SSSI adjacent to Humber Dock Marina and site compounds Wellington Street Island Wharf and Livingstone Road is designated for grey seals. This species is a land-breeding, marine mammal. The nearest breeding colony of this species is at Donna Nook in Lincolnshire approximately 40km south of the Scheme Site. Grey seals do spend time between foraging at sea lying on rocks or sandy beaches. It is considered unlikely that they

would be present within any site compounds, but potentially they may be present adjacent to them and in the Humber Dock Marina and connected Railway Dock. This species has been assessed as of very high value for biodiversity at an international level.

Bats

10.6.45 Nine buildings and all of the trees within or directly adjacent to the Scheme Site Boundary were assessed for their potential to support roosting bats in 2013. The Castle Buildings is where a single common pipistrelle bat was found roosting in a previous survey by WSP in 2005. Two buildings (Earl de Grey public house and Castle Buildings) and trees in Trinity Burial Ground SNCI were found to contain high bat roost potential. The site was assessed again in 2016 for bat roost potential and also included the application boundary changes and new compound sites. These buildings and trees were assessed as having high bat roost potential. The Myton Centre building proposed in the location of the temporary car park for the construction works was found to have low bat roost potential. In April 2018, the Arco site and Staples site buildings were assessed for bat roost potential, but none was found.

10.6.46 The remainder of the buildings and trees outside of Trinity Burial Ground SNCI were assessed as having negligible bat roost potential and no further surveys of these receptors were undertaken.

10.6.47 The Earl de Grey public house, Castle Buildings and trees in Trinity Burial Ground were subject to dusk emergence and dawn re-entry bat surveys in 2013, 2015 and 2016, 2017. The Myton Centre was surveyed in 2016 to detect bat roost presence or likely / absence. Automated static bat detectors were left to record in the Castle Buildings in 2013 and in Trinity Burial Ground SNCI in 2013 and 2015. The surveys revealed no evidence of bat roosting activity within any of the buildings or Trinity Burial Ground SNCI.

10.6.48 Full results are provided in Volume 3, Appendix 10.2. In the unlikely event that a roosting bat is found during the works, the site would be of low biodiversity value for bats within the local area.

10.6.49 Two bat activity walked transect surveys, one to the west and one to the east of the Scheme Site were undertaken twice in 2013 and 2016. Commuting route surveys were undertaken at Mytongate Junction in 2013 and 2016.

10.6.50 Bat activity within the survey boundary was dominated by a single species; common pipistrelle. Of the other three species recorded, noctules and Nathusius' pipistrelle are known to be migratory. The data suggest that these species were recorded passing through the site and are not normally resident in, or dependent upon, habitat features within the site. The single *Myotis* sp. pass recorded suggests that this species is also not normally resident.

10.6.51 The majority of the Scheme Site and the potential compound sites have been assessed as of low value to foraging and commuting bats due to the lack of semi-natural habitats and lack of habitat connectivity. Trinity Burial Ground SNCI contains mature trees and has been assessed as of moderate value for bat activity.

10.6.52 Bat activity surveys found most foraging activity to be concentrated at Trinity Burial Ground SNCI, which is an important foraging habitat for the local common pipistrelle bat population. The park to the north west of Mytongate Junction is also frequently used by foraging bats. Two commuting routes were identified at Mytongate Junction, both of which connect Trinity Burial Ground SNCI with habitats to the north, reinforcing its importance as a feeding resource.

10.6.53 Full results are provided in Volume 3, Appendix 10.2. Bats within the application site are considered to be of low biodiversity value within the local area under the resource valuation criteria in IAN 130/10 Table 1. The bat population recorded at the site is not considered to meet the criteria for valuation at county level, despite bats being protected by national and European legislation. This is because it is unlikely that the bat population present forms a critical part of a wider population within the county, as it comprises a small number of a common species within an urban setting (IAN 130/10: Table 1 resource valuation criteria).

Badgers

10.6.54 The survey area is largely unsuitable for badgers due to the highly urbanised location, level of human disturbance, lack of connectivity and lack of adequate foraging resources. As such they are considered to be likely absent. In the unlikely event that badgers move into the A63 eastbound recovery base compound site via the rail line and are found present, they would be assessed as of negligible biodiversity value in the survey area only.

Otters

10.6.55 The habitat in the River Hull is canalised with a steep vertical wooden retaining bank wall. The mudflats in the river are suitable to provide resting places for otters and this species use the River Hull as part of their home range for foraging. The Humber Estuary adjacent to Humber Dock Marina and the connecting Railway Dock and site compounds at Wellington Street Island Wharf and Neptune Street has man-made defences in the form of rock armour or vertical wooden bank walls. Adjacent to the site compound at Livingstone Road, the defences are more natural intertidal rocks and boulders, with some vertical wooden retaining defence on the bank of Fleet Drain. Mudflats are present at low tide outside of the defences. Otters are likely to use the Humber as a foraging resource, with the mudflats and natural rocks and boulders at Livingstone Road site compound being more suitable for use as a resting place. Otter presence in any of the sites would be assessed as of low biodiversity value within the local area.

Other notable species

10.6.56 Trinity Burial Ground SNCI and other public park areas within the main site; site compounds at Wellington Street Island Wharf, Livingstone Road, land south east of Mytongate Junction, Neptune Street and the A63 eastbound recovery base and the temporary car park location at the Myton Centre all contain habitat cover that is suitable to support UKBAP and LBAP species European hedgehog. If present on site, this species is assessed as being of low biodiversity value within the local area.

Invasive species

10.6.57 The invasive shrub cotoneaster was identified during the field survey within areas of introduced shrub to the east of the Scheme Site at the A63 and Market Place junction and A63 and Queen Street junction and in the site compounds at land south east of Mytongate Junction and Staples. Three scattered false acacia trees were identified within the main site on the verge outside of Trinity Burial Ground SNCI.

Valuation of ecological receptors

10.6.58 A summary of the valuation of ecological receptors relevant to the Scheme is provided in Table 10.8: Summary of valuation of ecological receptors.

Table 10.8: Summary of valuation of ecological receptors

Ecological receptor	Valuation
Humber Estuary SAC / SPA / Ramsar	International
Humber Estuary SSSI	National
Trinity Burial Ground SNCI, River Hull SNCI	County/Unitary Authority Area
UKBAP (NERC Act 2006 S41) Priority habitats - Princes Dock; Humber Dock Marina; Trinity Burial Ground; Adjacent to site compounds at Wellington Street Island Wharf, Livingstone Road and Neptune Street	National
Scrub Main site; site compounds at Wellington Street Island Wharf, Livingstone Road, A63 eastbound recovery base, land south east of Mytongate Junction, Neptune Street and Staples site	Negligible
LBAP Scattered amenity trees Main site; site compounds at land south east of Mytongate Junction, Staples site, Arco site; temporary car park at the Myton Centre	County
Grasslands (semi-improved and poor semi-improved) Main site; site compound at Neptune Street	Negligible
Tall ruderal Site compounds at Wellington Street Island Wharf, Livingstone Road, A63 eastbound recovery base and Neptune Street	Negligible

Ecological receptor	Valuation
Standing water Main site; Humber Dock Marina; Railway Dock	Regional
Amenity grassland Main site; site compounds at Livingstone Road, land south east of Mytongate Junction, Neptune Street, Arco site; temporary car park at the Myton Centre	Negligible
Ephemeral / short perennial Site compounds at Wellington Street Island Wharf, Livingstone Road and Neptune Street	County
Introduced shrub Main site; site compounds at land south east of Mytongate Junction, Staples site and Arco site; temporary car park at the Myton Centre	Negligible
Hedgerows – (Poor quality) Site compounds at Livingstone Road, A63 eastbound recovery base and Staples site; temporary car park at the Myton Centre	Local
All Buildings	Negligible
Terrestrial Invertebrates Trinity Burial Ground SNCI; site compounds at Wellington Street Island Wharf; Livingstone Road, A63 eastbound recovery base and Neptune Street; temporary car park at the Myton Centre	Local
Aquatic Invertebrates Humber Estuary SSSI	National
Aquatic Invertebrates River Hull SNCI	Local
Aquatic Invertebrates Humber Dock Marina; Railway Dock; Princes Dock	Negligible
Fish (Sea and river lamprey) Humber Dock Marina; Railway Dock;	International
Fish (European eel, salmon, sea trout) Humber Dock Marina; Railway Dock;	Local
Reptiles Site compound at A63 eastbound recovery base	Local
Birds Main site; Trinity Burial Ground SNCI; site compounds at land south east of Mytongate Junction, A63 eastbound recovery base, Staples site, Arco site; temporary car park at the Myton Centre	Local
Birds Site compounds at Neptune Street, Wellington Street Island Wharf and Livingstone Road	International
Aquatic marine mammals Humber Dock Marina; Railway Dock; site compounds at Wellington Street Island Wharf, Livingstone Road and Neptune Street	International
Bats	Local

Ecological receptor	Valuation
All areas	
Badgers All areas	Negligible
Otters Humber Dock Marina; Railway Dock; site compounds at Neptune Street, Wellington Street Island Wharf and Livingstone Road	Local
Notable species (hedgehogs) Main site; Trinity Burial Ground SNCI; site compounds at Wellington Street Island Wharf, Livingstone Road, land south east of Mytongate Junction, A63 eastbound recovery base and Neptune Street; temporary car park at the Myton Centre	Local
Invasive Species – cotoneaster Main site at the A63 and Market Place junction and A63 and Queen Street junction; site compounds at Staples site, land south east of Mytongate Junction Invasive Species - False acacia Main site	Schedule 9 of the Wildlife and Countryside Act 1981 (as amended)

10.6.59 Ecological receptors assessed as having negligible value are scrub, semi-improved grasslands, tall ruderal, Princes Dock, amenity grassland, introduced shrub, buildings, aquatic invertebrates (in Humber Dock Marina, Railway Dock and Princes Dock), reptiles and badgers are not considered further in this chapter, as the effects of impacts on these habitats would be insignificant and a Detailed Assessment is not necessary (IAN 130/10).

10.6.60 Mitigation measures and predicted environmental effects are considered for the remaining ecological receptors that are of local value or higher or are subject to some form of legal protection.

10.7 Mitigation

10.7.1 Mitigation measures employed to reduce the impact of the Scheme on ecological receptors can be categorised as follows:

- Impact avoidance: measures taken during the Detailed Design process and Operation Phases of the Scheme to avoid impacts to identified ecological receptors.
- Impact mitigation: measures employed to reduce or minimise the scale of impact on identified ecological receptors.
- Compensation: where residual impacts are unavoidable, measures to compensate for the effects of development, such as replacement of habitat lost.

Mitigation of Construction Phase impacts

10.7.2 The following measures would be employed to mitigate potential impacts of Construction Phase operations on ecological receptors. Mitigation measures are detailed for each receptor separately. The potential impacts on the Humber Estuary are fully assessed within a separate Assessment of Implications on European Sites (AIES) Screening Report, document reference TR010016/APP/6.13.

Humber Estuary SAC / SPA / Ramsar / SSSI Sites

10.7.3 Impacts to the Humber Estuary are likely to arise from contaminants entering the Estuary via ground water or surface water sources, or through dewatering operations (Chapter 11, Road drainage and the water environment).

10.7.4 Standard pollution prevention measures would be used in site compounds and working areas to mitigate pollution incidents before contaminants could reach the Estuary. Pollution prevention measures would be specified within the CEMP. An outline Environmental Management Plan (OEMP) is provided at document reference TR010016/APP/7.3.

10.7.5 It is understood that Yorkshire Water will grant consent to discharge to the existing highway drainage connections. However, should the consent not be granted, the surface water drainage from the underpass at Mytongate Junction would be pumped to a new dock wall outfall at the Humber Quays development, near the location of other existing outfalls. The final location of which is yet to be decided. The surface water would discharge onto existing rock armour in the Estuary (see Chapter 11, Road drainage and the water environment). This would mitigate by reduction, the risk of adverse impacts to estuarine habitats during construction of the outfall and remove the possibility of discharges scouring the river bed and causing silt plumes that could be detrimental to estuarine wildlife.

10.7.6 The re-suspension of sediments has the potential to release nutrients into the water column. High nutrient levels and lower light penetration can lead to algal blooms and a drop in levels of dissolved oxygen. The rapid dispersal of nutrients combined with dilation from tidal action would minimise the likelihood of algal blooms. Any potential impact would be short-lived and an ecological balance would quickly return.

10.7.7 The Scheme would retain the existing highway gullies. In addition, new water collection features would be introduced to collect surface water run-off from impermeable areas as attenuation for the additional flow rates. This would restrict surface water flows to the existing flow rates to the public sewer network, Princes Dock and the Humber Dock.

10.7.8 Concrete mixing and washing areas would be located more than 10m from waterbodies. Wash water would not be discharged to the water environment and would be disposed of appropriately.

10.7.9 Disposal of excavated material and trimmed excess pile and wall material would be described, documented and disposed of in accordance with relevant statutory instrument and guidance with chemical analysis being undertaken where appropriate.

10.7.10 Construction of the Scheme would not increase air emissions significantly. For more details see Chapter 6 Air quality.

10.7.11 Impacts from piling into Humber Dock Marina during construction of Princes Quay Bridge and the re-location of Spurn Lightship could include noise, vibration, dust, groundwater contamination and silting / sedimentation. The potential impacts on the Humber Estuary European Sites is fully assessed within the AIES, see document reference TR010016/APP/6.13.

10.7.12 To summarise, to mitigate impacts to fauna in the Estuary prior to piling commencing, the following recommendations should be followed:

- The piling work is programmed to be undertaken outside of the Humber lamprey migratory seasons at a time when fewest lamprey numbers will be present in the Humber Estuary.
- A trained marine fauna ecologist and ornithologist would act as observers to check that the dock area and up to 500m beyond the dock gates is clear of marine mammals, fish and birds.
- The dock gates would be closed during piling to control and contain silt and sediment and absorb noise and vibration from entering the Humber Estuary.
- A soft start-up of machinery to disperse any potential fish, birds or mammals present in the dock.

Non-statutory designated sites

Trinity Burial Ground SNCI

10.7.13 Currently, 72 trees are to be removed from Trinity Burial Ground SNCI. Of these, 36 would be permanently lost as part of the Scheme and a further 36 trees lost to accommodate the tent for the archaeological works and the new entrance.

10.7.14 Retained trees near to construction areas would be protected from construction related damage to canopy and root systems by establishing root protection areas in accordance with BS5837:2012 Trees in relation to design, demolition and construction – Recommendations. Standard pollution control measures would be employed to mitigate pollution incidents, such as fuel spillages, within or adjacent to the burial ground.

10.7.15 Compensation includes replanting 55 larger native semi mature trees (>30cm diameter) close to Trinity Burial Ground as there would be little space within it. The

understorey in the remaining area of Trinity Burial Ground is to include some native shrubs and plants.

10.7.16 Within the retained area of the SNCI, 24 hour temporary lighting during works would be installed, but would be directed away from the remaining trees in order to reduce disturbance to wildlife that use the site such as bats and birds.

River Hull SNCI

10.7.17 Direct impacts to the River Hull SNCI are unlikely. Indirect impacts from pollution would be mitigated by standard pollution prevention measures in site compounds and working areas on pollution incidents before contaminants could reach the river. Pollution prevention measures would be specified within the CEMP. An OEMP is provided at document reference TR010016/APP/7.3.

UKBAP (NERC Act 2006 Section 41) Priority habitats

10.7.18 UKBAP Priority habitats 'mudflats', 'saltmarsh' 'deciduous woodland', broad-leaved woodland' and Broad habitat 'intertidal substrate foreshore – mud and made ground', are located either within or adjacent to the Scheme Site.

10.7.19 The woodland UKBAP Priority habitats are located in Trinity Burial Ground and mitigation and compensation are covered in Sections 10.7.13, 10.7.14 and 10.7.15.

10.7.20 The mudflats, saltmarsh and intertidal substrate foreshore - mud habitats are located adjacent to Humber Dock Marina and connecting Railway Dock, and site compounds at Wellington Street Island Wharf and Livingstone Road. Mitigation for pollution incidents on these habitats would be as in Section 10.7.4.

10.7.21 Intertidal substrate foreshore – man made habitat is located within Humber Dock Marina and Princes Dock. The former would be directly impacted by piling to create supports for the deck that would carry the proposed new Princes Quay Bridge and there would be a small loss of habitat beneath the pile footprints. No mitigation for habitats within Humber Dock Marina and Railway Dock is proposed. The dock gates would be closed during piling to control and contain silt and sediment and absorb noise and vibration from entering the Humber Estuary. The movement of the Spurn Lightship would additionally disturb sediments. The impacts of this are discussed further in the AIES at document reference TR010016/APP/6.13.

10.7.22 A Marine Mammal Mitigation Plan based upon the protocol in JNCC (2010) would be included in the contractor's CEMP and implemented as part of the works. See the OEMP at document reference TR010016/APP/7.3.

Scattered amenity trees

10.7.23 Outside of Trinity Burial Ground, approximately 245 amenity trees are to be removed to accommodate the Scheme. Compensation would include the planting

of 307 native trees across the Scheme Site. Potential site compound areas are to be reinstated as they were only required for the construction period. The Myton Centre which is to be used as a temporary car park will be landscaped as an area of replacement public open space at the end of the Construction Phase. Tree replacement is shown at Volume 2, Figure 9.9 Trees removed. Root protection areas would be established to protect retained trees near construction areas in accordance with BS5837:2012.

Standing water

10.7.24 Impacts from pollution incidents to standing water habitats at Humber Dock Marina, Railway Dock and Princes Dock would be mitigated by applying standard pollution prevention measures to pollution incidents before contaminants could reach the dock areas. Pollution prevention measures would be specified within the CEMP.

10.7.25 Impacts from piling for Princes Quay Bridge have been outlined in Section 10.7.11 and further evaluation of noise and vibration levels and sediment release is within the AIES. Humber Dock Marina would be impacted during piling.

Ephemeral / short perennial

10.7.26 This habitat is present in site compounds at Wellington Street Island Wharf, Neptune Street and Livingstone Road. Vegetation removal in these compounds would impact this UKBAP (NERC Act 2006 S41) and Hull BAP habitat. Mitigation should be to reduce the amount of this habitat lost by retaining an area in a corner of each site throughout the works and compensation should leave the site to revegetate naturally upon completion.

Hedgerows

10.7.27 A species-poor elder hedgerow is present in the area of the Myton Centre which is to be used as a temporary car park. It is approximately 45m in length and is to be compensated with 104m of hedgerow (to be confirmed) containing species of native hedgerow woody plants within the Myton Centre. The hedgerows within the site compounds at Livingstone Road and A63 eastbound recovery base would be reinstated only.

Terrestrial invertebrates

10.7.28 To compensate for the loss of habitat that supported invertebrates in Trinity Burial Ground SNCI, the planting described in Section 10.7.15 of this chapter would be implemented. The loss of ephemeral / short perennial habitat and tall ruderal and semi-improved grasslands in site compounds at Wellington Street Island Wharf, Neptune Street and Livingstone Road would be mitigated by reducing the amount of ephemeral / short perennial habitat lost by retaining an area in a corner of each site throughout the works and compensated by leaving the site to revegetate naturally upon completion.

Aquatic invertebrates

10.7.29 To prevent impacts from disturbance from the piling to install Princes Quay Bridge including noise, vibration and disturbance of sediments would involve the dock gates being closed during piling to control and contain silt and sediment and absorb noise and vibration from entering the Humber Estuary and a soft start-up of machinery to disperse any potential animals present in the dock. Mitigation for pollution impacts would be standard pollution prevention measures on pollution incidents before contaminants could reach the River Hull or Humber Estuary. Pollution prevention measures would be specified within the CEMP.

Fish

10.7.30 Direct impacts to fish are likely during the piling works to construct Princes Quay Bridge. Mitigation proposals for indirect impacts from noise, vibration and sediment disturbance are provided in Sections 10.7.3 to 10.7.11. Mitigation for pollution events to fish in the Humber Estuary and River Hull is described in Section 10.7.4. A soft start-up of machinery would disperse fish away from the piling area to the lock gates where they would not be indirectly impacted. This would be contained within the Marine Mammal Mitigation Plan based upon the protocol in JNCC (2010) included in the contractor's CEMP. See the OEMP at document reference TR010016/APP/7.3.

Reptiles

10.7.31 Reptile habitat is present in the A63 eastbound recovery base site compound and small numbers of reptiles may be present. Avoidance of death or injury to a reptile involves precautionary measures, with an ECoW being present prior to vegetation clearance to search the area where vegetation is to be removed first. Site clearance should be outside of the hibernation season (April-October). The ECoW would give a tool box talk to onsite contractors in order to relate applicable legislation, what signs to look for, and what to do should reptiles be encountered on site. If a reptile is found during site clearance, the ecologist would move it to a place of safety. The site compounds are to be re-instated after works cease which would compensate for potential habitat loss.

Birds

10.7.32 The main site and all potential compound sites with the exception of A63 westbound recovery base have some vegetation that could be used by common, UKBAP and LBAP breeding bird species. It is recommended that vegetation clearance is carried out outside the main breeding season (typically March to August inclusive). If this is not possible, it should be undertaken under the supervision of an ECoW who should check vegetation for active nests prior to clearance works commencing and identify any areas that should be avoided. Any active nests found must remain in situ, with a buffer of undisturbed vegetation, until all the young have fledged. Lighting of Trinity Burial Ground SNCI during

construction at night has the potential to disturb birds, but this would be directed away from the remaining trees.

10.7.33 The breeding and wintering bird surveys undertaken at site compounds at Neptune Street, Wellington Street Island Wharf and Livingstone Road found that there were no bird species breeding within these compounds that the Humber Estuary SAC / SPA / Ramsar / SSSI Sites were designated for. During the winter January / February surveys, bird species that the Humber Estuary was designated for were observed either adjacent to the site compounds in the mudflats or flying over the site compounds. Impacts to these bird species are likely to be from pollution or noise, vibration and sight disturbance.

10.7.34 Indirect impacts from pollution would be mitigated by applying standard pollution prevention measures in site compounds to pollution incidents before contaminants could reach the mudflats. Pollution prevention measures would be specified within the CEMP.

10.7.35 Mitigation measures to reduce disturbance to the birds feeding on the mudflats of the Humber Estuary, River Hull and Fleet Drain would include the erection of hoardings to block the works in the site compounds from view and reduce noise emissions. Monitoring bird surveys are to be carried out at the site compounds during construction in order to record the species of birds present and the effects of any noise or sight pollution upon them. If it is found that the noise and sight levels are impacting the wading bird population, then changes can be put into place to make these levels acceptable. Mitigation measures specified in Section 10.7.11 would reduce impacts from piling in Humber Dock Marina on any birds at Wellington Street Island Wharf site compound

Aquatic mammals

10.7.36 Grey seals may be present in the Humber Estuary, River Hull and Fleet Drain which are located adjacent to Humber Dock Marina, Railway Dock and site compounds at Neptune Street, Wellington Street Island Wharf and Livingstone Road. Direct impacts are considered unlikely, but in the event that a grey seal ventures onto the site, mitigation should include that trenches should be covered at night to prevent grey seal from falling in, or trenches should include an earth ramp to allow them to climb out. At night lighting should be directed away from the water in the three site compounds. Mitigation for this species from the construction of the Princes Quay Bridge is in Section 10.7.11 and they have been further assessed in AIES. A Marine Mammal Mitigation Plan based upon the protocol in JNCC (2010) would be included in the contractor's CEMP and implemented as part of the works. See the OEMP at document reference TR010016/APP/7.3.

Bats

10.7.37 No roosting bats were recorded during any of the surveys undertaken between 2013 and 2016. Demolition of buildings would not require ECoW supervision.

10.7.38 Updated bat surveys would be completed prior to the felling of trees with potential roosting features in Trinity Burial Ground SNCI, to confirm continued absence of roosts. Felling of trees with potential bat roost features in Trinity Burial Ground SNCI would be supervised by a bat licensed ECoW as a precautionary avoidance measure to account for the small possibility of unidentified roost presence. Cavities and other suitable roosting features would be inspected immediately prior to felling for signs of roosting bats. The trees would be felled sectionally in such a way that potential roost features are left intact. The felled tree sections would then be inspected on the ground and if they contain features that cannot be fully inspected, they would be left for 24 hours before removal. This allows time for any potential hidden bats to exit the tree sections overnight. Felling would be undertaken outside of sensitive roosting periods (not during maternity, May to August or during hibernation periods, November to March). Compensation would involve bat boxes, such as Schwegler 1FD and 1FF, to be placed in suitable mature trees within the remaining area of Trinity Burial Ground SNCI under the direction of a bat licensed ecologist. This would compensate for the loss of some of the potential roosting features within the mature trees that are to be removed.

10.7.39 Trinity Burial Ground SNCI is an important foraging habitat for the local common pipistrelle bat population. The park to the north west of Mytongate Junction is also frequently used by foraging bats. Two commuting routes were identified at Mytongate Junction, both of which connect Trinity Burial Ground SNCI with habitats to the north. Impacts to bats from the loss of the majority of trees in the burial ground would be compensated by replanting larger semi mature native trees (>30cm diameter) close to Trinity Burial Ground. The understorey in the remaining area of Trinity Burial Ground is to include some native shrubs and plants. Severance of the commuting route between Trinity Burial Ground SNCI and habitats to the north of the A63 by removal of the trees within Mytongate Junction and the northern section of Trinity Burial Ground SNCI, would impact bats by increasing the distance they have to fly over open areas to move between foraging resources. Compensation requires that the larger native trees are to be replanted on the verges at either side of the A63 in a line extending from Trinity Burial Ground to the Myton Centre. The large height of the trees would provide habitat ‘hop-overs’ for bats and reduce collisions with traffic. The larger trees would also be planted in the soft estate in the new Mytongate Junction. This should recreate the linear bat navigation route to Trinity Burial Ground that has been surveyed.

10.7.40 The A63 is currently lit at night and would be during construction. Trinity Burial Ground SNCI is not lit internally currently, but would be during construction after all the trees have been removed. The areas identified as site compounds are currently all lit at night, but the site compound at Wellington Street Island Wharf is only lit on the eastern and northern boundaries. The construction lighting scheme has not been designed as yet, but all the compound sites would have 24 hour lighting. Recommended mitigation would be to use covers to direct lighting where it is needed at the ground and not directly light up linear features.

Otters

10.7.41 Otters are likely to use the Humber Estuary, River Hull and Fleet Drain which are located adjacent to Humber Dock Marina, Railway Dock and site compounds at Neptune Street, Wellington Street Island Wharf and Livingstone Road as part of their home range. Direct impacts are considered unlikely, but in the event that an otter ventures onto the site, mitigation would include that trenches are to be covered at night to prevent otter from falling in, or trenches are to include an earth ramp to allow otter to climb out. Lighting in site compounds at Neptune Street, Wellington Street Island Wharf and Livingstone Road should be directed away from the water. Mitigation for this species from the construction of the Princes Quay Bridge is in Section 10.7.11. A Marine Mammal Mitigation Plan based upon the protocol in JNCC (2010) would be included in the contractor's CEMP and implemented as part of the works. See the OEMP at document reference TR010016/APP/7.3.

Notable species (hedgehogs)

10.7.42 Trinity Burial Ground SNCI and other vegetated areas within the main site; site compounds at Wellington Street Island Wharf, Livingstone Road (south part), land south east of Mytongate Junction, Neptune Street and A63 eastbound recovery base; and the temporary car park at Myton Centre have the potential to support UKBAP (NERC Act 2006 S41) and LBAP species European hedgehog. Mitigation includes that site clearance workers should be made aware of the risk of finding hedgehogs during site clearance, and if any are found they should be placed in an area of safety, away from the works area.

Invasive species (Schedule 9 of the Wildlife and Countryside Act 1981 (as amended))

10.7.43 The invasive shrub cotoneaster was identified during the field survey at the A63 / Market Place junction and A63 / Queen Street junction within areas of introduced shrub and amenity planting surrounded by hard standing. It was also noted in site compounds at land south east of Mytongate Junction and Staples site. These plants are to be removed and the arisings and topsoil in these areas should be treated as controlled waste. They must be disposed of at a suitably licensed or permitted disposal facility. The waste site operator must be informed that there is living cotoneaster in the material to be disposed of. The skip or wagon to be used for disposal would need lining and covering with membrane and cleaning again after the material has been disposed. Biosecurity method statements would be included in the CEMP.

10.7.44 Three false acacia trees were identified in the main site on the verge outside of Trinity Burial Ground SNCI. The trees are to be removed and treated as controlled waste as in Section 10.7.43.

Mitigation of Operation Phase impacts

Humber Estuary SAC / SPA / Ramsar / SSSI Sites

10.7.45 The increase in drainage area due to the proposed underpass would result in higher discharges to the Humber Estuary during the Operation Phase than the existing situation. All surface water from the underpass would pass through a pollution control device and a storage tank before reaching the Estuary. The additional pollutant load from the proposed discharge to the Humber would be monitored and controlled and not result in a deterioration of the existing Water Framework Directive water quality status and would not prevent the Humber from achieving the WFD objective of good ecological potential by 2027 (see Chapter 11, Road drainage and the water environment).

10.7.46 Discharge of surface water from the underpass at Mytongate Junction onto existing rock armour would prevent the discharge from scouring the river bed and creating silt plumes that could be detrimental to estuarine habitats and species. It is not yet determined if the outfall is required and the locations of the outfalls have yet to be decided (Section 10.4.4).

10.7.47 Mitigation to control the risk of pollution to the water environment and flooding during operation of the Scheme has been incorporated into the design of the underpass drainage system. This is described in Chapter 2, The Scheme.

10.7.48 The underpass drainage system would incorporate a shut-off valve and below-ground attenuation units to allow isolation and containment of contaminants lost to the drainage system in the event of a major incident. This would prevent accidental spillages reaching the Humber Estuary, protecting the water quality of the receiving water body. The underpass drainage system design would also incorporate an oil interceptor.

10.7.49 Air emissions from the operation of the Scheme would not increase significantly. For details see Chapter 6 Air quality.

10.7.50 Noise levels would have no major or moderate adverse impacts during operation and some beneficial effects of lower noise levels to the south of Mytongate Junction where the proposed road dips down may benefit fauna in the designated sites (see Chapter 7 Noise and vibration).

Non-statutory designated sites

Trinity Burial Ground SNCI

10.7.51 A replacement public open space is to be provided at the Myton Centre to compensate for the loss of part of Trinity Burial Ground SNCI (see Chapter 2 The Scheme). The primary function of this new site would be for public amenity and whilst some trees and shrubs would be planted, it would not replace the mature woodland habitat lost within the SNCI in the long term. There is no land available

adjacent to the application site that is suitable for replacing the habitat lost within the SNCI with new tree planting, due to the urban location of the Scheme.

10.7.52 Some shrubs and native planting to benefit wildlife in the remaining area of the SNCI is to be undertaken, but the area is to be used to improve the amenity of the site for the public which would entail making the site more open to discourage anti-social behaviour.

10.7.53 Existing lighting columns would be retained around the retained area of the SNCI after the completion of works and light pollution from the new junction which would be located closer to the SNCI would increase.

River Hull SNCI

10.7.54 Road drainage would not discharge to the River Hull during the Operation Phase and there would therefore be no risks to water quality within the river.

UKBAP (NERC Act 2006 Section 41) Priority habitats

10.7.55 The woodland UKBAP Priority habitats are located in Trinity Burial Ground. Operational mitigation is covered in Sections 10.7.52; 10.7.53 and 10.7.54.

10.7.56 The mudflats, saltmarsh and intertidal substrate foreshore – operational impacts to mud habitats located adjacent to Humber Dock Marina and connecting Railway Dock and site compounds at Wellington Street Island Wharf and Livingstone Road would be mitigated as described in Sections 10.7.45 – 10.7.50.

10.7.57 Intertidal substrate foreshore – man made habitat is located within Humber Dock Marina and Princes Dock and no operational impacts on this habitat are likely although there would be a small loss of habitat beneath the pile footprints.

Scattered amenity trees

10.7.58 Outside of Trinity Burial Ground, currently, the 245 trees to be removed are being replaced with 307 trees.

10.7.59 New tree planting would be maintained for five years during the Operation Phase to ensure establishment and growth to maturity in the long term (see Chapter 9, Landscape). No operational impacts from air quality are expected on the replacement trees.

Standing water

10.7.60 Impacts from road drainage pollution incidents to standing water habitats at Humber Dock Marina, Railway Dock and Princes Dock are unlikely as the road drainage would not discharge to the Humber and Railway Docks during the Operation Phase. If consent is not granted by Yorkshire Water, the proposed outfall discharge point to the Humber would be located in an area of existing outfalls outside of the docks. This is covered in Section 10.7.47.

Ephemeral / short perennial

10.7.61 This habitat is present in site compounds at Wellington Street Island Wharf, Neptune Street and Livingstone Road. These compounds would be reinstated after construction and would not be managed as a part of the Scheme. Ephemeral / short perennial habitat that was present is likely to recover its existing state in a short time.

Hedgerows

10.7.62 The replacement hedgerows at the temporary car park site at the Myton Centre and A63 eastbound recovery base site compound would be maintained during the Operation Phase to ensure establishment and growth to maturity in the long term.

Terrestrial invertebrates

10.7.63 The amount of lost habitat that supported invertebrates in Trinity Burial Ground SNCI would not be fully replaced, so there would continue to be less habitat for terrestrial invertebrates during the Operation Phase. The loss of ephemeral / short perennial habitat; tall ruderal and semi-improved grasslands in site compounds at Wellington Street Island Wharf, Neptune Street and Livingstone Road would be reinstated after construction and would not be managed as a part of the Scheme. These habitats that were present are likely to recover their existing state in a short time.

Aquatic invertebrates

10.7.64 Operation Phase impacts to the Humber Estuary and River Hull (Sections 10.7.45 to 10.7.50 and 10.7.54) are considered unlikely and so it is assumed that impacts to aquatic invertebrates supported by these rivers would also be unlikely.

Fish

10.7.65 Operation Phase impacts to the Humber Estuary and River Hull (Sections 10.7.45 to 10.7.50 and 10.7.54) and the standing water of the docks (Section 10.7.60) are considered unlikely and so it is assumed that impacts to fish in these rivers and docks would also be unlikely.

Reptiles

10.7.66 After the habitats in the site compound at A63 eastbound recovery base have been reinstated, no impacts to reptiles are considered likely during the Operation Phase.

Birds

10.7.67 The new tree and shrub planting across the Scheme Site would provide some replacement nesting and foraging habitat for common, UKBAP and LBAP species of birds. However, the amount of lost habitat that supported birds in Trinity Burial

Ground SNCI would not be fully replaced, so there would continue to be less habitat for birds during the Operation Phase. Increased light pollution would remain during the Operation Phase at Trinity Burial Ground SNCI.

10.7.68 The site compounds at Wellington Street Island Wharf, Neptune Street and Livingstone Road are to be reinstated after construction and should regain their existing habitats in a short time. The adjacent mudflats of the Humber Estuary, River Hull and Fleet Drain would be mitigated as described in Sections 10.7.45 to 10.7.50. No Operation Phase impacts to wading birds and waterfowl that the Humber Estuary is designated for are considered likely.

Aquatic mammals

10.7.69 Grey seals are unlikely to be impacted during the Operation Phase as water and drainage mitigation described in Sections 10.7.43 to 10.7.48 and the standing water of the docks (10.7.57) would prevent impacts to this species. There is to be no additional lighting of the Humber Estuary or River Hull during the Operation Phase.

Bats

10.7.70 Trees would be planted within landscaped areas between the main carriageway and slip roads, which would help to facilitate the continued movement of bats between habitats on either side of the road (see Chapter 9 Landscape). The trees would act as hop-over points, reducing the amount of open space that bats have to fly across, maintaining habitat connectivity and guiding bats over the road at height to reduce the risk of collisions with vehicles. The efficacy of the trees would improve over time as they grow and mature. New tree and shrub planting across the Scheme Site would provide some replacement bat foraging and commuting habitat in the area, but the amount of lost habitat that supported bats in Trinity Burial Ground SNCI would not be fully replaced, so there would continue to be less habitat for bats during the Operation Phase.

10.7.71 New permanent lighting would not be installed within the retained area of the SNCI after the completion of works, but light pollution from the new junction which would be located closer to the SNCI would increase which may deter bats from roosting in the bat boxes that are to be erected on the remaining trees.

10.7.72 New lighting within the Scheme is to comprise white LED lights which are more directional and produce lower spill than the existing lights which should produce a benefit to the species of bats found using the Scheme Site.

Otters

10.7.73 Otters are unlikely to be impacted during the Operation Phase as water and air pollution and drainage mitigation described in Sections 10.7.45 to 10.7.50 and the standing water of the docks (Section 10.7.60) would prevent impacts to this

species. There is to be no additional lighting of the Humber Estuary or River Hull during the Operation Phase.

Notable species (hedgehogs)

10.7.74 The Operation Phase of the Scheme is likely to impact upon hedgehogs. The permanent loss of part of Trinity Burial Ground SNCI that potentially supported hedgehogs would not be fully replaced, so there would continue to be less habitat for this species during the Operation Phase.

Invasive species (Schedule 9 of the Wildlife and Countryside Act 1981 (as amended))

10.7.75 The site is to be maintained during the Operation Phase and it is unlikely that the cotoneaster or false acacia trees would return after removal in the Construction Phase. In the event that this happens, this would be removed during the maintenance period.

Characterisation of ecological impacts

10.7.76 A summary of the impacts to each receptor described above is provided in Table 10.9: Characterisation process of ecological impacts taken from IAN 130/10 which is supplement to DMRB Volume 11, Section 3 Part 4 ‘Ecology and Nature Conservation’. This takes into account the findings from the AIES Screening Report which is based on the

Table 10.9: Characterisation process of ecological impacts

Resource	Proposed activity, biophysical change, related to receptor structure and function	Characterisation of impact	Mitigation proposals	Summary of characterisation
Humber Estuary Value: International Conservation of Habitats and Species Regulations 2017	Potential discharge of pollution from A63 to enter the Estuary through drainage system. Unknown impact on tidal mud and shales. Potential impacts from piling into Humber Dock Marina during construction of Princes Quay footbridge would include noise, vibration, dust, sedimentation, groundwater contamination and silting. Potential air quality impact small % of NOx increase on existing amounts. Potential death, injury or disturbance to marine fauna during construction of Princes Quay footbridge. Potential pollution impacts during operation.	SI: -ve PO: unlikely CO: indirect EC: small SZ: not assessed RE: not assessed DU: Permanent TF: N/A	Drainage design would ensure that adequate surface water interceptors are incorporated. Surface water would discharge onto existing rock armour in the Estuary. Trained marine fauna ecologists would act as observers to check that the dock area and up to 500m beyond the dock gates is clear of marine animals. The dock gates would be closed during piling to control and contain silt and sediment and absorb noise and vibration from entering the Humber Estuary. A soft start-up of machinery to disperse any potential fish, birds or mammals present in the dock. Impacts from piling fully assessed in AIES. Temporary protection during construction detailed in CEMP. Current amounts of NOx already exceed environmental standards. Very small negligible increase. Water quality would not be impacted by operational discharges and spillages as underpass drainage	Risk of accidental indirect impact. Small and unlikely to be Significant (Design must ensure no residual impact) Scheme certain to be insignificant in terms of air quality Noise levels in parts of the site during operation would reduce. Water quality would not be significantly impacted during operation. Probable. Impacts to the Humber Estuary designated sites has been concluded as not significant in the HRA Screening Report for Princes Quay currently undergoing consultation.

Resource	Proposed activity, biophysical change, related to receptor structure and function	Characterisation of impact	Mitigation proposals	Summary of characterisation
			system would incorporate a shut-off valve and below-ground attenuation units to allow isolation and containment of contaminants.	
Trinity Burial Ground SNCI Value: County / Unitary Authority Area Hull City Council designation	Permanent loss of 36 veteran mature trees (additional 36 to facilitate disinterment) and woodland understorey. Lighting of SNCI during construction at night and light pollution from new junction during operation.	SI: -ve PO: certain CO: direct EC: large 0.7ha SZ: complete loss RE: not reversible DU: permanent TF: avoid breeding bird season	Root protection zones on remaining trees. Compensation includes replanting 55 larger native trees (>30cm diameter) close to Trinity Burial Ground. The understorey in the remaining area of Trinity Burial Ground is to include some native shrubs and plants. Lighting during construction to directed away from remaining trees.	Certain permanent loss of large area of habitat and mature trees. Significant. Certain significant permanent extra light pollution during operation.
River Hull SNCI Value: County / Unitary Authority Area Hull City Council designation	Indirect impacts from pollution during construction.	SI: -ve PO: unlikely CO: indirect EC: v small SZ: not assessed RE: not assessed DU: Permanent TF: N/A	Mitigation by standard pollution prevention measures.	Unlikely, very small indirect pollution incident during construction. Not significant. No impacts expected during operation.
UKBAP (NERC Act 2006 S41) Priority Habitats – Value: National 'deciduous woodland' and broad-leaved woodland' – Trinity Burial Ground SNCI.	Trinity Burial Ground as in SNCI above.	Based on highest impacts which are to woodland habitats SI: -ve PO: certain	'deciduous woodland' and broad-leaved woodland' – mitigation and compensation as in Trinity Burial Ground SNCI above.	Certain, permanent loss of large area of habitat and mature trees. Significant. Operational impacts from lighting pollution.

Resource	Proposed activity, biophysical change, related to receptor structure and function	Characterisation of impact	Mitigation proposals	Summary of characterisation
'mudflats', 'saltmarsh', 'intertidal substrate foreshore – mud' Princes Dock; Humber Dock basin; Adjacent to site compounds at Neptune Street, Wellington Street Island Wharf and Livingstone Road. 'Intertidal substrate foreshore – man made – Humber Dock Marina; Princes Dock. Section 41 of the NERC Act 2006	Mitigation by standard pollution prevention measures. Humber Dock Marina would be directly impacted by piling to create supports for the deck that would carry the proposed Princes Quay footbridge (noise, vibrations, and disturbance of sediments). Impacts from the moving of Spurn Lightship could include additional disturbance of sediments.	CO: direct EC: large 0.7ha SZ: complete loss RE: not reversible DU: permanent TF: avoid breeding bird season	'mudflats', 'saltmarsh', 'intertidal substrate foreshore – mud – Mitigation by standard pollution prevention measures. No mitigation for habitats within Humber Dock Marina. The dock gates would be closed during piling to control and contain silt and sediment and absorb noise and vibration from entering the Humber Estuary.	Unlikely, very small indirect pollution incident in Construction Phase only. Not significant. Certain, direct, temporary, large, reversible impacts of noise, vibration and sediment disturbance. Significant. No adverse impacts during operation expected and no residual impacts Impacts to the Humber Estuary designated sites has been concluded as not significant in the HRA Screening Report for Princes Quay currently undergoing consultation.
Scattered Amenity Trees Value: Local – main site	245 amenity trees (outside of Trinity Burial Ground) are to be removed to accommodate the Scheme.	SI: -ve PO: certain CO: direct	Compensation by 307 x native tree planting incorporated into landscape plan. Trees to be managed.	Certain, direct loss of the majority of trees within the Scheme Site. Would

Resource	Proposed activity, biophysical change, related to receptor structure and function	Characterisation of impact	Mitigation proposals	Summary of characterisation
Hull City Council Local Biodiversity Action Plan		EC: not assessed SZ: loss RE: reversible DU: temporary TF: avoid breeding bird season		take time for compensation to replace maturity of trees lost. Significant. No significant operational impacts. Residual impacts – no loss of trees overall, slight gain.
Standing Water Value: Regional – Humber Dock Marina; Railway Dock 'regularly occurring populations of species which may be considered at an International level' (IAN 130/10)	Humber Dock Marina would be directly impacted by piling to create supports for the deck that would carry the proposed new Princes Quay Bridge (noise, vibrations, and disturbance of sediments). Impacts from moving of Spurn Lightship could include additional disturbance of sediments. Impacts from indirect pollution during construction.	SI: -ve PO: certain CO: direct EC: not assessed SZ: disturbance RE: reversible DU: temporary TF: N/A	No mitigation for habitats within Humber Dock Marina or Railway Dock during piling. The dock gates would be closed during piling to control and contain silt and sediment and absorb noise and vibration from entering the Humber Estuary. All docks - Mitigation by standard pollution prevention measures.	Certain, direct, temporary disturbance to standing water habitat of Humber Dock Marina. Significant. Both docks - Unlikely, very small indirect pollution incident. No impacts during operation. No residual impacts. Impacts to the Humber Estuary designated sites has been concluded as not significant in the HRA Screening Report for Princes Quay currently undergoing consultation.
Ephemeral / short Perennial	Impacts from loss of vegetation.	SI: -ve		

Resource	Proposed activity, biophysical change, related to receptor structure and function	Characterisation of impact	Mitigation proposals	Summary of characterisation
Value: Local - site compounds at Wellington Street Island Wharf, Livingstone Road and Neptune Street Section 41 of the NERC Act 2006 Hull City Council Local Biodiversity Action Plan		PO: certain CO: direct EC: 100% SZ: complete loss RE: reversible DU: temporary TF: avoid breeding bird season	Small area of habitat to be left in each site compound. Compounds to be left to regenerate after use.	Certain, direct, temporary loss of habitat which would regenerate quickly. No impacts during operation or residual impacts. Not significant.
Hedgerows Value: Local - site compounds at Livingstone Road, A63 eastbound recovery base and Staples site; car park site at the Myton Centre. Section 41 of the NERC Act 2006	Loss of 5 x species-poor intact hedgerows, four of which are not connected to the wider surrounds or act as a green corridor. One is (A63 eastbound recovery base) connected to the wider area as it runs alongside the verge of the A63.	SI: -ve PO: certain CO: direct EC: 100% SZ: loss RE: reversible DU: temporary TF: avoid breeding bird season	The species-poor hedgerows present in site compound – Myton Centre is approximately 45m in length and is to be compensated with 104m length of hedgerow containing species of native hedgerow woody plants . This would be managed during operation. The hedgerow in site compound – Livingstone Road, the one in Staples site and the one in site compound – A63 eastbound recovery base are to be re-instated only.	Temporary, certain loss of habitats that would benefit over time in Operation Phase from compensatory measures and management. Not significant.
Terrestrial Invertebrates Value: Local - Trinity Burial Ground SNCI; site compounds at Wellington Street Island	Woodland in Trinity Burial Ground has potential to support UKBAP and Hull BAP species. Habitat to be lost.	SI: -ve PO: certain CO: direct EC: 0.7ha of woodland; 100% of	Woodland in Trinity Burial Ground – mitigation and compensation as in Trinity Burial Ground SNCI above.	Certain, permanent loss of large area of habitat and mature trees. Significant. Less habitat during operation.

Resource	Proposed activity, biophysical change, related to receptor structure and function	Characterisation of impact	Mitigation proposals	Summary of characterisation
Wharf, Livingstone Road and Neptune Street Section 41 of the NERC Act 2006 Hull City Council Local Biodiversity Action Plan	Ephemeral / short perennial habitat in other two compounds has potential to support UKBAP and Hull BAP species. Habitat to be lost.	ephemeral / short perennial SZ: All animals in these areas RE: Not reversible (woodland) reversible (ephemeral / short perennial) DU: Temporary TF: N/A	Small area of ephemeral/short perennial habitat to be left in each site compound. Compounds to be left to regenerate after use.	Certain, direct, temporary loss of habitat which would regenerate quickly. No impacts during operation. Not significant.
Aquatic Invertebrates Value: National – Humber Estuary SSSI The Wildlife and Countryside Act 1981 as amended (primarily by the Countryside and Rights of Way Act 2000) Value: Local – River Hull SNCI Section 41 of the NERC Act 2006	Potential impacts from pollution events during construction, disturbance from piling to install Princes Quay Bridge including noise, vibration, disturbance of sediments. Potential impacts from pollution events during construction.	SI: -ve PO: Unlikely CO: indirect EC: not assessed SZ: not assessed RE: reversible DU: temporary TF: N/A	The dock gates would be closed during piling to control and contain silt and sediment and absorb noise and vibration from entering the Humber Estuary. A soft start-up of machinery to disperse any potential animals present in the dock. Full assessment of impacts is to be undertaken in the AIES. Mitigation by standard pollution prevention measures.	Unlikely, indirect, temporary impacts from piling and pollution events. No impacts during operation. Not significant.
Fish (Sea and river lamprey)		SI: -ve	Trained marine fauna ecologists would act as observers to check that	Probable direct and indirect impacts during

Resource	Proposed activity, biophysical change, related to receptor structure and function	Characterisation of impact	Mitigation proposals	Summary of characterisation
Value: International - Humber Dock Marina; Railway Dock; site compounds at Neptune Street, Wellington Street Island Wharf and Livingstone Road; Conservation of Habitats and Species Regulations 2017 Fish (European eel, salmon, sea trout) Value: Local - Humber Dock Marina; Railway Dock; site compounds at Neptune Street, Wellington Street Island Wharf and Livingstone Road Section 41 of the NERC Act 2006 Eels (England and Wales) Regulations 2009	Direct impacts to fish are likely during the piling works to construct Princes Quay Bridge. Indirect impacts from noise, vibration and sediment disturbance. Impacts from indirect pollution during construction.	PO: probable CO: direct EC: not assessed SZ: disturbance RE: reversible DU: temporary TF: N/A	the dock area and up to 500m beyond the dock gates is clear of marine animals. The dock gates would be closed during piling to control and contain silt and sediment and absorb noise and vibration from entering the Humber Estuary. A soft start-up of machinery to disperse any potential fish, birds or mammals present in the dock. Full assessment of impacts undertaken in the AIES. Mitigation by standard pollution prevention measures.	piling. Temporary and reversible. No impacts during operation. Not significant. Impacts to the Humber Estuary designated sites has been concluded as not significant in the HRA Screening Report for Princes Quay currently undergoing consultation.
Reptiles Value: Local - site compound at the A63 eastbound recovery base The Wildlife and Countryside Act 1981 as amended	Impacts from loss and severance of habitats. Potential killing or injury during site clearance.	SI: -ve PO: probable CO: direct EC: 0.3ha in A63 Eastbound layby SZ: loss of habitat RE: reversible	Ecological Clerk of Works (ECoW) being present prior to vegetation clearance to search the area where vegetation is to be removed first. Habitats to be reinstated.	Certain temporary loss of habitat that would be reinstated with no operational or residual impacts. Not significant.

Resource	Proposed activity, biophysical change, related to receptor structure and function	Characterisation of impact	Mitigation proposals	Summary of characterisation
		DU: temporary TF: avoid site clearance in hibernation season		
Birds Value: International - site compounds at Neptune Street, Wellington Street Island Wharf and Livingstone Road Conservation of Habitats and Species Regulations 2017 Wildlife and Countryside Act 1981 (as amended) Value: Local - Main site; Trinity Burial Ground SNCI; site compounds at land south east of Mytongate Junction, A63 eastbound recovery base, Arco site and Staples site; car park site at the Myton Centre Section 41 of the NERC Act 2006 Hull City Council Local Biodiversity Action Plan	International - In all three site compounds, bird species the Humber Estuary was designated for were observed either adjacent to the site compounds in the mudflats or flying over the site compounds. Impacts to these bird species are likely to be from pollution or noise, vibration and sight disturbance during construction. Local – loss of breeding habitat. Lighting of Trinity Burial Ground SNCI during construction at night and light pollution from new junction during operation due to lack of trees.	SI: -ve PO: probable CO: indirect EC: not assessed SZ: disturbance, loss of habitat	The erection of hoardings to block the works in the site compounds from view and reduce noise emissions. Monitoring bird surveys are to be carried out at the site compounds during construction in order to record the species of birds present and the effects of any noise or sight pollution upon them. If it is found that the noise and sight levels are impacting the wading bird population, then changes can be put into place to make these levels acceptable. At site compound – Wellington Street Island Wharf, trained marine fauna ecologists would act as observers to check that the dock area and up to 500m beyond the dock gates is clear of marine birds. The dock gates would be closed during piling to control and contain	International – probable, temporary indirect impacts during construction with no impacts during operation or residual impacts expected. Not significant. Local – Certain permanent loss of habitat in Trinity Burial Ground. Impacts from light pollution during operation. Significant. Temporary, certain loss of habitat in other site compounds that would be re-instated with no operational impacts. No impacts from light pollution during operation or residual impacts. Not significant.

Resource	Proposed activity, biophysical change, related to receptor structure and function	Characterisation of impact	Mitigation proposals	Summary of characterisation
		RE: Not reversible (Trinity Burial Ground) reversible (all other sites) DU: permanent (Trinity Burial Ground) temporary (all other sites) TF: avoid site clearance in breeding season	silt and sediment and absorb noise and vibration from entering the Humber Estuary. A soft start-up of machinery to disperse any potential birds present in the dock. Full assessment of impacts is to be undertaken in the AIES. Mitigation by standard pollution prevention measures to remove habitat outside of breeding season. Habitats to be re-instated with the exception of Trinity Burial Ground. Lighting to be directed away from remaining trees during construction. Mitigation planting would replace some lost habitat. Habitat enhancement would improve bird nesting and feeding opportunities.	Impacts to the Humber Estuary designated sites has been concluded as not significant in the HRA Screening Report for Princes Quay currently undergoing consultation.
Aquatic mammals Value: International - Humber Dock Marina; Railway Dock; site compounds at Neptune Street, Wellington Street Island Wharf and Livingstone Road	Grey seals may venture onto the site and fall in trenches and be disturbed by the lighting during construction. Disturbance during construction of Princes Quay Bridge from noise, vibration and sediment disturbance.	SI: -ve PO: unlikely CO: indirect	Mitigation should include that trenches should be covered at night to prevent grey seal from falling in, or trenches should include an earth ramp to allow them to climb out. At night in the three site compounds, lighting should be directed away from the water. Mitigation for the	Unlikely, indirect impacts during piling and construction works. Temporary and reversible. No impacts during operation or residual impacts. Not significant

Resource	Proposed activity, biophysical change, related to receptor structure and function	Characterisation of impact	Mitigation proposals	Summary of characterisation
Conservation of Habitats and Species Regulations 2017. Wildlife and Countryside Act 1981 (as amended)	Impacts from indirect pollution and lighting during construction.	EC: not assessed SZ: disturbance RE: reversible DU: temporary TF: N/A	construction of the Princes Quay footbridge includes: Trained marine fauna ecologists would act as observers to check that the dock area and up to 500m beyond the dock gates is clear of marine animals. The dock gates would be closed during piling to control and contain silt and sediment and absorb noise and vibration from entering the Humber Estuary. A soft start-up of machinery to disperse any potential animals present in the dock. Full assessment of impacts is to be undertaken in the AIES. Mitigation by standard pollution prevention measures. Lighting not directed on water during operation.	Impacts to the Humber Estuary designated sites has been concluded as not significant in the HRA Screening Report for Princes Quay currently undergoing consultation.
Bats Pipistrelle bats Value: Local – All areas	Loss of potential roosts within trees and old wall in Trinity Burial Ground.	SI: -ve PO: certain	Precautionary avoidance measures are to include that demolition of trees in Trinity Burial Ground SNCI would be overseen by a bat licensed ECoW. Trees would be felled sectionally and sections searched by	Certain, direct, permanent loss of historic roost, potential tree roosts to be compensated for.

Resource	Proposed activity, biophysical change, related to receptor structure and function	Characterisation of impact	Mitigation proposals	Summary of characterisation
Conservation of Habitats and Species Regulations 2017. Wildlife and Countryside Act 1981 (as amended)	Small possibility of unidentified roost presence in trees in Trinity Burial Ground SNCI when felling. Loss of foraging area for a small number of pipistrelle bats in Trinity Burial Ground and severance of commuting route to it across Mytongate Junction. Lighting of Trinity Burial Ground SNCI during construction at night and light pollution from new junction during operation due to lack of trees.	CO: direct EC: 1 disused roost, 0.7ha foraging habitat lost for small number of bats SZ: disturbance RE: not reversible DU: permanent TF: outside of sensitive periods for bats	ECoW or left overnight for bats to exit before removal from site. Compensation includes the erection of bat boxes on the remaining trees in Trinity Burial Ground SNCI. Compensation includes that the larger native trees are to be replanted on the verges at either side of the A63 in a line extending from Trinity Burial Ground to the Myton Centre. The large height of the trees would provide habitat 'hop-overs' for bats and reduce collisions with traffic. The larger trees would also be planted in the soft estate in the new Mytongate Junction. This should recreate the linear commuting route to Trinity Burial Ground. Lighting to be directed away from remaining trees during construction. During operation, mitigation would be to use covers to direct lighting where it is needed at the ground and not directly light up linear features.	Certain, direct, permanent loss of foraging and commuting habitat would be partially replaced over time as it matures. Certain, permanent extra light pollution during operation. Significant.
Otters Value – Local - Humber Dock Marina; Railway Dock; site compounds at Neptune Street,	Otters may venture onto the site and fall in trenches.	SI: -ve PO: unlikely	Mitigation would include that trenches are to be covered at night to prevent otter from falling in, or trenches are to include an earth ramp to allow otter to climb out.	Unlikely, direct and indirect impacts during piling and construction works. Temporary and reversible.

Resource	Proposed activity, biophysical change, related to receptor structure and function	Characterisation of impact	Mitigation proposals	Summary of characterisation
Wellington Street Island Wharf and Livingstone Road Conservation of Habitats and Species Regulations 2017. Wildlife and Countryside Act 1981 (as amended)	Disturbance during construction of Princes Quay Bridge from noise, vibration and sediment disturbance. Impacts from indirect pollution and lighting during construction.	CO: indirect EC: not assessed SZ: disturbance RE: reversible DU: temporary TF: N/A	At night in the three site compounds, lighting should be directed away from the water. Mitigation for the construction of the Princes Quay Bridge includes: Trained marine fauna ecologists would act as observers to check that the dock area and up to 500m beyond the dock gates is clear of marine animals. The dock gates would be closed during piling to control and contain silt and sediment and absorb noise and vibration from entering the Humber Estuary. A soft start-up of machinery to disperse any potential animals present in the dock. Full assessment of impacts is to be undertaken in the AIES. Mitigation by standard pollution prevention measures. Lighting not directed on water during operation.	No impacts during operation or residual impacts. Not significant.
Hedgehogs Value: Local – Terrestrial areas	Woodland to be permanently lost in Trinity Burial Ground SNCI has potential to support hedgehogs.	SI: -ve PO: probable CO: direct	Ecological Clerk of Works (ECoW) being present prior to vegetation clearance to search the area where vegetation is to be removed first.	Certain, temporary loss of habitat that would be re-instated with no operational or residual impacts with the

Resource	Proposed activity, biophysical change, related to receptor structure and function	Characterisation of impact	Mitigation proposals	Summary of characterisation
Section 41 of the NERC Act 2006	Habitats elsewhere to be temporarily lost. Impacts to individuals during vegetation clearance.	EC: 0.7ha of Trinity Burial Ground, not assessed rest of site	Habitats to be re-instated with the exception of Trinity Burial Ground SNCI.	exception of permanent loss of part of Trinity Burial Ground. Potentially significant.
		SZ: disturbance, loss of habitat		
		RE: not reversible		
		DU: permanent		
		TF: N/A		
Invasive species Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) cotoneaster (main site – A63 and Market Place junction and A63 and Queen Street junction); land south east of Mytongate Junction	Legal impact of allowing these species to spread.	SI: N/A	Cotoneaster plants are to be removed and the arisings and topsoil in these areas to be treated as controlled waste. To be disposed of at a suitably licensed or permitted disposal facility. Biosecurity method statements for both species. The site is to be maintained during the Operation Phase and it is unlikely that the cotoneaster or false acacia would return after removal in the Construction Phase. Should this happen, it would be removed during maintenance.	Probable, direct legal impact of spreading these species to be mitigated fully and no spread is predicted. Not significant.
		PO: probable		
		CO: direct		
		EC: not assessed		
		SZ: not assessed		
		RE: reversible		
		DU: temporary		
		TF: legal constraint		
Key SI (Sign): Positive (beneficial (+ve)) or Negative (adverse (-ve)) PO (Probability of Occurring): Certain, Probable, Unlikely CO (Complexity): Direct, Indirect, Cumulative				

Resource	Proposed activity, biophysical change, related to receptor structure and function	Characterisation of impact	Mitigation proposals	Summary of characterisation
EC (Extent): Area measures and percentage of total (e.g. area of habitat / territory lost) SZ (Size): Description of level of severity of influence (e.g. complete loss, number of animals affected) RE (Reversibility): Reversible or Not Reversible (can the effect be reversed, whether or not this is planned) DU (Duration): Permanent (P) or Temporary (T) in ecological terms. Where differing timescales are determined in relation to the life cycle of the receptor, these should be defined. TF (Timing and frequency): Important seasonal and / or life cycle constraints and any relationship with frequency considered.				

10.8 Predicted environmental effects

10.8.1 The predicted effects of the Scheme on ecological receptors during both the Construction Phase and Operation Phase have been assessed, taking into account mitigation proposals, in accordance with IAN 130/10 table 2.

10.8.2 Residual impacts are those that are predicted to remain after the successful implementation of mitigation measures. Residual impacts have been assessed as significant or not significant based on a range of factors.

10.8.3 Where significant residual impacts to ecological receptors have been identified, the significance of the effect has been evaluated, based on the value of the receptor, in accordance with IAN 130/10 table 3. This assigns ecological impacts to overall significance categories used in other topic areas.

10.8.4 There would be no significant effects if preferred Option A main compound at Arco is chosen or the alternative site compound at Staples is selected. Both site compounds were assessed at negligible biodiversity value.

10.8.5 The impact assessment is outlined below and a summary is provided in Table 10.10: Summary of ecological receptors.

Construction effects

Humber Estuary SAC / SPA / Ramsar / SSSI Sites

10.8.6 Neutral residual impacts are predicted to the Humber Estuary during the Construction Phase, following the implementation of mitigation measures.

10.8.7 With the use of pollution control measures during de-watering and general site operations, as specified in the CEMP, the risk of harmful levels of contaminants from construction works reaching the Humber Estuary would not be significant. Any requirement to construct the surface water outfall at the location of an existing dock wall would avoid direct impacts to estuarine habitats.

10.8.8 Pollution of the Humber Estuary via groundwater contaminant mobilisation during construction has been assessed as unlikely. There is limited hydraulic connectivity between the proposed underpass and the Humber Estuary and the zone of influence of de-watering is relatively small (see Chapter 11 Road drainage and the water environment).

10.8.9 Pollution of the Estuary during the construction of Princes Quay Bridge has been assessed as unlikely and insignificant as demonstrated in the AIES Screening Report, document reference TR010016/APP/6.13.

Trinity Burial Ground SNCI

10.8.10 There would be a significant adverse residual impact on Trinity Burial Ground SNCI during the Construction Phase. The Scheme would require the removal of approximately 0.7ha of the total area (0.8ha) of the SNCI, including the felling of 72 mature trees and understorey, which would constitute a significant adverse impact to the site. In addition, the remaining piece of the SNCI would be lit during construction. The significance of the effect on Trinity Burial Ground SNCI during construction would be moderate adverse, as the receptor is of county value.

River Hull SNCI

10.8.11 Neutral residual impacts are predicted to the River Hull during the Construction Phase, following the implementation of pollution protection mitigation measures.

UKBAP (NERC Act 2006 Section 41) Priority Habitats

10.8.12 Trinity Burial Ground SNCI contains UKBAP Priority habitats 'deciduous woodland' and 'broad-leaved woodland'. The Construction Phase requires approximately 0.7ha of these habitats to be removed which would constitute a major adverse significant impact.

10.8.13 'Mudflats', 'saltmarsh' and 'intertidal substrate foreshore - mud' would have neutral significant residual impacts during the Construction Phase, following the implementation of pollution protection mitigation measures. There would be no significant adverse effect arising from air emissions.

10.8.14 'Intertidal substrate foreshore – man made' Broad habitat is located within Humber Dock Marina and Princes Dock. Humber Dock Marina would have major adverse significant impacts during construction from the loss of the small amount of habitat under the piling footprint and disturbance of sediments, noise and vibration from construction traffic and the relocation of Spurn Lightship. Princes Dock would have neutral insignificant adverse impacts following the implementation of pollution protection mitigation measures.

Scattered amenity trees

10.8.15 A significant residual impact would result from the loss of mature amenity trees across the Scheme during the Construction Phase. The loss of amenity trees to facilitate construction of the Scheme cannot be avoided and the loss of trees would be significant within the Scheme Site. The significance of the effect on mature amenity trees would be moderate adverse, as this receptor is of county value.

Standing water

10.8.16 Humber Dock Marina and the connected Railway Dock could potentially contain unknown populations of species that the Humber Estuary is designated for. The impacts from piling and disturbance during construction would have a large

adverse significant impact on the habitat as it is of regional value. Impacts from indirect pollution events during construction on these docks and Princes Dock would not be significant following the implementation of pollution protection mitigation measures.

Ephemeral / short perennial

10.8.17 This UKBAP Priority habitat occurs in three of the site compounds (Livingstone Road, Wellington Street Island Wharf and Neptune Street) and these sites would have a slight adverse but insignificant impact from vegetation removal during construction.

Hedgerows

10.8.18 During construction, the loss of five species-poor intact hedgerows (Myton Centre, A63 Eastbound recovery site, Staples Site and Livingstone Road) would be a slight adverse but insignificant impact.

Terrestrial invertebrates

10.8.19 Most of the woodland habitat in Trinity Burial Ground SNCI and ephemeral / short perennial habitat in three site compounds (Section 10.8.17) would be removed to facilitate construction and would in turn this would remove habitats that are likely to support UKBAP and Hull BAP terrestrial invertebrates. This would be a slight adverse and insignificant impact.

Aquatic invertebrates

10.8.20 The nationally important assemblage of invertebrates in the Humber Estuary SSSI is unlikely to be impacted by construction works following mitigation measures. Indirect pollution events to this invertebrate assemblage and the locally important assemblage in the River Hull are also unlikely to be impacted by the construction works following mitigation measures. Neutral impacts are considered likely.

Fish

10.8.21 Direct and indirect impacts to internationally important sea and river lamprey and UKBAP salmon, sea trout and European eels are unlikely following mitigation measures described for the Humber Estuary designated sites during construction.

Reptiles

10.8.22 The temporary loss of habitat and mitigation to move reptiles out of harm by an ECoW would leave no residual adverse impacts and is not significant.

Birds

10.8.23 Residual impacts upon priority or qualifying species of birds of the Humber Estuary after mitigation is unlikely and insignificant. The permanent loss of habitat in Trinity Burial Ground SNCI and the amenity trees across the site cannot be replaced and

would leave a slight adverse impact upon UKBAP and LBAP bird species which would not be significant.

Aquatic mammals

10.8.24 With mitigation as described for the Humber Estuary (see Sections 10.8.6 to 10.8.9), the residual impacts upon grey seals and other aquatic mammals would be neutral and insignificant.

Bats

10.8.25 Residual adverse impacts would occur from the removal of bat foraging and commuting habitat in Trinity Burial Ground and the removal of amenity trees around the site which cannot be adequately mitigated or compensated for. Taking this into account with increased lighting during construction, there would be a slight adverse insignificant impact upon bats.

Otters

10.8.26 With mitigation, there would be neutral residual impacts upon this species from construction.

Other species

10.8.27 The loss of habitat in Trinity Burial Ground and site compounds to support hedgehogs would result in a slight adverse and insignificant residual impact.

Invasive species (Schedule 9 of the Wildlife and Countryside Act 1981 (as amended))

10.8.28 Mitigation to remove Schedule 9 species from site prior to construction to prevent their spread would have neutral and insignificant impacts.

Operation

Humber Estuary SAC / SPA / Ramsar / SSSI Sites

10.8.29 New water collection features would be introduced to collect surface water run-off from impermeable areas as attenuation for the additional flow rates. This would restrict surface water flows to the existing flow rates to the public sewer network, Princes Dock and the Humber Dock and subsequently the Humber Estuary. The location of the surface water drainage outfall through dock wall onto existing rock armour would prevent the discharge from scouring the river bed and creating silt plumes. There would be no operational impacts from noise or vibration as Princes Quay Bridge would have no vehicular traffic and the noise levels are to reduce overall along the Scheme. Pollution prevention mitigation undertaken during construction would prevent long-term effects. There would be no significant adverse increase to air emissions during operation. Overall, there would be neutral operational residual and insignificant impacts.

Trinity Burial Ground SNCI

10.8.30 Operational residual impacts would be moderate adverse and significant for the following reasons:

- The permanent loss of a third of the SNCIs footprint.
- The compensatory tree planting would take many years to achieve the maturity and ecological value of the trees that are to be removed.
- The SNCI would have additional illumination from the permanent lighting installed within the retained area of the SNCI after the completion of works and light pollution from the new junction which would be located closer to the SNCI would increase.

River Hull SNCI

10.8.31 With no increase in noise or air pollution and no water discharges into this river, there is predicted to be neutral residual impacts to the SNCI during operation.

UKBAP (NERC Act 2006 Section 41) Priority Habitats

10.8.32 Trinity Burial Ground SNCI contains UKBAP Priority habitats 'deciduous woodland' and 'broad-leaved woodland'. The Operation Phase would constitute a major adverse significant impact on the nationally valued habitats due to the same reasons given in Section 10.8.30.

10.8.33 'Mudflats', 'saltmarsh' and 'intertidal substrate foreshore - mud' would have neutral significant residual impacts during the Operation Phase, following the implementation of pollution protection mitigation measures. There would be no significant adverse increase to air emissions during operation. Overall, there would be neutral operational residual and insignificant impacts.

10.8.34 'Intertidal substrate foreshore - man made' Broad habitat is located within Humber Dock Marina and Princes Dock. Humber Dock Marina would have major adverse significant impacts during operation from the loss of the small amount of habitat beneath the piling footprint. Princes Dock would have neutral adverse impacts during operation.

Scattered amenity trees

10.8.35 The compensatory scattered amenity tree planting of 307 trees is an increase on the numbers of trees removed (245), but would take many years to achieve the maturity and ecological value of the trees that are to be removed and would have a moderate adverse residual significant impact.

Standing water

10.8.36 The standing water in Humber Dock Marina would have large adverse and significant residual impacts during operation from the loss of the small amount of

habitat beneath the piling footprint. Princes Dock and Railway Dock are predicted to have neutral residual impacts.

Ephemeral / short perennial

10.8.37 The time taken for this habitat to reinstate itself once construction has ended and the Operation Phase has commenced is very short, as this habitat is early successional and could re-grow within one season. A small portion of each of the three site compounds (Livingstone Road, Wellington Street Island Wharf and Neptune Street) would have been left intact during construction and would provide a seed source. It is considered that there would be neutral significant impacts.

Hedgerows

10.8.38 The 45m of hedgerows removed from Myton Centre during construction would be replaced with 104m of hedgerows which are species-rich compared to the ones lost. These would during operation provide a slight beneficial but insignificant residual impact.

Terrestrial invertebrates

10.8.39 The permanent loss of the majority of Trinity Burial Ground and the time delay in replanting achieving the same maturity and ecological value would leave a slight adverse and insignificant residual impact upon terrestrial invertebrates. The loss of ephemeral / short perennial habitat in three compounds would be replaced in short succession and is considered to have neutral residual impacts.

Aquatic invertebrates

10.8.40 The nationally important assemblage of invertebrates in the Humber Estuary SSSI is unlikely to be impacted during operation due to the neutral impacts of air emissions, water discharge flow and noise. Indirect pollution events to this invertebrate assemblage and the potentially locally important assemblage in the River Hull are also unlikely to be impacted during operation following mitigation measures. Neutral impacts are considered likely.

Fish

10.8.41 Direct and indirect impacts to internationally important sea and river lamprey and UKBAP salmon, sea trout and European eels are unlikely following mitigation measures described for the Humber Estuary designated sites during operation and the neutral impacts of air emissions and noise. Neutral impacts are considered likely.

Reptiles

10.8.42 Reptile habitat in the site compounds would reinstate rapidly and there would be neutral residual impacts upon reptiles during operation.

Birds

10.8.43 Residual impacts upon priority or qualifying species of birds of the Humber Estuary after mitigation is unlikely and insignificant. The permanent loss of habitat in Trinity Burial Ground SNCI and the amenity trees across the site cannot be replaced and would leave a slight adverse but insignificant impact upon UKBAP and LBAP bird species.

Aquatic mammals

10.8.44 The mitigation for the Humber Estuary in Section 10.8.29 would also provide mitigation for grey seals and other aquatic mammals. There is predicted to be neutral impacts during operation.

Bats

10.8.45 Residual impacts would occur from the permanent removal of bat foraging and commuting habitat in Trinity Burial Ground and the removal of amenity trees around the site which cannot be adequately mitigated or compensated for. This together with increased lighting during operation would have a slight adverse but insignificant residual impact upon bats.

Otters

10.8.46 With mitigation, there would be neutral residual impacts upon this species during operation.

Other species

10.8.47 The permanent loss of habitat in Trinity Burial Ground to support hedgehogs would result in a slight adverse and insignificant residual impact.

Invasive species (Schedule 9 Wildlife and Countryside Act 1981 (as amended))

10.8.48 Removal of Schedule 9 species from site prior to construction to prevent their spread would have neutral impacts during operation.

Table 10.10: Summary of ecological receptors

Ecological receptor	Valuation	Mitigation during construction	Residual impacts (Construction)	Significance of effect (Construction)	Mitigation during operation	Residual impacts (Operation)	Significance of effect (Operation)
Humber Estuary SAC / SPA / Ramsar Sites	International	Drainage design would ensure that adequate surface water interceptors are incorporated. Surface water would discharge onto existing rock armour in the Estuary. Trained marine fauna ecologists would act as observers to check that the dock area and up to 500m beyond the dock gates is clear of marine animals. The dock gates would be closed during piling to control and contain silt and sediment and absorb noise and vibration from entering the Humber Estuary. A soft start-up of machinery to disperse any potential fish, birds or mammals present in the dock. Impacts from piling to be fully assessed in AIES. Temporary pollution control protection	No significant impacts Probable	No significant impacts Probable	Location of surface water drainage outfall through dock wall onto existing rock armour. Pollution control measures within drainage design. Water quality would not be impacted by operational discharges and spillages as underpass drainage system would incorporate a shut-off valve and below-ground attenuation units to allow isolation and containment of contaminants. Parts of site would have reduced noise levels.	No significant impacts Probable	No significant impacts Probable

Ecological receptor	Valuation	Mitigation during construction	Residual impacts (Construction)	Significance of effect (Construction)	Mitigation during operation	Residual impacts (Operation)	Significance of effect (Operation)
		during construction detailed in CEMP.					
Humber Estuary SSSI	National	Drainage design would ensure that adequate surface water interceptors are incorporated. Surface water would discharge onto existing rock armour in the Estuary. Trained marine fauna ecologists would act as observers to check that the dock area and up to 500m beyond the dock gates is clear of marine animals. The dock gates would be closed during piling to control and contain silt and sediment and absorb noise and vibration from entering the Humber Estuary. A soft start-up of machinery to disperse any potential fish, birds or mammals present in the dock. Impacts from piling to be fully assessed in AIES. Temporary pollution control protection	No significant impacts Probable	No significant impacts Probable	Location of surface water drainage outfall through dock wall onto existing rock armour. Pollution control measures within drainage design. Water quality would not be impacted by operational discharges and spillages as underpass drainage system would incorporate a shut-off valve and below-ground attenuation units to allow isolation and containment of contaminants. Parts of site would have reduced noise levels.	No significant impacts Probable	No significant impacts Probable

Ecological receptor	Valuation	Mitigation during construction	Residual impacts (Construction)	Significance of effect (Construction)	Mitigation during operation	Residual impacts (Operation)	Significance of effect (Operation)
		during construction detailed in CEMP.					
Trinity Burial Ground SNCI	County / Unitary Authority Area	Minimise number of trees removed. Protection of retained trees with root protection areas. Compensation includes replanting 55 larger native trees (>30cm diameter) close to Trinity Burial Ground. The understorey in the remaining area of Trinity Burial Ground is to include some native shrubs and plants. Lighting during construction to directed away from remaining trees.	Significant impact Certain permanent loss of one third of total area and temporary loss up to 7/8 of site including 72 mature trees.	Moderate adverse Certain	No opportunities exist to totally mitigate reduction in area of site by replacement tree planting or enhancement of remaining area. Light pollution from new junction during operation cannot be mitigated.	Significant – permanent loss of one third of total area.	Moderate adverse Certain
River Hull SNCI	County / Unitary Authority Area	Mitigation by standard pollution prevention measures.	No significant impacts Probable	No significant impacts Probable	With no increase in noise or air pollution and no water discharges into this river.	No significant impacts Probable	No significant impacts Probable
UKBAP (NERC Act 2006 S41) Priority Habitats Princes Dock; Humber Dock Marina	National	Mitigation by standard pollution prevention measures. No mitigation for habitats within Humber Dock Marina, the dock	Significant impacts (Humber Dock Marina) Certain	Major adverse significant impacts Certain	Small amount of land lost beneath piling footprint, cannot be replaced.	Significant impacts (Humber Dock Marina) Certain	Major adverse significant impacts Certain

Ecological receptor	Valuation	Mitigation during construction	Residual impacts (Construction)	Significance of effect (Construction)	Mitigation during operation	Residual impacts (Operation)	Significance of effect (Operation)
UKBAP Priority Habitat (NERC Act 2006 S41) Trinity Burial Ground	National	gates would be closed during piling and would control and contain silt and sediment and absorb noise and vibration from entering the Humber Estuary. Trinity Burial Ground – Minimise number of trees removed. Protection of retained trees with root protection areas. Lighting during construction at night directed away from remaining trees.	No significant impacts (Princes dock) Probable Significant impact Certain permanent loss of one third of total area and temporary loss up to 7/8 of site including 55 mature trees.	No significant impacts (Princes dock) Probable Major adverse Certain	No opportunities exist to totally mitigate reduction in area of site by replacement tree planting or enhancement of remaining area. Time lag for trees to reach the same maturity as ones lost. Light pollution from new junction during operation cannot be mitigated.	No impacts in Princes Dock Significant impact Certain	No impacts in Princes Dock Major adverse Certain
LBAP Mature scattered amenity trees	County	Minimise number of trees removed (245). Protection of retained trees with root protection areas.	Significant - loss of many mature amenity trees across Scheme Site footprint.	Moderate adverse Certain	New amenity tree planting of 307 trees to replace and increase the number of trees felled during construction.	Significant impacts Certain – new tree planting would be well established but unlikely to reach maturity in time	Moderate adverse Certain

Ecological receptor	Valuation	Mitigation during construction	Residual impacts (Construction)	Significance of effect (Construction)	Mitigation during operation	Residual impacts (Operation)	Significance of effect (Operation)
Standing Water – Humber Dock Marina; Railway Dock 'regularly occurring populations of species which may be considered at an International level' (IAN 130/10) (Humber Dock Marina has been assessed as national in UKBAP Priority habitats above)	Regional	No mitigation for habitats within Humber Dock Marina or railway Dock during piling, The dock gates would be closed during piling to control and contain silt and sediment and absorb noise and vibration from entering the Humber Estuary. All docks - Mitigation by standard pollution prevention measures.	Significant impacts (Humber Dock Marina) Certain No impacts in Railway Dock	Large adverse significant impacts Certain No impacts in Railway Dock	Small amount of land lost beneath piling footprint, cannot be replaced.	Significant impacts (Humber Dock Marina) Certain No impacts in Railway Dock	Large adverse significant impacts Certain No impacts in Railway Dock
LBAP Ephemeral / short perennial site compounds at Wellington Street Island Wharf, Livingstone Road and Neptune Street	Moderate	Small amount of habitat to be retained in corner of each compound	Significant impact Certain	Moderate adverse Certain	Habitat would regrow quickly.	No significant impacts Probable	No significant impacts Probable
UKBAP Hedgerows site compounds at Livingstone Road, A63 eastbound recovery base and Staples site; temporary car park at the Myton Centre	Local (these hedgerows are considered to have little value for wildlife)	Hedgerows to be removed during construction	No significant impact Certain	Slight adverse Certain	The species-poor hedgerows present in the area of the temporary car park at Myton Centre is approximately 45m in length and is to be compensated with 104m length of hedgerow containing species of native hedgerow woody	No significant impacts Certain	Slight beneficial Probable

Ecological receptor	Valuation	Mitigation during construction	Residual impacts (Construction)	Significance of effect (Construction)	Mitigation during operation	Residual impacts (Operation)	Significance of effect (Operation)
					plants. This would be managed during operation. The hedgerow in site compounds at Livingstone Road, Staples site and A63 eastbound recovery base are to be re-instated only. Habitats would benefit over time in Operation Phase from compensatory measures and management.		
LBAP Terrestrial Invertebrates Trinity Burial Ground SNCI; site compounds at Wellington Street Island Wharf, Livingstone Road and Neptune Street	Local	Small area of Trinity Burial Ground to be left. Small area of ephemeral / short perennial habitat to be left in each site compound.	No significant impact Certain, permanent loss of large area of habitat and mature trees. No significant impact Certain direct, temporary loss of habitat.	Slight adverse Certain Slight adverse Certain	Woodland in Trinity Burial Ground – mitigation and compensation as in Trinity Burial Ground SNCI above. Ephemeral/short perennial to be left to regenerate after use.	Less habitat during operation. Insignificant Certain Habitat would regenerate quickly. No impacts during operation. No significant impacts Probable	Slight adverse Certain No significant impacts Probable

Ecological receptor	Valuation	Mitigation during construction	Residual impacts (Construction)	Significance of effect (Construction)	Mitigation during operation	Residual impacts (Operation)	Significance of effect (Operation)
Aquatic Invertebrates Humber Estuary SSSI	National	The dock gates would be closed during piling and would control and contain silt and sediment and absorb noise and vibration from entering the Humber Estuary. A soft start-up of machinery to disperse any potential animals present in the dock. Full assessment of impacts is to be undertaken in the AIES. Mitigation by standard pollution prevention measures.	No significant impacts Probable	No significant impacts Probable	Unlikely to be impacted during operation due to the neutral impacts of air emissions, water discharge and noise.	No significant impacts Probable	No significant impacts Probable
River Hull SNCI	Local		No significant impacts Probable	No significant impacts Probable		No significant impacts Probable	No significant impacts Probable
Fish Humber Estuary SAC / SPA / Ramsar / SSSI Sites	International (sea and river lamprey)	Mitigation measures described for the Humber Estuary designated sites during construction	No significant impacts Probable	No significant impacts Probable	Mitigation measures described for the Humber Estuary designated sites during operation and neutral impacts of air emissions and noise.	No significant impacts Probable	No significant impacts Probable
River Hull SNCI	Local (European eel, salmon and sea trout)		No significant impacts Probable	No significant impacts Probable		No significant impacts Probable	No significant impacts Probable

Ecological receptor	Valuation	Mitigation during construction	Residual impacts (Construction)	Significance of effect (Construction)	Mitigation during operation	Residual impacts (Operation)	Significance of effect (Operation)
Reptiles A63 eastbound recovery base	Local	Ecological Clerk of Works (ECoW) being present prior to vegetation clearance to search the area where vegetation is to be removed first. Very small amount of habitat loss.	No significant impacts Probable	No significant impacts Probable	Habitats to be reinstated or left to regenerate.	No significant impacts Probable	No significant impacts Probable
Birds Site compounds at Neptune Street, Wellington Street Island Wharf and Livingstone Road Main site; Trinity Burial Ground SNCI; site compounds at land south east of Mytongate Junction and A63 eastbound recovery base; temporary car park site at the Myton Centre	International Local	Mitigation measures described for the Humber Estuary designated sites during construction Clearance of potential nesting habitat outside breeding season. Destruction of nests would be avoided by sensitive timing of works. Sensitive lighting design. Loss of habitat in Trinity Burial Ground.	No significant impacts Probable No significant impact Certain	No significant impacts Probable Slight adverse impact Certain	Mitigation measures described for the Humber Estuary designated sites during operation Mitigation during operation as in Trinity Burial Ground SNCI above	No significant impacts Probable No significant impact Certain	No significant impacts Probable Slight adverse Certain
Aquatic mammals Humber Dock Marina; Railway Dock; site compounds at Neptune	International	Mitigation in the docks as for Humber Estuary SAC / SPA / Ramsar Sites.	No significant impacts Probable	No significant impacts Probable	Mitigation measures described for the Humber Estuary	No significant impacts Probable	No significant impacts Probable

Ecological receptor	Valuation	Mitigation during construction	Residual impacts (Construction)	Significance of effect (Construction)	Mitigation during operation	Residual impacts (Operation)	Significance of effect (Operation)
Street, Wellington Street Island Wharf and Livingstone Road		Mitigation should include that trenches should be covered at night to prevent grey seal from falling in, or trenches should include an earth ramp to allow them to climb out. At night lighting should be directed away from the water.			designated sites during operation		
Bats All areas	Local	Precautionary avoidance measures are to include that demolition of the Castle Buildings and trees in Trinity Burial Ground SNCI would be overseen by a bat licensed ECoW. Trees would be felled sectionally and sections searched by ECoW or left overnight for bats to exit before removal from site. Increased lighting during construction and loss of foraging habitat	No significant impact Certain	Slight adverse Certain	Compensation includes the erection of bat boxes on the remaining trees in Trinity Burial Ground SNCI. Compensation includes that the larger native trees are to be replanted on the verges at either side of the A63 in a line extending from Trinity Burial Ground to the Myton Centre. The large height of the trees would provide habitat 'hop-overs' for bats and reduce collisions with traffic.	No significant impact Certain Time lag for trees to reach the same maturity as ones lost. Mytongate Junction would have increased lighting	Slight adverse Certain
Otters Humber Dock Marina; Railway Dock; site compounds at Neptune	Local	Mitigation would include that trenches are to be covered at night to prevent otter	No significant impacts Probable	No significant impacts Probable	Mitigation in the docks as for the Humber Estuary SAC / SPA / Ramsar Sites	No significant impacts Probable	No significant impacts Probable

Ecological receptor	Valuation	Mitigation during construction	Residual impacts (Construction)	Significance of effect (Construction)	Mitigation during operation	Residual impacts (Operation)	Significance of effect (Operation)
Street, Wellington Street Island Wharf and Livingstone Road		from falling in, or trenches are to include an earth ramp to allow otter to climb out. At night in the three site compounds, lighting should be directed away from the water. Mitigation in the docks as for the Humber Estuary SAC / SPA / Ramsar Sites					
Other Species - Hedgehog All terrestrial areas	Local	Ecological Clerk of Works (ECoW) being present prior to vegetation clearance to search the area where vegetation is to be removed first. Loss of habitat during construction	No significant impact Probable	Slight adverse Probable	Habitats to be re-instated with the exception of Trinity Burial Ground SNCI which is a permanent loss.	No significant impact Probable	Slight adverse Probable
Invasive Species Cotoneaster (main site – A63 and Market Place junction and A63 and Queen Street junction); land south east of Mytongate Junction	Legal requirement	Cotoneaster plants are to be removed and the arisings and topsoil in these areas to be treated as controlled waste. To be disposed of at a suitably licensed or permitted disposal facility.	No significant impacts Probable	No significant impacts Probable	The site is to be maintained during the Operation Phase and it is unlikely that the cotoneaster or false acacia would return after removal in the Construction Phase. Should this happen, it would be removed during maintenance.	No significant impacts Probable	No significant impacts Probable

Ecological receptor	Valuation	Mitigation during construction	Residual impacts (Construction)	Significance of effect (Construction)	Mitigation during operation	Residual impacts (Operation)	Significance of effect (Operation)
		Biosecurity method statements for both species.					

10.9 Conclusion

10.9.1 During the Construction and Operation Phases of the Scheme, significant residual impacts are predicted on the following ecological receptors:

- Trinity Burial Ground (UKBAP Priority habitat (NERC Act 2006 S41) - major adverse from construction and operation; SNCI – moderate adverse from construction and operation) – permanent removal of one third of its total area and removal of 7/8 of the mature trees and vegetation with no opportunity to compensate thoroughly.

- Humber Dock Marina (UKBAP Broad Priority habitat – major adverse from construction and operation) (Standing water – large adverse from construction and operation). Permanent loss of habitat beneath pile footprint; impacts from piling.

- Mature amenity trees across the Scheme Site (LBAP – Moderate adverse from construction and operation) – although the number replanted is to increase on the number felled, the felling of trees to facilitate construction would be unlikely to reach maturity quickly.

- Ephemeral / short perennial in site compounds at Wellington Street Island Wharf, Neptune Street and Livingstone Road (LBAP – Moderate adverse from construction) – removal of habitat during construction would quickly regenerate.

10.9.2 As a consequence of the loss of these habitats, the following fauna would be impacted insignificantly:

- Terrestrial invertebrates in Trinity Burial Ground (UKBAP / LBAP – Slight adverse from construction and operation), Wellington Street Island Wharf, Neptune Street and Livingstone Road (LBAP – Slight adverse from construction only).

- Birds in Trinity Burial Ground, site compounds/temporary car park at land south east of Mytongate Junction, Myton Centre, A63 eastbound recovery base (UKBAP / LBAP – Slight adverse from construction and operation) as permanent loss of habitat in Trinity Burial Ground and in other sites compensatory planting would be unlikely to reach pre-construction maturity quickly.

- Bats in all areas of the site (European Protected Species – Slight adverse from construction and operation) due to the permanent loss of foraging habitat in Trinity Burial Ground and trees removed across the site.

- Hedgehogs in all terrestrial areas of the site (UKBAP – Slight adverse from construction and operation) with permanent habitat loss from Trinity Burial Ground.

10.9.3 Hedgerows in site compounds / temporary car park area at Livingstone Road, Myton Centre, A63 eastbound recovery base and Staples site (UKBAP, poor quality) – would have insignificant impacts as slight adverse from construction and slight beneficial in operation) as they would be reinstated with species-rich hedgerows and an increase in length.

10.9.4 With the successful implementation of mitigation measures, the Scheme is not predicted to have any significant adverse or beneficial residual impacts to other ecological receptors of value during the Construction Phase, including the Humber Estuary statutory designated site and its associated fauna.

10.9.5 No significant adverse or beneficial residual impacts are predicted to any of the other ecological receptors of value during the Operation Phase, including the Humber Estuary statutory designated site following the successful implementation of mitigation measures.

Chapter 11. Road drainage and the water environment

11.1 Executive summary

11.1.1 The assessment of the road drainage and the water environment considers the potential effects of the construction and operation of the Scheme on surface water, groundwater and flood risk.

Surface water and flood risk

11.1.2 There are a number of surface water features or receptors in close proximity to the Scheme Site, namely the Humber Estuary, the River Hull, Albert Dock, Humber Dock, Railway Dock and Princes Dock. The Scheme Site lies within the Environment Agency's Flood Zone 3 within the Humber floodplain.

11.1.3 Mitigation measures during the Construction Phase would be implemented through an Outline Environmental Management Plan (OEMP, provided at document reference TR10016/APP/7.3), which would manage the risk of increased runoff and pollution to surface water receptors by specifying temporary arrangements, including sustainable urban drainage (SuDs) where possible, to collect runoff and remove oils, chemicals and suspended solids.

11.1.4 There is a risk of neutral significance of pollution from accidental spillages during construction after appropriate mitigation measures within the OEMP. There is also a risk of neutral significance of pollution from the mobilisation of sediment and contamination of water from the construction of the Princes Quay Bridge foundations in the Humber Dock Marina after appropriate mitigation measures, including silt control, within the OEMP.

11.1.5 The OEMP should include a surface water sampling plan that is implemented prior to and during the Construction Phase, as well as into the early stages of the Operation Phase. These measures would reduce the potential residual impact during construction on all attributes (except flood risk) to neutral significance.

11.1.6 Impacts ranging from large / very large beneficial to very large adverse significance during construction include the alteration of ground elevations, which has the potential to alter flood routes depending on the scale and source of the flooding and the phase of construction. Impacts can be of adverse or beneficial significance depending on the location. Management of flood risk during construction would be outlined in the OEMP and would include use of the Environment Agency's Flood Warning service.

11.1.7 Under the Operation Phase, underpass drainage would be pump discharged to the Humber Estuary via a proposed tidal outfall (with flap valve) or pumped to the existing Yorkshire Water sewer network. Drainage from the 'at grade' system (i.e.

drainage of the A63 either side of the underpass) would discharge via attenuation to the Yorkshire Water sewer network. Assessment of water quality impacts to the Humber both in terms of routine runoff and the risk of accidental spillages indicate that the potential residual impacts are of neutral significance to the Humber in terms of water quality and biodiversity. At the request of the Environment Agency, the proposed underpass drainage system would include an oil interceptor and shut off valve to isolate and contain any contaminants released during an accidental spillage.

11.1.8 The proposed outfall to the Humber Estuary would result in an impact of neutral significance on the channel morphology and therefore the hydromorphological elements, of the water body. This is due to the presence of existing rock armour scour protection at the outfall location(s) which would prevent disturbance of sediment at this location.

11.1.9 Design mitigation measures for the Operation Phase include the design of the underpass drainage to accommodate a rainfall event with a 1 in 100-year return period plus a 30% allowance for climate change without flooding the road and underpass. Emergency procedures would be put in place to minimise the risk to road users in the event of a pump power failure for this rainfall event.

11.1.10 Alteration of ground elevations as a result of the Scheme result in a complex pattern of flooding impacts on the Humber floodplain primarily related to the presence of the underpass and the raising of road levels to the east and west of the underpass. Operation flood risk impacts range from large / very large beneficial to very large adverse significance depending on the location on the floodplain and the source and extent of the flooding.

11.1.11 There is an existing procedure in place whereby flood alerts from the Environment Agency are issued to the Highways England Emergency Planning team who consider an appropriate response, for example, the closure of the underpass. This response would be implemented by the local emergency services. This procedure has been updated and amended to reflect the particular requirements of flooding of the underpass. The revised procedure was written in consultation with relevant stakeholders including Highways England, the emergency services and the Humber Local Resilience Forum.

11.1.12 The effects of climate change on flood risk were considered and found to be relatively minor for pluvial flood events and for groundwater flooding. However, the impact of climate change on rising sea levels and subsequent wave overtopping of flood defences has significant effects on the flooding in Hull. When climate change is considered, the area of flooding extends throughout much of Hull beyond the Scheme Site.

Groundwater

11.1.13 Groundwater receptors include the Chalk, a principal aquifer, and the overlying superficial deposits, which although classed as unproductive strata, include some

permeable layers. Receptors potentially affected due to groundwater acting as a pathway include surface water features hydraulically connected to groundwater, abstractions, and structures and cultural heritage.

11.1.14 Mitigation measures during the Construction Phase would be implemented through an Outline Environmental Management Plan (OEMP provided at document reference TR10016/APP/7.3), which would manage the risk of pollution to groundwater receptors by specifying construction design mitigation and temporary arrangements to minimise the potential for mobilisation of suspended solids and existing contamination. The OEMP would also include a groundwater monitoring plan that is implemented prior to and during the Construction Phase, as well as potentially into the Operation Phase.

11.1.15 Design mitigation measures implemented during the Construction Phase and realised during Operation Phase include measures to address the difficult ground conditions and sub-artesian groundwater levels, particularly in relation to the underpass. The underpass would be excavated within a 'box' with diaphragm walls extending into the top of the Chalk to minimise inflow and associated water level drawdown within the superficial deposits outside the box. All other excavation works associated with the Scheme, such as for rising main and sewer diversions and archaeological investigations, are primarily within the made ground and cohesive superficial deposits where dewatering requirements are generally likely to be minimal. The use of sheet pile walls during excavations, such as for ground stability at Trinity Burial Ground, would also assist in minimising dewatering requirements.

11.1.16 These mitigation measures would reduce the potential residual impact on almost all groundwater attributes to neutral significance during the Construction Phase.

11.1.17 An impact of slight or moderate adverse significance is predicted in terms of the potential impact that any contaminated groundwater within the superficial deposits may have on the structural integrity of nearby buildings foundations. However, best practice methodologies implemented through the OEMP will ensure that the cause, source or spread of new or existing contamination is minimised.

11.1.18 During the Operation Phase, there will be no discharges to groundwater. Potential impacts of structures on groundwater are mitigated by the design. Therefore, residual impacts on groundwater attributes during the Operation Phase are all of neutral significance.

Water Framework Directive assessment

11.1.19 The impact assessment concluded that Scheme is not considered to impact on the current status of the Water Framework Directive (WFD) 'Humber Middle' or 'Fleet Drain' surface water bodies or the 'Hull and East Riding Chalk' groundwater body. Neither does it contribute to the failure of these water bodies nor affect their ability to achieve the Water Framework Directive water body objectives.

11.2 Introduction

11.2.1 This chapter presents a Detailed Level assessment of the potential effects of the Scheme on the water environment, during construction and operation. It has been prepared in accordance with Design Manual for Roads and Bridges (DMRB) Volume 11, Section 2, Part 4 and DMRB Volume 11 Section 3, Part 10 (HD 45/09).

11.2.2 For the purposes of this assessment, the Road drainage and water environment chapter considers the following:

- Surface water bodies (watercourses, lakes, ponds, reservoirs), and their WFD chemical and ecological status
- Groundwater bodies (bedrock aquifers, superficial aquifers) and their WFD quantitative and chemical status
- Nitrate Vulnerable Zones (NVZs)
- Surface water and groundwater-dependent designated sites
- Aquatic ecology associated with surface water and groundwater-dependent features
- Recreational and human health associated with surface water and groundwater features
- Licensed surface water and groundwater abstractions, and Source Protection Zones (SPZs)
- Consented discharges
- Road drainage
- Flood risk and groundwater flooding
- Climate change
- Major events or disasters (referred to as events)

11.2.3 The chapter is supported by the following appendix and supplementary reports, which are cross-referenced in the text where relevant:

- Volume 3, Appendix 11.1 Surface water quality impact assessment
- Volume 3, Appendix 11.2 Flood risk assessment including the flood emergency evacuation plan as an Appendix
- Volume 3, Appendix 11.3 Flood risk modelling technical report

- Volume 3, Appendix 11.4 Groundwater report, including Ground investigation report[160] (and Factual reports on ground investigation[161][162][163]) as annexes
- Volume 3, Appendix 11.5 Pumping test report
- Volume 3, Appendix 11.6 Groundwater modelling report
- Volume 3, Appendix 11.7 Groundwater modelling update
- Existing drainage analysis report - 1168-08-000-RE-001-A1[164]
- Underpass flood detection technology options report[165]
- Volume 3, Appendix 11.8 Drainage impact assessment report (Document reference TR010016/APP/6.6)
- Volume 3, Appendix 11.9 Additional flood risk assessment information requirements

11.2.4 Following a summary of the relevant legislation, policy and guidance documents pertinent to this assessment, the methodologies used are described in more detail. The existing baseline conditions are then described for each receptor, followed by the proposed mitigation measures implemented during the Construction and Operation Phases. The potential residual impacts, i.e., with mitigation measures implemented, are considered during the construction and operation of the Scheme.

11.2.5 The study area is a function of the receptor type and the pathway to that receptor from the Scheme, and therefore different study areas for different elements of this chapter are presented as necessary. The Scheme Site lies within an urbanised area where connectivity to the water environment is in many cases heavily modified by drainage systems. For example, almost all surface water is collected and transported via the local drainage and sewerage network to the local wastewater treatment works (WwTW) at Saltend.

[160] Mott MacDonald Grontmij (2014e) A63 Castle Street Improvements, Hull - Ground Investigation Report.

[161] EGS (2016) A63 Garrison Road, Castle Street Improvement, Hull, Factual Report on Ground Investigation. Report No A5066-15A. For Balfour Beatty Limited and Ove Arup & Partners

[162] ESG (2016) Princess Quay Footbridge, A63 Castle Street Improvement, Hull, Factual Report on Ground Investigation. Report No A5066-15. For Balfour Beatty Limited and Ove Arup & Partners

[163] ESG (2016) Trinity Burial Ground, A63 Castle Street Improvement, Hull, Factual Report on Ground Investigation. Report No A5049-15. For Balfour Beatty Limited and Ove Arup & Partners

[164] Mott MacDonald Grontmij (2013). A63 Castle Street Improvements, Hull – Existing Drainage Analysis Report. Report for Highways Agency. Doc Ref: 1168-08-000-RE-001-A1

[165] Arup (2017). Underpass Flood Detection Technology Options, December 2017

11.3 Legislative, regulatory and policy background

National legislation and policy

Water Framework Directive

11.3.1 The key European Union (EU) legislation covering the water environment which has a bearing on the Scheme is the WFD[166], which establishes a framework for the management of water resources throughout the EU. The WFD was transposed into UK law through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003[167], which came into force in January 2004. The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 came into force in April 2017[168]. These replace the 2003 regulations, consolidating amendments made since then, and primarily affect the management of water quality by the Environment Agency.

11.3.2 The key objectives of the WFD, provided for in the area River Basin Management Plan (RBMP)[169], are as follows:

- To prevent deterioration of the status of surface waters and groundwater
- To achieve objectives and standards for protected areas
- To aim to achieve good status for all water bodies or, for heavily modified water bodies and artificial water bodies, good ecological potential and good surface water chemical status
- To reverse any significant and sustained upward trends in pollutant concentrations in groundwater
- The cessation of discharges, emissions and loses of priority hazardous substances into surface waters
- Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants

[166] Directive 2000/60/EC. Available online at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32000L0060

[167] Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. Available online at: http://www.legislation.gov.uk/uksi/2003/3242/contents/made

[168] The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. Available online at: https://www.legislation.gov.uk/uksi/2017/407/contents/made

[169] Environment Agency (2016a). Humber River Basin Management Plan. Available online at: https://www.gov.uk/government/publications/humber-river-basin-district-river-basin-management-plan

The Environmental Permitting Regulations

11.3.3 The Environmental Permitting Regulations (EPR) 2010[170] aims to protect groundwater and surface waters from pollution by controlling the inputs of potentially harmful and polluting substances. The Regulations implement the WFD and the Groundwater Daughter Directive 2006. The EPR replace the Groundwater Regulations and those parts of the Water Resources Act 1991[171] that relate to the regulation of discharges to controlled waters (including groundwater).

The Highways Act

11.3.4 Under the Highways Act 1980 (Section 100)[172], Highways England has a right to discharge runoff from highways into inland and tidal waters, or groundwaters (for example controlled waters as defined under the Water Resources Act 1991), subject to the requirement not to pollute controlled waters.

The Water Resources Act

11.3.5 Section 93 of the Water Resources Act (1991)[173] provides for the establishment of groundwater protection zones. The requirements of Section 93 are implemented and set out in the Environment Agency's approach to groundwater protection[174] and the Environment Agency's groundwater protection guides[175] covering: requirements, permissions, risk assessments and controls. These replace the Environment Agency's 2013 Groundwater protection: principles and practice (GP3).

11.3.6 The Environment Agency's approach to groundwater protection[176] includes the Environment Agency's position statements, which provide information about its approach to managing and protecting groundwater. They detail how the Environment Agency delivers government policy for groundwater and adopts a risk-based approach where legislation allows. Many of the approaches set out in the position statements are not statutory but may be included in, or referenced by, statutory guidance and legislation.

[170] The Environmental Permitting (England and Wales) Regulations 2010. Available online at: https://www.legislation.gov.uk/ukdsi/2010/9780111491423/contents

[171] Water Resources Act (1991). Available online at: https://www.legislation.gov.uk/ukpga/1991/57/contents

[172] Highways Act (1980). Available online at: https://www.legislation.gov.uk/ukpga/1980/66

[173] Water Resources Act (1991). Available online at: https://www.legislation.gov.uk/ukpga/1991/57/contents

[174] Environment Agency (2018) The Environment Agency's Approach to Groundwater Protection. Version 1.2. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/692989/Envirnment-Agency-approach-to-groundwater-protection.pdf

[175] Groundwater protection guides. Available online at: https://www.gov.uk/government/collections/groundwater-protection

[176] Environment Agency (2018) The Environment Agency's Approach to Groundwater Protection. Version 1.2. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/692989/Envirnment-Agency-approach-to-groundwater-protection.pdf

11.3.7 SPZs are defined for groundwater supplies used for human consumption. The Environment Agency's position statement relating to the use of sustainable drainage systems can be found in The Environment Agency's approach to groundwater protection.

The National Planning Policy Framework

11.3.8 The National Planning Policy Framework (NPPF)[177] applies to this Scheme under Chapter 10 *("Meeting the challenge of climate change, flooding and coastal change")* and the supporting Planning Practice Guidance (PPG)[178], in relation to flood risk. It states that where development is located in areas which are vulnerable to flooding, care should be taken to ensure that risks can be managed.

11.3.9 The Land Drainage Act[179] and Flood and Water Management Act[180] are also relevant to manage flood risk for any works within 8m of ordinary watercourses and to the discharge of surface water drainage to ordinary watercourses.

Local

11.3.10 HCC is the Lead Local Flood Authority (LLFA). The HCC Strategic Flood Risk Assessment (SFRA)[181] confirms the majority of Hull is protected from flooding by existing defences although the consequences of a defence breach or overtopping event would be significant. The SFRA also provides a more nuanced representation of Flood Zone 3a (split into Flood Zone 3ai (Low) to Flood Zone 3aiv (High)) depending on predicted flood depths.

11.3.11 The HCC Local Flood Risk Management Strategy (LFRMS)[182] brings together information on flooding in Hull and identifies ways of managing risk in partnership with the relevant Risk Management Authorities. The LFRMS outlines a number of actions in the following areas:

- Prevention of risk
- Protection from risk

[177] Department of Communities and Local Government (2012). National Planning Policy Framework. March 2012. Available online at: https://www.gov.uk/government/publications/national-planning-policy-framework--2

[178] Department of Communities and Local Government (2016) Planning Practice Guidance. Available online at: https://www.gov.uk/government/collections/planning-practice-guidance. November 2016

[179] Land Drainage Act (1991). Available online at: https://www.legislation.gov.uk/ukpga/1991/59/contents

[180] Flood and Water Management Act (2010). Available online at: https://www.legislation.gov.uk/ukpga/2010/29/contents

[181] Arup (2016). Strategic Flood Risk Assessment. Report for Hull City Council. December 2016. Available online at: http://www.hullcc.gov.uk/pls/portal/docs/PAGE/HOME/PLANNING/PLANNING%20POLICY/FLOOD%20RISK%20ASSESSMENT/SFRA%20REPORT%20-%20DECEMEBER%202016.PDF

[182] Hull City Council (2015). Hull City Council Local Flood Risk Management Strategy. Available online at: http://www.hullcc.gov.uk/pls/portal/docs/PAGE/HOME/PLANNING/FLOOD%20RISK/LOCAL%20FLOOD%20RISK%20MANAGEMENT/LFRMS%20FINAL%20VERSION.PDF

- Preparing for risk
- Recovery and review of risk

11.3.12 In addition, the HCC LFRMS provides a summary of ongoing and future projects aimed in the Hull area with a total value of approximately £234M.

11.3.13 The HCC Surface Water Management Plan (SWMP)[183] provides a long term strategy for surface water management in the city of Hull and includes identification, assessment and selection of preferred options for implementation.

11.3.14 HCC provide guidance on the requirements for Drainage Impact Assessments including points of discharge, discharge rates and volumes, construction, water quality, maintenance and design functionality[184]. A Drainage Impact Assessment is required for all Major Development.

11.3.15 HCC's Local Plan 2016 to 2032[185] was adopted on 23 November 2017 and is used to guide new development in the city for the next 15 years, up to 2032. The Local Plan contains the following policies relevant to the water environment:

- Policy 37 Flood Defences
- Policy 38 Surface Water Storage and Drainage
- Policy 39 Sustainable Drainage
- Policy 40 Addressing Flood Risk in Planning Applications
- Policy 41 Groundwater Protection
- Policy 44 Biodiversity and Wildlife

11.4 Approach and methodology

Scope of the assessment

11.4.1 The general approach to this assessment is in accordance with the DMRB most notably:

[183] Hull City Council (2009). Surface Water Management Plan. November 2009. Available online at: http://www.hullcc.gov.uk/pls/portal/docs/PAGE/HOME/PLANNING/PLANNING%20POLICY/SURFACE%20WATER%20MANAGEMENT%20PLAN/SURFACEWATERMANAGEMENTPLAN.PDF

[184] Hull City Council (2015). Hull City Council Guide to Drainage Impact Strategies and Drainage Impact Assessments. December 2015. Available online at: http://www.hullcc.gov.uk/pls/portal/docs/PAGE/HOME/PLANNING/FLOOD%20RISK/LOCAL%20FLOOD%20RISK%20MANAGEMENT/DRAINAGE%20IMPACT%20ASSESSMENT%20GUIDE%20-%20DECEMBER%202015.PDF

[185] Hull City Council (2017). Hull local Plan 2016 to 2032, November 2017. Available online at: http://www.hull.gov.uk/resident/planning-and-building-control/local-plan

- DMRB Volume 4, Section 2: Part 3 (HD33/16) Design of Highway Drainage Systems[186]
- DMRB Volume 11, Section 2: Part 1 (HW 201/08) General Principles of Environmental Assessment[187]
- DMRB Volume 11, Section 3, Part 10 (HA 45/09): Road Drainage and the Water Environment[188]

11.4.2 The guidance sets out the methods used to assess the impact of the Scheme on the water environment (surface water, groundwater and flood risk). Where possible, this assessment conforms to this guidance unless agreed otherwise with Highways England and the relevant stakeholder or regulator. Agreements with regulators and stakeholders are discussed later in this section.

11.4.3 The approach takes into consideration comments from the Planning Inspectorate in response to the Scheme's Scoping Report published in March 2013[189]. These were provided as a Scoping Opinion (document reference TR010016/APP/6.9), which is discussed in Chapter 4 Consultation.

11.4.4 The Scoping Opinion requested that a WFD assessment is undertaken which considers the following:

- The current status of water bodies that have the potential to be affected by the Scheme
- The current reasons for failure and the actions required to reach 'good' status
- The potential impact of the Scheme and any mitigation required to minimise impacts
- The potential to further improve the status of affected water bodies through the Scheme

11.4.5 Volume 3, Appendix 11.1 Surface water quality impact assessment considers the proposed discharge in the context of the Water Framework Directive (WFD).

[186] Highways England (2016) Design Manual for Roads and Bridges, Volume 4, Section 2, Part 3, HD33/16, Design of Highway Drainage Systems. Available online at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol4/section2/hd3316.pdf

[187] Highways Agency (2008) Design Manual for Roads and Bridges, Volume 11, Section 2, Part 1, HA 201/08, General Principles and guidance of Environmental Impact Assessment. Available online at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section2/ha20108.pdf

[188] Highways Agency (2009). Design Manual for Roads and Bridges, Volume 11, Section 3, Part 10, HD45/09, Road Drainage and the Water Environment. Available online at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/

[189] Mott MacDonald Grontmij (2013b) A63 Castle Street Improvements, Hull – Environmental Statement Scoping Report - 1168-10-221-RE-001-PD1

11.4.6 As there will be no drainage to ground via soakaways or drainage fields, DMRB Volume 11 Section 3 Part 10 Annex I Method C - Assessment for Routine Runoff on Groundwaters is not applicable.

11.4.7 Furthermore, as all drainage will be captured either by the underpass drainage system or discharged to a Yorkshire Water sewer, DMRB Volume 11 Section 3 Part 10 Annex I Method D – Assessment of Pollution Impacts from Spillages is not applicable to groundwater.

11.4.8 The requirements of the WFD assessment outlined above have been incorporated within this chapter. As part of the assessment, all waterbody aspects relevant to WFD have been assessed including ecological, hydromorphological, quantitative and chemical aspects to ensure the aims and principles of the WFD are adhered to and that the Scheme results in no deterioration of the receiving surface water and groundwater water bodies. The WFD assessment was carried out with due regard to the relevant guidance from the Planning Inspectorate, namely Advice Note Eighteen: The Water Framework Directive[190].

Consultation

11.4.9 In addition to requests for information, consultation was undertaken with key stakeholders namely:

- The Environment Agency, to discuss existing flood risk information including flood models; agree the approach to, and discuss the outcomes of, the flood risk assessment (FRA) (including the agreement on which flood scenarios to assess) and the water quality impact assessment; and to consult on the mitigation measures for flood risk and water quality impacts from the proposed discharge into the Humber. The Environment Agency was also consulted on the approach to and findings of the groundwater assessment, as well as the groundwater modelling approach. Following a meeting in August 2018 subsequent to a review of the draft FRA, the Environment Agency requested additional information on flood risk to be provided at a later date. These additional requirements are summarised in Volume 3, Appendix 11.9 Additional flood risk assessment information requirements.

- Natural England, to discuss water quality impacts and agree principles on the location of the proposed outfall to the Humber to prevent scour and sediment mobilisation.

- HCC, to discuss existing flood related data (including flood models), the outcome of the FRA, the proposed drainage strategy including the location of the proposed underpass discharge, and discussion of mitigation measures for flood risk impacts.

[190] The Planning Inspectorate (2017). Advice note eighteen: The Water Framework Directive. June 2017, version 1. Available online at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2017/06/advice_note_18.pdf

- Humberside Fire and Rescue, Humberside Police and Yorkshire Ambulance Service on the arrangements and requirements for emergency plans in response to flooding of the Scheme.
- Highways England Regional Control Centre and the Area 12 Maintenance Area Contractor on the arrangements and requirements for emergency plans in response to flooding of the Scheme.
- Yorkshire Water, to discuss the drainage strategy including design requirements to discharge to Yorkshire Water's sewers and opportunity to discharge water from the underpass.
- British Waterways Marinas Limited (BWML), the Marine Management Organisation (MMO), landowners and local residents throughout the planning and implementation of the pumping test. This is detailed in Volume 3, Appendix 11.4 Pumping test report.
- MMO to discuss the location of the proposed underpass discharge outfall.
- BWML to discuss the potential of discharging underpass drainage to Humber Dock or Railway Dock.

Impact assessment

11.4.10 The impact assessment has been carried out in accordance with the general approach detailed in Chapter 5 Environmental Impact Assessment process, together with the guidance contained in DMRB HD45/09[191].

Assessment of value / importance

11.4.11 The assessment identifies the water features within the study area (and any downstream water bodies) and determines the importance (value) of the features, based on the examples of criteria set out in Table 11.1.

11.4.12 The conservation value of water resources is in part defined by legislation, which protects all controlled waters in England and Wales and, in effect, protects all water bodies (surface water or groundwater). Therefore, there cannot be any water feature which has negligible value. The value of controlled waters can be defined further by considering the use and conservation importance of the water body. The criteria used in this assessment to determine the value of each water feature and its attributes are set out in Table 11.1.

11.4.13 As outlined in DMRB guidance Volume 11 Section 2, there are general guidelines to follow for the assessment of sensitivities of receptors and magnitude of impacts. However, a large aspect of the assessment relies on reasoned argument,

[191] Highways Agency (2009). Design Manual for Roads and Bridges, Volume 11, Section 3, Part 10, HD45/09, Road Drainage and the Water Environment. Available online at: http://www.dft.gov.uk/ha/standards/dmrb/

professional judgement and taking on board the advice and views of appropriate organisations, such as the Environment Agency. More details can also be found in Volume 3, Appendix 11.1 Surface water quality impact assessment.

Table 11.1: Importance of water environment attributes

Value	Criteria	Typical examples
Very high	Attribute has a high quality and rarity on a regional or national scale.	Surface Water: Site protected / designated under EU or UK habitat legislation (Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar site, Site of Special Scientific Interest (SSSI), WPZ, salmonid / cyprinid water). Species protected by EC legislation. WFD high status water bodies. Critical hydrological importance to economic and social uses, e.g. water supply, navigation, recreation, amenity, etc. Groundwater: Principal aquifer providing a regionally important resource or supporting site protected under EU and UK habitat legislation; SPZ1. Archaeological feature or structure, which may be affected by changes to the groundwater regime, with very high importance and rarity, international scale and very limited potential for substitution, or over 100 residential, commercial or industrial properties. Flood Risk: Receptor is at high risk from flooding (FZ3b); or floodplain or defence protecting more than 100 residential properties from flooding.
High	Attribute has a high quality and rarity on a local scale.	Surface Water: Species protected under EC or UK habitat legislation; WFD status (or potential) is currently 'good' or has a target of good. Hydrological importance to economic and social uses, e.g. water supply, navigation, recreation, amenity, etc. Groundwater: Principal or Secondary A aquifer providing locally important resource or supporting river ecosystem; SPZ2. Archaeological feature or structure, which may be affected by changes to the groundwater regime with high importance and rarity, national scale, and limited potential for substitution, or between 10 and 100 residential, commercial or industrial properties. Flood Risk: Receptor is at high risk from flooding (FZ3a); floodplain or defence protecting between 10 and 100 residential properties or industrial premises from flooding.
Medium	Attribute has a medium quality and rarity on a local scale.	Surface Water: Site protected under Local habitat legislation (SNCI), Local Natural Reserve (LNR)); WFD status (or potential) is moderate or has a target of moderate. Limited hydrological importance to economic and social uses, e.g. water supply, navigation, recreation, amenity, etc. Groundwater: Secondary B or undifferentiated aquifer which is of limited value because the water quality does not allow potable or other quality sensitive uses, exploitation may be for agricultural or industrial use but is not extensive; limited connection to

Value	Criteria	Typical examples
		surface water and may provide some support to local site of nature conservation interest; SPZ3. Archaeological feature or structure, which may be affected by changes to the groundwater regime with high or medium importance and rarity, regional scale, and limited potential for substitution, or between 1 and 10 residential, commercial or industrial properties. Flood Risk: Receptor is at moderate risk from flooding (FZ2); floodplain or defence protecting 10 or fewer industrial properties from flooding.
Low	Attribute has a low quality and rarity on a local scale.	Surface Water: WFD status (or potential) is poor, or water body is not classified under the WFD. Minimal hydrological importance to economic and social uses, e.g. water supply, navigation, recreation, amenity, etc. Groundwater: Unproductive strata, with no known past or existing exploitation and not providing baseflow to rivers or supporting a site of nature conservation interest. Archaeological feature or structure, which may be affected by changes to the groundwater regime with medium or low importance and rarity and local scale. No residential, commercial or industrial properties. Flood Risk: Receptor is at low risk from flooding (FZ1); floodplain with limited constraints and a low probability of flooding of residential and industrial properties.

Source: Table A4.3 in DMRB HD 45/09, Annex IV

Assessment of magnitude

11.4.14 The assessment of the magnitude of the impact of the Scheme considers any incorporated mitigation measures or strategies, including the likely effectiveness of the mitigation, the timescale over which the impact occurs and the substitutability of the attribute. The criteria used for determining the magnitude of impact is based on Table A4.4 in DMRB HD 45/09, Annex IV and is summarised in Table 11.2. More details can also be found in Volume 3, Appendix 11.1 Surface water quality impact assessment.

Table 11.2: Definition of magnitude of an impact on a water environment attribute

Magnitude	Criteria	Typical example
Major adverse	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity.	Surface Water: Failure of both soluble and sediment-bound pollutants in Highways. Agency Water Risk Assessment Tool (HAWRAT) (Method A, Annex I) and compliance failure with Environmental Quality Standard **(**EQS) values (Method B). Calculated risk of pollution from a spillage >2% annually (Spillage Risk Assessment, Method D, Annex I). Loss or extensive change to a fishery. Loss or extensive change to a designated Nature Conservation Site.

Magnitude	Criteria	Typical example
		Major changes to flow regime (low, mean and / or high flows – at the site, upstream and / or downstream) resulting in loss of economic and social uses.
		Groundwater: Major permanent or long term change to groundwater quality or available yield. Existing resource is lost or irreparably impacted upon. Loss of, or extensive impact on, the integrity of a site of nature conservation interest. Changes in groundwater quality, levels or yields that may present a major risk to structures or archaeological features.
		Flood Risk: Increase in peak flood level (1% annual probability) >100mm. (Hydrological Assessment of Design Floods and Hydraulic Assessment, Methods E and F, Annex I).
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute.	Surface Water: Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A, Annex I) but compliance with EQS values (Method B). Calculated risk of pollution from spillages >1% annually and <2% annually. Partial loss in productivity of a fishery. Partial loss or change of the integrity of a site of nature conservation interest. Moderate changes to flow regime resulting in a reduction of economic and social uses.
		Groundwater: Moderate changes to the groundwater quality, levels or yields predicted to have some impact on resource use. Partial loss or change of the integrity of a site of nature conservation interest. Changes in groundwater level and / or quality that may present a minor risk to structures or archaeological features.
		Flood Risk: Increase in peak flood level (1% annual probability) >50mm
Minor adverse	Results in some measurable change in attributes quality or vulnerability.	Surface Water: Failure of either soluble or sediment-bound pollutants in HAWRAT. Calculated risk of pollution from spillages >0.5% annually and <1% annually. Minor changes to flow regime resulting in minimal reduction of economic and social uses.
		Groundwater: Some measurable changes to groundwater quality, levels or yields but the changes represent no more than a slight risk to resource use, sites of nature conservation interest, structures or archaeological features.
		Flood Risk: Increase in peak flood level (1% annual probability) >10mm.
Negligible	Results in effect on attribute, but of insufficient	The Scheme is unlikely to affect the integrity of the water environment.

Magnitude	Criteria	Typical example
	magnitude to affect the use or integrity.	Surface Water: No risk identified by HAWRAT (Pass both soluble and sediment-bound pollutants). Risk of pollution from spillages <0.5%. Minimal changes to flow regime resulting in negligible reduction of economic and social uses.
		Groundwater: No measurable changes to groundwater quality, levels or yields resulting in a negligible risk to resource use, sites of nature conservation interest, structures or archaeological features.
		Flood Risk: Negligible change in peak flood level (1% annual probability) <+/- 10mm
Minor Beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring.	Surface Water: HAWRAT assessment of either soluble or sediment-bound pollutants becomes Pass from an existing site where the baseline was a Fail condition. Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is <1% annually). Minor changes to flow regime resulting in minimal increase of economic and social uses.
		Groundwater: Minor improvement in groundwater quality and / or resource availability
		Flood Risk: Reduction in peak flood level (1% annual probability) >10mm
Moderate beneficial	Results in moderate improvement of attribute quality.	Surface Water: HAWRAT assessment of both soluble and sediment-bound pollutants becomes Pass from an existing site where the baseline was a Fail condition. Calculated reduction in existing spillage by 50% or more (when existing spillage risk >1% annually). Moderate changes to flow regime resulting in an increase of economic and social uses.
		Groundwater: Moderate improvement in groundwater quality and / or resource availability.
		Flood Risk: Reduction in peak flood level (1% annual probability) >50mm.
Major beneficial	Results in major improvement of attribute quality.	Surface Water: Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse. Major changes to flow regime resulting in increased economic and social uses.
		Groundwater: Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. Major improvement in groundwater quality and / or resource availability. Recharge of an aquifer.
		Flood Risk: Reduction in peak flood level (1% annual probability) >100mm.

Source: Table A4.4 in DMRB HD 45/09, Annex IV

Assessment of significance

11.4.15 The significance of potential effects due to construction and operation (including maintenance) of the Scheme have been predicted through considering both the value of the receptor (Table 11.1) and the predicted magnitude of impact (Table 11.2). The overall assessment scores are based on criteria set out in Table A4.6 in DMRB HD45/09 (Qualifying Conditions for Overall Assessment Scores). Effects that are Moderate or above are considered significant.

11.4.16 The likely significance of effects was calculated using the matrix given in Table 11.3 below, using professional judgement to consider site specific factors that may be of relevance.

Table 11.3: Definition of significance of potential effects

		Magnitude of impact			
		Negligible	**Minor**	**Moderate**	**Major**
Importance of attribute	**Very high**	Neutral	Moderate / Large	Large / Very Large	Very Large
	High	Neutral	Slight / Moderate	Moderate / Large	Large / Very Large
	Medium	Neutral	Slight	Moderate	Large
	Low	Neutral	Neutral	Slight	Slight / Moderate

Specific methodologies

Flood risk and drainage – surface water

11.4.17 The Underpass Drainage Strategy[192] was undertaken in accordance with the NPPF[193] and the associated (PPG)[194] (Department for Communities and Local Government), the DMRB[195] and the HCC guidance on Drainage Impact Assessments[196]. The drainage strategy included appropriate allowances for climate change.

11.4.18 An FRA (see Volume 3, Appendix 11.2) was undertaken in accordance with the NPPF and the supporting PPG and in response to the requirements of the

[192] Arup (2017). Underpass Drainage Strategy Report, September 2017

[193] Department of Communities and Local Government (2012). National Planning Policy Framework. March 2012

[194] Department of Communities and Local Government (2016) Planning Practice Guidance. Available online at: https://www.gov.uk/government/collections/planning-practice-guidance. November 2016

[195] Highways Agency (2006). Design Manual for Roads and Bridges, Volume 4, Section 2, Part 3, HD33/06, Surface and Sub-surface drainage systems for highways. Available online at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol4/section2/hd3306.pdf

[196] Hull City Council (2015b). Hull City Council Guide to Drainage Impact Strategies and Drainage Impact Assessments. December 2015

Environment Agency. This includes incorporating the appropriate climate change allowance[197].

11.4.19 Consultation has taken place with HCC and the Environment Agency throughout the FRA to agree the scope of the assessment, the flood scenarios to be considered and to review the results of the impact assessment and discuss mitigation measures including emergency procedures.

11.4.20 A site-specific FRA was undertaken using a detailed 1D/2D hydraulic model which allows the comparison of predicted flooding with the Scheme with the flooding under baseline conditions. The flood risk model was developed with the Infoworks ICM software (version 8) and based on Yorkshire Water's existing Infoworks CS (1D) model of the sewerage network as a starting point. The model was used to predict the impact of the Scheme on tidal (including wave overtopping) and fluvial flooding from the Hull and Humber, surface water flooding from rainfall (pluvial) and sewerage flooding. Flooding from a combination of sources was also considered as was the impact of climate change. Table 11.4 presents the flood scenarios which were agreed with the Environment Agency for consideration in the FRA. The outcome of the FRA is summarised in Sections 11.4, 11.5, 11.6, 11.7 and 11.8 with further details presented in Volume 3, Appendix 11.2 Flood risk assessment report and Volume 3, Appendix 11.3 Flood risk modelling technical report. The Environment Agency requested additional information on flood risk to be provided at a later date; these requirements are summarised in Volume 3, Appendix 11.9 Additional flood risk assessment information requirements.

11.4.21 The study area for the FRA extends approximately 1km north and west of the Scheme and is bound to the south and east by the Humber Estuary and the River Hull respectively.

Table 11.4: Flooding scenarios considered in the FRA

Source of flooding	Description of event	Return periods considered (1 in X-years)
Pluvial (Rainfall)	These scenarios consider surface water flooding generated from an intense rainfall event.	1 in 30 1 in 100 1 in 100 with 30% additional allowance for climate change
Tidal from River Hull (when Hull Tidal Surge Barrier fails to close)	These scenarios consider tidal flooding from the River Hull if the tidal barrier fails to close. In the absence of a 1 in 200-year event plus climate change scenario, the 1 in 1000-year event was agreed with the Environment Agency as an approximation.	1 in 200 1 in 1000

[197] Environment Agency (2016b). Flood risk assessment: climate change allowances. Guidance to support the NPPF. Available online at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Source of flooding	Description of event	Return periods considered (1 in X-years)
Combined fluvial and tidal from River Hull (when Hull Tidal Surge Barrier fails to close)	These scenarios consider flooding from a combined tidal and fluvial baseflow event if the tidal barrier fails to close.	1 in 200 1 in 1000
Wave overtopping (defended) from Humber Estuary	These scenarios consider tidal flooding resulting from wave overtopping of the existing Humber flood defences.	1 in 200 1 in 1000 1 in 200 plus climate change
Tidal (undefended) from Humber Estuary	These scenarios consider tidal flooding from the Humber Estuary if the existing Humber flood defences were not in place.	1 in 200 1 in 200 plus climate change

Potential impacts on groundwater – groundwater model

11.4.22 A numerical groundwater flow model was developed to investigate potential impacts on groundwater receptors during the Construction and Operation Phases of the Scheme. The model focussed on the underpass, as this structure is considered most likely to impact the groundwater regime. Impacts for the pumping station and Holiday Inn retaining wall have been inferred from the impacts predicted for the underpass, as these structures have similar depths and lateral extents. A separate 2d flow model was created to assess the impacts of the underpass tension piles and bridge piers on groundwater flow. The model design, calibration and results are described in Volume 3, Appendix 11.6 Groundwater modelling report and Volume 3, Appendix 11.7 Groundwater modelling update.

Surface water quality

11.4.23 For the proposed option of surface water discharge from the underpass direct to the Humber, the water quality impacts of routine road drainage on surface water bodies have been assessed using the DMRB HAWRAT Method A (assessment of pollution impacts from routine runoff to surface waters):

- Step 1 assesses the quality of direct highway runoff against toxicity thresholds, assuming no in-river dilution, treatment or attenuation
- Step 2 assesses the diluting capacity of the watercourse for acute impacts of soluble pollutants, and the likelihood and extent of sediment deposition for chronic impacts of sediment-bound pollutants
- Step 3 assesses the effectiveness of existing and proposed treatment systems for soluble pollutants and if the site is predicted to accumulate sediments, the percentage of settlement required to ensure that the extent of sediment coverage complies with the threshold deposition index value

11.4.24 The assessment considers the impact of dissolved copper and zinc on the water quality of the receiving waters. These metals are used as indicators of the level of

impact as they are generally the main metallic pollutants associated with road drainage and can be toxic to aquatic life.

11.4.25 The DMRB guidance states that care must be taken when considering the use of HAWRAT in urban highways and where the receiving water course is tidal, which applies to this Scheme. Therefore, in consultation with Highways England and the Environment Agency, it was agreed to undertake a modified Step 2 assessment based on mass-balance calculation to assess the dilution in the receiving water. Further details of the assessment methodology can be found in Volume 3, Appendix 11.1 Surface water quality impact assessment.

11.4.26 The water quality impacts of accidental spillages on surface water bodies have been assessed using the DMRB Method D – Assessment of Pollution Impacts from Spillages. This method defines the risk as the probability that there will be a spillage of pollutant, which will subsequently reach and impact the water body to such an extent that either a Category 1 or 2 incident (a serious pollution incident) occurs. Further details can be found in Volume 3, Appendix 11.1 Surface water quality impact assessment.

11.4.27 A comparison of the baseline water quality (taken as part of the 2013 Ground Investigation; see Volume 3, Appendix 11.4 Groundwater report, Annex A) was also made to the relevant environmental quality standards (EQS). Surface water quality samples were taken on three occasions between August and December 2013 from the Humber Estuary, the River Hull (upstream and downstream of the Scheme area) and the Humber Dock, and on seven occasions between August and December 2013 from Railway Dock (east and west). Additional samples have been undertaken at each of the sampling locations on four occasions between May and August 2014 to provide further baseline monitoring data. Further details can be found in Volume 3, Appendix 11.1 Surface water quality impact assessment.

11.4.28 No assessment of routine road drainage on surface water bodies was undertaken for the proposed option of surface water discharge from the underpass to the existing Yorkshire Water combined sewer due to the significant dilution within the wider Hull sewer network and treatment at the Saltend WwTW.

Groundwater quality

11.4.29 Groundwater quality sampling was undertaken as part of the 2013 GI, as presented in Volume 3, Appendix 11.4 Groundwater report (Annex A). The results screened against relevant EQS and drinking water standards (DWS). The main conclusions of this monitoring programme are presented in Volume 3, Appendix 12.1 Ground contamination assessment, and are also summarised in Volume 3, Appendix 11.4 Groundwater report.

Limitations and assumptions

Assumptions and prerequisites – surface water and flood risk

11.4.30 The surface water hydrology is dominated by the local topography and the combined sewerage system operated by Yorkshire Water. There are only very minor areas of permeable ground in the Scheme area and from the analysis of the existing local topography direct surface water runoff to a surface water course does not occur apart from a small area adjacent to the proposed Princes Quay Bridge where surface water runoff is known to flow directly to Humber Dock marina and Princes Quay. Furthermore, localised direct surface water runoff to adjacent surface water features cannot be discounted.

11.4.31 All existing surface water across the Scheme area is assumed to drain to the existing Yorkshire Water combined sewerage system. There is no evidence of surface water drainage discharging directly to a water body although localised direct surface water runoff to the docks cannot be discounted.

11.4.32 For the option of surface water discharge from the underpass directly to the Humber, the Scheme would result in a net reduction of discharge to the Yorkshire Water sewer – see Volume 3, Appendix 11.8 Drainage impact assessment. For the option of surface water discharge from the underpass to the existing Yorkshire Water network, the Scheme would result in a net increase of approximately 66 l/s to the sewer. This water would be discharged to the Humber Estuary via Saltend WwTW under Yorkshire Water's existing discharge consent. However, given the size of the wider Hull sewer network, it is assumed that dilution of this additional runoff would have a negligible impact on Saltend WwTW and the sewerage network and subsequent outfall to the Humber Estuary. Therefore, no assessment is undertaken of any impacts on receptors via this pathway. Consultation is ongoing with Yorkshire Water regarding this option.

11.4.33 The Saltend WwTW discharges to the Humber Lower WFD water body (GB530402609201). However, given the dilution and treatment outlined in Section 11.4.32 and the fact that this water body is outside the 1km study area, the Humber Lower water body was not considered as part of the WFD assessment.

11.4.34 There are no planned marine dredging activities associated with the construction or operation of the Scheme and therefore no assessment of impact against the Centre for Environment, Fisheries and Aquaculture action levels is considered.

11.4.35 It is assumed that temporary drainage from site compounds will be via closed drainage systems to a surface water body or to a Yorkshire Water sewer.

Assumptions and prerequisites - groundwater

11.4.36 There is a need to assess the impacts of potential damage to aquatic ecosystems due to the pollution of watercourses from mobilised suspended solids, heavy metal contamination and spillages of fuel and oil during construction and operation. As

groundwater could act as a pathway for contaminant migration, this is also considered in the groundwater impact assessment.

11.4.37 It is intended that all routine drainage will be collected and disposed of offsite, and that soakaways or other means of discharging water to the ground are not required. Therefore, there is no requirement for DMRB Volume 11 Section 3 Part 10 Annex I Method C (Assessment of Pollution Impacts from Routine Runoff to Groundwaters).

11.4.38 All routine drainage will be captured either by the underpass drainage system, which would either be discharged to the Yorkshire Water sewer or the Humber Estuary, or the at-grade drainage which would be discharged to the Yorkshire Water sewer. Therefore, DMRB Volume 11 Section 3 Part 10 Annex I Method D – Assessment of Pollution Impacts from Spillages is not required. However, the potential for contamination of groundwater and associated receptors remains during the Construction Phase.

11.4.39 The groundwater impact assessment takes into consideration the earthworks design concept as described in Chapter 2 The Scheme.

Limitations – surface water and flood risk

11.4.40 Predictions of surface water flooding only take place within the study area. Impacts of flooding from tidal or fluvial sources outside of the study area either directly or via the sewerage system are not considered to have an impact on the Scheme. More detailed limitations and assumptions associated with the surface water and flood risk modelling are given in Volume 3, Appendix 11.2 Flood risk assessment and Volume 3, Appendix 11.3 Flood risk modelling technical report. Additional information requirements are also considered at Volume 3 Appendix 11.9 Additional flood risk assessment information requirements.

11.4.41 Surface water quality sampling was undertaken for a limited number of samples in the River Hull, Humber Estuary and Humber and Railways Docks, as presented in Volume 3, Appendix 11.1 Surface water quality impact assessment. These results only provide a snapshot of the water chemistry conditions in the watercourse between August 2013 and August 2014 when the surveys were undertaken for this assessment. Apart from ad hoc sampling in 2012 for cations and the anti-fouling agent tributyltin, the Environment Agency water quality monitoring at Albert Dock also ceased in 2008, although sampling data for this assessment was supplemented with additional, more recent, Environment Agency monitoring data from locations further afield. To confirm the findings in this assessment are still valid and to provide a more extensive baseline data set, a programme of surface water quality sampling would be required prior to, during and following construction of the Scheme, the locations of which should be agreed with the Environment Agency.

Limitations – groundwater

11.4.42 The groundwater assessment is necessarily constrained by the information available. The 2013 and 2015/16 ground investigations (as presented in Volume 3, Appendix 11.4 Groundwater report), and subsequent monitoring and sampling have provided comprehensive data relating to the geology and hydrogeology within the Scheme Site Boundary. However, the Scheme is linear and there is limited pertinent data for the central Hull area outside of this, and the site compounds situated at a distance from the Scheme. This has implications with respect to the baseline conceptual hydrogeological model, particularly with respect to hydraulic gradients.

11.4.43 The significant tidal impact on groundwater levels in the area meant that dip data had to be treated with some caution. In view of this, groundwater level data loggers were deployed in selected boreholes later on in the monitoring programme.

11.4.44 The groundwater flow model was developed using MODFLOW[198] [199]. Although the model has nine layers to represent the Chalk and the overlying superficial deposits and was calibrated using groundwater level data from the 2013 ground investigation and subsequent monitoring, it is considered to be a relatively simplified version of the complex hydrogeological system that exists beneath Hull. In particular, the strongly heterogeneous nature of the made ground and presence of pockets of perched groundwater mean that the model struggled to adequately represent this unit.

11.4.45 Calibration of the groundwater model outside the Scheme Site Boundary was affected by the paucity of available monitoring data and a substantial level of uncertainty with respect to boundary conditions. Although model boundaries were generally set distant from the area of interest so as to reduce their influence, they will have affected the model particularly with respect to predicted hydraulic gradients. In view of the above limitations, the quantitative model predictions should be considered as indicative rather than absolute in terms of the potential changes in groundwater levels and flows that might occur during the Construction and Operation Phases of the Scheme.

11.4.46 Groundwater quality sampling was undertaken for a limited period during the 2013 ground investigation, as presented in Volume 3, Appendix 11.4 Groundwater report. These results only provide a snapshot of the water quality conditions in the superficial deposits and Chalk. As such, a programme of groundwater quality sampling would be required prior to, during and following construction of the Scheme and should be included in the groundwater monitoring plan.

[198] McDonald, M.G. and Harbaugh, A.W., 1984. A modular three-dimensional finite-difference groundwater flow model. U.S. Geological Survey Open-File Report 83-875, 528pp. Available online at: https://pubs.usgs.gov/of/1983/0875/report.pdf

[199] ESI (2011) Groundwater Vistas Version 6.53, Build 8 Interface for Modflow

11.5 Existing environment

Location of proposed compounds

11.5.1 The Scheme includes a number of proposed compound and temporary working or parking areas. These are outlined in Table 11.5 below and are shown in Volume 2, Figures 11.1 Map of surface water features and 11.2 Groundwater features in order to provide context for the assessment of their baseline environmental condition.

Table 11.5: Summary of compounds and temporary working / parking areas

Compound Name	Location	Proposed use and description of existing condition
Arco (preferred 'Option A')	Existing Arco site, south of A63 and west of St James Street	Offices, concrete batching, jet grouting and bentonite slurry facilities. Existing buildings to be demolished. This is the preferred compound location for the above facilities.
Staples (alternative Option B)	Existing Staples / American Golf site north east of Mytongate Junction	Offices, concrete batching facility, jet grouting and bentonite slurry facilities. Existing buildings to be demolished. This is an alternative option for the Arco site and will only be used if the Arco site is not taken forward.
Wellington Street Island Wharf	South of Wellington Street West to the east of Albert Dock	Main site offices and accommodation
A63 eastbound recovery base	A63 layby to north of St Andrews Quay	Vehicle recovery
A63 westbound recovery base	A63 bus layby west of Garrison roundabout	Temporary parking / stop area for vehicle recovery
Livingstone Road	Livingstone Road	Materials compound
Land south east of Mytongate Junction	Trinity Burial Ground	Temporary working compound for Trinity Burial Ground
Neptune Street Set Down	Neptune Street east of Clive Sullivan Way and north of Albert Dock	Compound for Princes Quay Bridge, vehicle recovery drop-off and traffic management
Myton Centre Parking	Porter Street / William Street	Temporary contractor / staff parking. Existing Myton Centre building to be demolished. To be reinstated as Public Open Space upon completion of the Scheme (March 2025 onwards)

11.5.2 The Arco compound (Option A) is the preferred location for the concrete batching, jet grouting and bentonite slurry facilities. The compound would require demolition of the existing Arco buildings.

11.5.3 If the Arco compound is not used, the same facilities would be placed at the Staples compound (Option B). If the Arco compound is used, there would be no compound at the Staples site.

Determination of baseline conditions

11.5.4 The baseline conditions were determined by a combination of desk based studies, site visits, surveys and consultation. In addition to this, more detailed studies were undertaken, which included:

- Development of a numerical flood risk model of the area to determine the existing flood levels and flows in the vicinity of the Scheme
- Comprehensive ground investigations to determine geological and hydrogeological conditions in the vicinity of the Scheme, including implementation of groundwater level and quality monitoring, permeability tests and a pumping test
- Development of a numerical groundwater model to understand potential impacts on groundwater receptors during the Construction and Operation Phases of the Scheme

11.5.5 The approaches to the detailed studies are described below.

Desk based assessment

11.5.6 The desk based assessment has taken into consideration the DMRB guidance, legislation and policy documents outlined in Section 11.3. In addition, data was collated from the following sources:

- Ordnance Survey (OS) for maps
- Environment Agency for information relating to surface water and groundwater abstractions, consented discharges, surface water and groundwater quality data, aquifer designations, nitrate vulnerable zones, groundwater vulnerability and groundwater source protection zones, the Humber RBMP, the Hull and East Riding Abstraction Licensing Strategy[200] and The Humber Environment in Focus[201]
- UK Hydrographic Office for tidal information at Albert Dock

[200] Environment Agency (2013). Hull and East Riding Abstraction Licensing Strategy. Reference LIT 7867. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/305452/lit_7867_a7b9fe.pdf

[201] Environment Agency (2011). The Humber Environment in Focus 2011. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/297466/gene0611btzc-e-e.pdf

- Flood Estimation Handbook (FEH) web service for hydrological data[202]
- British Geological Survey (BGS) for borehole records, geological maps[203], geological cross-sections (Lithoframe viewer[204]), and the 3D geological model of the superficial deposits of the Holderness area[205]
- Environment Agency and HCC for Flood Risk Management Strategies and Plans[206,207,208]
- HCC for information relating to unlicensed groundwater and surface water abstractions
- Landmark Information Ground Services Envirocheck report[209] for confirmation of environmental data such as designated sites
- Literature review. Key groundwater baseline information sources included but were not limited to: - The Chalk Aquifer of Yorkshire. BGS Research Report RR/06/04[210], East Yorkshire Chalk Aquifer: Conceptual Model[211], and information relating to previous below-ground construction projects in the area

11.5.7 This assessment also takes into account previous reports relating to this Scheme, including but not limited to:

- Ground Investigation Report for the A63 Castle Street[212]

[202] Centre for Ecology and Hydrology (2018). The Flood Estimation Handbook (FEH) web service. Available online at: https://fehweb.ceh.ac.uk/.

[203] British Geological Survey geological maps and boreholes records. Available online at: http://www.bgs.ac.uk/geoindex/

[204] Lithoframe viewer. Available online at: http://www.bgs.ac.uk/services/3Dgeology/lithoframeSamples.html

[205] Burke, H. F., Morgan, D. J., Kessler, H. and Cooper, A. H. (2010) A 3D geological model of the superficial deposits of the Holderness area. British Geological Survey commissioned report No. CR/09/132. Available online at: http://nora.nerc.ac.uk/id/eprint/16850/1/CR09132N.pdf

[206] Halcrow (2007). Strategic Flood Risk Assessment. Report for Hull City Council. November 2007. Available online at: http://www.hullcc.gov.uk/pls/portal/docs/PAGE/HOME/PLANNING/PLANNING%20POLICY/FLOOD%20RISK%20ASSESSMENT/SFRA_NOVEMBER%202007.PDF

[207] Halcrow (2007b). Surface Water Management Plan. Report for Hull City Council. November 2009

[208] Environment Agency (2010). River Hull Flood Risk Management Strategy. May 2010

[209] Landmark Information Group Services (2013) Report Ref. 43865337-1, Envirocheck Report on Castle Street, Hull

[210] Gale, I. N. and Rutter, H. K. (2006) The Chalk Aquifer of Yorkshire. British Geological Survey. Research Report RR/06/04. Available online at: http://nora.nerc.ac.uk/id/eprint/3700/1/RR06004.pdf

[211] ESI (2010) East Yorkshire Chalk Aquifer: Conceptual Model. Prepared for the Environment Agency. Ref: 602711R1D1

[212] Acer (1995) A63 Trunk Road Improvements, Castle Street, Hull – Geotechnical Interpretative Report on Ground Investigation

- Preliminary Sources Study Report (PSSR)[213]
- 2009 Flood Risk Assessment Report[214]
- Environmental Assessment Report (EAR) (Options Selection Stage)[215]
- Environmental Statement Scoping Report (ESSR)[216]
- Scheme Handover Report[217]

11.5.8 The groundwater assessment additionally takes into account the findings of the 2013 and 2015/16 ground investigation (GI) for the Scheme, (see Volume 3, Appendix 11.4 Groundwater report, Annexes A to D) and Appendix 12.1 Ground contamination assessment, and the subsequent groundwater monitoring programme.

11.5.9 Volume 3, Appendix 11.2 Flood risk assessment, Volume 3, Appendix 11.9 Additional flood risk assessment information requirements, Volume 3, Appendix 11.3 Flood risk modelling technical report and Appendix 11.4 Groundwater report include full details of the sources of information that inform these assessments.

Site walkovers

11.5.10 Walkover surveys of the study area were undertaken in April 2013 and December 2013 to visually inspect watercourses and surface water bodies to gain an understanding of the local topography, hydrological regime, hydrological features, sediment processes and characteristics of the surface water environment. This information augmented and informed the desk-based assessments including the FRA.

Aerial survey

11.5.11 An aerial LiDAR survey was undertaken in May 2013 to provide existing ground elevations for the FRA amongst other requirements. The survey area extended approximately 1km from the Scheme, bounded to the south by the Humber Estuary. This provided ground elevation data with a horizontal resolution of 0.5m and a vertical resolution of 0.025m improved using a ground station during the survey.

[213] Pell Frischmann (2004) A63 Castle Street Improvements, Hull, Project Support Framework – Preliminary Sources Study Report, Report Reference W11189/VAA/02 Revision 1

[214] Pell Frischmann (2009). Highways Agency - Project Support Framework- A63 Castle Street Improvements, Hull. Flood Risk Assessment Report. Doc Ref: W11189/T13/03. October 2009

[215] Pell Frischmann (2010) A63 Castle Street Improvement Hull - Environmental Assessment Report (Options Selection Stage), Report Reference W11189/T13/02 Final Rev 2

[216] Pell Frischmann (2011) A63 Castle Street Improvements – Environmental Statement Scoping Report

[217] Pell Frischmann (2011) A63 Castle Street Improvements – Scheme Handover Report

Ground investigation

11.5.12 The 2013 ground investigation is described in detail in the Ground investigation report (Volume 3, Appendix 11.4 Groundwater report, Annex A). The purpose of this intrusive investigation and monitoring programme was to confirm and supplement the geotechnical and hydrogeological findings from the PSSR and other previous investigations, and to inform the preliminary design and the ES. The findings of these investigations are also discussed in detail in Chapter 12 Geology and soils.

11.5.13 The 2013 intrusive ground investigation comprised exploratory boreholes, trial pits, window samples, self-boring pressure-meter tests (SBPT) and archaeological standard cone penetration tests (SCPTs). These were supplemented by geophysical surveys, permeability tests, a pumping test, and groundwater level and quality monitoring. The investigation was restricted to the Scheme Site Boundary. Surface water quality monitoring of nearby water bodies was also undertaken.

11.5.14 A second round of ground investigation was conducted in 2015 and 2016 to inform the engineering design of the Scheme, and focussed on the A63 mainline, the Princes Quay Bridge (for pedestrians, cycles and disabled users) and the Trinity Burial Ground. This ground investigation comprised exploratory boreholes, window samples, cone penetration tests and geotechnical and geoenvironmental laboratory testing, and was supplemented by groundwater level monitoring. Details are provided in Volume 3, Appendix 11.4 Groundwater report, Annexes B to D.

11.5.15 Groundwater strike data, water level dip data and logger data, permeability test data and groundwater quality sampling are particularly relevant to the groundwater assessment. Details of exploratory holes, installations, monitoring and test data are provided in Volume 3, Appendix 11.4 Groundwater report.

11.5.16 The surface water quality monitoring also provides additional supporting information to Volume 3, Appendix 11.1 Surface water quality impact assessment.

11.5.17 The larger diameter borehole drilling and test pumping programme, results and analysis are described in Volume 3, Appendix 11.5 Pumping test report.

Surface water and flood risk

Overview

11.5.18 The description of the existing surface water environment (i.e. the study area) considers the Scheme Site Boundary and a 1km radius around it. Included in the Scheme Site Boundary is the proposed rising main and outfall required for the proposed underpass drainage system. Surface water features are presented in Volume 2, Figure 11.1 Map of surface water features.

Hydrology

11.5.19 The surface water hydrology is dominated by the local topography and the combined sewerage system operated by Yorkshire Water. All surface water is assumed to drain to the combined sewerage system as the study area is largely impermeable and those isolated permeable areas (e.g. parks or gardens) are surrounded by impermeable areas. The combined sewer ultimately discharges to the Humber Estuary, via Saltend WwTW. There are localised areas of known direct surface water runoff from adjacent ground near the proposed Princes Quay Bridge to both Humber Dock and Princes Quay. Furthermore, localised surface water runoff from ground adjacent to other surface water features cannot be discounted.

11.5.20 There is only a relative small amount of permeable ground within the Scheme Site Boundary associated with the vegetated islands within the existing Mytongate Junction and a portion of the Trinity Burial Ground. Therefore, surface water infiltration to groundwater is likely to be limited. It is likely that during severe rainfall events, flow in excess of the infiltration capacity of permeable ground will flow overland and enter the existing Yorkshire Water sewer network.

11.5.21 There are two main natural surface water bodies in the area (the Rivers Humber and Hull) both of which are heavily modified. Surface water bodies adjacent to the Scheme, including artificial docks, are summarised in Table 11.5 along with distances from the Scheme Site Boundary.

11.5.22 Fleet Drain is an artificial water body and is adjacent to the proposed location of one of the site compounds at Livingstone Road. Apart from the water bodies mentioned in Table 11.6, an examination of OS maps at scales of 1: 2,500, 1: 5,000, 1: 25,000 and 1: 50,000 did not indicate any further surface water bodies within the study area.

Table 11.6: Summary of surface water bodies in the study area

Water body	Approximate distance from Scheme (m)	Description
Humber Estuary	540m south	Tidal. River flows in eastwards direction.
River Hull	100m east	Tidal in lower reaches. River flows in southwards direction into Humber Estuary. Protected at downstream end / confluence with the Humber by the Hull Tidal Surge Barrier.
Albert Dock	385m south	Active commercial dock. Connected to the Humber Estuary via locks (locks open for 3 hours either side of high tide). Approx. area: 27,300 m2
Humber Dock	Adjacent to Princes Quay Bridge	Part of the active Hull Marina. Connected to Humber Estuary via locks and the Humber Dock Basin. Approx. area: 27,000 m2

Water body	Approximate distance from Scheme (m)	Description
Railway Dock	73m south	Part of the active Hull Marina. Connected to Humber Dock. Approx. area: 10,000 m2
Princes Dock	20m north	Believed to be hydraulically isolated, although historically connected to the Humber Dock. Princes Quay Shopping centre built over part of Princes Dock on stilts. Approx. area 11,000 m2
Fleet Drain	6.41km west of main Scheme. Adjacent to Livingstone Road compound	Artificial watercourse discharging to the Humber River. Sluice gate at outfall to Humber. Catchment area 39.48 km2

11.5.23 The study area falls within the Humber Middle (GB530402609202) transitional water body in the Humber RBMP. Table 11.7 presents its characteristics and status as assessed in 2016. The Humber Middle water body also includes Albert Dock, Humber Dock, Princes Dock and the lower reaches of the River Hull (up to Bransholme; TA 08855 33392) within its extents. The Humber Middle water body is designated as a 'heavily modified' water body due to flood protection modifications. Current road drainage from the study area discharges indirectly into the Humber Estuary at Saltend WwTW, which is located within the Humber Lower transitional water body (GB530402609201). This is also designated as 'heavily modified'.

11.5.24 The study area also falls within the Fleet Drain (GB104026066750) artificial water body in the Humber River Basin District. Table 11.7 presents its characteristics and status as assessed in 2016.

11.5.25 The Humber Estuary is estuarine within the study area and is therefore tidally dominated. Freshwater river flows from the Humber basin are, on average, 246m^3/s[218], flowing in an easterly direction. The volume of water passing Spurn Head during a spring tide is about 1.7 x 10^9 m^3 but is only 60 per cent of this during a neap tide[218]. The flow during a significant tidal or flood event would be significantly greater than this and would be dominated by the tidal cycle.

11.5.26 The River Hull flows southwards through Hull to enter the Humber Estuary immediately downstream of the Scheme Site. The River Hull is very heavily modified and is protected from flooding by the Hull Tidal Surge Barrier at the mouth of the river. The upper reaches of the River Hull are designated separately to the lower reach (River Hull from Arram Beck to Humber GB104026067212). Within the study area, however, the River Hull watercourse is part of the Humber Middle water body.

[218] Data available online at: http://www.humber.com/Estuary_Information/Navigating_the_Estuary/Estuary_History/

11.5.27 The study area does not fall within a Drinking Water Protected Area (DrWPA). A small section, to the east of the Scheme Site and the Fleet Drain water body lies within the existing and proposed 2017 surface water NVZ.

Table 11.7: WFD surface water body status and objectives (adapted from Humber RBMP[219])

Water body ID	GB530402609202	GB104026066750
Water body Name	Humber Middle	Fleet Drain
River Basin District	Humber	Humber
Typology Description	Transitional Water	River
Hydromorphological Status	Heavily Modified due to flood protection	Artificial
Current Ecological Quality (Overall)	Moderate Potential	Moderate Potential
Biological quality	Moderate	Bad
Hydromorphology	Supports good (2013)	Supports good
Other substances	Not assessed	Not assessed
Physico-chemical quality	Moderate	Moderate
Specific pollutants	High	Not assessed
Supporting elements	Moderate	Moderate
Current Chemical Quality (Overall)	Fail	Good
Other pollutants	Good	Not assessed
Priority hazardous substances	Fail	Not assessed
Priority substances	Good	Not assessed
Predicted Ecological Quality	Moderate Potential	Good
Predicted Chemical Quality	Good	Good
Protected Area	Yes, Conservation of Wild Birds directive, Habitats and Species Directive and Nitrates Directive.	Yes, Nitrates Directive

11.5.28 The 2016 RBMP states that if the status matches the predicted future status or potential then the predicted future status has already been achieved and no further improvement in status is expected. The main environmental objective is to prevent deterioration in status between 2015 and 2021 or to achieve the future target of moderate or good potential or status by 2021 or 2027. A plan of WFD surface water bodies is shown at Volume 2, Figure 11.4.

[219] Environment Agency (2016). Humber River Basin Management Plan. Available online at: https://www.gov.uk/government/publications/humber-river-basin-district-river-basin-management-plan

Drainage

11.5.29 All current highway drainage within the Scheme discharges into the existing Yorkshire Water combined surface water and foul sewers, via three connection points with a combined total area of 4.697 hectares:

- Combined gravity sewers draining areas to the west and immediately to the east of Mytongate Junction (total area: 1.947 ha)
- Surface water gravity sewers draining the Mytongate Junction and the area to the north of the junction (total area: 0.958 ha)
- Combined and surface water gravity sewers draining the area to the east of the Mytongate Junction (total area: 1.792 ha)

11.5.30 The combined sewer ultimately discharges to the Humber Estuary, via Saltend WwTW. The Saltend WwTW is located to the east of Hull.

11.5.31 Existing drainage plans and areas are presented in the Existing Drainage Analysis Report[220].

11.5.32 Liaison with the Highways England Managing Agents Contract confirms that the majority of storm water sewers in the Scheme Site Boundary are public sewers. However, there may be small lengths of private highways drainage in some areas. There is no evidence of any surface water drainage system discharging directly to any of the water bodies identified in the study area (shown in Table 11.6) although this cannot be completely discounted.

11.5.33 The proposed compound sites for construction (except for the Myton Centre temporary parking area) are currently drained via existing combined drainage systems and are largely impermeable, brownfield sites. The Myton Centre parking area is currently a permeable grassed area. It is likely that during severe rainfall events, rainfall in excess of the infiltration capacity of the soil will flow overland and enter the Yorkshire Water sewer network.

Flooding

11.5.34 The study area is located within Flood Zone 3a of the Environment Agency's Flood Map for Planning, with a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year[221]. Further details can be found in the Volume 3, Appendix 11.2 Flood

[220] Mott MacDonald Grontmij (2013a). A63 Castle Street Improvements, Hull – Existing Drainage Analysis Report. Report for Highways Agency. Doc Ref: 1168-08-000-RE-001-A1

[221] Arup (2016). Strategic Flood Risk Assessment. Report for Hull City Council. December 2016. Available online at: http://www.hullcc.gov.uk/pls/portal/docs/PAGE/HOME/PLANNING/PLANNING%20POLICY/FLOOD%20RISK%20ASSESSMENT/SFRA%20REPORT%20-%20DECEMEBER%202016.PDF

risk assessment and Volume 3 Appendix 11.9 Additional flood risk assessment information requirements.

11.5.35 The Scheme Site and the surrounding area lie within either an Environment Agency Flood Warning Area or a Flood Alert Area. Within a Flood Warning Area, the Environment Agency issues flood warnings to residents or businesses when flooding is expected and recipients of these warnings are urged to take immediate action. Within a Flood Alert Area, the Environment Agency issues flood alerts to residents or businesses when flooding is possible and recipients of these alerts should prepare for flooding. Flood alerts cover larger areas than flood warnings and are issued more frequently.

11.5.36 The Scheme area is within the following Flood Warning Areas:

- 122FWF112 Hull City Centre
- 122FWT024 North Bank of the Humber Estuary in the West of Hull
- 122FWT029 North Bank of the Humber Estuary at Hessle Haven for the Livingstone Road compound

11.5.37 The study area is within the following Flood Warning Areas:

- 122FWF118 River Hull at Old Town, Dry Pool and Sutton Fields
- 122FWT041 River Hull and Humber Estuary at Hull City Centre

11.5.38 According to the SFRA, the city of Hull, and the Scheme are protected from flooding by the existing Humber Estuary and River Hull flood defences. The Humber Estuary defences generally provide a standard level of protection to a 1 in 200-year event, but in some areas, for example, to the east of Albert Dock East the level of protection falls to a 1 in 5-year event. New flood defences have been installed in Albert Dock (completed in November 2015) which provide a standard level of protection to a 1 in 200-year event. The River Hull defences generally provide a standard level of protection greater than a 1 in 200-year event.

11.5.39 The proposed compound site at A63 eastbound layby north of St Andrews Quay is located within Flood Zone 2. Proposed compounds at Arco, Staples, Wellington Street Island Wharf and Land south east of Mytongate Junction are located within Flood Zone 3. The proposed compound at Livingstone Road is partly located in Flood Zones 2 and 3.

11.5.40 The eastern half of the Scheme Site is within the area that was flooded during the 1969 River Hull tidal flood event that occurred before the installation of the Tidal Surge Barrier on the River Hull.

11.5.41 Surface water flooding during the 2007 floods has been identified in the vicinity of the Scheme. The Scheme area was also flooded during the 5 December 2013 tidal surge event.

11.5.42 Predictions from the flood risk model developed for Volume 3 Appendix 11.2 Flood risk assessment confirm that under baseline conditions:

- There are some isolated areas of minor surface water flooding to the north and east of the Scheme. There was no predicted surface water flooding within the Scheme area.
- In the vicinity of the Scheme Site, predicted flooding under a 1 in 200-year return period wave overtopping event from the Humber Estuary reaches the periphery of the Scheme area resulting in flooding to the west and south of Mytongate Junction and parts of Kingston Retail Park. This assumes the existing Humber flood defences are in place and the Albert Dock gate is closed.
- Without the Humber north bank flood defences, the extent of flooding under a 1 in 200-year return period tidal event is widespread with significant areas of Hull affected. Flood depths reach a maximum of 1.2m along the existing A63.
- The failure of the Hull Tidal Surge Barrier to close would result in extensive flooding west of the River Hull (the flood risk model does not consider the area to the east of the River Hull) under a tidal event with a return period of 1 in 200-years. The A63 east of Mytongate Junction is flooded up to a maximum of 1m in places with flooding extending north of Mytongate Junction to Ferensway and Anlaby Road. It is noted that the failure of the Hull Tidal Surge Barrier to close during a high tide event is extremely unlikely as it is fitted with a system to automatically close the barrier if the power fails.

11.5.43 There is no evidence of existing groundwater flooding in the vicinity of the Scheme[222].

11.5.44 Yorkshire Water's DG5 sewer flooding register[223] highlighted four properties at risk of internal flooding from sewers and 12 properties at risk of external flooding from sewers within Hull.

11.5.45 The HCC Preliminary Flood Risk Assessment highlights that sewer network flooding is a major concern for the city.

11.5.46 The storm surge event of 5 December 2013 and findings within Volume 3 Appendix 11.2 Flood risk assessment clearly demonstrate that the study area is already at risk of flooding from wave overtopping from the Humber Estuary with

[222] Arup (2016). Strategic Flood Risk Assessment. Report for Hull City Council. December 2016. Available online at: http://www.hullcc.gov.uk/pls/portal/docs/PAGE/HOME/PLANNING/PLANNING%20POLICY/FLOOD%20RISK%20ASSESSMENT/SFRA%20REPORT%20-%20DECEMEBER%202016.PDF

[223] Halcrow (2011). Hull City Council. Preliminary Flood Risk Assessment. Report for Hull City Council. July 2011. Available online at: http://www.hullcc.gov.uk/portal/page-_pageid=221,689618&_dad=portal&_schema=PORTAL

the existing flood defences. Localised and minor flooding will also occur during extreme rainfall events.

11.5.47 Due to the numerous residential, commercial and industrial properties within the Humber floodplain adjacent to the Scheme Site and the presence of flood defences, the floodplain is considered of very high importance in terms of conveyance of flow.

Water quality – WFD status

11.5.48 An assessment of the impact of the proposed Humber outfall from underpass drainage for the Humber Middle water body is available in Volume 3, Appendix 11.1 Surface water quality impact assessment. The assessment includes, where appropriate, the 2015 WFD Environmental Quality Standards (EQS) for annual average concentrations[224].

11.5.49 The Humber Middle water body was assessed in 2016 as having moderate ecological potential and failed chemical status. The moderate ecological potential classification is due to its biological quality elements, specifically angiosperms, only achieving moderate potential, and its physico-chemical quality, namely dissolved inorganic nitrogen, which exceeded the EQS for good status.

11.5.50 The chemical status of the Humber Middle water body failed in 2009 and in 2016, due to tributyltin compounds which are classified as Priority Hazardous Substances. Tributyltin compounds are used in anti-fouling pesticides in marine paints and industrial water systems. In the Humber RBMP 2009[225], the justification for not achieving good predicted status in 2016 was that further time was required to identify specific sources and their relative contributions although the sale and use of tributyltin compounds is now restricted. It must be noted there are no future objectives for tributyltin due to the restrictions on sale and use of such compounds.

11.5.51 Objectives for the Humber Middle water body have been set to maintain moderate ecological potential and good chemical status. These objectives indicate that no further improvement in status or potential is anticipated. The rivers Humber and Hull, and Humber and Railway Docks (as defined by the Humber Middle water body) are therefore of medium importance in terms of water quality.

11.5.52 Fleet Drain was assessed in 2016 as having a moderate ecological potential and good chemical potential. Objectives have been set to achieve good ecological potential by 2027. The water body achieved good chemical potential in 2015 and no further objectives have been set, therefore Fleet Drain is of high importance in terms of water quality.

[224] The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015

[225] Environment Agency (2009). The Humber Flood Risk Management Strategy. Summary Document. December 2009

11.5.53 Dissolved copper and zinc are heavy metals that are commonly found in road surface runoff. Zinc is present in car tyres and vehicle components and copper is released principally as a product of corrosion[226]. Water quality data provided by the Environment Agency indicates that the average concentration of dissolved copper in the Humber Estuary at Albert Dock between 2003 and 2008 was 4.9 µg/l which is higher than the current EQS for marine waters (3.76 µg/l for dissolved organic carbon concentration less than 1 mg/l)[227]. The average concentration of dissolved zinc for the same period was 9.2 µg/l which is higher than the current EQS for marine waters (6.8 µg/l) at this particular location within the Humber Middle water body. Apart from ad hoc sampling in 2012 for cations and the anti-fouling agent tributyltin, there has been no sampling at this location for water quality parameters since 2008.

11.5.54 Water quality sampling was undertaken by the Environment Agency on Fleet Drain, upstream of one of the proposed construction compounds, however, dissolved copper and zinc was not measured. All analyses were at good or high status apart from phosphates (moderate) and dissolved oxygen (poor).

11.5.55 There are Environment Agency sampling locations downstream of the study area at Saltend Jetty (6.1km downstream on the Humber Estuary) and Drypool Bridge (1.4km upstream of the River Hull and Humber confluence). A review of these data was carried out and included in Volume 3, Appendix 11.1 Surface water quality impact assessment. This review highlighted samples for copper and zinc that exceeded the relevant EQS values at both Saltend Jetty and Drypool Bridge although average concentrations tended to be lower when compared to those from Albert Dock.

11.5.56 There are localised areas around the Scheme Site where surface water runoff is discharged directly to Humber Dock which forms part of the Humber Middle water body and as such, the Scheme contributes to the water body's chemical status.

11.5.57 Surface water drainage from the Scheme currently drains via the Yorkshire Water sewer network and the Saltend WwTW before ultimately discharging indirectly to the Humber Lower water body. However, given the dilution and treatment provided by Saltend WwTW and its sewerage network, the impact of the Scheme on water quality within the Humber Lower water body has not been assessed.

11.5.58 The eastern most part of the study area falls within the catchment of the River Hull from Arram Beck to Humber water body (GB104026067212). However, the are no surface water courses in this water body and within the study area that affected by the Scheme. Where the River Hull falls within the study area it is designated as

[226] Highways Agency (2009). Design Manual for Roads and Bridges, Volume 11, Section 3, Part 10, HD45/09, Road Drainage and the Water Environment. Available online at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/hd4509.pdf

[227] The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015

part of the Humber Middle water body. As such, the River Hull from Arram Beck to Humber water body has not been considered in the assessment.

Water quality monitoring – 2013 ground investigation

11.5.59 The results of surface water quality sampling between August 2013 and August 2014 on surface waters within the study area showed concentrations of dissolved inorganic nitrogen (approximately equivalent to the sum of nitrate, nitrite and ammoniacal nitrogen) exhibited widespread exceedances of the EQS. Further details can be found in Volume 3, Appendix 11.1 Surface water quality impact assessment.

11.5.60 Concentrations of dissolved zinc exceeded the EQS 25 times out of 39 in the water quality sampling. Dissolved arsenic concentrations exceeded the EQS in all water quality samples and dissolved copper displayed widespread exceedances of the EQS.

11.5.61 Other chemical parameters included in the 2016 WFD RBMP assessment and used in the HAWRAT assessment (see HD45/09) were not found to exceed the EQS.

Ecosystems – designations

11.5.62 The Humber Estuary is a Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar site. More details can be found in Chapter 10 Ecology and nature conservation.

11.5.63 The Humber Estuary SSSI (1044527) is designated for its nationally important habitats, including intertidal mudflats, sandflats, coastal saltmarsh, saline lagoons, sand dunes and standing waters. The range of salinity, substrate and exposure to wave action influences the estuarine habitats and range of species that utilise them. The unit closest to the Scheme Site (unit 184) comprises littoral sediments. This unit is unfavourable recovering due to low dissolved oxygen concentrations. Reduction of the dissolved oxygen sag has been a priority of the Environment Agency through the recent Review of Consents work.

11.5.64 The Humber Estuary SAC (UK0030170) is primarily designated for its estuary, and mudflats and sandflats not covered by seawater at low tide. The SAC does not meet its objectives due to water quality, namely water pollution due to diffuse sources and discharges.

11.5.65 The Humber Estuary SPA (UK9006111) is designated primarily for migratory birds. Key issues to the vulnerability of the SPA are listed as including coastal squeeze (reduction in coastal habitat due to the presence of a fixed land boundary such as a sea wall and rising sea levels), impacts on the sediment budget and geomorphological structure and function of the Estuary (due to flood defence works as well as other influences), changes in water quality (namely water pollution due to discharges) and flows. Coastal squeeze is being addressed

through the development and implementation of the Humber Flood Risk Management Strategy[228].

11.5.66 Ramsar sites are wetlands of international importance designated under the Ramsar Convention. The Humber Estuary Ramsar Site (UK11031) is designated for a number of bird species.

11.5.67 Due to the SSSI, SAC, SPA and Ramsar designations the Humber is of Very High importance in terms of biodiversity. Further consideration of the ecology and ecosystems included in the above designations is included in Chapter 10 Ecology and Nature Conservation.

11.5.68 The downstream portion of Fleet Drain adjacent to the proposed compound site is within the Humber Estuary Ramsar site, SSSI, SPA and SAC and, as such, is of very high importance in terms of biodiversity.

Ecosystems – WFD status

11.5.69 The Humber Middle water body also incorporates Albert Dock, Humber Dock (but not Railway Dock), Princes Dock and the lower reaches of the River Hull. Although the current status of the fish population is considered to be good, with the tidal regime (freshwater flow) supporting good, the overall ecological potential is considered to be moderate. This is due to water quality, namely dissolved inorganic nitrogen which has a moderate status and biological quality elements, specifically angiosperms, only achieving moderate potential. There is a localised area adjacent to the proposed Princes Quay Bridge where surface water runoff flows directly to Humber Dock. As such, this contributes to the water body's ecological status.

11.5.70 The objective for dissolved inorganic nitrogen is to maintain moderate status as measures to achieve good status were considered to be disproportionately expensive due to the cost required to identify and reduce nitrogen pollution from diffuse pollution sources. The overall ecological potential is not predicted to increase, with objectives from the 2016 Cycle 2 WFD remaining at moderate due to it being disproportionately expensive and technically infeasible. However, the predicted status for 2027 for angiosperms is good. Mitigation measures listed include the following:

- Preserve and where possible enhance ecological value of marginal aquatic habitat, banks and riparian zone
- Managed realignment of flood defence

[228] Environment Agency (2008). The Humber Flood Risk Management Strategy. Summary Document. March 2008. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/308281/Humber_Strategy_Summary.pdf

- Removal of hard bank reinforcement / revetment, or replacement with soft engineering solution

11.5.71 The Scheme discharges indirectly to the Humber Lower water body via the Yorkshire Water sewer network and the Saltend WwTW. However, given the size, and hence the degree of dilution within the wider sewer network, together with the treatment provided at Saltend WwTW, the Scheme area is not considered to affect the water body's ecological status.

11.5.72 The current status of biological quality elements (invertebrates) in the Fleet Drain water body is considered to be bad with physico-chemical quality elements moderate and hydromorphological elements supporting good status. The moderate status of physico-chemical quality is limited by poor dissolved oxygen status which has been attributed to sewer misconnections contributing domestic waste water to Fleet Drain. The bad status of invertebrates is linked to urban and transport runoff.

Surface water abstractions and consented discharges

11.5.73 There are no licensed or unlicensed surface water abstractions within the study area.

11.5.74 The nearest abstractions are located at the Clough Road Industrial Area, 2 to 3km to the north of the Scheme Site, abstracting from the River Hull or the Beverley and Barmston Drain (a tributary of the River Hull). These abstractions are located upstream of the Scheme Site Boundary.

11.5.75 Two licensed surface water abstractions are located at Saltend and King George Dock, nearly 5km to the east of the Scheme Site and abstracting from the Humber Estuary, downstream of the Scheme. These abstractions are more relevant to consider and are detailed further in Table 11.8: Licensed surface water abstractions downstream of the Scheme. Both abstractions are used for cooling purposes only and therefore the Humber is of low importance in terms of water supply.

11.5.76 There are no surface water supply abstractions associated with the River Hull although there is one consented discharge associated with the River Hull downstream.

Table 11.8: Licensed surface water abstractions downstream of the Scheme

Licence number	NGR	Licence holder	Description	Watercourse	Maximum abstraction rate (m3)
2/26/32/078	TA 141 284	B P Chemicals (UK) Ltd, the Utilities Section, Saltend, Hedon, Hull	Industrial, Commercial and Public Services – Chemicals. General Cooling (existing	Humber Estuary – Saltend and King George Dock	12,697,243.7 (annual) 36,005 (daily) 1,500 (hourly)

Licence number	NGR	Licence holder	Description	Watercourse	Maximum abstraction rate (m3)
			licences only) (low loss)		
2/26/32/326	TA 150 284	Hull Bulk Handling Ltd, Fernwood House, Fernwood Drive, Main Road, Watnall, Nottingham	Industrial, Commercial and Public Services – Dust Suppression	Humber Estuary - Queen Elizabeth Dock	250,000 (annual) 2,500 (daily)
2/26/33/028	TA 149 287	Saltend Cogeneration Co, Level 20, Canada Square, London	Industrial, Commercial and Public Services – Chemicals – General cooling	Humber Estuary – King George Dock	26,280,000 (annual) 72,000 (daily)
2/26/33/033	TA 1427 2906	Aarhuskarlshamn Plc, Kind George Dock, Hull	Industrial, Commercial and Public Services – Food and Drink. Non-evaporative Cooling	Humber Estuary – Saltend and King George Dock	7,884,000 (annual) 21,600 (daily) 900 (hourly)

11.5.77 Table 11.9 summarises the consented discharges to surface water within the study area.

Table 11.9: Consented discharges to surface water

Consent number	NGR	Description	Receiving watercourse	Discharge rate	Approximate distance from Scheme
WRA7647	TA 1021 2827	Salt water effluent from filter backwash arising from recirculation of public aquarium exhibition tanks at The Deep	River Hull	20 m3/d	190m southeast (d/s)
WRA7783	TA 0804 2712	Emergency sewage discharge from Hull (west) Sewage Pumping Station	Humber Estuary	N/A	1.3km southwest (u/s)
WRA8021	TA 1063 2829	Emergency sewage discharge from Pilots Way Sewage Pumping Station	Humber Estuary	N/A	605m east (d/s)

Consent number	NGR	Description	Receiving watercourse	Discharge rate	Approximate distance from Scheme
YWUCD2/53	TA0339726056	Storm sewage discharge from Ferry Road CSO	Fleet Drain	N/A	(distance from Livingstone Road compound 386m upstream)
WRA8011	TA0253025270	Emergency sewage discharge from Cliff Bridge SPS	Humber Estuary	N/A	(distance from Livingstone Road 1.08km upstream)
WRA7466	TA1143028470	Trade discharge from Mauri Products Ltd	Humber Estuary	30l/s	1.2km downstream
WRA7880	TA1173028620	Treated sewer from Keystore Ltd	Humber Estuary	1.5m3/d	1.2km downstream
3163	TA1215028250	Treated sewer from Shed K	Humber Estuary	N/A	1.9km downstream

11.5.78 The discharge points for consents WRA7647 and WRA8021 are located within 1km downstream of the Scheme. Although WRA7647 discharges to the River Hull, this is at the confluence with the Humber and can therefore be considered to be downstream of the Scheme on the Humber. Due to the size and intermittent nature of the discharges in relation to tidal flows, the Humber's river flows are of low importance in terms of dilution.

11.5.79 The discharge of final effluent from Saltend WwTW is outside the study area, immediately downstream of Saltend and King George Dock and approximately 5km to the east of the Scheme Site.

Economic and social uses

11.5.80 The Humber Estuary is a major port and provides access to many docks that are a major regional source of employment. Albert Dock is used as a landing point for the Hull fishing industry. The Humber Estuary is also home to several marinas and small boat clubs. It is of very high importance in terms of economic value and high importance in terms of recreation.

11.5.81 The Humber and Railway Docks are active marinas making up the Hull Marina, which in total can accommodate 220 permanent moorings plus 20 additional temporary moorings. It is therefore of very high importance in terms of recreation and human health, and high importance in terms of value to the economy.

11.5.82 Princes Dock is now an ornamental water feature in the Princes Quay Shopping Centre. From consultation with British Waterways Marina Limited, it is believed that Princes Dock is now hydrologically isolated from the Humber Dock, despite their historic connection. However, it is of very close proximity to the Scheme Site and its water quality should therefore be considered, albeit as low importance.

11.5.83 Albert Dock is a major commercial dock and is used as a landing point for the Hull fishing industry. It is therefore of very high importance in terms of economic value. Due to the presence of construction compounds and the location of the proposed tidal outfall in close proximity, Albert Dock should be considered as a receptor with very high importance for economic and social uses.

11.5.84 There are no areas designated for the protection of economically significant aquatic species (freshwater fish and shellfish) identified within the study area. The nearest designated shellfish waters are located approximately 40km downstream from the Scheme Site at the mouth of the Estuary. However, these are sufficiently far enough downstream to not be impacted by the Scheme. These shellfish waters are not considered further in the impact assessment.

11.5.85 Fleet Drain is a minor watercourse which has no navigational or commercial use, although there is potential recreational use for the local community. Fleet Drain is therefore of low importance for economic value, recreation and human health.

11.5.86 There are no bathing waters within the study area. The nearest bathing waters are approximately 30km east of the Scheme Site, near the mouth of the Humber Estuary. However, these are sufficiently far enough downstream to not be impacted by the Scheme. These bathing waters are not considered further in the impact assessment.

11.5.87 The main surface water receptors considered in the impact assessment are summarised in Table 11.10, in line with definitions provided in Table 11.1.

Table 11.10: Summary of importance and quality of surface water attributes

Feature	Attribute	Indicator of quality	Importance
Humber Estuary	Water quality	WFD water quality required to maintain moderate overall status	Medium
	Water supply	Location and usage of surface water abstractions located 5km downstream and used for cooling purposes only.	Low
	Dilution and removal of waste products	Emergency (i.e. intermittent) sewage discharges located more than 500m away both upstream and downstream. Consented discharge (rate 20m3/d) downstream of the Scheme Site.	Low
	Biodiversity	SSSI, SAC, SPA and Ramsar protected area. WFD biological water quality status required to achieve good ecological potential by 2027.	Very high

Feature	Attribute	Indicator of quality	Importance
	Value to the economy	The Humber Estuary is a major port and provides access to several docks, the location of many active employers.	Very high
	Recreation and human health	Access to the Humber Dock marina.	High
River Hull	Water quality	WFD water quality required to moderate overall status	Medium
	Dilution and removal of waste products	Consented discharge (rate 20m3/d) located 190 m southeast and downstream of the Scheme Site.	Low
	Biodiversity	WFD biological water quality status required to achieve good ecological potential by 2027.	High
	Value to the economy	Commercial navigation and mooring along the River Hull.	High
	Recreation and human health	Footpaths adjacent to parts of the River Hull.	Medium
Fleet Drain	Water quality	WFD water quality required to meet good overall status by 2027.	High
	Water supply	No abstractions within 1km of the site compound Livingstone Road.	Low
	Dilution and removal of waste products	Emergency (i.e. intermittent) sewage discharges located more than 500m away. Consented discharges (discharge rate 20m3/d) located 190m east of the Scheme Site. Consented discharge point located 380m from site compound Livingstone Road.	Low
	Biodiversity	SSSI, SAC, SPA and Ramsar protected area. WFD biological water quality status required to achieve good ecological potential by 2027.	Very high
	Value to the economy	Fleet Drain is not navigable, is not used for commercial activities nor fishing.	Low
	Recreation and human health	Fleet Drain used only for local amenity.	Low
Albert Dock	Water quality	WFD water quality required to maintain moderate overall status	Medium
	Biodiversity	WFD biological water quality status required to achieve good ecological potential by 2027	High
	Recreation and human health	Public access to Albert Dock is restricted to employees of local businesses	Low
	Value to economy	Albert Dock is a major commercial port and source of employment in the area	Very high
Humber and Railway Docks	Water quality	WFD water quality required to maintain moderate overall status	Medium
	Biodiversity	WFD biological water quality status required to achieve good ecological potential by 2027	High
	Recreation and Human health	Public access to and use of marina	Very high

Feature	Attribute	Indicator of quality	Importance
	Value to economy	220 boat moorings	High
Princes Dock	Water quality	Hydrologically isolated ornamental water feature WFD water quality required to maintain moderate overall status	Medium
	Biodiversity	WFD biological water quality status required to achieve good ecological potential by 2027	High
	Recreation and human health	Hydrologically isolated ornamental open water feature part of Princes Quay Shopping Centre	Low
	Value to economy	Princes Dock is an ornamental open water feature part of Princes Quay Shopping Centre. Believed to be hydrologically isolated from Humber Dock.	Low
Humber Floodplain	Conveyance of flow	Numerous residential, commercial and industrial properties lie in floodplain adjacent to Scheme area protected by flood defences. Extent of flooding within the study area affected by Scheme. All construction site compounds are protected by flood defences except the Livingstone Road site compound.	Very high
		Construction site compound at Livingstone Road is not protected by the flood defence.	Medium

Groundwater

Hydrogeology

11.5.88 The description of the existing groundwater environment (referred to as the baseline hydrogeological conceptual model) focuses on the Scheme area but also considers the wider Hull area, as shown in Volume 2, Figure 11.2 Groundwater features. A plan of the WFD groundwater body can be found at Volume 2, Figure 11.5. Details of licensed groundwater abstractions within this study area have been collated as part of this assessment.

11.5.89 The baseline hydrogeological conceptual model summarised below is described in more detail in Volume 3, Appendix 11.4 Groundwater report, briefly summarised below and presented in Volume 2, Figure 11.3 Hydrogeological conceptual model.

11.5.90 The geological sequence roughly comprises a series of aquifers and aquitards (geological units that have low permeability and restrict groundwater flow) within the superficial deposits, which are between 20 and 30m thick. The superficial deposits overlie the Chalk bedrock aquifer. The sequence comprises (in rough stratigraphic order, with the most recent unit first):

- Made ground (aquifer or aquitard depending on material composition)
- Cohesive alluvium (aquitard)
- Granular alluvium (aquifer)

- Glacial till (aquitard)
- Glaciolacustrine deposits (aquitard)
- Fluvio-glacial deposits (aquifer)
- Chalk bedrock (aquifer)

11.5.91 In reality, the geological sequence is more complex than this, as are the hydrogeological properties of, and hydraulic relationships between the different units. For example, the cohesive alluvium or glacial till may contain thin, more permeable horizons, and the granular alluvium is only present across the eastern half of the Scheme Site, within an alluvial channel feature.

11.5.92 The made ground is typically dry although perched groundwater is occasionally present, with water levels often less than 2m below ground level (bgl). The nature of the made ground suggests that perched aquifers are laterally and possibly vertically discontinuous.

11.5.93 Other than the made ground, the permeable superficial deposits are generally confined, although there may be some localised unconfined units. Groundwater heads are typically between -0.5 and 2 m above ordnance datum (AOD) within the superficial deposits overlying the fluvio-glacial deposits. Within the fluvio-glacial deposits, which directly overlie and are in hydraulic continuity with the Chalk, the range is typically -1.0 to 2.5m AOD due to the tidal impact.

11.5.94 The Chalk aquifer is confined and has a strong tidal influence reflected in groundwater heads, which varied by up to 4m over the monitoring period, from -1.5 to 2.5m AOD. The lag time between high tide in the Humber Estuary at Albert Dock and the peak tidal impact in the Chalk within the Scheme footprint is between around 50 and 60 minutes. There is evidence of heterogeneity with respect to aquifer properties within the Chalk aquifer in this area, which means that the tidal response is variable.

11.5.95 Neither the Chalk nor the superficial deposits have exhibited an obvious response to short term recharge events or seasonal recharge during the monitoring period and are thought to be recharged indirectly.

11.5.96 In general, the local hydraulic gradient in the Chalk (within the Scheme area) is slightly to the north during high tide, and slightly to the south during low tide. Monitoring to date suggests that regional groundwater flow across the wider Hull area is generally to the south, towards the Humber Estuary.

11.5.97 Similarly, monitoring to date does not indicate a measurable lateral hydraulic gradient in any of the superficial deposits, except in the granular alluvium across the eastern part of the Scheme area. Here, the hydraulic gradient appears to have an east to west component, although it is assumed that there may also be a north-south component along the course of the alluvial channel feature.

11.5.98 The vertical hydraulic gradient between the superficial deposits and the Chalk is generally slightly downwards, although the gradient reverses depending on the state of the tide. The hydraulic gradient within the superficial deposits (glaciolacustrine deposits and above) is also generally slightly downwards. The data suggests that leakage between aquifer units is minimal except where the more impermeable superficial deposits thin towards the eastern end of the Scheme Site Boundary.

11.5.99 Although the Chalk and Humber Estuary are known to be in hydraulic continuity, there is little information that confirms the degree of hydraulic connection between the two. However, it is thought that clogging of the Estuary bed by fine material as a consequence of saline intrusion in response to heavy exploitation of the aquifer means that there is now only little leakage between the two. Depending on the hydraulic gradient, the Chalk will either provide some baseflow to the Estuary or be susceptible to further saline intrusion. Although the degree of connection is not understood well, the importance of the Chalk aquifer in terms of conveyance of flow has been classified as very high due to the designated status of the Humber Estuary

11.5.100 Groundwater from the permeable superficial deposits may also provide baseflow to the Humber Estuary, although this is likely to be very limited due to their limited storage, and the presence of aquitards. Again, the designated status of the Humber Estuary dictates that the importance of the superficial deposits in terms of conveyance of flow is classified as very high, despite the likely very limited connection between the two.

11.5.101 In summary, the geology and hydrogeology of the Scheme area and the wider Hull area is complex, particularly in terms of the superficial deposits. Key groundwater issues that could potentially affect the Construction and Operation Phases of the Scheme are the high groundwater heads (approaching ground level) in both the Chalk and superficial deposits, substantial heterogeneity in terms of aquifer properties and the degree of hydraulic continuity between aquifer units, and the strong tidal influence.

11.5.102 There is limited geological and hydrogeological information outside the Scheme area, which implies some uncertainty with respect to the hydrogeological conceptual model, particularly in terms of hydraulic gradients across the wider Hull area and the degree of leakage between the Chalk and superficial deposits, and the Humber Estuary.

11.5.103 Notwithstanding the above constraints, the Environment Agency has confirmed that it is satisfied in principle with the investigation that has been undertaken and the conclusions drawn from this, including the groundwater modelling approach.

Groundwater quality

11.5.104 The Chalk groundwater quality is representative of a confined aquifer with reducing conditions that has been subject to modern saline intrusion (due to over-abstraction) as well as a component of paleo saline groundwater.

11.5.105 Water quality in the superficial deposits is also representative of generally (though not always) reducing conditions and there is evidence of mixing with saline water. Water quality in the superficial deposits, particularly in the made ground, has also been affected by former land uses.

11.5.106 Elevated concentrations of total petroleum hydrocarbons (TPH) and polyaromatic hydrocarbons (PAH) have been recorded in perched groundwater within the made ground at some locations, which is attributed to historic land uses.

11.5.107 Copper has been recorded as being elevated above the DWS in groundwater within the Chalk and superficial deposits at comparable concentrations to those reported for the docks.

11.5.108 Elevated concentrations of other metals such as arsenic, boron, iron, manganese, chromium, nickel and selenium are comparable with those found elsewhere within the confined Yorkshire Chalk aquifer.

11.5.109 Ammoniacal nitrogen concentrations are consistently higher within the superficial deposits than the Chalk. This is likely to be due to the anaerobic degradation of organic material present within the superficial deposits (peat and organic-rich clay). The elevated ammonium concentrations coupled with relatively low concentrations of nitrate are indicative of a reducing environment in the confined Chalk and superficial deposits.

11.5.110 The electrical conductivity of groundwater within both the superficial deposits and Chalk is sufficiently high to be potentially corrosive to wrapped steel or wrapped ductile iron pipes.

Aquifer designations

11.5.111 The superficial deposits underlying Hull are not designated as an aquifer and are classed by the Environment Agency as unproductive strata that have negligible significance for water supply or river base flow. However, the 2013 ground investigation and earlier investigations show that permeable horizons of reasonable thickness and extent are present, and therefore the importance of groundwater supply for the superficial deposits has been classified as medium to low.

11.5.112 The Chalk underlying Hull is classed as a principal aquifer. The Environment Agency's Approach to Groundwater Protection[229] uses aquifer designations that have been consistent with the WFD since 2010. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems. Principal aquifers are classed as layers of rock or drift deposits that have high intergranular and / or fracture permeability, meaning they usually provide a high level of water storage. They may support water supply and / or river base flow on a strategic scale.

11.5.113 The Humber RBMP, published in 2009, identifies the Chalk in this area as Water body ID GB40401G700700 (Hull and East Riding Chalk). The Cycle 2 (2016) review classified the quantitative and chemical status of this groundwater body as poor due to saline intrusion, with an objective to achieve good qualitative status and good chemical status by 2027. The groundwater body is designated as a DrWPA, with a non-statutory groundwater Safeguard Zone established around Hull for nitrates.

11.5.114 Although the Scheme Site Boundary itself does not lie within a NVZ, one of the site compound sites to the west are situated within NVZ G106 (Yorkshire Chalk).

11.5.115 Despite the currently poor status of the groundwater body, the Chalk is classed as a principal aquifer providing a strategically important resource, and the importance of Chalk aquifer in terms of both groundwater supply and groundwater quality is considered to be very high.

11.5.116 The Environment Agency's groundwater vulnerability classification for the Chalk underlying central Hull and the Scheme Site Boundary is low due to the soil and overlying geology, which will limit the transport of contaminants to the Chalk. Along the banks of the Humber Estuary and at two of the site compounds, the Chalk vulnerability is classified as medium-high.

11.5.117 The superficial deposits are classed as unproductive strata and therefore have no vulnerability classification. The low permeability of the made ground and cohesive alluvium will limit transport of pollutants to underlying permeable horizons such as the granular alluvium.

Groundwater dependent terrestrial ecosystems

11.5.118 There are no groundwater dependent terrestrial ecosystems in the vicinity of the Scheme Site.

[229] Environment Agency (2018) The Environment Agency's Approach to Groundwater Protection. Version 1.2. Available online at:: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/692989/Envirnment-Agency-approach-to-groundwater-protection.pdf

Groundwater abstractions

11.5.119 In the first half of the 20th century, many industries in the Hull area relied on their own boreholes for water supply, and these coupled with public water supply groundwater abstractions resulted in saline intrusion within the Chalk aquifer. Many of these boreholes have now been abandoned and the remaining groundwater abstraction in the region is managed to ensure that the saline front is stable or retreating.

11.5.120 The Chalk underlying Hull is included in Groundwater Management Unit (GWMU) South in the Environment Agency's Hull and East Riding Abstraction Licensing Strategy[230]. Water is available for licensing but restrictions will be placed on licences to protect both groundwater and surface water resources, as well as to minimise the risk of saline intrusion.

11.5.121 The Scheme Site lies within source protection zone (SPZ) 3; total catchment for four large public water supply groundwater abstractions located between 5 and 8 km to the north-west, and one industrial use abstraction located approximately 1 km to the north-west. A SPZ3 is defined as the area around a source within which all groundwater recharge is presumed to be discharged at the abstraction and it therefore represents the total catchment of that abstraction.

11.5.122 Details of licensed groundwater abstractions within the study area are summarised in Table 11.11 based on information obtained from Environment Agency, and their locations are shown in Volume 2, Figure 11.2 Groundwater features.

11.5.123 Further licensed groundwater abstractions are located within the public water supply SPZ3, although these are mostly licensed to abstract one Ml/d (1000m3/d) or less and are located sufficiently far away that the Scheme does not fall within their catchments (assumed to be a 1km radius from the abstraction for the purpose of this assessment). Only the Hull Truck Theatre Company Ltd borehole is less than 1km from the Scheme Site Boundary.

11.5.124 HCC is not aware of any unlicensed groundwater abstractions within the study area.

Table 11.11: Licensed groundwater abstractions within the study area

Licence number	Name	Use	Aquifer	Grid reference	Max daily quantity (m3/d)
2/26/32/026	Stadium (Vicar Lane) Ltd	Agriculture (Horticulture and Nurseries) - Spray Irrigation Direct	Chalk	TA 0580 3310	122.7

[230] Environment Agency (2013). Hull and East Riding Abstraction Licensing Strategy. Reference LIT 7867. Available online at:: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/305452/lit_7867_a7b9fe.pdf

Licence number	Name	Use	Aquifer	Grid reference	Max daily quantity (m3/d)
2/26/32/045	Anchor Nurseries Ltd	Agriculture (Horticulture and Nurseries) - Spray Irrigation Direct	Chalk (two boreholes)	TA 0694 3640 TA 0701 3641	273
2/26/32/053	Lawson	Agriculture (General) - Spray Irrigation Direct	Superficial deposits	TA 0423 3364	68.2
2/26/32/059	Ideal Standard Manufacturing (Uk) Ltd	Industrial, Commercial and Public Services (Machinery and Electronics) - General Use (medium loss)	Chalk	TA 0620 3005	700
2/26/32/087	Wheldon Nurseries	Agriculture (Horticulture and Nurseries) - Spray Irrigation Direct	Superficial deposits	TA 0720 3670	109.1
2/26/32/126	Yorkshire Water Services Ltd	Water Supply (Public) - Potable Water Supply	Chalk (four adit sources)	TA 02 33 1 TA 04 29 1 TA 04 34 1 TA 06 35 1	10,0000
2/26/32/134	Keygrowing Ltd	Agriculture (Horticulture and Nurseries) - Spray Irrigation Direct	Chalk	TA 0640 3650	600
2/26/32/204	Sewell	Amenity (Private Non-Industrial) - Make-up or Top Up Water	Chalk	TA 0430 3360	68
2/26/32/206	C H Plaxton and Co	Agriculture (General) - Spray Irrigation Direct	Chalk	TA 0700 3620	90.9
2/26/32/217	Keygrowing Ltd	Agriculture (Horticulture and Nurseries) - Spray Irrigation Direct	Chalk	TA 0627 3633	340
2/26/32/235	Glen Avon Services	Agriculture (Horticulture and Nurseries) - Spray Irrigation Direct	Chalk	TA 0417 3393	450
2/26/32/265	Twinacre Nurseries Ltd	Agriculture (Horticulture and Nurseries) - Spray Irrigation Direct	Chalk	TA 0293 3224	23
2/26/32/279	J Lancaster and Son	Agriculture (Horticulture and Nurseries) - Spray Irrigation Direct	Chalk	TA 0650 3650	114
2/26/32/288	Coletta and Tyson Ltd	Agriculture (General) - Spray Irrigation Direct	Chalk (two boreholes)	TA 0560 3550 TA 0560 3550	381.2

Licence number	Name	Use	Aquifer	Grid reference	Max daily quantity (m3/d)
2/26/32/344	Coletta and Tyson Ltd	Agriculture (Horticulture and Nurseries) - Spray Irrigation Direct	Chalk	TA 0710 3675	140
2/26/32/423	Hull Truck Theatre Co Ltd	Industrial, Commercial and Public Services (Other) - Non-Evaporative Cooling	Chalk	TA 0895 2920	168
NE/026/0032/024	Coletta and Tyson Ltd	Agriculture (Horticulture and Nurseries) - Spray Irrigation Direct	Chalk	TA 05131 34361	160
NE/026/0032/025	Coletta and Tyson Ltd	Agriculture (Horticulture and Nurseries) - Spray Irrigation Direct	Chalk	TA 06917 35233	82
NE/026/0032/026	Coletta and Tyson Ltd	Agriculture (Horticulture and Nurseries) - Spray Irrigation Direct	Chalk	TA 06800 36300	82
NE/026/0032/033	Kirk	Agriculture (General) - Spray Irrigation Direct	Chalk	TA 05370 33640	91
NE/026/0032/035	J P Colbridge Ltd	Agriculture (Horticulture and Nurseries) - Spray Irrigation Direct	Chalk	TA 03898 33899	250
NE/026/0032/046	Red Roofs Nursery Ltd	Agriculture (General) - Spray Irrigation Direct	Chalk	TA 05012 34586	200
NE/026/0032/048	Durnford	Agriculture (Horticulture and Nurseries) - Heat Pump	Chalk (two boreholes)	TA 05650 34215 TA 05677 34252	1,920

Notes: [1] Detailed grid references not provided by Environment Agency

Buildings and infrastructure

11.5.125 The Scheme is situated within a heavily built up area of Hull with domestic, industrial and commercial buildings in very close proximity to the existing A63. The details of the building foundations are not known but are assumed to consist of a mixture of shallow ground bearing slab foundations, timber piles and some deeper piles (depending on the age and type of building).

11.5.126 Subsidence due to changes in groundwater heads over and above natural variations is a risk given the geotechnical properties of the ground and the cohesive alluvium in particular. In addition to drawdown arising from dewatering operations, groundwater flooding could occur if below ground structures

associated with the Scheme, and the underpass in particular, act as barriers to groundwater flow.

11.5.127 Groundwater quality changes could also potentially impact on buildings and infrastructure if, for example, the groundwater becomes more aggressive or contaminant migration occurs.

Railway Dock, Albert Dock and Humber Dock

11.5.128 The walls of all three docks are thought to be lined and therefore likely to be largely isolated from groundwater within the superficial deposits except perhaps through their bases (unless there is also significant seepage through the walls). They do not rely on groundwater to maintain water levels.

Cultural heritage

11.5.129 Potential impacts due to groundwater level changes on buried archaeological features are considered in Chapter 8 Cultural heritage.

Summary of groundwater receptors

11.5.130 Groundwater receptors considered in the impact assessment are summarised in Table 11.12, in line with the definitions provided in Table 11.1.

Table 11.12: Summary of Importance and quality of groundwater receptor attributes

Feature	Attribute	Indicator of quality	Importance
Chalk Aquifer	Groundwater Supply / Quality	Principal aquifer and DrWPA status, regionally important for supply. WFD water body target to achieve Good by 2027.	Very high
	Vulnerability	Low groundwater vulnerability over the Scheme Site Boundary and medium-high vulnerability at two site compounds.	Medium - low
	Economic Value	SPZ3 for public water supply and industrial abstractions.	Medium
	Conveyance of Flow	Chalk may provide baseflow to the Humber Estuary SAC / SPA / Ramsar /SSSI Sites.	Very high
	Biodiversity	Humber Estuary SAC / SPA / Ramsar and SSSI protected area. Humber Middle water body WFD target status objective for Moderate status by 2027.	Very high
Superficial Deposits	Groundwater Supply / Quality	Unproductive strata with poor groundwater quality. Permeable horizons present.	Medium - low
	Vulnerability	Shallow low permeability horizons protect underlying superficial deposits.	Low
	Economic Value	Domestic, industrial and commercial properties (between 10 and 100) within zone of influence	High

Feature	Attribute	Indicator of quality	Importance
		and with foundations intersecting superficial deposits. Archaeological features are present, particularly in the made ground.	
	Conveyance of Flow	Limited potential hydraulic connection with the docks, River Hull and Humber Estuary SAC / SPA / Ramsar / SSSI Sites. Granular alluvial deposits, where present across the eastern part of the Scheme, have limited hydraulic connection with the underlying Chalk.	Very high
	Biodiversity	Humber Estuary SAC / SPA / Ramsar and SSSI protected area Humber Middle water body WFD target status objective for Moderate status by 2027.	Very high

11.6 Mitigation

11.6.1 Mitigation measures include those inherent in the design and those that would be implemented during the construction and operation of the Scheme. The potential impacts identified in Section 11.6 assume that the mitigation measures described below are in place.

Construction

Construction design mitigation

11.6.2 Special consideration has been given to the groundwater risks associated with the Scheme and the preliminary design takes these into account to provide mitigation within the context of the findings of the 2013 and 2015/16 ground investigation (see Volume 3, Appendix 11.4 Groundwater report, Annex A). Particular issues are the low strength of the ground and the high groundwater heads. Ground conditions are described in Chapter 12 Geology and soils, while the preliminary design is described in Chapter 2 The Scheme.

11.6.3 The structure most likely to impact the groundwater regime is the underpass beneath Mytongate Junction, which would be approximately seven metres deep at maximum dredge. An indicative section along the mainline of the underpass is shown in Volume 2, Figure 11.3 Hydrogeological conceptual model. The retaining walls and cut-off walls at both ends of the excavation would comprise diaphragm walls embedded in the fluvio-glacial deposits and Chalk to effectively form a box. The diaphragm walls would be designed to prevent excessive settlement and groundwater mounding behind them and excessive groundwater entry into the excavation.

11.6.4 The excavation would intersect made ground, cohesive alluvium and glacial till, and a small amount of granular alluvium. Ground stabilisation works are proposed in the form of jet grouting and potentially soil mixing. A top down method of

construction is proposed, so that the underpass 'box' is excavated into stabilised ground to minimise dewatering requirements and the likelihood of ground instability. The ground stabilisation works would also minimise groundwater inflow through the base of the excavation and the risk of ground heave prior to base slab construction. Tension pile and bridge pile would be designed to ensure they do not act as a barrier to groundwater flow.

11.6.5 The underpass 'box' would be dewatered to allow construction of a permanent base slab, drainage systems and the carriageway to virtually isolate the underpass from the groundwater system. Tension piles into the superficial deposits, and into the top of the Chalk in the central part of the excavation, would be installed to enable the permanent slab to resist buoyancy.

11.6.6 As part of the enabling works, it is intended that part of the Trinity Burial Ground would be excavated to a depth of around 2mbgl to allow the removal of buried remains below the Scheme. Sheet piles installed along the perimeter of the area for ground stability reasons will also form a groundwater cut-off.

11.6.7 Other construction design mitigation requirements include the inclusion of stanks within rising main and sewer diversion pipe trenches to avoid the creation of preferential flow pathways.

11.6.8 Given the similar hydrogeological and hydrological conditions at the Arco and Staples sites, which are being considered as the potential compound for the jet grouting, bentonite plant and concrete batch plant, the construction design mitigation requirements would be similar for both locations.

Construction Phase mitigation

11.6.9 Measures to control the risk of pollution during construction would be implemented through an OEMP (provided at document reference TR10016/APP/7.3).

11.6.10 Contractors would be required to operate in accordance with the Environment Agency's environmental permitting guidance[231].

11.6.11 Construction Industry Research and Information Association (CIRIA) Environmental Good Practice on Site (2010)[232] guidance should also be taken into account.

11.6.12 All fuel, oil and chemicals would be stored in accordance with the requirements of the Control of Pollution (Oil Storage) Regulations 2001[233] to ensure that fuel, oil

[231] Environment Agency (2018). Discharges to surface water and groundwater: environmental permits. Available online at: https://www.gov.uk/guidance/discharges-to-surface-water-and-groundwater-environmental-permits. Last accessed April 2018.

[232] CIRIA (2010). Environmental Good Practice on Site Guidance. Third Edition.

[233] The Control of Pollution (Oil Storage) (England) Regulations 2001. Available online at: http://www.legislation.gov.uk/uksi/2001/2954/contents/made

and chemicals do not discharge to surface water or groundwater receptors, to protect water quality. Construction plant would be refuelled in designated areas on an impermeable surface, away from drains and watercourses. If any refuelling does need to take place in other areas of the site, a prescribed safe method would be used. An emergency spill plan would be generated and spill kits would be available at appropriate locations.

11.6.13 To protect the water quality of surface water and groundwater receptors, closed drainage systems, oil separators and settlement tanks will be put in place to capture site runoff and to remove oils, chemicals and suspended solids that may be mobilised during construction. Best practice methodologies would be adopted to control discharges to drains and runoff, and discharges to sewer or surface water, including those from construction dewatering, should only be made with the appropriate consents or permits in place. Any non-compliant discharges would be collected and disposed of offsite.

11.6.14 The Scheme involves direct construction within the Humber Dock marina for the piled foundations of Princes Quay Bridge. This activity would require a Marine Licence from the MMO and specific mitigation to control sediment and silt disturbance and the containment of any spills of construction materials would be required. These are outlined in the OEMP.

11.6.15 Other construction best practice approaches would also be adopted, such as covering of stockpiles to avoid the mobilisation of soils, treatment and recycling of water used in the bentonite, jet grouting and concrete batch plants, and use of settlement tanks and kiln driers to treat jet grouting arisings before offsite disposal. Care would be taken when working near existing sewers to avoid damage. The OEMP would also include an erosion prevention and sediment control plan, with the aim of minimising erosion by reducing disturbance, and stabilising exposed materials.

11.6.16 Any buried bentonite slurry and jet grouting supply pipelines would be wrapped in waterproof membrane to avoid any materials entering the ground, should a pipe burst occur.

11.6.17 Mitigation of extreme flooding impacts from tidal, fluvial and pluvial sources during construction should be considered in the OEMP. The construction of the underpass would create excavations where construction workers and plant would be at risk. Standby temporary pumping arrangements may be required to remove any flood water and this would be subject to best practice guidance to control discharges to sewer or surface waters. Emergency and evacuation procedures would be incorporated into the OEMP in response to all sources of flooding and would include use of the Environment Agency Flood Warning service.

11.6.18 The piling methodology should be selected to minimise the potential for alteration of the hydraulic properties of the surrounding ground, down-drag of contaminants and generation of suspended solids so as to avoid cross-contamination between aquifer units. For example, the use of continuous flight auger (CFA) techniques

would significantly reduce the vibration generated by the piling works, and the use of permanent or temporary casing, possibly coupled with reverse circulation drilling would also reduce the migration of fines into the surrounding aquifer.

11.6.19 A piling risk assessment would be undertaken prior to commencement of the works and Environment Agency guidance on minimising pollution risk due to piling would be adhered to[234] [235] [236].

11.6.20 Construction materials should be chosen appropriately to minimise groundwater contamination via direct contact.

11.6.21 Suitable geotechnical monitoring systems would be required to monitor wall movement, settlement and pore water pressures.

11.6.22 A groundwater monitoring plan should also be included in the OEMP and implemented prior to, during and following construction of the underpass to ensure the changes in groundwater heads are within acceptable limits. Groundwater and surface water quality should also be monitored at key locations. The Environment Agency should be consulted about the level of monitoring required.

11.6.23 Groundwater abstractions and discharges required as part of construction dewatering would be carried out under the relevant licences and permits, an in accordance with Environment Agency requirements and the necessary authorisations. Abstraction exceeding 20m^3/d for dewatering purposes (excluding the contribution from direct rainfall to the excavation that would previously have infiltrated into the ground) may require an abstraction licence. The Environment Agency would need to be satisfied that there would be no significant adverse impacts on groundwater receptors or the receiving water bodies before these are granted.

11.6.24 Groundwater would be pumped from excavations into lagoons / settlement tanks to enable sediment to drop out, and if necessary, sediment removal would be aided by the addition of flocculants. After sediment removal, water would be discharged to a sewer or watercourse subject to appropriate consents or permits in place.

11.6.25 Given the similar hydrogeological and hydrological conditions at the Arco and Staples sites, which are being considered as the potential compound for the jet grouting, bentonite plant and concrete batch plant, the construction phase

[234] Environment Agency (not dated). Piling into contaminated sites. Available online at: http://webarchive.nationalarchives.gov.uk/20140329082414/http://cdn.environment-agency.gov.uk/scho0202bisw-e-e.pdf

[235] Environment Agency (2001). Piling in layered ground: risks to groundwater and archaeology. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/320701/scho0906bllt-e-e.pdf

[236] Westcott, F. J., Lean, C. M. B & M L Cunningham (2001). Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention. NGWCLC Report NC/99/73. Available at: http://webarchive.nationalarchives.gov.uk/20140329082415/http://cdn.environment-agency.gov.uk/scho0501bitt-e-e.pdf

mitigation requirements would be similar for both locations. As the Arco site is further away from Mytongate Junction, booster pumps would be required on bentonite slurry supply pipelines, which may increase the risk of blockages or equipment breakdown. However, mitigation to avoid materials entering the ground during maintenance and rehabilitation works would reduce this risk at both sites.

Operation

11.6.26 Mitigation to control the risk of pollution to the water environment and flooding during operation of the Scheme has been incorporated into the design of the underpass drainage system, as described in Chapter 2 The Scheme.

11.6.27 The underpass drainage system would incorporate a shut-off valve and below-ground attenuation units to allow isolation and containment of contaminants lost to the drainage system in the event of a major incident or spillage. This would prevent accidental spillages reaching the Humber Estuary or the Yorkshire Water sewer network (depending on the surface water outfall option), thereby protecting the water quality of the receiving water body.

11.6.28 The underpass drainage system design would also incorporate an oil interceptor in line with the Environment Agency's guidance on the oil storage regulations[237].

11.6.29 The underpass drainage would be designed to protect against flooding in a 1 in 100-year return period rainfall event, with a 30% allowance for climate change. This allowance exceeds the current Highways England standard of 20% as outlined in the DMRB HD 33/06[238]. This departure from standard has been agreed in principle with Highways Agency (now Highways England), at the request of the Environment Agency to meet a site-specific situation and in consideration of historic flooding in Hull. At the time of this agreement in 2014, the Environment Agency still had responsibility for planning issues related to surface water / pluvial flooding. Subsequently and following the issue of the updated climate change allowances in 2016[239] and consultation with the LLFA, HCC requested that a 40% allowance for climate change be adopted. In consultation with the Environment Agency and LLFA, it was agreed that a 40% allowance for climate change be included in the design process as part of sensitivity analysis.

11.6.30 The drainage design also accounts for overland flows (external to the Scheme area) entering the underpass and the westbound diverge slip road (which ultimately discharges to the underpass drainage) during such an event.

[237] Environment Agency (2015). Oil storage regulations for businesses. Available online at: https://www.gov.uk/guidance/storing-oil-at-a-home-or-business

[238] Highways Agency (2006). Design Manual for Roads and Bridges, Volume 4, Section 2, Part 3, HD33/06, Surface and Sub-surface drainage systems for highways. Available online at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol4/section2/hd3306.pdf

[239] Environment Agency (2016b). Flood risk assessment: climate change allowances. Guidance to support the NPPF. Available online at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

11.6.31 The at-grade drainage system discharges into existing Yorkshire Water sewers and presents no change over the existing situation, except for the greater (30%) attenuation allowance for climate change.

11.6.32 The at-grade highway surface water flows would be diverted into an underground drainage network by combined kerb drains and existing gullies. The proposed highway drainage would discharge flows into the existing outfalls at the existing (or a reduced) rate. Flows greater than existing rates would be attenuated below ground in oversized pipes to avoid increased flooding of the carriageway.

11.6.33 Maintenance and emergency procedures would be put in place to minimise the risk to road users using the underpass during a flood event. There are traffic diversion routes around the underpass which are predicted to be unaffected during a 1 in 100-year return period rainfall event, with a 30% allowance for climate change.

11.6.34 Water from the underpass drainage would be pumped at a provisional rate of 100 litres per second to the Humber Estuary. Emergency procedures would be developed to minimise the risk to road users should the pump cease to operate due to power failure over an extended period. An alternative power supply source, for example, a standby generator or uninterruptible power supply, would manage the risk of power failure. As an ultimate fall-back position, the systems would ensure sufficient time to implement a road closure. Further details can be found in the Underpass Drainage Strategy Report[240] and the Underpass Flood Detection Technology Options Report[241] .

11.6.35 For extreme tidal flooding events such as those witnessed on 5 December 2013, there is an existing procedure in place whereby flood alerts from the Environment Agency are issued to the Highways England Emergency Planning team at the North East Regional Control Centre (NERCC) who consider an appropriate response, for example, the closure of the underpass. This procedure is currently being reviewed for the Scheme. The Flood Emergency Evacuation Plan Report[242] is appended to Volume 3, Appendix 11.2 Flood risk assessment. A summary of the key aspects of the Plan are provided below:

- Upon receipt of a flood alert, personnel from the Area Maintenance Team (AMT) and key assets (including a high-volume pump owned by Highways England) will be put on ‘standby’ for deployment.
- Upon receipt of a flood warning, the NERCC will monitor the underpass via CCTV, variable message signs (VMS) will be activated to direct traffic away

[240] Arup (2017). Underpass Drainage Strategy Report, September 2017

[241] Arup (2017). Underpass Flood Detection Technology Options, December 2017

[242] Arup (2018). Flood Emergency and Evacuation Plan Report, Draft 1, May 2018

from the underpass and personnel from the AMT will be moved closer to the underpass to put in place a physical road closure, if required.

- Upon receipt of a severe flood warning, the high-volume pump will be moved to the underpass and a physical road closure will be put in place by the AMT personnel. VMS will direct traffic away from the underpass and long pre-agreed strategic diversion routes. The underpass will be monitored via CCTV.

- All relevant measures outlined above would remain in place until a 'Warnings no longer in force' notification is issued by the Environment Agency.

- The underpass pumping station would have high volume alarms to alert the NERCC to pump failure, which would trigger the above closure responses, if required. This would only be required in the event of a failure of all other warnings and would provide a last chance warning of flooding of the underpass.

- The plan would be under the ownership of Highways England with a review every 2 years.

11.6.36 The flood defences at Albert Dock have been upgraded by the Environment Agency in 2015 which provides a 1 in 100 to 1 in 200-year standard of protection[181]. Furthermore, there are current proposals to upgrade remaining sections of the Humber North Bank flood defences as part of the £42m Humber Hull Frontages projects[243]. The standard of protection of the Scheme would be for a return period of 1 in 200 years with an allowance for climate change to the 2040s[197]. The remaining climate change allowance would be accounted for with a 'managed adaptive approach' which would allow for easier upgrading of the defences in the future. Further details will be provided in line with Volume 3, Appendix 11.9 Additional flood risk information requirements.

11.6.37 The Scheme lies within a heavily urbanised area with no opportunity for alternative drainage options within the design, such as soakaways and other SuDs features, due to limited space availability (e.g., around the at grade highway drainage) or due to the reduction in proposed ground levels in the underpass.

11.6.38 The rising main pipe trench would include stanks to avoid the bedding becoming a conduit for groundwater flow and mobilisation of existing contamination. Granular fill within the pipe trench would prevent the rising main from acting as a barrier to flow where it is perpendicular to groundwater flow.

[243] Construction Enquirer (2018). Green light for £42m Humber flood scheme, January 2018. Available online at: http://www.constructionenquirer.com/2018/01/09/green-light-for-42m-humber-flood-scheme/.

11.6.39 The diaphragm walls for the underpass 'box', which would prevent excessive settlement behind, and excessive groundwater entry into the excavation during construction would be retained.

11.6.40 The risk of a reduction in potential infiltration area due to the removal of existing grassed areas, for example the Mytongate traffic islands and part of Trinity Burial Ground, has been mitigated to a certain degree by the creation of public open space where the Myton Centre currently stands. Potential infiltration is likely to be low in these areas anyway, due to the low permeability of the made ground and underlying cohesive alluvium.

11.6.41 The groundwater monitoring plan will include a recommendation that groundwater monitoring is continued into at least into the early stages of the Operation Phase to ensure the changes in groundwater heads remain within acceptable limits in the longer term. Groundwater and surface water quality should also be monitored at key locations.

11.6.42 During the Operation Phase, a long-term increase in groundwater head may occur due to reductions in abstraction volume (e.g. abandonment of nearby industrial abstraction boreholes), increasing the risk of groundwater flooding. This could be mitigated by installation of relief wells outside the underpass 'box'.

11.7 Predicted environmental effects

11.7.1 This section considers the magnitude of potential impacts on surface water, groundwater and flood risk receptors, following the implementation of the mitigation measures set out above. The impact assessment, including predicted overall impact significance, is presented in Table 11.15 and Table 11.16 for surface water and groundwater construction impacts respectively, and Table 11.20 and Table 11.21 for surface water and groundwater operational impacts respectively.

Construction Phase - surface water and flood risk

General

11.7.2 Table 11.13 summarises the construction activities considered to have the potential to impact on surface water features, along with their potential impacts.

Table 11.13: Potential impacts on surface water features during construction

Construction activity	Potential impact
Earthworks (including removal of hardstanding, and exposure of made ground and / or soils)	• Reduced flows to receiving water course • Increase in suspended solids and reduction in water quality in receiving watercourse.
Construction dewatering	• Increased flows to receiving water course • Increase in suspended solids and reduction in water quality in receiving watercourse.

Construction activity	Potential impact
Construction of Princes Quay Bridge foundations in Humber Dock	• Increase in suspended solids and reduction in water quality • Impact on operation and recreational users of the Humber Dock Marina
Plant and vehicle washing	• Increased flows to receiving water course • Increase in suspended solids and reduction in water quality in receiving watercourse.
Alterations to ground elevations	• Alterations to runoff pathways resulting in overloading of drainage system and \ or surface water flooding.
Accidental spillages of oils, fuels, chemicals, concrete, bentonite slurry, jet grouting arisings, cement or admixtures	• Pollution of, and therefore reduction in water quality, of receiving watercourse.
Increase in hardstanding area within temporary site compounds and other construction areas.	• Increased flows to receiving water course

11.7.3 The severity of the impacts would be exacerbated by extreme weather conditions, such as intense or prolonged rainfall.

11.7.4 Potential water quality impacts during the Construction Phase mostly relate to the mobilisation of suspended solids. Although there would also be a risk from accidental spillage of fuels, chemicals, bentonite slurry, cement, admixtures, jet grouting arisings, lubricants and hydraulic fluids from the construction plant as well as concrete, cement and admixtures, and ground stabilisation compounds, mitigation of such spillages would be considered by the OEMP.

11.7.5 There would also be a risk of mobilisation of contaminants from the disturbance of potentially contaminated land, which may enter watercourses via runoff (see Chapter 13 Materials).

11.7.6 Water quality impacts are likely to be short term during the construction period. However, some potential construction impacts, such as the deposition of sediments in watercourses, can have longer term consequences, especially with respect to aquatic ecology (see Chapter 10 Ecology and nature conservation).

11.7.7 Construction works will have the greatest potential to impact on the surface water environment when they take place within or directly adjacent to surface water features, such as the construction of the underpass drainage system outfall into the Humber Estuary (if chosen), and any construction works directly adjacent to Princes Dock, Humber Dock, Railway Dock and Fleet Drain. In particular, construction of Princes Quay Bridge foundations would take place within the Humber Dock Marina.

11.7.8 The construction of the new outfall, should the underpass drainage be discharged to the Humber Estuary, would require construction within the existing Humber flood defences and would therefore be subject to consent (Flood Risk Activity Environmental Permit) from the Environment Agency. The impacts described

above are considered with specific reference to each of the surface water features and are summarised in Table 11.15.

11.7.9 Table 11.15 highlights the magnitude and significance of each impact following mitigation, as defined in Table 11.2 and Table 11.3. A summary of the impacts on each respective water body is also provided below, highlighting the magnitude of impact.

Construction activities potentially affecting all surface water receptors

11.7.10 Decreases in impermeable areas associated with temporary compounds, earthworks or excavations may result in a decrease in localised surface water runoff entering surface water receptors due to increased infiltration, or due to off-site disposal of runoff. This has the potential to affect the water quality, biodiversity, economic value and recreational use of all surface water receptors. Furthermore, it has the potential to affect the dilution of waste in the River Hull, Fleet Drain and the Humber Estuary and affect the water supply associated with the Humber Estuary and Fleet Drain. Dilution of waste or water supply has not been considered for the other receptors as there are no consented discharges or licensed abstractions associated with these receptors. With appropriate mitigation and construction best practice outlined in the OEMP (see Table 11.15), the residual impact on all receptors would be of negligible magnitude.

11.7.11 Construction activities may result in an increase in suspended solids and associated reduction in water quality as a result of earthworks, piling, construction dewatering and plant and vehicle washing. This activity could impact on receptors via direct surface water runoff or indirectly via disposal to the sewer system and would potentially affect the water quality, biodiversity (excluding Princes Dock) and recreational use of the surface water bodies. With appropriate mitigation and construction best practice outlined in the OEMP (see Table 11.15), the residual impact on all receptors would be of negligible magnitude.

11.7.12 Pollution arising from an accidental spillage of construction materials (oils, fuels, chemicals concrete, cement, bentonite slurry or jet grout arisings etc) would potentially affect the water quality, biodiversity (excluding Princes Dock), economic value and recreational use of all surface water receptors. This activity would impact on receptors via direct surface water runoff or indirectly via disposal to the sewer system and would potentially affect the water quality, biodiversity and recreational use of the surface water bodies. With appropriate mitigation and construction best practice outlined in the OEMP (see Table 11.15), the residual impact on all receptors would be of negligible magnitude.

11.7.13 Increases in impermeable areas associated with temporary construction compounds may result in an increase in surface water runoff entering surface water receptors, either via direct runoff or indirectly via the sewer system. This has the potential to affect the water quality, biodiversity, economic value and recreational use of all surface water receptors. Furthermore, it has the potential to affect the dilution of waste in the River Hull, Fleet Drain and the Humber Estuary

and affect the water supply associated with the Humber Estuary and Fleet Drain. Dilution of waste or water supply has not been considered for the other receptors as there are no consented discharges or licensed abstractions associated with these receptors. With appropriate mitigation and construction best practice outlined in the OEMP (see Table 11.15), the residual impact on all receptors would be of negligible magnitude.

11.7.14 Construction activities affecting specific surface water receptors are described below.

Humber Estuary

11.7.15 The increase in groundwater flow due to construction dewatering is predicted to be less than 10m^3 per day through the base and walls of the underpass structure (see Volume 3, Appendix 11.4 Groundwater report). However, the construction of the underpass and the works at the Trinity Burial Ground would likely occur in stages and thus the increase in groundwater flow would likely be less than predicted. Therefore, the increase in flow which would be discharged either to the Humber (via the outfall pipe, once and if constructed) or sewer is likely to have an impact of negligible magnitude on water supply (and subsequently dilution of other identified consented discharges, and value to economy and recreation) in the Humber, due to the scale of the discharges in relation to flows within the Humber (see Section 11.5).

Humber and Railway Docks

11.7.16 The Scheme involves the construction of the piled foundations for the Princes Quay Bridge directly within the Humber Dock Marina. This has the potential to affect the water quality of the docks from the mobilisation of sediment or direct release of contaminants into the dock. This, in turn, has the potential to affect the economic value and recreation use of the marina. With mitigation and best practice methods implemented through the OEMP, the impact would be of negligible magnitude. Furthermore, the area of construction will not affect the boat moorings and hence the impact is of negligible magnitude.

Humber floodplain

11.7.17 Alteration of ground elevations, temporary increase in hardstanding area within the site compounds, earthwork activities and construction dewatering could result in changes to the flood risk and the conveyance of flood waters within the floodplain.

11.7.18 Changes to ground elevations, and the construction of the Mytongate Bridge and the excavation of underpass, is likely to divert and / or store flood flows. Mitigation measures in the OEMP would manage the impact of flood waters in the Scheme area, but based on the findings of the FRA under the Operation Phase (see Volume 3, Appendix 11.2 Flood risk assessment), it is considered that the alteration of ground levels would impact on the conveyance of flow during construction. The extent and magnitude of the impact would depend on the phase

of construction (for example, how much of the underpass has been excavated), the location in the Scheme area and the source and scale of the flooding event. This would result in some areas of the floodplain having an impact of major beneficial magnitude and some areas have an impact of major adverse magnitude.

11.7.19 The increase in groundwater flow due to construction dewatering is predicted to be less than 10m^3 per day through the base and walls of the underpass structure (see Volume 3, Appendix 11.4 Groundwater report). However, the construction of the underpass and thus the exposure of different sections of the superficial deposits would likely occur in stages and thus the increase in groundwater flow would likely be less than predicted. Therefore, the increase in flow which would be discharged either to the Humber (via the outfall pipe, once and if constructed) or sewer is considered to have a negligible magnitude impact on the conveyance of flow.

11.7.20 Earthwork activities (such as the temporary and localised removal of hardstanding area at existing ground levels) are likely to increase infiltration and reduce the magnitude of any flooding which occurs, thereby reducing the conveyance of flood flows. Therefore, it is considered that earthworks activities would have a negligible magnitude impact on the conveyance of flow within the floodplain.

11.7.21 Dependent on the location of the working compound at either the Arco or Staples site, there will be a requirement to demolish a number of existing buildings. This has the potential to alter flood flow routes across and adjacent to the chosen compound site. The removal of buildings from the floodplain would act to increase, albeit by a small amount, the amount of available floodplain storage volume but is considered to have a negligible magnitude impact on the conveyance of flow.

11.7.22 An increase in impermeable, hardstanding area within the temporary construction site compounds and from the removal of permeable areas, for example, part of the Trinity Burial Ground, as part of the Scheme during the Construction Phase is likely to increase surface water runoff rates and could lead to localised flooding. To avoid an increase in flood risk, mitigation measures set out in the OEMP would include the use of closed drainage systems incorporating SuDs where possible. As such, the impact on the conveyance of flow is of negligible magnitude.

Construction Phase – groundwater

11.7.23 Table 11.14 summarises the construction activities considered to have the potential to impact on groundwater features, along with the potential impacts.

11.7.24 Impacts on groundwater heads due to temporary excavation works are unlikely to persist beyond the end of the construction period, although impacts due to permanent structures such as the underpass would remain (refer to Operation – groundwater Section below). Water quality impacts may persist beyond the end of the construction period, depending on, for example, the degree of ground disturbance or the location and scale of a spillage.

Table 11.14: Potential impacts on groundwater during construction

Construction activity	Potential impact
Construction of the underpass	• Changes in groundwater flow patterns in the superficial deposits and the Chalk, including groundwater mounding as a result of placement of the impermeable diaphragm walls. • Some very limited dewatering in the local superficial deposits, as a result of upflow through the base of the underpass cutting during excavation. • Contamination of groundwater in direct contact with construction materials. Jet grouting and / or soil mixing are likely to be used to stabilise the ground within and in the vicinity of the underpass excavation. A bentonite mud is used during the construction of the diaphragm walls to keep excavations open. Materials for these and other construction activities, including piling, are likely to come into direct contact with groundwater within both the Chalk and the superficial deposits. • Mobilisation of existing contamination in the superficial deposits due to ground disturbance and / or local changes in groundwater flow patterns. This might include leaching of contaminated soils and migration of contaminated groundwater (although any ground excavated during construction that is identified as hazardous waste will be disposed of offsite). • Downwards migration of contaminants in the superficial deposits (and the made ground in particular) into the Chalk. This might occur through downward smearing during piling and / or removal of some of the low permeability superficial deposits that protect the Chalk during excavation works. • Excavation activities are also likely to generate suspended solids in groundwater.
Construction of other structures such as bridge pier foundations, slip roads, and the pumping station, rising main and sewer diversions.	• Changes to local groundwater heads and flow patterns, including groundwater mounding, especially around underground structures, such as the Porter Street Bridge and Princes Quay Bridge foundations and the pumping station, sheet piling and retaining walls. Contamination of groundwater in direct contact with construction materials. • Mobilisation of existing contamination in the superficial deposits through ground disturbance and / or local changes in groundwater flow patterns. • Creation of preferential pathways and downwards migration of contaminants present in the superficial deposits into the Chalk. • Increase in suspended solids in groundwater.
Excavations, including for the exhumation of human remains at Trinity Burial Ground	• Dewatering of the superficial deposits may be required if groundwater is encountered during excavations for rising main and sewer diversions, archaeological investigations, or the exhumation of human remains at Trinity Burial Ground, for example. • Mobilisation of existing contamination in the superficial deposits through ground disturbance and / or local changes in groundwater flow patterns. • Increase in suspended solids concentrations.
Pre-construction preparation of site compounds	• Mobilisation of existing contamination and / or suspended solids in the superficial deposits through ground disturbance.

Construction activity	Potential impact
	• Downwards migration of contaminants and / or suspended solids present within the superficial deposits into the Chalk, especially at site compounds where confining layers are absent. • Creation of preferential pathways during construction of, or changes to, closed drainage systems.
Stockpiling and placement of construction materials	• Increase in suspended sediment concentrations in groundwater due to rainwater infiltration through bare surfaces, placed construction materials or uncovered stockpiles. This is only likely to be an issue in areas where hard standing has been removed. Site compounds are likely to be covered in hardstanding and have closed drainage systems installed.
Accidental spillages	• Pollution of groundwater. Accidental spillages of concrete, bentonite slurry, cement and mixtures, jet grouting arisings, or oils, fuels and chemicals from unbunded storage tanks or pipeline bursts may have the potential to pollute groundwater via infiltration, particularly in areas where hardstanding has been removed or pipelines are buried. Site compounds are likely to have closed drainage systems installed with discharge to sewer.
Damage to sewerage pipes during diversion works or because of vibration due to other construction work.	• Pollution of groundwater due to the accidental or uncontrolled release of sewage.

11.7.25 The impacts described above are considered with specific reference to each of the groundwater features and are summarised in Table 11.16.

11.7.26 Table 11.16 highlights the magnitude and significance of each impact following mitigation, as defined in Table 11.2 and Table 11.3, and based on the importance of the groundwater attribute receptors, as summarised in Table 11.12. A summary of the impacts on each respective groundwater feature is also provided below, highlighting the magnitude of impacts.

Chalk aquifer – groundwater level and flow

11.7.27 Impacts on groundwater level and flow due to construction of the underpass, and particularly the installation of diaphragm walls and tension piles within the Chalk, have been investigated by means of a numerical groundwater flow model. This predicts a negligible impact on Chalk groundwater supply in the immediate area of the Scheme and therefore no impact on catchment resource.

11.7.28 Based on the model, other structures such as the Porter Street Bridge and Princes Quay Bridge foundations, the Holiday Inn retaining wall and the pumping station and rising main, would also be likely to cause a negligible impact on Chalk groundwater supply.

11.7.29 Excavations in Trinity Burial Ground would be within the made ground and cohesive alluvium in this area. The presence of the remaining cohesive alluvium and glaciolacustrine deposits of low hydraulic conductivity beneath this suggests

that upwards inflow to the excavation would be minimal and the impact magnitude on Chalk groundwater supply would also be negligible.

11.7.30 Although the Scheme Site is located with the catchment area (SPZ3) of a number of public water supply abstractions and one industrial abstraction, it is anticipated that there would be a negligible impact on the economic value of the Chalk due to the negligible impact on Chalk groundwater supply as a result of the Scheme. Likewise, the impact on conveyance of flow between the Chalk and the Humber Estuary, and the biodiversity of the Humber Estuary would be negligible.

Chalk aquifer – groundwater quality

11.7.31 Groundwater quality impacts could potentially arise due to:

- Changes in groundwater flow patterns affecting the degree of saline intrusion
- Mobilisation of existing contamination through ground disturbance and / or changes in groundwater flow patterns
- Groundwater coming into direct contact with construction materials
- Pollution arising from spills; infiltration of water with elevated suspended solids concentrations
- Mobilisation of suspended solids due to excavation activities

11.7.32 As the model predicts a negligible impact on Chalk water supply (groundwater heads and flows), there would also be negligible impact in groundwater quality due to additional saline intrusion.

11.7.33 Groundwater quality could potentially be impacted by the introduction of materials, for example jet grouting, the use of bentonite muds during diaphragm wall construction or the installation of piles. As the materials would be in direct contact with groundwater, they have the potential to affect the groundwater quality due to their material properties. Providing appropriate mitigation measures are in place, the magnitude of this impact would be negligible in terms of groundwater quality, and all associated attributes of the Chalk aquifer (economic value, conveyance of flow and biodiversity).

11.7.34 Ground disturbance due to the placement of the diaphragm walls and tension piles into the top of the Chalk may also result in the mobilisation of suspended solids and / or changes in the local groundwater quality regime within the Chalk. Construction activities may also cause existing contamination in the shallow superficial deposits (and the made ground in particular) to migrate into the Chalk. This could be exacerbated through, for example, downward smearing during piling and / or removal of some of the low permeability superficial deposits that protect the Chalk during excavation works. Providing appropriate mitigation measures are in place, the magnitude of this impact is likely to be negligible in terms of groundwater quality and economic value.

11.7.35 Ground disturbances during pre-construction preparation of the Livingstone Road site compound may also result in the mobilisation and downwards migration of suspended solids into the Chalk, where the lower permeability cohesive superficial deposits are thinner and there is a potential for hydraulic continuity between the Chalk and any groundwater contained within the cohesive deposits.

11.7.36 Pollution as a result of accidental spillages or infiltration of suspended solids in areas containing stockpiles is likely to have a negligible impact on the Chalk groundwater quality and associated attributes. The Chalk is protected by the significant thickness and low permeability of the overlying cohesive superficial deposits. Furthermore, all site compounds will have closed drainage systems installed during the construction period, to ensure no infiltration to groundwater.

11.7.37 Although the local hydraulic gradient is towards the Estuary at low tide, the degree of hydraulic connection between the Chalk and the Estuary in this area is thought to be limited. Furthermore, the Estuary is outside of the modelled zone of influence of the underpass construction. Therefore, the impacts on conveyance of flow to, and the biodiversity of, the Humber Estuary due to pollution as a result of spillages, direct contact with construction materials and mobilisation of contamination due to ground disturbance are all considered to be negligible.

Superficial deposits – groundwater level and flow

11.7.38 Groundwater level and flow impacts due to construction of the underpass have been investigated by means of a numerical groundwater flow model. This predicts a change in groundwater levels within the cohesive deposits of less than 1m, which is within the natural range in groundwater levels. This is therefore likely to have a negligible impact on groundwater supply within the superficial deposits in the immediate area of the Scheme.

11.7.39 Other structures such as the Porter Street Bridge and Princes Quay Bridge foundations, the Holiday Inn retaining wall, the pumping station, are not as laterally extensive as the underpass and therefore are likely to have a smaller and much more local effect on groundwater supply in the superficial deposits in comparison to the underpass. The impact magnitude is also assumed to be negligible.

11.7.40 Excavations within Trinity Burial Ground, and construction of the rising main and sewer diversions may require local dewatering of the superficial deposits. These excavation works are not as extensive as the underpass and are only within the made ground and cohesive alluvium. Dewatering requirements are likely to be minimal, as any groundwater present will be limited and perched within the cohesive alluvium at these locations. They are therefore likely to have a much smaller effect on groundwater supply in the superficial deposits in comparison to the underpass structure. The use of sheet pile cut off walls during excavations at Trinity Burial Ground and any sewer diversions adjacent to the docks for ground stability purposes would additionally mitigate against potential impacts on local groundwater heads due to any dewatering that may be required.

11.7.41 Changes in groundwater levels in the cohesive alluvium due to dewatering of the underpass at the nearest buildings (the Whittington and Cat public house southwest of Mytongate and Booth House northwest of Mytongate) is predicted to be less than 0.05m. These are within the natural groundwater level range, and therefore, the impact magnitude in terms of economic value is considered to be negligible. Impacts on archaeology are considered fully in Chapter 8 Cultural heritage.

Superficial deposits – groundwater quality

11.7.42 Groundwater quality impacts on the superficial deposits may arise for similar reasons as those affecting the Chalk aquifer.

11.7.43 The zone of influence within the superficial deposits during construction of the underpass does not extend to the Humber Estuary, although it does extend beneath Railway Dock and part of Humber Dock. As the dock walls are lined, the only hydraulic connection between the docks and groundwater is likely to be via very limited leakage through the made ground and cohesive alluvium, through the base of the docks. It is unlikely that contaminant migration would occur through the dock walls or the base of the docks, and therefore the impact on groundwater quality and conveyance of flow is considered to be negligible. The increase in the rate of saline water ingress due to dewatering is not likely to be measurably more than at present, and therefore the impact on groundwater quality due to saline intrusion is considered to be negligible.

11.7.44 Groundwater quality could potentially be impacted by the introduction of materials which, if in direct contact with groundwater, have the potential to affect the groundwater quality. With suitable mitigation measures in place, the impact on groundwater quality and associated attributes (economic value, conveyance of flow and biodiversity) is considered to be negligible.

11.7.45 Disturbance of the superficial deposits would be unavoidable during construction, leading to potential local migration of existing contaminants due to changes in groundwater flow patterns and generation of suspended solids. The effects of this activity could occur during the Construction Phase and the start of the Operational Phase. This is likely to have only a minor adverse impact in terms of groundwater quality because the superficial deposits are classed as unproductive strata and current water quality is poor. The impact is also considered to be minor adverse in terms of economic value. Impacts on archaeology are considered fully in Chapter 8 Cultural heritage.

11.7.46 Other potential impacts on groundwater quality, for example spillages or cross contamination with tools, can be mitigated through appropriate practices during construction. Therefore, the impact has been considered as negligible in terms of groundwater quality, vulnerability and economic value.

11.7.47 The predicted impacts on water quality of surface water features due to groundwater in the superficial deposits acting as a pathway are considered to be

negligible in terms of conveyance of flow and biodiversity**.** This is because the hydraulic connection between the superficial aquifers, and the docks and Humber Estuary is likely to be very limited. Furthermore, the Humber Estuary is outside of the zone of influence of the main construction activities.

Construction impact assessments

11.7.48 Table 11.15 and Table 11.16 summarise the Construction Impact Assessments for surface water features and groundwater features, respectively.

Table 11.15: Significance of potential residual impacts on surface water features during construction

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
Reduced flows due to earthworks and removal of hardstanding resulting in increased infiltration	Humber Estuary	Water supply	Downstream abstractions	Low	None required	Negligible – scale of reduction in flows in relation to tidal flows within the Humber unlikely to impact on downstream abstractions.	Neutral
		Dilution and removal of waste products	Emergency sewage discharges	Low		Negligible – scale of reduced dilution in relation to tidal flows within the Humber unlikely to impact on its ability to dilute discharges. Identified discharges located upstream of existing road drainage discharge point at Saltend WwTW.	Neutral
		Value to economy	Major port	Very high		Negligible – the scale of the reduction in flows in relation to the tidal flows within the Humber will not result in loss of navigation.	Neutral
		Recreation and human health	Access to Humber and Railways Docks marina	High		Negligible – the scale of the reduction in flows in relation to the tidal flows within the Humber will not result in loss of navigation and access.	Neutral
	Fleet Drain	Water Supply	Downstream abstractions	Low		Negligible – scale of reduced flows compared to the influence of the tidally dominated Humber Estuary is unlikely to impact on flows downstream.	Neutral
		Dilution and removal of	Emergency sewage discharges	Low		Negligible – scale of reduced flows compared to the influence of the tidally	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
		waste products				dominated Humber Estuary is unlikely to impact its ability to dilute discharges.	
		Value to economy	Minor artificial watercourse	Low		Negligible - scale of reduced flows compared to the influence of the tidally dominated Humber Estuary will not result in loss of navigation.	Neutral
		Recreation and human health	Minor artificial watercourse	Low		Negligible – scale of reduced flows compared to the influence of the tidally dominated Humber Estuary will not result in loss of navigation or access.	Neutral
	River Hull	Dilution and removal of waste products	Consented discharges downstream	Low		Negligible – scale of reduced flows compared to the tidally dominated River Hull is unlikely to impact its ability to dilute discharges.	Neutral
		Value to economy	Commercial navigation and mooring along the River Hull.	High		Negligible - scale of reduced flows compared to the tidally dominated River Hull will not result in loss of navigation or impact commercial activities.	Neutral
		Recreation and human health	Footpaths adjacent to parts of the River Hull.	Medium		Negligible – scale of reduced flows compared to the tidally dominated River Hull will not result in loss of navigation or access.	Neutral
	Albert Dock	Recreation and human health	Limited public access	Low		Negligible – scale of any reduced surface water runoff compared to the storage in the tidally influenced Albert	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
						Dock will not result in any impact on access or recreation.	
		Value to economy	Major commercial dock	Very high		Negligible - scale of any reduced surface water runoff compared to the storage in the tidally influenced Albert Dock will not result in loss of navigation or impact commercial activities.	Neutral
	Humber and Railway Docks	Value to economy	310 boat moorings and public access	High		Negligible - scale of any reduced surface water runoff compared to the storage in the tidally influenced Albert Dock will not result in loss of navigation or impact commercial activities.	Neutral
		Recreation and human health	Public access and 220 boat moorings	Very high		Negligible - scale of any reduced surface water runoff compared to the storage in the tidally influenced Albert Dock will not result in impact on private moorings.	Neutral
	Humber Floodplain	Conveyance of flow	Properties within floodplain	Very high	Temporary pumping arrangements within OEMP to discharge flood waters to sewer or surface waters subject to consent, only compliant water to be discharged to Humber Estuary, non-compliant water collected and discharged off site.	Negligible – will slightly reduce additional flood risk.	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
Increased flows due to construction dewatering related to the underpass and Trinity Burial Ground works	Humber Estuary	Water supply	Downstream abstractions	Low	None required	Negligible – the predicted groundwater flow into the underpass during construction is less than 10m3 per day and therefore the scale of increased flows in relation to tidal flows within the Humber unlikely to impact on downstream abstractions.	Neutral
		Dilution and removal of waste products	Emergency sewage discharges	Low		Negligible – the predicted groundwater flow into the underpass during construction is less than 10m3 per day and therefore the scale of increased flows in relation to tidal flows within the Humber unlikely to impact on its ability to dilute discharges.	Neutral
		Value to economy	Major port	Very high		Negligible – will not result in loss of navigation as a result of negligible (10m3 per day) predicted volumes of groundwater entering underpass.	Neutral
		Recreation and human health	Access to Humber and Railways Docks marina	High		Negligible – will not result in loss of navigation and access as a result of negligible (10m3 per day) predicted volumes of groundwater entering underpass.	Neutral
	Humber Floodplain	Conveyance of flow	Properties within floodplain	Very high	Temporary pumping arrangements within	Negligible – the predicted groundwater flow into the	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
					OEMP to discharge flood waters to sewer or surface waters subject to consent, only compliant water to be discharged to surface water, non-compliant water collected and discharged offsite.	underpass during construction is less than 10m3 per day but this will not pose additional flood risk in adjacent areas.	
Increased suspended solids and reduction in water quality because of earthworks, piling, construction dewatering, plant and vehicle washing, etc	Humber Estuary	Water quality	WFD required to maintain moderate potential.	Medium	Mitigation by best practice methods implemented through the OEMP, including the use of temporary SuDS to reduce surface water runoff rates and appropriate pollution and silt control. Stockpiles to be covered and PPGs / GPPs to be adhered to. Proper use of bunding, spill kits, emergency clean-up and evacuation procedures through adherence to PPGs Permits to be obtained for construction dewatering. Only compliant (subject to consent) water to be discharged to surface water features or sewer, non-compliant water	Negligible – Only compliant water to be discharged to the Humber.	Neutral
		Recreation and human health	Access to Humber and Railways Docks marina	High		Negligible – will not result in loss of navigation and access if compliant water discharged to the Humber.	Neutral
		Value to economy	Major commercial port and access to docks	Very high		Negligible – will not result in loss of navigatioN/Access or impact on commercial activities, if compliant water discharged to the Humber.	Neutral
		Biodiversity	SSSI, SAC, SPA and Ramsar Sites WFD biological quality required to achieve good potential by 2027	Very high		Negligible – Only compliant water to be discharged to the Humber.	Neutral
	Fleet Drain	Water Quality	WFD required to achieve good potential by 2027	Medium		Negligible – Only compliant water to be discharged to Fleet Drain	Neutral
		Biodiversity	SSSI, SAC, SPA and Ramsar Sites WFD biological quality required to	Very high		Negligible – Only compliant water to be discharged to Fleet Drain	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
			achieve good potential by 2027.		collected and discharged off site.		
		Value to economy	Fleet Drain is not navigable, is not used for commercial activities nor fishing.	Low	Contaminated land classed as hazardous waste to be removed from site. Monitoring plan to include water quality sampling prior to, during and after construction (to be agreed with Environment Agency).	Negligible – no commercial activities on Fleet Drain	Neutral
		Recreation and human health	Minor artificial watercourse	Low		Negligible – will not result in loss of navigation or access, if compliant water discharged to Fleet Drain	Neutral
	Humber and Railway Docks	Water quality	WFD required to maintain moderate potential.	Medium		Negligible – Only compliant water to be discharged, if required, to Humber and Railway Docks	Neutral
		Biodiversity	WFD biological quality required to achieve good ecological potential by 2027	High		Negligible – Only compliant water to be discharged, if required, to Humber and Railway Docks	Neutral
		Value to economy	220 private boat moorings	High		Negligible - will not result in impact on commercial marina activities, if compliant water discharged to the docks.	Neutral
		Recreation and human health	Public access and 220 boat moorings	Very high		Negligible - will not result in impact on private moorings if compliant water discharged to the docks.	Neutral
	Albert Dock	Water quality	WFD required to maintain moderate potential.	Medium		Negligible – Only compliant water to be discharged, if required, to Albert Dock	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
		Biodiversity	WFD biological quality required to achieve good ecological potential by 2027	High		Negligible – Only compliant water to be discharged, if required, to Albert Dock.	Neutral
		Value to economy	Major commercial port and source of employment	Very high		Negligible – will not impact of commercial activities if compliant water discharged.	Neutral
		Recreation and human health	Limited public access	Low		Negligible – will not impact on access or recreation if compliant water discharged	Neutral
	Princes Dock	Water quality	WFD required to maintain moderate overall status	Medium		Negligible – Only compliant water to be discharged, if required, to Princes Dock.	Neutral
		Biodiversity	WFD biological water quality status required to achieve good ecological potential by 20227	High		Negligible – Only compliant water to be discharged, if required, to Princes Dock.	Neutral
		Value to economy	Princes Dock is an ornamental open water feature part of Princes Quay Shopping Centre. Believed to be hydrologically isolated from Humber Dock.	Low		Negligible – Only compliant water to be discharged, if required, to Princes Dock.	Neutral
		Recreation and human health	Ornamental water feature	Low		Negligible – Only compliant water to be discharged, if required, to Princes Dock.	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
	River Hull	Water quality	WFD required to maintain moderate potential.	Medium		Negligible – Only compliant water to be discharged, if required, to River Hull.	Neutral
		Biodiversity	WFD biological water quality status required to achieve good ecological potential by 2027.	High		Negligible – Only compliant water to be discharged, if required, to River Hull.	Neutral
		Value to economy	Commercial navigation and mooring along the River Hull	High		Negligible – will not result in impact on commercial activities or loss of navigation if only compliant water to be discharged to River Hull.	Neutral
		Recreation and human health	Footpaths adjacent to parts of the River Hull.	Medium		Negligible – will not result in loss of navigation or access if only compliant water to be discharged to River Hull.	Neutral
Changes in flood flow routes due to alteration of ground elevations and construction of structures	Humber Floodplain	Conveyance of flow	Properties within floodplain	Very high	OEMP to include emergency procedures to evacuate Scheme in the event of extreme flooding. Temporary pumping arrangements within OEMP to discharge flood waters to sewer or surface waters subject to consent, only compliant water to be discharged to Humber Estuary, non-compliant water collected and discharged off site.	Moderate beneficial to Major adverse – depending on the location, source and scale of the flooding in relation to the Scheme area. Refer to Table 11.18 and explanatory text for further details.	Large / Very Large beneficial to Very Large adverse

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
Pollution due to accidental spillages of oils, fuels, chemicals, concrete, cement or admixtures, bentonite slurry, jet grouting arisings, etc.	Humber Estuary	Water quality	WFD required to maintain moderate potential	Medium	Mitigation through OEMP best practice, including the appropriate use of pollution and silt controls. Proper use of bunding, spill kits, emergency clean-up and evacuation procedures through adherence to PPGs Stockpiles to be covered and PPGs / GPPs to be adhered to. Permits to be obtained for construction dewatering. Only compliant (subject to consent) water to be discharged to surface water features, non-compliant water collected and discharged off site. Contaminated land classed as hazardous waste to be removed from site. Monitoring plan to include water quality sampling prior to, during and after construction (to be agreed with Environment Agency).	Negligible – scale of accidental spillages in relation to tidal flows within the Humber unlikely to impact on river quality.	Neutral
		Biodiversity	SSSI, SAC, SPA and Ramsar WFD biological quality required to achieve good potential by 2027	Very high		Negligible – scale of accidental spillages in relation to tidal flows within the Humber unlikely to impact on river quality and subsequently biodiversity within the designated site.	Neutral
		Value to economy	The Humber Estuary is a major port and provides access to several docks, the location of many active employers.	Very high		Negligible – scale of accidental spillages in relation to tidal flows within the Humber unlikely to impact on commercial operations.	Neutral
		Recreation and human health	Access to the Humber Dock marina.	High		Negligible – scale of accidental spillages in relation to tidal flows within the Humber unlikely to impact on recreation and amenity.	Neutral
	River Hull	Water quality	WFD required to maintain moderate potential.	Medium		Negligible – scale of accidental spillages in relation to flows within the Hull unlikely to impact on river quality.	Neutral
		Biodiversity	WFD biological quality required to achieve good	High		Negligible – scale of accidental spillages in relation to tidal flows within the Hull unlikely to impact on	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
			ecological potential by 2027			river quality and subsequently biodiversity within the designated site.	
		Value to economy	Commercial navigation and mooring along the River Hull.	High		Negligible – scale of accidental spillages unlikely to impact on commercial operations.	Neutral
		Recreation and human health	Footpaths adjacent to parts of the River Hull.	Medium		Negligible – scale of accidental unlikely to impact on recreation and amenity.	Neutral
	Albert Dock	Water quality	WFD required to maintain moderate potential.	Medium		Negligible – scale of accidental spillages in relation to water within the docks unlikely to impact on water quality.	Neutral
		Biodiversity	WFD biological quality required to achieve good ecological potential by 2027	High		Negligible – scale of accidental unlikely to impact on quality and subsequently biodiversity within the Albert Dock	Neutral
		Value to economy	Major commercial port and source of employment	Very high		Negligible – scale of accidental spillages in relation to water within the docks unlikely to impact on commercial activities	Neutral
		Recreation and human health	Limited public access and use of dock	Low		Negligible – scale of accidental spillages in relation to water within the docks unlikely to impact on human health	Neutral
	Humber and	Water quality	WFD required to maintain moderate potential.	Medium		Negligible – scale of accidental spillages in relation to water within the	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
	Railway Docks					docks unlikely to impact on water quality.	
		Biodiversity	WFD biological quality required to achieve good potential by 2027	High		Negligible – scale of accidental spillages in relation to water within the docks unlikely to impact on biodiversity	Neutral
		Value to economy	220 boat moorings	High		Negligible – scale of accidental spillages in relation to water within the docks unlikely to impact on ability of marina to moor boats	Neutral
		Recreation and human health	Public use of marina	Very high		Negligible – scale of accidental spillages in relation to water within the docks unlikely to impact on human health	Neutral
	Fleet Drain	Water Quality	WFD required to achieve good potential by 2027	Medium		Negligible – Scale of accidental spillages in relation to the water unlikely to impact river quality	Neutral
		Biodiversity	SSSI, SAC, SPA and Ramsar WFD biological quality required to achieve good potential by 2027.	Very high		Negligible – scale of accidental spillage in relation to the water unlikely to impact river quality and subsequently biodiversity within the designated site.	Neutral
		Value to economy	Non-navigable watercourse, no commercial activities or fishing	Low		Negligible – scale of accidental spillages unlikely to impact on commercial operations.	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
		Recreation and human health	Local amenity use	Low		Negligible – scale of accidental unlikely to impact on recreation and amenity.	Neutral
	Princes Dock	Water quality	WFD required to maintain moderate overall status	Medium		Negligible – scale of accidental spillages in relation to water within the docks unlikely to impact on water quality.	Neutral
		Biodiversity	WFD biological water quality status required to achieve good ecological potential by 2027	High		Negligible – scale of accidental spillages in relation to water within the docks unlikely to impact on biodiversity.	Neutral
		Value to economy	Ornamental open water feature	Low		Negligible – scale of accidental spillages in relation to water within Princes Dock unlikely to impact on water quality (aesthetics).	Neutral
		Recreation and human health	Ornamental open water feature	Low		Negligible – scale of accidental spillages in relation to water within Princes Dock unlikely to impact on water quality (aesthetics) and associated amenity.	Neutral
Increase in surface water runoff due to increases in impermeable areas within construction area and compounds,	Humber Estuary	Water quality	WFD water quality required to maintain moderate overall status	Medium	Temporary pumping arrangements within OEMP to discharge surface water to sewer or surface water body.	Negligible – scale of increase in flows in relation to tidal flows within the Humber unlikely to impact on downstream abstractions.	Neutral
		Water supply	Downstream abstractions	Low	Drainage of temporary compounds and construction areas to	Negligible – scale of change in dilution in relation to tidal flows within the Humber	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
and plant and vehicle washings.					minimise increases in runoff and use temporary SuDS features, where appropriate	unlikely to impact on its ability to dilute discharges. Identified discharges located upstream of existing road drainage discharge point.	
		Dilution and removal of waste products	Emergency sewage discharges	Low		Negligible – scale of change in dilution in relation to tidal flows within the Humber unlikely to impact on its ability to dilute discharges. Identified discharges located upstream of existing road drainage discharge point.	Neutral
		Biodiversity	SSSI, SAC, SPA and Ramsar protected area. WFD biological water quality status required to achieve good potential by 2027.	Very high		Negligible – scale of increase in flows in relation to tidal flows within the Humber unlikely to impact on biodiversity.	Neutral
		Value to economy	The Humber Estuary is a major port and provides access to several docks, the location of many active employers.	Very high		Negligible – will not result in loss of navigation or impact on commercial activities as negligible impact on water supply and flows.	Neutral
		Recreation and human health	Access to the Humber Dock marina.	High		Negligible – will not result in impact on local amenity	Neutral
	River Hull	Water quality	WFD water quality required to	Medium		Negligible – scale of increase in flows in relation to flows within River Hull and	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
			moderate overall status by 2027.			Humber unlikely to impact on downstream abstractions.	
		Dilution and removal of waste products	Consented discharge (rate 20m3/d) located 190 m southeast and downstream of the Scheme.	Low		Negligible – scale of change in dilution in relation to River Hull and Humber unlikely to impact on its ability to dilute discharges. Identified discharges located upstream of existing road drainage discharge point.	Neutral
		Biodiversity	WFD biological water quality status required to achieve good ecological potential by 2027.	High		Negligible – scale of increase in flows in relation to flows within River Hull and the Humber unlikely to impact on biodiversity.	Neutral
		Value to the economy	Commercial navigation and mooring along the River Hull.	High		Negligible – will not result in loss of navigation or impact on commercial activities.	Neutral
		Recreation and human health	Footpaths adjacent to parts of the River Hull.	Medium		Negligible – will not result in impact on local amenity	Neutral
	Fleet Drain	Water quality	WFD water quality required to meet good overall potential by 2027.	High		Negligible – scale of increase in flows unlikely to impact on downstream abstractions.	Neutral
		Water supply	No abstractions within 1km of the site compound Livingstone Road.	Low		Negligible – scale of change in dilution in relation to tidal flows within the Humber unlikely to impact on its ability to dilute discharges.	Neutral
		Dilution and removal of	Emergency sewage discharges	Low		Negligible – scale of change in dilution in relation to tidal flows within the Humber	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
		waste products				unlikely to impact on its ability to dilute discharges. Identified discharges located upstream of existing road drainage discharge point.	
		Biodiversity	SSSI, SAC, SPA and Ramsar protected area. WFD biological water quality status required to achieve good ecological potential by 2027.	Very high		Negligible – scale of increase in flows in relation to tidal flows within the Humber unlikely to impact on biodiversity.	Neutral
		Value to economy	Fleet Drain is not navigable, is not used for commercial activities nor fishing.	Low		Negligible – will not result in impact on commercial activities.	Neutral
		Recreation and human health	Fleet Drain used only for local amenity.	Low		Negligible – will not result in impact on local amenity	Neutral
	Albert Dock	Water quality	WFD water quality required to maintain moderate overall status	Medium		Negligible – scale of changes in flow unlikely to impact on water quality.	Neutral
		Biodiversity	WFD biological water quality status required to achieve good ecological potential by 2027	High		Negligible – scale of increase in flows in relation to tidal flows within the Humber unlikely to impact on biodiversity.	Neutral
		Recreation and Human health	Public access to Albert Dock is restricted	Low		Negligible – will not result in impact on amenity use and public access	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
		Value to economy	Albert Dock is a major commercial port and source of employment in the area	Very high		Negligible – will not result in impact on commercial port.	Neutral
	Humber and Railway Docks	Water quality	WFD water quality required to maintain moderate overall status	Medium		Negligible – scale of changes in levels within the docks unlikely to impact on water quality.	Neutral
		Biodiversity	WFD biological water quality status required to achieve good ecological potential by 2027	High		Negligible – scale of changes in levels within the docks unlikely to impact on biodiversity	Neutral
		Value to economy	220 boat moorings	High		Negligible – scale of increased flows unlikely to impact on ability of marina to moor boats	Neutral
		Recreation and human health	Public use of marina	Very high		Negligible – scale of increase in flows / levels unlikely to impact on human health	Neutral
	Princes Dock	Water quality	WFD water quality required to maintain moderate overall status	Medium		Negligible – scale of changes of flows / levels within the docks unlikely to impact on water quality.	Neutral
		Biodiversity	WFD biological water quality status required to achieve good ecological potential by 2027	High		changes in flows / levels within Princes Dock unlikely to impact on biodiversity	Neutral
		Value to economy	Ornamental open water feature	Low		Negligible – scale of changes in flows / levels	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
						within Princes Dock unlikely to impact on water quality (aesthetics).	
		Recreation and human health	Ornamental open water feature	Low		Negligible – scale of changes in flows / levels within Princes Dock unlikely to impact on water quality (aesthetics) and associated amenity.	Neutral
	Humber Floodplain	Conveyance of flow	Properties within floodplain	Very high		Negligible – Scale of changes in floodplain flow in relation to floodplain storage unlikely to impact on flood receptors	Neutral
Reduction in water quality and increased suspended solids as a result of the construction of Princes Quay Bridge foundations and Humber outfall	Humber and Railway Docks	Water quality	WFD water quality required to maintain moderate overall status	Medium	Construction of foundations subject to consent from Environment Agency including Flood Risk Activity Environmental Permit and Marine Management Organisation. Mitigation by best practice methods implemented through the OEMP, including appropriate pollution and silt control. Proper use of bunding, spill kits, emergency clean-up and evacuation procedures	Negligible – mitigation will minimise impact on water quality	Neutral
		Biodiversity	WFD biological water quality status required to achieve good ecological potential by 2027	High		Negligible – mitigation will minimise impact on biodiversity	Neutral
		Value to economy	220 boat moorings	High		Negligible – area of construction will not impact on private boat moorings	Neutral
		Recreation and human health	Public use of marina	Very high		Negligible – area of construction will not impact on private boat moorings or recreational use of marina	Neutral
	Humber Estuary	Water quality	WFD water quality required to	Medium		Negligible – mitigation and dilution within marina prior to discharge to Humber	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
			maintain moderate overall status.		through adherence to PPGs Monitoring plan to include water quality sampling prior to, during and after construction (to be agreed with Environment Agency).	Estuary will limit impact on water quality	
		Biodiversity	SSSI, SAC, SPA and Ramsar protected area. WFD biological water quality status required to achieve good potential by 2027.	Very high		Negligible – mitigation and dilution within marina prior to discharge to Humber Estuary will limit impact on biodiversity	
		Value to economy	The Humber Estuary is a major port and provides access to several docks, the location of many active employers.	Very high		Negligible – indirect impact will not affect commercial activities within the Humber Estuary as the direct impact on water quality is negligible. Mitigation and dilution within marina prior to discharge to Humber Estuary will limit impact on biodiversity	Neutral
		Recreation and human health	Access to the Humber Dock marina.	High		Negligible - will not impact on access to the marina	Neutral

Table 11.16: Significance of potential residual impacts on groundwater features during construction

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
Changes to groundwater level or flow during construction	Chalk aquifer	Groundwater Supply / Quality	Principal Aquifer WFD target to achieve Good status	Very high	Design of excavations and piling mitigates groundwater dewatering and mounding risks. Groundwater monitoring plan to include water level monitoring prior to, during and after construction (to be agreed with Environment Agency).	Negligible - groundwater model predicts negligible impact on Chalk groundwater heads (worst case of <0.05m) and flow due to construction of underpass and associated piling within the Chalk. Other structures are also likely to have a negligible impact on Chalk groundwater supply. Excavation of Trinity Burial Ground predicted to have no change on Chalk groundwater heads and flows due to minimal predicted leakage from superficial deposits to Chalk.	Neutral
		Economic Value	SPZ3 of public water supply and industrial abstractions	Medium		Negligible – as negligible impact on groundwater supply.	Neutral
		Conveyance of Flow	Potential baseflow to the Humber Estuary	Very high			Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
		Biodiversity	Humber Estuary SAC / SPA / Ramsar /SSSI Sites	Very high			Neutral
	Superficial deposits	Groundwater Supply / Quality	Unproductive strata with permeable horizons present	Medium - Low	Design of excavations and piling minimises groundwater dewatering and mounding risks. Dewatering only to be undertaken with appropriate permissions / permits in place. Groundwater monitoring plan to include water level monitoring prior to, during and after construction (to be agreed with Environment Agency). Movement Assessments will assess and mitigate settlement risks at nearby buildings	Negligible - the groundwater model shows maximum changes in groundwater heads of <0.15m in the cohesive alluvium outside the walls of the underpass excavation. Other structures are not as extensive as the underpass and therefore not likely to have as great an impact on groundwater supply in the superficial deposits. Groundwater present at Trinity Burial Ground is likely to be limited and perched, and with minimal upwards inflow from the Chalk. As such dewatering is likely to be limited.	Neutral
		Economic Value	10 – 100 domestic, industrial / commercial properties	High		Negligible - the predicted change in groundwater heads in the cohesive deposits	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
						underlying the nearest buildings is predicted to be <0.05 m and less than seasonal variations.	
		Conveyance of Flow	Docks and Humber Estuary	Very high		Negligible – Only the docks are within the zone of influence of the underpass. Changes in groundwater levels and flows are minimal. Any excavations adjacent to the dock walls would be sheet piled for stability reasons; this would also minimise dewatering impacts.	Neutral
		Biodiversity	Humber Estuary SAC / SPA / Ramsar /SSSI Sites	Very high		Negligible – Zone of influence does not extend as far as Estuary.	Neutral
Additional saline intrusion during construction dewatering	Chalk Aquifer	Groundwater Supply / Quality	Principal Aquifer WFD target to achieve Good status	Very high	Design of excavation with ground treatment and diaphragm walls minimises dewatering and therefore drawdown risks, and hence the risk of inducing additional saline intrusion. Groundwater monitoring plan to include water level and	Negligible – as negligible impact on Chalk groundwater heads and flow due to construction of underground structures, and associated piling within the Chalk.	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
	Superficial Deposits	Groundwater Supply / Quality	Unproductive strata with permeable horizons	Medium - Low	water quality sampling prior to, during and after construction (to be agreed with Environment Agency).	Negligible – zone of influence due to dewatering the superficial deposits does not extend to Humber Estuary or River Hull. The presence of impermeable cohesive alluvium suggests that downwards leakage from the docks to the more permeable superficial deposits is not likely to be measurably more than at present.	Neutral
Changes to groundwater quality as a result of direct contact with construction materials (jet grouting, bentonite muds, piling materials, lime ground treatment, etc)	Chalk Aquifer	Groundwater Supply / Quality	Principal Aquifer WFD target to achieve Good status	Very high	Suitable materials and installation techniques, including selection of piling methodologies, should be chosen by the Contractor so as to minimise potential for groundwater pollution. Groundwater monitoring plan to include water quality sampling prior to, during and after construction (to be agreed with Environment Agency).	Negligible	Neutral
		Economic Value	SPZ3 of public water supply and industrial abstractions	Medium		Negligible	Neutral
		Conveyance of flow	Potential baseflow to Humber Estuary	Very high		Negligible	Neutral
		Biodiversity	Humber Estuary SAC / SPA / Ramsar / SSSI Sites	Very high		Negligible	Neutral
	Superficial deposits	Groundwater Supply / Quality	Poor groundwater quality	Medium - Low	Suitable materials and installation techniques, including selection of piling	Negligible	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
		Economic Value	10 – 100 domestic, industrial / commercial properties	High	methodologies, should be chosen by the contractor so as minimise groundwater pollution. Groundwater monitoring plan to include water quality sampling prior to, during and after construction (to be agreed with Environment Agency).	Negligible	Neutral
		Conveyance of Flow	Docks and Humber Estuary	Very high		Negligible – Only the docks are within the zone of influence (shown by the groundwater model). Changes to water level and flow are minimal. It is also unlikely contaminant migration would occur through dock walls.	Neutral
		Biodiversity	Humber Estuary SAC / SPA / Ramsar /SSSI Sites	Very high		Negligible – Zone of influence does not extend as far as Estuary.	Neutral
Mobilisation of contamination and generation of suspended solids through ground disturbance. Creation of new contamination pathways between the surface, superficial deposits and the Chalk.	Chalk Aquifer	Groundwater Supply / Quality	Principal Aquifer WFD target to achieve Good status	Very high	Selection of appropriate construction methodology (including piling) to minimise ground disturbance, generation of suspended solids and the potential for down-drag of contaminants. Foundation Works Risk Assessment to ensure appropriate foundation solutions are designed and undertaken to minimise risks. Best practice methodologies would be implemented and outlined in method	Negligible – even with mitigation measures in place, piling and placement of diaphragm walls within the Chalk has the potential to impact Chalk groundwater quality through the mobilisation of existing contamination within the Chalk, down-drag (smearing) of existing contamination in the superficial deposits	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
					statements and an OEMP to ensure any potential cause or spread of contamination is mitigated during construction (i.e. shallow soils will not be reused, but stockpiled separately on site, and subject to additional analysis. Known contaminated soils to be excavated, segregated, stored appropriately and disposed or treated offsite). Groundwater monitoring plan to include water quality sampling prior to, during and after construction (to be agreed with Environment Agency). Known preferential pathways to be removed or backfilled prior to adjacent construction works (i.e. large diameter boreholes LDBH02 during pumping station construction). Further investigation required at Livingstone Road to confirm the hydraulic connection between the shallow superficial deposits and the Chalk.	and generation of suspended solids. However, these are essential aspects of the design to mitigate ground stability issues and are deemed unavoidable. The Livingstone Road site compound has been identified as a potential location where the lower permeability cohesive deposits are thinner, allowing potential contaminants to migrate into the Chalk during pre-construction site preparation works – further investigation required to confirm this.	
		Economic Value	SPZ3 for public water supply and industrial abstractions	Medium		Negligible – as above. The assumed catchment of one industrial groundwater abstraction and SPZ3 for public water supplies intersect the construction footprint of the underpass.	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
		Conveyance of Flow	Potential baseflow to the Humber Estuary	Very high		Negligible –Zone of influence does not extend as far as Estuary.	Neutral
		Biodiversity	Humber Estuary SAC / SPA / Ramsar /SSSI Sites	Very high		Negligible – as above.	Neutral
	Superficial deposits	Groundwater Supply / Quality	Poor groundwater quality	Medium - Low	Construction techniques (including excavation) to be selected to minimise ground disturbance, generation of suspended solids and the potential for down-drag of contaminants. Best practice methodologies would be implemented and outlined in method statements and an OEMP to ensure any potential cause or spread of contamination is mitigated during construction. Construction compounds will be covered by hardstanding and have closed drainage systems. Groundwater monitoring plan to include water quality sampling prior to, during and after construction (to be agreed with Environment Agency).	Minor adverse - Disturbance of the ground will be unavoidable during construction. This and dewatering during excavation works may cause migration of existing contaminants due to changes in groundwater flow patterns and generation of suspended solids.	Neutral - Slight adverse
		Economic and Cultural Value	Domestic, industrial / commercial properties (10 – 100)	High		Minor adverse – as above.	Slight or Moderate adverse

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
		Conveyance of Flow	Chalk aquifer, docks and Humber Estuary	Very high	A specialist contractor will be required for the excavation of the burial ground, together with a detailed OEMP to avoid contaminant migration due to ground disturbance. Likely mitigation to include the use of sheet piling. Potentially contaminated water (from dewatering) would be disposed of appropriately and with the necessary permits in place. Further investigation required at Livingstone Road to confirm the hydraulic connection between the shallow superficial deposits and the Chalk.	Negligible – Only the docks are within the zone of influence but hydraulic connection between these and more permeable superficial deposits likely to be minimal. The Livingstone Road site compound has been identified as a potential location where the lower permeability cohesive deposits are thinner, allowing potential contaminants to migrate into the Chalk during pre-construction site preparation works – further investigation required to confirm this.	Neutral
		Biodiversity	Humber Estuary SAC / SPA / Ramsar / SSSI Sites	Very high		Negligible –Zone of influence does not extend as far as Estuary.	Neutral
Pollution due to accidental spillages (including from sewerage pipes)	Chalk aquifer	Groundwater Supply / Quality	Principal Aquifer WFD target to achieve good by 2027	Very high	Best practice methodologies will be implemented and outlined in method statements and an OEMP to ensure any potential cause	Negligible - the significant thickness and low permeability of the overlying superficial deposits	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
and stockpiling, where hard standing removed					or spread of contamination is mitigated during construction or all works. Groundwater monitoring plan to include water quality sampling prior to, during and after construction (to be agreed with Environment Agency). Known preferential pathways, such as the large diameter chalk borehole LDBH02, to be removed or appropriately backfilled prior to nearby construction works (particularly the pumping station).	are likely to protect the Chalk.	
		Vulnerability	Low and Medium-high groundwater vulnerability	Medium-low		Negligible – as above	Neutral
		Economic Value	SPZ3 for public water supply and industrial abstractions	Medium		Negligible – as above	Neutral
		Conveyance of Flow	Potential baseflow to the Humber Estuary	Very high		Negligible – as above	Neutral
		Biodiversity	Humber Estuary SAC / SPA / Ramsar / SSSI Sites	Very high		Negligible –as above.	Neutral
	Superficial deposits	Groundwater Supply / Quality	Unproductive strata with permeable horizons Poor groundwater quality	Medium - low	Best practice methodologies will be implemented and outlined in Method Statements and an OEMP to ensure any potential cause or spread of contamination is mitigated during construction, including sewer diversion works. Any buried bentonite and jet grouting supply pipelines would be wrapped in a waterproof membrane to protect against pipeline bursts. Groundwater monitoring plan to include water quality sampling prior to, during and after	Negligible – groundwater quality in the superficial deposits is already poor due to historical land use (particularly in the made ground).	Neutral
		Vulnerability	Low permeable shallow horizons	Low		Negligible – as above	Neutral
		Economic Value	Domestic, industrial / commercial properties (10 – 100)	High		Negligible – as above	Neutral
		Conveyance of Flow	Docks and Humber Estuary	Very high		Negligible – only the docks are within the zone of influence of the underpass but hydraulic connection between these and	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
					construction (to be agreed with Environment Agency).	more permeable superficial deposits likely to be minimal.	
		Biodiversity	Humber Estuary SAC / SPA / Ramsar / SSSI Sites	Very high		Negligible –Zone of influence does not extend as far as Estuary.	Neutral

Operation – surface water and flood risk

11.7.49 Table 11.17 summarises the operational activities considered to have the potential to impact on surface water features, along with their potential impacts.

Table 11.17: Potential impacts on surface water features during operation

Operation activity	Potential impact
Increased flows in the Humber Estuary due to increased impermeable area and operation of the rising main outfall from the underpass or via outfall at Saltend WwTW	• Increased flows to receiving water course
Alteration of flood flow routes due to presence of underpass and changes in ground levels	• Changes in flood risk to receptors (commercial and residential properties and infrastructure) within the Humber floodplain
Pollution of Humber Estuary from routine road runoff and accidental spillages	• Pollution of, and therefore reduction in water quality, of receiving watercourse.
Impact on Humber Dock Marina as a result of Princes Quay abutment foundations	• Impact on the recreational value of the Marina through a reduction in Marina area or direct impact on private boat moorings
Mobilisation of sediments and reduction channel morphology as a result of discharge to the Humber Estuary	• Increase in suspended solids and reduction in water quality in receiving watercourse. • Reduction in channel morphology diversity due to increase fine sediment supply and deposition

11.7.50 The severity of the impacts outlined above would be exacerbated by extreme weather conditions, such as intense or prolonged rainfall or during a tidal or fluvial flood event.

11.7.51 There are two main aspects of operation of the Scheme that are considered to have a potential impact on the local surface water environment. These are:

- The underpass drainage and its subsequent discharge to the Humber Estuary should this option be adopted
- The impact of the Scheme on the flood depths and flood flow pathways on the Humber floodplain

11.7.52 The principal operational risks to the Humber Estuary, should the Humber outfall underpass drainage option be adopted, arise from pollutants washed from the road surface by rainwater draining from the underpass and spillages of fuel or other contaminants because of road traffic accidents.

11.7.53 Further details of the surface water quality impacts of the proposed underpass drainage discharge to the Humber Estuary during operation can be found in Volume 3, Appendix 11.1 Surface water quality impact assessment, and of the flood risk impacts of the Scheme can be found in Volume 3, Appendix 11.2 Flood

risk assessment. Additional information requirements are also considered at Volume 3 Appendix 11.9 Additional flood risk assessment information requirements.

11.7.54 The proposed drainage for the Scheme would be split into two systems; the at-grade drainage system and the underpass drainage system[244]. These are described in Chapter 2 The Scheme.

11.7.55 Furthermore, there are currently two potential options for disposal of surface water collected by the underpass drainage system, namely a pumped rising main discharging directly to the Humber or a pumped discharge to the existing Yorkshire Water combined sewer. As outlined in the drainage impact assessment at Volume 3, Appendix 11.8, the proposed drainage system would result in:

- An increase of impermeable area drained by 0.382 ha equivalent to an overall increase in the drainage area of the Scheme of 22.8%. The additional area, over and above that discharged to the combined sewer, would be discharged to the Humber Estuary via the proposed outfall or via a pumped rising main to the existing Yorkshire Water network. This would result in an overall increase in the rate of surface water discharged to the Humber via the proposed outfall or, via the sewerage system, to Saltend WwTW. However, the timing of discharges would vary due to the differences in drainage path length and thus attenuation in the two systems.

- If a nominal 200 l/s pumped discharge to outfall into the Humber is included, there is a net reduction in peak discharge to the Yorkshire Water combined system of 37 l/s, approximately 8%.

- If a nominal 200l/s pumped discharge to the Yorkshire Water combined system is included, there is a net increase in peak discharge of 162 l/s, approximately 36%. However, the 200 l/s pumped discharge would not operate continuously.

- Attenuation in the existing Yorkshire Water combined networks (serving the at-grade drainage system) are attenuated through a combination of new and existing oversized pipes with appropriate siting of flow control devices.

- The underpass drainage system would include online attenuation storage immediately upstream of the pumping station, as follows:

    - 635m^3 of storage through a series of cylindrical tanks upstream of the pump station and the pump chamber for the 100 l/s Humber outfall option or;

[244] Arup (2017). Drainage Impact Assessment, November 2017, Doc Ref: HE514508-ARP-HDG-S0-RP-CD-000505

- 300m^3 of storage within the pumping station chamber for the 200 l/s Yorkshire Water sewer outfall option

11.7.56 The impacts described above are considered with specific reference to each of the surface water features and are summarised in Table 11.20. Table 11.20 highlights the magnitude and significance of each impact following mitigation, as defined in Table 11.2 and Table 11.3 respectively. A summary of the impacts on each respective water body is also provided below, highlighting the magnitude of the impacts.

Humber Estuary

11.7.57 The increase in drainage area due to the proposed underpass would result in higher discharges to the Humber Estuary during the Operation Phase if the outfall to Humber option were chosen. However, the discharge would be split between two discharge points; the at grade drainage system discharging to the Humber at Saltend via the WwTW, and the proposed underpass drainage system discharging direct to the Humber downstream of the entrance to Albert Dock. However, given the rate of discharge compared to the flow in the Humber (see Volume 3, Appendix 11.1 Surface water quality impact assessment), it is considered that the Humber's ability to dilute this and other consented discharges would not be affected. Therefore, there would be a negligible magnitude impact on the Humber's conveyance of flow, water supply and dilution attributes.

11.7.58 If the Yorkshire Water sewer option were chosen for the underpass drainage, there would be a negligible magnitude impact on the water supply, dilution, water quality and flood risk attributes of the Humber Estuary.

11.7.59 There would be a negligible magnitude impact on the Humber's surface water abstractions, as these are located further downstream and near to the existing drainage discharge point, via Yorkshire Water's combined sewer, at Saltend WwTW.

11.7.60 The impact of the proposed water quality discharges to the Humber is assessed using HAWRAT. Although step 1 of the DMRB HAWRAT assessment method A assessment (of pollution impacts from routine runoff to surface waters; Volume 3, Appendix 11.1 Surface water quality impact assessment) of acute impacts from soluble pollutants indicates that water quality of the road drainage fails the toxicity thresholds, they pass the modified step 2 method. This indicates that the discharge would have a negligible magnitude impact on the Humber Estuary's water quality, without the need for specific mitigation.

11.7.61 The additional pollutant load from the proposed discharge to the Humber Estuary (see Volume 3, Appendix 11.1 Surface water quality impact assessment for further details) would not result in a deterioration of the existing WFD water quality status and would not prevent the Humber from maintaining moderate overall WFD status. Therefore, there is a negligible magnitude impact on the Humber Estuary's biodiversity and consequently its national and international designations.

11.7.62 The modified step 2 HAWRAT Method A assessment also assessed the chronic impacts for sediment bound pollutants. This assessment indicates that the tidal velocity would only be less than the velocity threshold for less than half an hour during the neap tidal cycle (Volume 3, Appendix 11.1 Surface water quality impact assessment) and as such, sediment would not be deposited near the proposed outfall (underpass discharge to Humber option only) and accumulate over the tidal cycle. This indicates that the discharge would have a negligible magnitude impact on the Humber Estuary's water quality, without the need for specific mitigation.

11.7.63 It is also considered that the rock armouring present directly below the proposed outfall location(s) would protect intertidal muds and sands from scour and prevent the generation of a sediment plume that could occur with operational discharges. The loss of intertidal habitats (including intertidal muds and sands) is one of the key river basin management issues identified in the Humber RBMP. However, the presence of the rock armouring means that any impact on the morphology of the water body would be of negligible magnitude.

11.7.64 The DMRB assessment method D (assessment of pollution impacts from spillages) states that for outfalls discharging close to sensitive sites (e.g. Ramsar) as is the case for the Scheme, the acceptable risk of serious pollution incident should have an annual probability of less than 0.5%. The assessment method confirms that the risk of serious pollution incident would be considerably less than 0.5% (0.0004%) and therefore no pollution reduction measures are required for the Scheme (see Volume 3, Appendix 11.1 Surface water quality impact assessment). This indicates the impact of spillages on water quality and consequently biodiversity in the Humber Estuary would be of negligible magnitude.

Humber floodplain

11.7.65 The Scheme would have the potential to alter the conveyance of flow within the Humber floodplain due to the alteration of ground levels and construction of structures such as the underpass and footbridges.

11.7.66 The flood risk impact of the Scheme has been fully assessed in the FRA and the details of the impacts are presented in the supplementary Flood Risk Assessment Report (Volume 3, Appendix 11.2) with further information requirements clarified at Volume 3, Appendix 11.9. A summary of the FRA findings is presented below at Table 11.18.

11.7.67 The proposed alteration of the ground levels as part of the Scheme, and the proposed construction of the underpass, together with the heavily urbanised nature of the area surrounding the Scheme Site, mean that the impacts to a range of flooding scenarios are complex and result in both adverse and beneficial impacts depending on the location within the study area.

11.7.68 A summary of the impacts is provided in Table 11.16 for scenarios with the greatest impact for a given flooding source. The magnitude of the impact is

defined in Table 11.2 and significance in Table 11.3. Climate change impacts are discussed in Section 11.8.

Table 11.18: Summary of magnitude of peak impact from selected sources and scenarios from the FRA

Flooding source	Scenario	Areas of adverse impact \ magnitude	Areas of beneficial impact \ magnitude
Pluvial	A 1 in 100-year return period event with 30% increase in rainfall intensity for climate change impacts	No change in flood depths across Scheme and study area - Neutral	No change in flood depths across Scheme and study area - Neutral
Tidal – Humber Wave Overtopping	A 1 in 200-year return period event	Kingston Retail Park – Increase of maximum flood depth of up to 0.20m - Minor adverse Princes Quay – increase of maximum flood depth of up to 0.20m – Minor adverse Blanket Row, Blackfriargate and surrounding streets – increase of maximum flood depth of up to 0.20m – Minor adverse Market Place and surrounding streets north of A63 – increase of maximum flood depth of up to 0.10m – Negligible Queens Gardens – Increase of maximum flood depth of up to 0.57m – Moderate adverse	Commercial Road south of underpass and A63 carriageway east of underpass – Reduction of maximum flood depth of up to 0.50m – Minor beneficial
Tidal – Humber Wave Overtopping	A 1 in 1000-year return period event	Kingston Retail Park – Increase of maximum flood depth of up to 0.40m – Moderate adverse Princes Quay – increase of maximum flood depth of up to 0.20m – Minor adverse Underpass – Increase of maximum flood depth of up 5.80m - Major adverse Blanket Row, Blackfriargate and surrounding streets – increase of maximum flood depth of up to 0.20m – Minor adverse	Commercial Road south of underpass and A63 carriageway east of underpass – Reduction of maximum flood depth of up to 0.50m – Moderate beneficial A1079 Ferensway north of underpass – Reduction of maximum flood depth of up to 0.66m – Moderate beneficial A1079 Ferensway and surrounding streets north of A63 – Reduction of maximum flood depth of up to 0.30m – Minor beneficial Area to north-west of St Stephens's shopping

Flooding source	Scenario	Areas of adverse impact \ magnitude	Areas of beneficial impact \ magnitude
		Queens Gardens – Increase of maximum flood depth of up to 0.20m – Minor adverse Land east of Dock Office Row – Increase of maximum flood depth of up to 0.90m – Moderate adverse	centre – Reduction of maximum flood depth of up to 0.30m – Minor beneficial
Tidal – Humber Wave Overtopping	A 1 in 200-year return period event with consideration of climate change	North end of Kingston Retail Park – Increase of maximum flood depth of up to 0.40m – Moderate adverse Underpass – Increase of maximum flood depth of up 5.80m - Major adverse	Commercial Road south of underpass and A63 carriageway east of underpass – Reduction of maximum flood depth of up to 0.50m – Moderate beneficial A1079 Ferensway north of underpass – Reduction of maximum flood depth of up to 0.66m – Moderate beneficial
Tidal – Humber Wave Overtopping	A 1 in 200-year return period event (without existing flood defences)	Kingston Retail Park – Increase of maximum flood depth of up to 0.20m - Minor adverse Blanket Row, Blackfriargate and surrounding streets – increase of maximum flood depth of up to 0.20m – Minor adverse Queens Gardens – Increase of maximum flood depth of up to 0.10m – Negligible Underpass – Increase of maximum flood depth of up 5.80m - Major adverse	Commercial Road south of underpass and A63 carriageway east of underpass – Reduction of maximum flood depth of up to 0.50m – Minor beneficial A1079 Ferensway north of underpass – Reduction of maximum flood depth of greater than 0.50m – Moderate beneficial
Tidal – Humber Wave Overtopping	A 1 in 200-year return period event with consideration of climate change (without existing flood defences)	Kingston Retail Park – Increase of maximum flood depth of up to 0.20m - Minor adverse Blanket Row, Blackfriargate and surrounding streets – increase of maximum flood depth of up to 0.20m – Minor adverse George Street - Increase of maximum flood depth of up to 0.40m – Moderate adverse	Commercial Road south of underpass and A63 carriageway east of underpass – Reduction of maximum flood depth of up to 0.50m – Minor beneficial A1079 Ferensway north of underpass – Reduction of maximum flood depth of greater than 0.50m – Moderate beneficial

Flooding source	Scenario	Areas of adverse impact \ magnitude	Areas of beneficial impact \ magnitude
		Underpass – Increase of maximum flood depth of up 5.80m - Major adverse	
Tidal from River Hull	A 1 in 200-year return period event (tidal barrier fails to close)	Blanket Row, Blackfriargate and surrounding streets south of A63 – increase of maximum flood depth of up to 0.20m – Minor adverse Humber Dock and Railway Dock – Increase of maximum flood depth of up to 0.30m – Minor adverse Princes Quay – Increase of maximum flood depth of up to 0.60m – Moderate adverse Underpass – Increase of maximum flood depth of up 5.80m - Major adverse	Commercial Road south of underpass and A63 carriageway east of underpass – Reduction of maximum flood depth of up to 0.50m – Minor beneficial Kingston Retail Park – Reduction of maximum flood depth of up to 0.58m – Moderate beneficial A1079 Ferensway, St Luke's Street, Osborne Street and surrounding roads – Reduction of maximum flood depth of up to 0.40m – Minor beneficial
Tidal from River Hull	A 1 in 1000-year return period event (tidal barrier fails to close)	Blanket Row, Blackfriargate and surrounding streets south of A63 – increase of maximum flood depth of up to 0.20m – Minor adverse Humber Dock and Railway Dock – Increase of maximum flood depth of up to 1.03m – Major adverse Princes Quay – Increase of maximum flood depth of up to 0.20m – Minor adverse Underpass – Increase of maximum flood depth of up 5.80m - Major adverse	Commercial Road south of underpass and A63 carriageway east of underpass – Reduction of maximum flood depth of up to 0.52m – Moderate beneficial Kingston Retail Park – Reduction of maximum flood depth of up to 0.59m – Moderate beneficial A1079 Ferensway, St Luke's Street, Osborne Street and surrounding roads – Reduction of maximum flood depth of up to 0.66m – Moderate beneficial

11.7.69 Flooding from a 1 in 100-year return period plus 30% climate change pluvial event does not affect the Scheme and no appreciable differences in maximum flood depths are noted throughout the study area. This results in an impact of negligible magnitude.

11.7.70 Flooding to the Scheme from a 1 in 200-year return period wave overtopping event from the Humber is predicted to reach the periphery of the Scheme study area, which would result in some increased flooding in Queens Gardens resulting in an impact of moderate adverse magnitude (Table 11.18). Queens Gardens and the surrounding areas are at risk of flooding in the baseline condition. It is considered

that given the relatively low importance of this receptor (public open space) compared with other adjacent receptors (including residential and commercial properties) that mitigation of this additional risk is not required and, if provided, would likely result in a further increase in flood risk impact to adjacent, more sensitive, receptors.

11.7.71 Conversely to the above, the Scheme decreases maximum predicted flood depths within the boundary of the Scheme Site resulting in an impact of minor beneficial magnitude (Table 11.18). Further details can be found in Volume 3, Appendix 11.2 Flood risk assessment report.

11.7.72 Flooding from a wave overtopping event from the Humber for a 1 in 1000-year event is predicted to extend north of the Scheme Site beyond Hull Royal Infirmary and to flood the proposed underpass. Under this scenario, predicted maximum flood depths in the underpass structure and westbound exit slip road are 6m and 2.05m respectively; an impact of major adverse magnitude (Table 11.18). There is a predicted increase in flood depth in the Kingston Retail Park car park under the Scheme scenario of 0.40m; an impact of minor adverse magnitude (Table 11.18). The proposed underpass would prevent some flood water extending northwards past Mytongate Junction resulting in a decrease in predicted flood depth by up to 0.1m in the area between Anlaby Road and Castle Street; an impact of moderate beneficial magnitude (Table 11.18). Impacts of minor beneficial magnitude also occur within the Scheme Site Boundary (not including the underpass and westbound exit slip road) due to an increase in ground levels. Impacts of minor beneficial magnitude also occur in areas to the north-west of St Stephen's Shopping Centre.

11.7.73 Tidal flooding of the Scheme from the River Hull could occur in the event of the Hull Tidal Surge Barrier failing to close. This is unlikely as it incorporates a system to automatically close the barrier in the event of a power failure. However, if the barrier failed to close, under a 1 in 200-year event the underpass structure would be flooded to a predicted maximum depth of 3.4m and the westbound diverging slip road would be flooded to a maximum depth of 0.65m; both impacts of major adverse magnitude (Table 11.18). Consequently, the presence of the underpass has the effect of preventing flood flows reaching the area north and west of Mytongate Junction, particularly around the junction of Ferensway and Anlaby Road as well as the area south of Mytongate Junction (Kingston Retail Park car park and Trinity Burial Grounds) removing flood waters in both of these locations, resulting in an impact of moderate beneficial magnitude (Table 11.18). There would be a predicted increase in maximum flood depths in the Humber and Railways Docks resulting in an impact of minor adverse magnitude (Table 11.18). Consequently, flood flows are diverted towards the Princes Quay water body, with a predicted maximum flood depth of 0.60m in the water body; an impact of moderate adverse magnitude (Table 11.18).

11.7.74 The predicted impact of the Scheme on tidal flooding from the River Hull under a 1 in 1000-year event with the Hull Tidal Surge Barrier failing to close results in the

same impact magnitudes as described above for the 1 in 200-year event. The more extensive flooding (greater predicted flood depths) in this event result in the flooding of Humber and Railway docks, with an increase in predicted flood depth of 1.03m under the Scheme scenario; an impact of major adverse magnitude (Table 11.18). Under this scenario, the proposed underpass is completely flooded with flood waters beginning to extend westwards along the A63. However, the extent of beneficial effects is greater south of the existing A63, in Kingston Retail Park and areas to the north of the A63 around St Luke's Street and Osborne Street resulting in an impact of moderate beneficial magnitude.

11.7.75 Widespread and significant flooding is predicted from the Humber during a 1 in 200-year event without existing flood defences (Volume 3, Appendix 11.2 Flood risk assessment) regardless of whether the Scheme proceeds. The impact of a flood of this magnitude would be significant, not just for the Scheme but for the whole of Hull. During such an event, the A63 would be completely flooded west of Mytongate Junction regardless of whether the Scheme goes ahead.

11.7.76 The probability of flooding from combined sources (high sea levels in the River Hull and Humber during high fluvial baseflow conditions in the River Hull) was also considered in the FRA. However, the analysis indicates that the dependence between the different sources of flooding within the area is very low (essentially, they are independent). Consequently, flooding arising from combined sources with a 1 in 1000-year return period would not reach the boundaries of the Scheme Site and hence is not included in Table 11.20.

11.7.77 The risk of groundwater flooding to the Scheme and from the Scheme is considered to be slight. The walls of the underpass structure are estimated to discharge an average of 7m^3 per day into the underpass drainage system. This flow rate can be accommodated by the proposed underpass drainage which is designed to discharge either 100 or 200 litres per second (8640 or 17280 m^3 per day) dependent on the chosen outfall option. Furthermore, the risk of groundwater flooding due to the mounding around the underpass structure is negligible as the predicted change in groundwater levels is small in comparison to the natural variation of groundwater levels.

11.7.78 Analysis of flood routes and flow velocities during the extreme tidal events shows that the greatest impact results from the presence of the underpass structure. Predicted maximum velocities of water (combined with the depth) flowing into the underpass would be classified as 'danger for all' under Defra's Hazard to People Classification[245].

[245] Defra and Environment Agency (2006). Flood Risks to People. Phase 2. FD2321/TR2. Guidance Document. Flood and Coastal Defence R&D Programme. March 2006. Available online at: file:///C:/Users/gbcabr/Downloads/FD2321_3437_TRP.pdf

Humber and Railway Docks

11.7.79 The southern piled foundations for the abutment of Princes Quay Bridge would be constructed directly within the northern part of Humber Dock Marina, adjacent to the dock wall. The presence of the foundations will act to reduce the area of the Humber Dock Marina. However, none of the existing private leisure moorings would be removed or affected as a result of this. Therefore, the impact of the Scheme operation on economic value and recreation / human health of the Humber and Railway Docks is of negligible magnitude.

11.7.80 Operation – groundwater. Table 11.19 summarises the aspects of the Scheme's operation considered to have the potential to impact on groundwater features, along with the potential impacts.

11.7.81 There would be no drainage to ground via soakaways or similar. Therefore, DMRB Volume 11 Section 3 Part 10 Annex I Method C - Assessment for Routine Runoff on Groundwaters is not applicable.

11.7.82 As all drainage would be captured either by the underpass drainage system and discharged to either the River Humber or the Yorkshire Water sewer, or, for the at-grade drainage system, discharged to a Yorkshire Water sewer, DMRB Volume 11 Section 3 Part 10 Annex I Method D – Assessment of Pollution Impacts from Spillages is not applicable to groundwater.

Table 11.19: Potential impacts on groundwater features during operation

Aspect	Potential impact
Underpass	Changes in groundwater levels and flow immediately to the north and south of the underpass diaphragm walls. The underpass would have the potential to act as a groundwater dam, particularly as it is roughly perpendicular to the tidally-dependent hydraulic gradient. The resulting groundwater mounding may affect structures and / or cause groundwater flooding. Mobilisation of existing contamination within the superficial deposits, or poor groundwater quality resulting from saline intrusion, due to changes in groundwater flow patterns within the zone of influence of the underpass and resulting in a reduction in groundwater quality. Inflow to underpass discharged to drainage system, resulting in loss of aquifer resource.
Construction of other structures such as bridge piers, slip roads, pumping station, rising main and sewer diversions	Changes to local groundwater levels and flow patterns (and possible limited groundwater mounding). Mobilisation of existing contamination within the superficial deposits due to changes in groundwater flow patterns within zones of influence resulting in a reduction in groundwater quality. The rising main and sewer diversion bedding has the potential to act as a flow conduit, resulting in changes in groundwater flow patterns and a reduction in groundwater quality through the mobilisation of existing contamination.
Changes to infiltration area	Within the Scheme Site Boundary, there would be a small reduction in potential infiltration area due to the removal of existing grassed areas, for example the Mytongate traffic islands

Aspect	Potential impact
	and part of Trinity Burial Ground. This would have the effect of reducing recharge to the made ground underlying the Scheme. This is counteracted by the increase in infiltration area at the Myton Centre, where buildings are to be demolished and replaced with a public open space.

11.7.83 The magnitude of the potential impacts of operation on groundwater features are considered below and summarised in Table 11.21.

Chalk aquifer – groundwater level and flow

11.7.84 Impacts have been investigated by means of a numerical groundwater flow model. This predicts a negligible impact on Chalk groundwater supply (groundwater levels and flows) due to operation of the underpass as changes in Chalk groundwater heads and inflows to the underpass are minimal, and consequently negligible magnitude impact on all other attributes of the Chalk (vulnerability, economic value, conveyance of flow and biodiversity).

11.7.85 Other structures such as the bridge foundations and the pumping station, are also likely to cause a negligible magnitude impact on Chalk groundwater supply.

11.7.86 There is negligible magnitude impact on groundwater supply to the Chalk as a result of changes to infiltration areas during operation of the underpass. This is due to the presence of low permeability cohesive superficial deposits overlying the Chalk.

Chalk aquifer – groundwater quality

11.7.87 All road drainage would be captured and removed offsite. The negligible impact on groundwater supply and the presence of the low permeability superficial deposits overlying the Chalk mean that operation of the Scheme is likely to have a negligible magnitude impact in terms of changes to groundwater quality, economic value and conveyance of flow.

11.7.88 As the numerical model predicts a negligible impact on Chalk water supply (groundwater heads and flows) due to operation of the underpass, there would also be a negligible magnitude impact in groundwater quality due to additional saline intrusion.

Superficial deposits - groundwater level and flows

11.7.89 Impacts have been investigated by means of a numerical groundwater flow model. This predicts changes in groundwater levels within the cohesive deposits of less than 1m, which is within the natural range in groundwater levels. Operation of the Scheme is therefore likely to have a negligible magnitude impact on groundwater supply (groundwater levels and flows) and a negligible magnitude impact on economic value (with respect to structures), conveyance of flow and biodiversity of the superficial deposits.

11.7.90 Other structures such as the bridge foundations, pumping station, rising main and sewer diversions, are also likely to cause a negligible magnitude impact on the superficial deposits in terms of groundwater supply, economic value, conveyance of slow and biodiversity.

11.7.91 The changes in infiltration area during operation of the underpass will primarily affect made ground as this is underlain by low permeability cohesive alluvium. Groundwater in made ground is perched and not laterally extensive. More permeable horizons of the superficial deposits are protected by overlying low permeability cohesive deposits. Therefore, the impact magnitude of infiltration reduction is considered to be negligible.

Superficial deposits - groundwater quality

11.7.92 All road drainage would be captured and removed offsite. However, within the zone of influence of the underpass and other structures, changes in groundwater flow patterns could cause some further mobilisation of existing contamination within the superficial deposits over and above what may have occurred during the Construction Phase. However, the duration of the construction period means that additional water quality changes are likely to be minimal. Therefore, the impact magnitude of this is considered to be negligible in terms of groundwater quality and economic value.

11.7.93 The predicted impacts on water quality of surface water features due to groundwater in the superficial deposits acting as a pathway are considered to be negligible in terms of conveyance of flow. This is because of the very limited hydraulic connection between the docks and the Humber Estuary and superficial deposits aquifer units.

11.7.94 Impacts on archaeology are considered further in Chapter 8 Cultural heritage.

Operation impact assessment

11.7.95 Table 11.20 and Table 11.21 summarises the operational impact assessment for surface water and groundwater bodies.

Table 11.20: Significance of potential residual impacts on surface water during operation

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
Increased flows in the Humber due to increased impermeable area	Humber Estuary	Water Supply	Downstream abstractions	Low	No mitigation required	Negligible – very slight increase in overall drainage discharge rates to the Humber Estuary. Abstractions located adjacent to Yorkshire Water Saltend WwTW outfall.	Neutral
		Dilution and removal of waste products	Emergency sewage discharges and other consented discharges	Low	No mitigation required	Negligible – Although a proportion of the drainage discharge is to be discharged upstream of emergency discharges and other consented discharges, discharge rates are very small in comparison to tidal flows within the Humber Estuary.	Neutral
		Water Quality	WFD required to maintain moderate overall potential.	Medium	No mitigation required	Negligible – Discharge rates are very small in comparison to tidal flows within the Humber Estuary.	Neutral
		Conveyance of flow	Properties within the floodplain	Very high	No mitigation required	Negligible – Discharge rates are very small in comparison to tidal flows within the Humber Estuary.	Neutral
Alteration of flood flow routes due to the changes in ground levels and construction of structures	Humber floodplain	Conveyance of flow	Properties within the floodplain	Very high	Underpass drainage designed for 1 in 100-year, plus 30% allowance for climate change, rainfall event.	Ranges from Moderate beneficial to Major adverse depending on the location, source of flooding and return period of event. Further detail is provided in Table 11.18.	Very Large adverse to Large / Very Large beneficial

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
					Emergency procedures in case of pump failure or extreme flooding event.		
Pollution from routine road runoff and accident spillages	Humber Estuary	Water Quality	WFD water body required to maintain moderate overall status	High	Environment Agency requested the provision of oil water interceptor and shut off valve / penstock to isolate and contain contaminants as a result of accidental spillages in the underpass drainage	Negligible - No risk identified by Method A (Acute impacts due to soluble pollutants and chronic impacts due to sediment bound pollutants both pass at modified Step 2) Risk of pollution from spillages <0.5% (HAWRAT method D).	Neutral
		Biodiversity	SSSI, SAC, SPA and Ramsar WFD water body required to achieve good biological potential by 2027	Very high	No mitigation required	Negligible - Additional pollutant load unlikely to prevent the Humber Middle from achieving good ecological potential by 2027. Risk of pollution from spillages <0.5% (HAWRAT Method D).	Neutral
Impact on Humber Dock Marina as a result of Princes Quay Bridge abutment foundations	Humber and Railway Docks	Value to economy	220 boat moorings	High	No mitigation required	Negligible – scale of lost dock / marina area is small and restricted to north dock wall. No moorings lost or affected	Neutral
		Recreation and human health	Public use of marina	Very high	No mitigation required		Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
Mobilisation of sediments and reduction in channel morphology as a result of discharge to Humber Estuary	Humber Estuary	Water quality	WFD water body required to maintain moderate overall status	Medium	No mitigation required	Negligible – the presence of existing rock armour at the outfall location(s) would dissipate flows from the outfall and prevent mobilisation of sediment or a reduction in channel morphology	Neutral
		Biodiversity	SSSI, SAC, SPA and Ramsar WFD water body required to achieve good biological potential by 2027	Very high			Neutral

Table 11.21: Significance of potential residual impacts on groundwater features during operation

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
Changes to groundwater level or flow as a result of operation	Chalk aquifer	Groundwater supply / quality	Principal Aquifer WFD target to achieve Good status	Very high	Design minimises groundwater mounding risks. Design minimises inflow to the underpass and therefore changes in groundwater levels and flows, and potential loss of aquifer resource. Other structures are likely to have a small and more local impact in comparison to the Chalk.	Negligible - groundwater model predicts negligible impact on Chalk groundwater heads (0.03 m) and flows due to operation of the underpass. For the same reason, other structures are also likely to have a negligible impact on groundwater supply.	Neutral
		Vulnerability	Low and Medium-high groundwater vulnerability	Medium - low		Negligible - Chalk confined by overlying low permeability cohesive superficial deposits and therefore negligible impact on	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
					Groundwater monitoring plan may be required by Environment Agency.	groundwater supply due to changes in infiltration areas.	
		Economic value	SPZ3 for public water supply and industrial abstractions	Medium		Negligible – as negligible impact on groundwater supply.	Neutral
		Conveyance of Flow	Potential baseflow to the Humber Estuary	Very high		Negligible – as negligible impact on groundwater supply. Humber Estuary is outside zone of influence.	Neutral
		Biodiversity	Humber Estuary SAC / SPA / Ramsar / SSSI Sites	Very high		Negligible – as negligible impact on groundwater supply. Humber Estuary outside zone of influence.	Neutral
	Superficial deposits	Groundwater Supply / quality	Unproductive strata with permeable horizons	Medium - low	Design minimises risks arising from changes in groundwater levels and flows, including potential groundwater mounding. Rising main and sewer diversion design to include consideration of bedding material and inclusion of stanks to avoid creation of preferential pathways. A groundwater monitoring plan may be required by Environment Agency. Movement Assessments will assess and mitigate settlement risks at nearby buildings.	Negligible - groundwater model predicts changes in groundwater level of <0.14m outside the walls of the underpass, which is within the range of natural groundwater head variations. Other structures are not likely to have any greater impact on groundwater supply in the superficial deposits.	Neutral
		Vulnerability	Low permeability shallow horizons	Low		Negligible - Permeable horizons of the superficial deposits are confined by overlying low permeability cohesive deposits and therefore negligible impact on groundwater supply due to changes in infiltration areas. Furthermore, the granular alluvium is absent at the Myton	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
						Centre location, where the public open space is to be created and where there is a potential increase in infiltration.	
		Economic value	10 – 100 Domestic, industrial / commercial properties	High		Negligible - the predicted change in groundwater heads in the cohesive deposits underlying the nearest buildings is predicted to be <0.05m and less than seasonal variations.	Neutral
		Conveyance of Flow	Docks and Humber Estuary	Very high		Negligible – Only the docks are within the zone of influence due to seepage into the underpass. Changes in groundwater levels and flows are minimal and the degree of hydraulic connectivity between groundwater and the docks is also considered to be minimal.	Neutral
		Biodiversity	Humber Estuary SAC / SPA / Ramsar / SSSI Sites	Very high		Negligible – Humber Estuary is outside zone of influence	Neutral
Additional saline intrusion during operation	Chalk aquifer	Groundwater supply / quality	Principal Aquifer and DrWPA status. WFD target to achieve Good by 2027	Very high	Design of underpass minimises the risk of inducing additional saline intrusion. Groundwater quality monitoring plan to be continued into operation if risk of contaminant migration is identified in the early stages.	Negligible– as negligible impacts on Chalk groundwater heads and flows due to operation of the underpass.	Neutral
	Superficial deposits	Groundwater supply / quality	Poor groundwater quality	Low		Negligible – although the zone of influence due to dewatering during operation would extend beneath Railway Dock and part of Humber Dock, the dock walls are lined, and the only hydraulic	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
						connection with groundwater likely to be via very limited leakage through the cohesive alluvium, which may form the base of the docks. The increase in the rate of saline water ingress due to dewatering would not be likely to be measurably more than at present.	
Reduction in groundwater quality during operation	Chalk aquifer	Groundwater supply / quality	Principal Aquifer. WFD target to achieve Good by 2027	Very high	Groundwater quality monitoring plan to be continued into operation if risk of contaminant migration is identified in the early stages.	Negligible – all road drainage to be captured and removed offsite. Negligible impact on groundwater supply due to diaphragm walls and piling.	Neutral
		Vulnerability	Low and Medium-high groundwater vulnerability	Medium - low		Negligible – Chalk protected by overlying low permeability superficial deposits.	Neutral
		Economic value	SPZ3 for public water supply and industrial abstractions	Medium		Negligible – as negligible impact on Chalk groundwater quality and groundwater supply.	Neutral
		Conveyance of flow	Potential baseflow to the Humber Estuary	Very high		Negligible – as negligible impact on groundwater supply. Humber Estuary is outside zone of influence.	Neutral
		Biodiversity	Humber Estuary SAC / SPA / Ramsar / SSSI Sites	Very high		Negligible – as negligible impact on groundwater supply. Humber Estuary is outside zone of influence.	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
	Superficial deposits	Groundwater supply / quality	Poor groundwater quality	Low	Groundwater quality monitoring plan to be continued into operation if risk of contaminant migration is identified in the early stages. Rising main and sewer diversion design to include consideration of bedding material and inclusion of stanks to avoid creation of preferential pathways for any existing contamination.	Negligible - All road drainage will be captured and removed offsite. Within the zone of influence of the underpass and other structures, changes in groundwater flow patterns may cause some further mobilisation of existing contamination within the superficial deposits over and above what may have occurred during the Construction Phase. However, the duration of the construction period means that additional water quality changes are likely to be minimal.	Neutral
		Vulnerability	Low permeability shallow horizons	Low		Negligible - Permeable horizons of the superficial deposits are confined by overlying low permeability cohesive deposits and therefore negligible impact on groundwater supply due to changes in infiltration areas. Furthermore, the granular alluvium is absent at the Myton Centre location, where the public open space is to be created and there is a potential increase in infiltration.	Neutral
		Economic value	10 – 100 Domestic, industrial / commercial properties	High		Negligible – as above	Neutral

Potential impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude of impact	Significance
		Conveyance of Flow	Docks and Humber Estuary	Very high		Negligible - Humber Dock and Railway dock are within the zone of influence of the underpass but hydraulic connection between these and more permeable superficial deposits likely to be minimal.	Neutral
		Biodiversity	Humber Estuary SAC / SPA / Ramsar / SSSI Sites	Very high		Negligible – Humber Estuary is outside zone of influence.	Neutral

11.8 Climate change effects

Surface water and flood risk

11.8.1 In line with the NPPF[246] the impacts of climate change on the extent of flooding is predicted using the flood risk model:

- There is only a slight increase in surface water flooding outside of the Scheme area when allowing for a 30% increase in rainfall intensity for climate change in a 1 in 100-year return period rainfall event. There is only a slight difference in the flood extent and the difference in flood depth is negligible (0.05 to 0.10m) localised in small areas indicating the sewer drainage network in the study area can accept additional surface water flows.

- Arup[247] carried out a sensitivity analysis of 40% increase in rainfall intensity for climate change in a 1 in 100-year return period rainfall event. The results of the analysis concluded negligible increases in flood depths (between 3mm and 12mm increases) in areas along slip roads adjacent to the proposed underpass.

- Conversely, the impact of climate change on rising sea levels and wave height has significant effects on the flooding in Hull. Sea levels are predicted to increase by 1.125m between 2011 and 2125 and wave heights are expected to increase by 10%. When incorporating climate change impacts into the flood risk predictions for the 1 in 200-year return period wave overtopping from the Humber Estuary, the area of the flooding extends well beyond the boundaries of the Scheme Site reaching depths of up to 1.20m in the study area.

- As expected, the impact of climate change under the undefended Humber event for a 1 in 200-year return period shows similar magnitude of impact as described above for the defended scenario.

- For the tidal flooding scenarios from the River Hull with the Tidal Surge Barrier open, it was agreed with the Environment Agency that the 1 in 1000-year return period event should be used as a surrogate for a 1 in 200-year return period event with climate change impacts. The extent of the flooding under climate change has increased northwards and westwards as compared to the baseline model prediction. Under the 1 in 1000-year 'climate change' scenario flood water completely fills the underpass and begins to flood west along Castle Street. However, it is noted that a 1 in 200-year plus

[246] Environment Agency (2016b). Flood risk assessment: climate change allowances. Guidance to support the NPPF. Available online at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

[247] Arup (2017). A63 Drainage Assessment for a 100yr rainfall plus 40% Climate Change (Technical Note 237912-00 002), January 2017.

climate change River Hull flooding event is likely to be greater in magnitude than a 1 in 1000-year event (without climate change) as is the case for wave overtopping flooding from the Humber.

- The Chalk is confined in Hull but long term changes in groundwater head may affect the degree of leakage between the Chalk and overlying superficial deposits.

Groundwater

11.8.2 Climate change is likely to increase the intensity of recharge events to the superficial deposits, which could therefore increase groundwater levels and potentially the risk of groundwater mounding and flooding up-gradient of the underpass and possibly also other structures. An increase in recharge may result in increased flow through the underpass walls into the drainage system. Conversely, climate change could result in periods of drought and a reduction in groundwater levels, leading to increased drawdown in the superficial deposits. The Chalk is confined in Hull but long term changes in groundwater head may affect the degree of leakage between the Chalk and overlying superficial deposits.

11.8.3 The UKCP09 projections for climate change for the Yorkshire and Humber region by 2080 are not likely to result in any additional effects to groundwater receptors. As the Chalk and superficial deposits are largely recharged indirectly, any seasonal changes in rainfall occurrence are unlikely to impact on aquifer recharge, especially considering annual mean precipitation is estimated to remain static.

11.9 Water Framework Directive assessment

Introduction

11.9.1 This section outlines the assessment of potential construction and relation impacts on the ability of the relevant WFD water bodies to meet their current objectives.

11.9.2 The key objectives of the WFD, provided for in the area River Basin Management Plan (RBMP)[248], are as follows:

- To prevent deterioration of the status of surface waters and groundwater
- To achieve objectives and standards for protected areas
- To aim to achieve good status for all water bodies or, for heavily modified water bodies and artificial water bodies, good ecological potential and good surface water chemical status

[248] Environment Agency (2016a). Humber River Basin Management Plan. Available online at: https://www.gov.uk/government/publications/humber-river-basin-district-river-basin-management-plan

- To reverse any significant and sustained upward trends in pollutant concentrations in groundwater
- The cessation of discharges, emissions and loses of priority hazardous substances into surface waters
- Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants

11.9.3 The assessment outlined here details how the following WFD objectives have been considered as part of this assessment and are summarised in Table 11.22.

11.9.4 The baseline condition of the various WFD elements are provided in Section 11.5 and Table 11.7. The assessment was carried out with due regard to the Planning Inspectorate Guidance[249].

11.9.5 Table 11.22 indicates that the construction and operation of the Scheme will not cause deterioration in the status of receiving water bodies nor will it impact on the ability of the water bodies to achieve their objectives and standards under the Water Framework Directive.

11.9.6 The Humber Lower water body (GB530402609201) has not been considered as part of the WFD water body assessment. The Humber Lower water body would receive flow from the Scheme (via the Yorkshire Water combined sewer system and Saltend WwTW). However, the size of the Yorkshire Water drainage network and the associated dilution and treatment prior to discharge to the Humber Lower water body would mean that any impact would be negligible.

11.9.7 The eastern most part of the study area falls within the catchment of the River Hull from Arram Beck to Humber water body (GB104026067212). However, the are no surface water courses in this water body and within the study area that affected by the Scheme. Where the River Hull falls within the study area it is designated as part of the Humber Middle water body. As such, the River Hull from Arram Beck to Humber water body has not been considered in the assessment.

Table 11.22: Summary of WFD water body assessment

Water body name [ID]	WFD aspect		Impacts on status or ability to meet target	Reference
Humber Middle [GB530402609202]	Ecological	Biological	None if YW sewer outfall for underpass drainage.	See Table 11.15 and Table 11.20 and Volume 3, Appendix 11.1
		Physico-chemical quality		

[249] The Planning Inspectorate (2017). Advice note eighteen: The Water Framework Directive. June 2017, version 1. Available online at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2017/06/advice_note_18.pdf

Water body name [ID]	WFD aspect		Impacts on status or ability to meet target	Reference
		Hydromorphological supporting elements	Negligible if Humber Estuary outfall for underpass drainage due to relatively low flow rates and large degree of dilution in Estuary. Negligible impact on hydromorphology if Humber Estuary outfall constructed due to presence of existing rock armour at outfall location.	Surface water quality impact assessment
		Specific pollutants (including copper and zinc)		
	Chemical	Priority substances	None if YW sewer outfall for underpass drainage. Negligible if Humber Estuary outfall for underpass drainage due to relatively low flow rates and large degree of dilution in Estuary.	See Table 11.15 and Table 11.20 and Volume 3, Appendix 11.1 Surface water quality impact assessment
		Other substances with EQS		
Fleet Drain [GB104026066750]	Ecological	Biological	No construction related impact due to mitigation outlined in OEMP. No operational impact.	See Table 11.15 and Table 11.20
		Physico-chemical quality		
		Hydromorphological supporting elements		
		Specific pollutants (including copper and zinc)		
	Chemical	Priority substances	No construction related impact due to mitigation outlined in OEMP. No operational impact.	See Table 11.15 and Table 11.20
		Other substances with EQS		
Hull and East Riding Chalk [GB40401G700700]	Quantitative		Construction Phase and Operation Phase zone of influence is small in comparison to the WFD groundwater body quantitative	See Table 11.16, Table 11.21 and Volume 2, Appendix 11.4 Groundwater report

Water body name [ID]	WFD aspect	Impacts on status or ability to meet target	Reference
		resource availability. Negligible additional saline intrusion because of construction due to mitigation included in the Scheme design and OEMP.	
	Chemical	Zone of influence is small in comparison to the WFD groundwater body as a whole, and located towards the downstream end of the water body. Negligible additional saline intrusion because of construction due to mitigation included in the Scheme design and OEMP. Negligible operational impact due to mitigation included in Scheme design.	See Table 11.16, Table 11.21 and Volume 2, Appendix 11.4 Groundwater report

11.10 Conclusions

Surface water and flood risk

11.10.1 During construction, all of the potential residual impacts are of neutral significance to surface water features, after mitigation by best practice methods implemented through the OEMP. An exception to this is that alterations of ground elevations during construction would alter flood flow routes and result in potential residual impacts ranging from very large adverse in some areas to large / very large beneficial significance in other areas on the Humber floodplain. The significance would depend on the phase and location of the construction within the Scheme area, the source and scale of the flooding and the construction work being undertaken. The findings are based on the impacts assessed as part of Volume 3 Appendix 11.2 Flood Risk Assessment under the Operation Phase. Additional information requirements are also considered at Volume 3 Appendix 11.9 Additional flood risk assessment information requirements.

11.10.2 Under the Operation Phase, the underpass drainage could be discharged to the Humber Estuary via a proposed tidal outfall or via a pumped outfall to the existing Yorkshire Water sewer network. The HAWRAT based assessment of water quality impacts to the Humber considered routine runoff and the risk of accidental spillages. This indicated that the potential residual impacts are of neutral significance to the Humber in terms of water quality and biodiversity. At the request of the Environment Agency, the proposed underpass drainage system would include an oil water interceptor and a shut off valve to isolate and contain any contaminants released during a major incident on the A63. In terms of water supply and dilution and removal of waste products, the discharge to the Humber has a potential residual impact of neutral significance.

11.10.3 The Scheme is not considered to impact on national and European designated sites.

11.10.4 Mitigation measures for the Operation Phase include the design of the underpass drainage to accommodate a rainfall event with a 1 in 100-year return period plus a 30% allowance for climate change without flooding the road. Emergency procedures would be put in place to minimise the risk to road users in the event of a pump power failure for this rainfall event.

11.10.5 Alteration of ground elevations as a result of the Scheme result in a complex pattern of impacts on the conveyance of flood flow in the Humber floodplain primarily related to the presence of the underpass and the raising of road levels to the east and west of the underpass. Residual impacts range from very large beneficial to very large adverse significance depending on the location within the floodplain and the source and scale of the flood event. Currently, the greatest flood risk to the Scheme arises from tidal flooding (wave overtopping) from the Humber Estuary.

11.10.6 There is an existing procedure in place whereby flood alerts from the Environment Agency are issued to the Highways England Emergency Planning team who consider an appropriate response, for example, the closure of the underpass. This response would be implemented by the local emergency services. This procedure has been updated and amended to reflect the particular requirements of flooding of the underpass. The revised procedure was written in consultation with relevant stakeholders including Highways England, the emergency services and the Humber Local Resilience Forum.

11.10.7 The Scheme is not considered to impact on the current status of the WFD ‘Humber Middle’ or ‘Fleet Drain’ surface water bodies. Neither does it contribute to the failure of these water bodies or affect their ability to achieve the WFD water body objectives or affect the delivery of the RBMP actions to maintain their moderate overall status.

11.10.8 A surface water monitoring and sampling plan will be agreed with the Environment Agency, and implemented prior to and during the construction period, and also into the early phase of operation. The monitoring locations should be agreed with the

Environment Agency and regular dialogue between the contractor and the Environment Agency should be maintained during this process.

Groundwater

11.10.9 Underground structures assessed for potential impacts to groundwater focus on the Mytongate underpass, but also include Trinity Burial Ground and other excavations, bridge piled foundations, Holiday Inn retaining wall, the pumping station and rising main and sewer diversions. The majority of structures encounter the superficial deposits only, although the underpass diaphragm walls and tension piles, and bridge piled foundations penetrate the underlying Chalk principal aquifer. Although the superficial deposits are classified as unproductive strata, permeable aquifer horizons are present, particularly to the east of Mytongate and at depth.

11.10.10 In addition to the Chalk aquifer and permeable aquifer horizons of the superficial deposits, water receptors dependant on groundwater as a pathway include:

- The Humber Estuary SAC / SPA / Ramsar / SSSI Sites
- A large number of adjacent buildings that are potentially sensitive to ground movement
- Public water supply abstractions to the northwest of Hull
- One industrial abstraction less than 1km north of Mytongate
- The docks, in particular Humber Dock and Railway Dock, that are located within the underpass zone of influence

11.10.11 Considering the mitigation measures included in the preliminary design and appropriate best practice which would be adopted during construction via the OEMP, the Construction Phase of the Scheme is anticipated to have an overall residual impact of neutral significance on both Chalk and superficial deposits groundwater supply.

11.10.12 With mitigation in place via the OEMP, the residual impacts on the Chalk groundwater quality in the Construction Phase are all of neutral significance, especially in relation to indirect groundwater receptors.

11.10.13 With mitigation in place, the residual impacts on the groundwater quality of the superficial deposits and its indirect receptors are generally of neutral significance in the Construction Phase. The greatest residual impacts generally relate to nearby structures, where the mobilisation of existing contamination through ground disturbances may have, at worse, a moderate significance due to changes to water quality affecting the structural integrity of foundations. However, any known contaminated soils are to be removed off site during construction, and other best practice methodologies implemented through the OEMP will ensure that the cause or spread of contamination or mobilisation of suspended solids is minimised.

11.10.14 Residual impacts due to the Operation Phase of the Scheme are generally of neutral significance on both groundwater supply and quality of the Chalk and the superficial deposits, including all indirect receptors such as national and European designated sites and nearby buildings. The operational impacts are not considered to cause any significant additional saline intrusion.

11.10.15 The Scheme is not considered to impact on the current or target status of the WFD Chalk water body and DrWPA. Neither does it affect the ability to achieve the WFD water body objectives nor affect the delivery of the RBMP actions to achieve moderate status.

11.10.16 The Scheme is not considered to impact on national and European designated sites.

11.10.17 A groundwater monitoring and sampling plan will be agreed with the Environment Agency, and implemented prior to and during the construction period, and also possibly into the early phase of operation. Regular dialogue between the contractor and the Environment Agency will be maintained during this process.

11.10.18 A Construction and Operation Phase monitoring and sampling plan will be included in the Groundwater Management, Dewatering and Discharge Control Plan, as outlined in the OEMP (document reference TR010016/APP/7.3).

Chapter 12. Geology and soils

12.1 Executive summary

12.1.1 An assessment of the impact of the Scheme construction and operation on the geology and soils of the area was undertaken using the generic sensitivity – magnitude – significance methodology.

12.1.2 The methodology allows the identification of potential sensitive receptors which may be impacted as a result of the Scheme, with the development of appropriate mitigation measures to minimise potentially adverse impacts or enhance beneficial impacts.

12.1.3 The Scheme Site is located in an urban setting and no sensitive geological or geodiverse receptors were identified that would be affected by construction or operation of the Scheme.

12.1.4 Historic potentially contaminating activities within the Scheme area were identified and localised soil contamination recorded by the recent 2013 and 2016 ground investigations. Peat and organic material within the natural superficial deposits were also recorded as generating elevated concentrations of ground gas.

12.1.5 With the implementation of the relevant mitigation measures, the predicted environmental effects on soils and geology are considered to be neutral or slightly adverse.

12.2 Introduction

12.2.1 Superficial and solid geology is a key factor when determining the environmental character and quality of any given geographic area. The underlying solid geology is a key determinant of the landform, whilst the physical and chemical properties of the rocks and overlying soils influence the type and variety of vegetation that will grow, the agricultural quality, flood risk and water storage capacity. Historic land uses may have resulted in altering the geology and soils by introducing contaminants or disturbed ground.

12.2.2 Geological conditions and resources can determine the geographical distribution and physical scale of some types of industry. Industry, even if long closed, can have long-term effects on the environment, through the alteration of landforms and the nature of surface deposits, as well as changes in drainage or the contamination of land.

12.2.3 Construction of highways can have a significant impact on geological and soil resources, while the nature and condition of the soil and solid geology can be a major constraint of the Scheme. Under some circumstances, construction work can also compound the environmental effects caused by previous activities.

12.2.4 This chapter is concerned with the following aspects of geology and soils considered relevant to the Scheme:

- General geology and geomorphology
- Designated sites
- Soil deterioration
- Impacts of construction
- Land contamination

12.2.5 To avoid repetition, there is overlap with other environmental topics considered in this Environmental Statement and reference should be made to the following Chapters:

- Creation of dust (refer to Chapter 6 Air quality)
- Potential impacts of land contamination on ecology (refer to Chapter 10 Ecology and nature conservation)
- Risk of flooding and changes to the hydrogeology and hydrology of the study area (refer to Chapter 11 Road drainage and the water environment)
- Materials and earthworks balance (refer to Chapter 13 Materials)

12.3 Legislative, regulatory and policy background

Land contamination

12.3.1 Part 2A of the Environmental Protection Act 1990 ('Part 2A')[250] sets out a regime for identifying and dealing with Contaminated Land in the UK. The Contaminated Land Regulations 2006[251] (as amended by the Contaminated Land (Amendment) Regulations 2012)[252] and associated Statutory Guidance (Environmental Protection Act 1990; Part 2A Contaminated Land Statutory Guidance April 2012)[253] set out the procedural matters for the Part 2A regime.

12.3.2 For a site to constitute 'contaminated land', one or more significant pollutant linkages must be identified through which (a) significant harm is being caused or there is the significant possibility of significant harm being caused or (b) significant

[250] Part 2A of the Environmental Protection Act 1990. Available online at: http://www.legislation.gov.uk/ukpga/1990/43/part/IIA

[251] Contaminated Land Regulations 2006. Available online at: http://www.legislation.gov.uk/uksi/2006/1380/contents/made

[252] Contaminated Land Regulations 2012. Available online at: http://www.legislation.gov.uk/uksi/2012/263/made

[253] Statutory Guidance (Environmental Protection Act 1990; Part 2A Contaminated Land Statutory Guidance April 2012. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/223705/pb13735cont-land-guidance.pdf

pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused.

12.3.3 Land contamination is also a 'material' planning consideration under the Town and Country Planning Act 1990[254], which directly impacts on development control decisions. It is the responsibility of the landowner or developer to take appropriate steps to ensure that risks from land contamination to future users and the wider environment are acceptable. In most cases, where new development is taking place, the enforcement of remediation requirements will be through planning conditions and building control rather than through a remediation notice under Part 2A.

National Planning Policy

12.3.4 The National Planning Policy Framework[255] (NPPF) was published in March 2012 and sets out to make the planning system less complex by replacing Planning Policy Statements (PPS) and Planning Policy Guidance (PPGs). The NPPF sets out how the planning system should protect and enhance geological conservation interests and states that "*local planning authorities should set criteria based policies against which proposals for any development affecting geodiversity sites will be judged*."

12.3.5 Chapter 11 of the NPPF, 'Conserving and Enhancing the Natural Environment' prescribes that; *"The planning system should contribute to and enhance the natural and local environment by:*

- *Protecting and enhancing valued landscapes, geological conservation interests and soils (for example any Sites of Special Scientific Interest)*
- *'Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability*
- *Remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate"*

12.3.6 Circular 06/2005 referenced within NPPF provides further guidance in respect of statutory obligations for biodiversity and geological conservation and their impact within the planning system and stipulates that English Nature (now Natural England) are to be consulted by both the relevant planning authority and the Scheme developer.

[254] DMRB, Volume 4, Section 1, Part 2, HD22/08 Managing Geotechnical Risk, 2008

[255] National Planning Policy Framework March 2012 Department for Communities and Local Government. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

12.3.7 Paragraphs 120 to 121 of NPPF require that planning policies should ensure that the site is suitable for its new use, taking account of ground conditions, land instability from natural or historical uses such as mining and pollution or contamination arising from previous uses. Guidance on land affected by contaminated[256] land to support the NPPF highlights that responsibility for securing a safe development rests with the developer or landowner.

12.3.8 The National Policy Statement for National Networks (NN NPS), December 2014, sets out the government's vision and policy for the future development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail network in England. It provides planning guidance for promoters of NSIPs on the road and rail networks. The NN NPS identifies the requirement "*to identify any effects and seek to minimise impacts, on soil quality, taking into account any mitigation measures proposed"*. The NN NPS also identifies that developments on previously developed land "*should ensure that they have considered the risk posed by land contamination and how it is proposed to address this"*.

Regional planning policy

12.3.9 The Yorkshire and Humber Plan Regional Spatial Strategy to 2026 (YHPRSS) was revoked in February 2013. As such, Development Plans across the region comprise the relevant Local Plan, as described below.

Local planning policy

12.3.10 The new Hull Local Plan was submitted to the Planning Inspectorate in December 2016. The Planning Inspectorate responded to the plan in October 2017 with further consultation by Hull City Council (HCC) ending on 31 January 2017. The Hull Local Plan 2016-2032[257] was adopted on 23 November 2017 and supersedes the previous version which was adopted in 2000 and expired in 2006. The new Local Plan will guide development in the city up to 2032. The following 'saved' policies from the expired local plan have been deleted:

- ME2: Pollution - development will not be allowed if it has an unacceptable pollution impact.
- ME3: Development near pollution sources – development near a known or potential source of pollution will not be allowed unless it can be clearly demonstrated that the level of risk is acceptable.
- ME4: Removing contamination - development on contaminated land will be supported. The developer will be required to investigate any suspected contamination and undertake an agreed programme of work to prevent the site being a hazard.

[256] Published June 2014. Available online at: https://www.gov.uk/guidance/land-affected-by-contamination

[257] Published November 2017. Available online at: http://www.hull.gov.uk/resident/planning-and-building-control/local-plan

- NE16: Statutory sites of nature conservation importance (including geological sites) will be identified if appropriate.

12.3.11 The Hull Local Plan 2016-2032 replaces the above policies ME2, ME3, ME4 and NE16 with Policy 48 – Land Affected by Contamination. No additions are made in Policy 48 compared to the policies it replaces. Policy 48 states that development which "*involves the development of land known or suspected to be contaminated; and / or would have a vulnerable end user; and / or could create a new pathway between a contamination source and a vulnerable receptor (including local, national and internationally designated wildlife sites and the groundwater aquifer) must be accompanied by an appropriate contamination assessment"*. Additionally, "*development will be supported where it has been demonstrated that appropriate mitigation can be carried out and will have conditions attached to require the appropriate works to be carried out"*.

12.3.12 Policy 41 Groundwater Protection is also included in the Hull Local Plan 2016-2032 which requires that the location and design of development has regard to the presence of Source Protection Zones and that appropriate assessment is carried out.

12.3.13 All of the above policies have been considered in this chapter.

12.4 Study area

12.4.1 The study area referred to in this chapter includes a 500m buffer zone either side of the A63 (refer to Volume 2, Figure 12.1). The study area includes the existing A63 Castle Street and the proposed A63 Castle Street Improvements, associated slip roads and side roads, the northern section of the Trinity Burial Ground and land required for the construction of pedestrian footbridges. The study area lies within the administrative boundary of HCC.

12.4.2 Compound sites to be used for the construction of the Scheme are not included since these shall be used temporarily, do not require excavation works and shall be managed under the Construction Environmental Management Plan (CEMP).

12.5 Approach and methodology

Impact assessment

12.5.1 Several previous surveys and reports have been carried out which have informed the development of the current preferred option for the Scheme. This includes the main ground investigation undertaken in 2013 (Geotechnics, 2013) designed to inform the assessment of land contamination, hydrogeology and provide information pertinent to geotechnical design. This was supplemented by further investigations in 2015 (ESG, 2016a to d).

12.5.2 Reports which provide relevant information on soils and geology within the study area include:

- Pell Frischmann (February 2010), 3 Castle Street Improvements – Hull, Environmental Assessment Report (Options Selection Stage), Final Revision 2, Document Reference: W11189/T13/02 (EAR, 2010)
- MMSJV (October 2013) A63 Castle Street Improvement, Hull – Annex A to Preliminary Sources Study – 27282, Revision PD3, Report ref. 1168-09-153-RE-003-PD3 (Annex A to PSSR, 2013)
- MMSJV (March 2013), A63 Castle Street Improvements, Hull, Environment Statement Scoping Report, Final Revision 1, Report Reference: 112630/AE/01 (Scoping Report, 2013)
- Geotechnics (October 2013), Ground Investigation at A63, Castle Street Improvement, Hull, Project No: PC135320 (Geotechnics, 2013)
- ESG (April 2016), A63 Castle Street Improvements Main Site GI. Factual Report on Ground Investigation. Ref: A5066-15
- ESG (April 2016), Princes Quay Footbridge, A63 Castle Street Improvement, Hull. Factual Report on Ground Investigation. Ref: A5066-15
- ESG (April 2016), Trinity Burial Ground, A63 Castle Street Improvement, Hull. Factual Report on Ground Investigation. Ref: A5066-15
- ESG (April 2016), A63 Garrison Road, Castle Street Improvement, Hull. Factual Report on Ground Investigation. Ref: A5066-15A
- MMSJV (June 2018), Ground Contamination Assessment, A63 Castle Street Improvement, Hull, Report Reference: HE514508-MMSJV-EGT-S0-RP-LE-000001 (GCA, 2018) – Appendix 12.1, Volume 3

12.5.3 The assessment has been carried out in accordance with DMRB (1993); Volume 11; Environmental Assessment, Section 3; Part 11; Geology and Soils and the significance of any potential impacts assessed in line with HA 205/08. Potential geotechnical risks associated with ground instability and settlement from construction activities have been identified during this preliminary design stage and shall be managed in accordance with HD 22/08[258].

12.5.4 The DMRB does not provide any quantitative guidance on the assessment of potential impacts. In the absence of any published guidance to determine potential impacts and the associated significance, professional judgement and experience will be used in this assessment.

12.5.5 To assess land contamination, desk study information was reviewed and updated to develop a preliminary conceptual site model (CSM) in accordance with CIRIA

[258] DMRB, Volume 4, Section 1, Part 2, HD22/08 Managing Geotechnical Risk, 2008

C552[259]. The CSM forms the basis to investigate potential pollutant linkages via a source-pathway-receptor model.

12.5.6 Potential contaminant sources principally due to historic industrial activities were identified from the Environmental Assessment Report 2010. The ground investigations undertaken in 2013 (Geotechnics, 2013) and 2015 (ESG, 2016a - d) therefore incorporated the sampling and assessment of soil, ground gas, groundwater and surface waters to allow the potential risks from land contamination to be assessed.

12.5.7 A risk assessment was undertaken using the source-pathway-receptor model to view the significance of land contamination within the study area. This is considered best practice methodology to evaluate environmental risks arising from potential land contamination, according to Department of the Environment, Food and Rural Affairs (Defra) and Environment Agency[260] guidance documentation.

12.5.8 Data from the 2013 and 2015 ground investigations are included in Volume 3, Appendix 12.1, Ground Contamination Assessment, 2018 (GCA, 2018) which has been used to review the potential impacts due to contaminated land in this chapter in accordance with best practice guidance[260]. The impacts of waste management and potential re-use of materials is provided in Chapter 13 Materials.

Assessment of value, sensitivity, magnitude and significance

12.5.9 In accordance with the principles set out in HA 205/08, the significance of potential impacts has been reviewed based on professional judgement on the value (sensitivity) of each criteria and magnitude of each impact. As such, it considers whether an impact is:

- adverse or beneficial
- permanent or temporary
- direct or indirect
- significant or has insignificant effect

12.5.10 The sensitivity matrix in Table 12.1 and the magnitude of impacts given in Table 12.2, have been used to assess the significance of impacts for ground contamination receptors. No geological sensitive receptors have been identified for the study area.

[259] Contaminated Land Risk Assessment. A guide to good practice. CIRIA, 2001

[260] Model Procedures for the Management of Land Contamination. Contaminated Land Report 11. Environment Agency / Defra. September 2004

Table 12.1: Environmental value and description

Value (sensitivity)	Typical descriptors
High	Site workers, site users or adjacent site users / residents Locally abstracted groundwater or nearby surface water Designated sites of ecological importance
Medium	Aquifer which is not abstracted or non-sensitive surface water feature Buried services, foundations and services Sites of local ecological importance
Low	Waste disposal / treatment facility

Table 12.2: Magnitude of impacts

Magnitude of impact	Typical criteria descriptors
Major	Potential risk from ground contamination to receptors assessed as high or very high using the source-pathway-receptor model[261]
Moderate	Potential risk from ground contamination to receptors assessed as moderate using the source-pathway-receptor model[261]
Minor	Potential risk from ground contamination to receptors assessed as moderate / low using the source-pathway-receptor model[261]
Negligible	Potential risk from ground contamination to receptors assessed as low or negligible using the source-pathway-receptor model[261]
No change	No risk from ground contamination sources identified

12.5.11 The magnitude of predicted impacts and sensitivity (value) was used to assess the significance of potential environmental effects as described in HA 205/08 (refer to Chapter 5 Environmental Impact Assessment process).

Consultation

12.5.12 Consultation with the Environment Agency and the Environmental Services department at HCC has been undertaken. Prior discussions were held with the Environmental Health Officer (EHO) at HCC to confirm the scope of the main ground investigation works in 2013 and proposed chemical analysis testing suite. Communication continued throughout the works, particularly when any unanticipated ground conditions were encountered.

Scope of assessment

12.5.13 No significant areas of geological concern (physical or geomorphological) have been identified within the study area (Scoping Report, 2013).

12.5.14 The following aspects have been scoped out of the assessment for the reasons given in Sections 12.5.15 to 12.5.21; Agricultural Land Classification, General Soil

[261] Refer to risk assessment methodology given in Ground Contamination Assessment report - Appendix 12.1

/ geology and soil degradation, designated and non-designated sites, Regionally Important Geological and Geomorphological Sites (RIGS) and risks in relation to geotechnical engineering.

Agricultural land classification

12.5.15 The Scheme Site is located within an urban area and has no impact upon land utilised for agricultural use. The Agricultural Land Classification Map, 1:250,000 scale (Yorkshire and Humber) (2010) confirms that the Scheme is located where the land is 'predominately in urban use'.

General soil / geology, soil degradation

12.5.16 Soil type within the study area is identified on mapping available through the Cranfield Soil and AgriFood Institute (incorporating the National Soil Resources Institute) website[262] as "*loamy and clayey soils of coastal flats with naturally high groundwater*". The soil unit extends beyond the boundary of the study area and is not a rarity at a local scale. Given the urban location of the Scheme Site, limited areas of soils will be impacted including areas of current landscaping, the northern section of Trinity Burial Ground and William Street Park. The 2013 (Geotechnics, 2013) and 2015 (ESG, 2016a to d) ground investigations encountered Made Ground at all but one exploratory hole location, illustrating that natural soils within the study area have already been removed or disturbed. This is also anticipated within the Trinity Burial Ground given the expected density of burials and indicated by the 2015 (ESG, 2016c) investigation.

12.5.17 The 2015 site investigations indicated a reduced thickness in made ground associated with reduction of ground levels at various locations. The thickness of made ground across the site generally varies between 1.2m and 2.9m, with the exception of the area adjacent to the Princes Quay pedestrian, cycle and disabled user bridge, where the made ground encountered varies between 1.78m to 11.5m.

12.5.18 In addition, the 2013 (Geotechnics, 2013) and 2015 (ESG, 2016a-d) ground investigation encountered peat and organic layers within the majority of the exploratory holes, at various depths. Since the study area has already been disturbed due to urban development, the impact on soils has been removed from the scope of the assessment.

Designated and non-designated sites:

12.5.19 There are no statutory designated or non-statutory designated geological or geomorphological features within the study area.

[262] Available online at: http://www.landis.org.uk/soilscapes/index.cfm

Regionally Important Geological and Geomorphological Sites (RIGS)

12.5.20 Consultation with the East Yorkshire RIGS Group confirmed that there are no geological or soils RIGS within the study area. A number of urban RIGS are located within 1km of the study area (refer to Table 12.3) and have been designated due to their educational value. There are no planned works or demolition proposed at or in close proximity to these identified urban RIGS. The impact on RIGS has therefore been scoped out of the assessment.

Table 12.3: Summary of identified RIGS

Structure	Location	Designated for
Lloyds / TSB Bank	On corner of Chapel Street and Paragon Street	Granite with Rapakivi structures
King William Statue and toilets	Market Place	Various rocks
Methodist Hall	King Edward Square	Tilberthwaite Tuff
Festival House	93 St James Street	Fossils in Ironstone
HSBC Bank	Near War Memorial	Granite Pillars
Williamsons Solicitors	Lowgate	Ashburton 'Marble'
Monument Buildings		Granite pillars with xenoliths
Police Station	Queens Gardens	Tilberthwaite Tuff
Western Cemetery	Spring Bank, Hull	Variety of rock types and monumental styles – weathering of

12.5.21 The assessment of potential risks in relation to geotechnical engineering including earthworks has been considered where these may have an impact on the soils and geological aspects of the environment (e.g. settlement, instability). These risks will be managed via the geotechnical reporting, design assessment and certification procedures as prescribed within HD 22/08. All other geotechnical risks (e.g. failure of retaining wall or foundations, pile wall installation) are beyond the scope of Environmental Impact Assessment and are reported in the geotechnical risk register for the Scheme and are not included in this chapter.

Assumptions and limitations

12.5.22 The assessment of contamination is based on a review of desk study information and interpretation of the results from the ground investigation included in the GCA, 2018 provided in Volume 3, Appendix 12.1. The location of exploratory holes was restricted due to access constraints. Undetected areas of contamination may be present beyond the extent of the current ground investigation, which may be encountered during phases of future ground investigation or construction. However, implementation of the mitigation measures outlined in Section 13.7 would allow identification of and remedial measures for contamination, if deemed necessary.

12.6 Baseline conditions (existing environment)

Geology

12.6.1 The general geological sequence present beneath the Scheme Site has been assessed through the ground investigation exercise undertaken in 2013 (Geotechnics, 2013) and 2015 (ESG, 2016 a-d).

12.6.2 The geology underlying the Scheme Site is complex with multiple layers of superficial deposits overlying the chalk. The different superficial units encountered were found to have widely varying permeability and strength. Units were also encountered in discontinuous layers.

12.6.3 Table 12.4 summarises the general strata and units anticipated beneath the majority of the Scheme Site. Localised variations were encountered.

12.6.4 The natural cohesive alluvium present beneath the made ground is typically described as very soft to soft clay. The alluvial deposits vary in thickness (typically up to 13m in thickness) and represent poor ground conditions which would potentially be susceptible to ground instability, settlement and heave during the proposed Scheme, unless appropriate control measures are adopted during construction.

Table 12.4: Summary of general strata

Stratum	Unit	Depth (mbgl*)	Notes
Made Ground	Cohesive Sandy gravelly Clay and ash fill with gravel of chalk, flint, concrete clinker and occasional cobbles of brick	0.0 to 12.0	0.0 to 13.0mbgl
	Granular Sand and Gravel with gravel of brick, concrete, mixed natural rock	0.0 to 13.0	
Superficial - Alluvium	Cohesive Alluvium Clay and silt	0.6 to 15.8	Continuous across the site
	Granular Alluvium Sand and gravel	4.1 to 24.0	Not found to be present west of Mytongate Junction
	Relic Peat and Organic Lenses	2.5 to 22.6	Discontinuous Lenses The peat is seen as a firm consolidated layer rather than the familiar compressible material
Superficial - Glacial	Glacial Till Sandy gravelly clay	8.2 to 23.5	Continuous layer to the west of Mytongate and discontinuous further east
	Glacial Lacustrine	13.3 to 26.6	Continuous across the site

Stratum	Unit	Depth (mbgl*)	Notes
	Laminated clay and silt		
	Fluvio Glacial Chalk gravel with sand	7.0 to 33.6	Relatively continuous
Bedrock	Chalk	18.63 (base not encountered)	Structureless weathered rock overlaying unweathered rock comprising cretaceous Chalk of the Burnham Chalk Formation. This unit is typically in the region of 100 to 150m thick and is predominantly thinly bedded and characterised by continuous tabular and lenticular flints

* mgbl = metres below ground level

Land contamination

12.6.5 Areas of potential concern with regards to potential contaminated land risks were identified in the EAR, 2010. These relate to historic industrial land use and observations from the previous geotechnical ground investigation (1994) which included descriptions of 'waste' within made ground in the vicinity of Mytongate Junction. These potential sources are illustrated on Volume 2, Figure 12.2 Potential sources of land contamination and described in GCA, 2018 (Volume 3, Appendix 12.1). These sources have the potential to impact soils and groundwater beneath and in the vicinity of the Scheme Site.

12.6.6 Historic potentially contaminating activities within the Scheme area include: former warehousing; docks; timber yards; saw mill; metal works; the Humber works (brass and copper); Humber lead works; pig market; railway lines; and the disused Trinity Burial Ground.

12.6.7 Potential receptors to contaminated land risks include human health (site users, construction workers, adjacent site users / residents), controlled waters (groundwater and surface waters), ecology, buildings and buried structures / services.

12.6.8 The 2013 ground investigation (Geotechnics, 2013) incorporated sampling and field monitoring to target areas of potential concern, as well as providing data from across the wider area of the Scheme to assess land quality. Soil, ground gas, surface water and groundwater samples were collected for chemical analysis to inform the contaminated land risk assessment and assess potential impacts to the identified receptors during construction and operation.

12.6.9 The 2015 site investigation (ESG, 2016a to d) targeted areas previously not investigated or to provide further information on previously investigated areas. Soil samples were collected for chemical analysis to inform the contaminated land risk assessment and assess potential impacts to the identified receptors during construction and operation.

12.6.10 The full details of this assessment are given in GCA, 2018 provided in Volume 3, Appendix 12.1.

12.6.11 The Scheme Site lies within Hull city centre, with limited areas of soft landscaping. Land use and the extent of areas covered by either buildings or hardstanding will not change significantly as a result of the Scheme. With the exception of construction workers, the potential for human receptors to come into contact with potentially contaminated soils is therefore limited by the surface cover which effectively breaks the pathway for exposure. Soil data obtained during the ground investigation was compared to soil screening values (as detailed within the GCA, 2018 provided in Volume 3, Appendix 12.1) which reflect the current site use and proposed future Scheme (i.e. commercial and not residential land use).

12.6.12 No concentrations of soil contaminants were identified above the adopted soil screening values within natural materials, as detailed within the GCA, 2018 included in Volume 3, Appendix 12.1 and therefore, no remedial measure have been identified for natural materials for the protection of human health.

12.6.13 Elevated concentrations of heavy metals (lead, nickel) and PAHs[263] above the relevant screening criteria for human health were identified in isolated areas of made ground, typically in the vicinity of Mytongate Junction (refer to Volume 3, Appendix 12.1, Drawings 1 and 2). Typically, these exceedances were at depths of <1 metres below ground level (mbgl) and associated with isolated fragments of clinker.

12.6.14 Asbestos fibres were identified in localised made ground samples. The majority of these positive identifications were recorded in the vicinity of Mytongate Junction at depths less than 1mbgl (refer to Volume 3, Appendix 12.1, Drawings 3 and 4).

12.6.15 For re-use, treatment or disposal options for excavated materials, an understanding of the waste classification of these materials is required. A summary of the three principal stages, the waste assessment process and outcome is provided in the GCA, 2018 (Volume 3, Appendix 12.1).

12.6.16 Stage 2 of the assessment (EA Technical Guidance WM3[264] - Hazardous Properties Assessment) was undertaken using the industry recognised HazWasteOnline™ screening tool; a web-based software for classifying waste that follows the latest EA guidance and European regulations. Approximately 7% of all soil samples analysed were identified as Hazardous Waste (LoW Code 17-05-03) and approximately 93 % of soil samples were analysed identified as Non-Hazardous Waste (LoW Code 17-05-04), which may be acceptable as an inert or non-hazardous landfill.

[263] Polycyclic aromatic hydrocarbons

[264] EA Technical Guidance WM3, Waste Classification, Guidance on the Classification and Assessment of waste (1st edition 2015)

12.6.17 The majority of soil samples identified as Hazardous Waste were typically from made ground within 0.5m of ground level, in the vicinity of Mytongate Junction. Two soil samples were identified as Hazardous Waste in deep made ground in the vicinity of Humber Dock Marina and single Hazardous Waste samples were identified at the Scheme Site's eastern and western extents and on Garrison Road (now known as Roger Millard Way).

12.6.18 With exception of the samples identified to contain hazardous properties, the results from the ground investigation indicated that materials would generally be suitable for acceptance at an inert or non-hazardous landfill, should they require disposal. Further discussion on the impacts of the waste management and re-use and handling of excavated materials (including potentially contaminated soils) is given in Chapter 13 Materials.

12.6.19 Leachable concentrations of hydrocarbons and heavy metals were recorded and the significance of potential impacts to controlled waters are discussed in Chapter 11 Road drainage and the water environment.

12.6.20 The significance of potential impacts to ecology from land contaminated are discussed in Chapter 10 Ecology and nature conservation.

12.6.21 The Scheme would involve construction of various buried concrete structures, including piles, slabs and shallow foundations. Aggressive chemicals in soils have the potential to attack buried concrete. Sulphate and pH testing undertaken on soil samples collected indicate an aggressive chemical environment for concrete (ACEC) varying across the study area, laterally and with depth. The ACEC class for each structural element should be determined individually.

12.6.22 Foundations and any buried concrete should be specified in accordance with the recommendations of Concrete in aggressive ground, Special Digest 1:2005, Third edition, BRE Construction Division.

12.6.23 There is also the potential (albeit very small) for organisms that caused death from smallpox to be present, if human tissue has survived within the Trinity Burial Ground. Organisms that caused death from anthrax also have a potential to survive in soil. Trial trenches excavated within the burial ground in 2015 (refer to Chapter 8, Cultural heritage) however did not identify any evidence of surviving tissue. The burial horizon was identified to extend to 1.85mbgl.

Ground gas

12.6.24 Preliminary ground gas monitoring was undertaken as part of the 2013 ground investigation (Geotechnics, 2013). The results indicate that peat and organic material within the superficial deposits are generating concentrations of ground gas (namely methane), with methane dissolved into the shallow groundwater (refer to Volume 3, Appendix 12.1).

12.6.25 Given the shallow groundwater levels recorded across the Scheme area (typically resting at 2.0 to 3.0mbgl), the water table generally rested above the response zone of the completed monitoring installation, where potentially gassing strata (peat and organic alluvium deposits) were targeted. This can affect ground gas measurements since groundwater can impact the flow of soil gas from the strata being monitored. Measured ground gas concentrations and flow rates may not be fully representative of actual ground gas conditions associated with the targeted strata.

12.6.26 Elevated methane gas concentrations greater than the lower explosive limit (LEL) of 5% (by volume of methane in air) were recorded at various monitoring locations and assuming the complete outgassing of methane from groundwater in a confined space, the methane LEL could also theoretically be achieved.

Unexploded ordnance

12.6.27 Historic bombing raids are known to have occurred within parts of the study area (EAR, 2010). Areas of 'medium' risk due to the potential for unexploded ordnance (UXO) were identified in the far west and east of the Scheme Site area. The remaining areas were identified as 'low' risk.

12.6.28 Specialist Explosive Ordnance Disposal (EOD) support was provided during the 2013 ground investigation. An EOD Engineer supervised the excavation of exploratory holes in areas identified with a 'medium' UXO risk. No anomalies from the magnetometer surveys carried out or suspected UXO items were identified during the ground investigation. Before the commencement of the 2015 ESG (2016a - d) intrusive works cone magnetometer penetration tests were undertaken at the exploratory hole locations to confirm the absence of detectable unexploded ordnance (ESG 2016a).

12.6.29 Specialist EOD support will be required during sub-surface construction or earthworks within areas of the Scheme Site where a potential UXO risk has been identified. The surveys undertaken during the ground investigation only screened the area immediately around the exploratory holes.

Baseline risks

12.6.30 As described in Section 12.5.5, the significance of land contamination and ground gas within the study area was assessed using the source-pathway-receptor model.

12.6.31 Potential land contamination and ground gas sources have been identified. Specific proposed construction activities which may be affected by these potential sources include:

- Site clearance and preparatory works
- Earthworks, including the excavation of approximately 7m depth of superficial deposits for construction of the underpass at Mytongate

- Ground improvement which may take the form of jet grouting and deep soil mixing
- Installation of foundations and embedded retaining walls including diaphragm walls, secant piles, sheet piles and tension piles
- Localised dewatering and containment of groundwater
- Re-routing and installation of utilities
- Piling and installation of diaphragm walling through organic-rich deposits

12.6.32 The significance of these potential land contamination and ground gas risks in terms of the sensitivity of receptors and magnitude of potential impacts have been assessed using HA 205/08. Results of analysis and monitoring undertaken during the site investigation were assessed in line with statutory guidance[265] and potential risks have been characterised in terms of significance as detailed in Table 12.5 and Table 12.6, without the consideration of mitigation measures.

12.6.33 Measures for addressing contaminated soils, ground gas and potential UXO encountered during construction will be included in a CEMP. An outline Environmental Management Plan (OEMP) is provided as document reference TR010016/APP/7.3.

[265] Refer to Section 6 in Appendix 12.1

Table 12.5: Potential land contamination and ground gas risks during construction

Activity	Potential hazard	Risk receptor	Value (sensitivity)	Magnitude	Significance *
Earthworks (generation of dust, removal of hardstanding and increased infiltration, exposure of materials previously located at depth, material disposal)	Exposure to soils containing elevated concentrations of contaminants (e.g. heavy metals and hydrocarbons) in localised areas of Made Ground.	Site workers and adjacent users	High	Moderate [Adverse]	Moderate [Adverse]
	Exposure to soils containing elevated concentrations of contaminants associated with Trinity Burial Ground.	Site workers and adjacent users	High	Moderate [Adverse]	Moderate [Adverse]
	Exposure to asbestos fibres in localised areas of Made Ground	Site workers and adjacent users	High	Moderate [Adverse]	Moderate [Adverse]
	Increased leaching of contaminants (e.g. hydrocarbons) from soils leading to further impacts to underlying groundwater and potential contaminant migration	Principal Aquifer Surface water features	High	Moderate [Adverse]	Moderate [Adverse]
	Release and migration of ground gas which could accumulate in confined spaces leading to asphyxiation and / or risk of explosion	Site workers	High	Major [Adverse]	Large [Adverse]
	Generation of excavated materials classed as hazardous which cannot be re-used without pre-treatment	Off site disposal route	Low	Moderate [Adverse]	Slight [Adverse]
Jet grouting, deep soil mixing and piling within the superficial deposits	Release and migration of ground gas due to pressures induced by jet grouting which could accumulate in confined spaces leading to asphyxiation and / or risk of explosion.	Site workers	High	Major [Adverse]	Large [Adverse]
Localised dewatering of excavations and containment	Release and migration of dissolved methane in the groundwater which could accumulate in confined spaces leading to asphyxiation and/or risk of explosion	Site workers and adjacent users	High	Major [Adverse]	Large [Adverse]
	Release of contaminants within groundwater / run-off which may impact local water quality	Surface water features	Medium	Minor [Adverse]	Slight [Adverse]
Re-routing of water main and installation of utilities	Direct contact of buried services with elevated contaminants (hydrocarbons) and degradation / permeation of materials.	Buried services	Medium	Moderate [Adverse]	Moderate [Adverse]

Activity	Potential hazard	Risk receptor	Value (sensitivity)	Magnitude	Significance *
	Release and migration of ground gas which could accumulate in confined spaces leading to asphyxiation and / or risk of explosion.	Site workers	High	Major [Adverse]	Large [Adverse]
Piling - installation of secant pile walls and tension piles	Release and migration of ground gas which could accumulate in confined spaces leading to asphyxiation and / or risk of explosion.	Site workers and adjacent users	High	Major [Adverse]	Large [Adverse]
	Release of contaminants present in groundwater within the superficial deposits, impacting groundwater quality within the underlying Principal Aquifer	Principal Aquifer	High	Minor [Adverse]	Moderate [Adverse]

* without mitigation

Table 12.6: Potential land contamination and ground gas risks during operation

Activity	Potential impact	Risk receptor	Value (sensitivity)	Magnitude of risk	Significance of risk*
Operation	Piles act as preferential pathways for the downward migration of contaminants present in groundwater within the superficial deposits, impacting groundwater quality within the underlying Principal Aquifer	Principal Aquifer	High	Minor [Adverse]	Moderate [Adverse]
	Release and migration of ground gas which could accumulate in confined spaces leading to asphyxiation and / or risk of explosion.	Site users Buildings and services	High	Moderate [Adverse]	Moderate [Adverse]
	Direct contact of buried services and structures with localised aggressive contaminants in soils and / or groundwater which may attack material integrity if not selected / designed appropriately.	Buried services and structures	Medium	Moderate [Adverse]	Moderate [Adverse]

* without mitigation

12.7 Mitigation

12.7.1 As discussed in Section 12.5.14, given the lack of potential geological or geodiverse receptors, no adverse impacts on general soils and geology have been identified.

12.7.2 Geotechnical risks for the Scheme which may have an impact on the soils and geological aspects of the environment (e.g. settlement, instability) have been identified and will be managed (together with other geotechnical risks) in accordance with HD 22/08.

12.7.3 Potential land contamination and ground gas risks have been identified following completion of the ground investigation.

Construction

12.7.4 Proposed mitigation measures to be implemented during construction are summarised in Table 12.7.

Table 12.7: Mitigation of potential impacts during construction

Potential impact	Proposed mitigation	Significance following mitigation
Settlement of sections of new highway or adjacent land due to consolidation of underlying soils (e.g. as a result of increasing the load on the ground or by localised dewatering)	• No increase beyond the existing load (e.g. lightweight fill or foamed concrete used where increases in ground level is required to avoid inducing settlement) or ground improvement measures. • Provide adequate groundwater cut off to limit dewatering requirements. Monitor groundwater levels during dewatering / excavation works to limit consequences. If drawdown of groundwater reaches a level where settlement may occur, activities suspended to allow groundwater to return to background levels.	Neutral
Heave of the ground surrounding the active construction area caused by jet grouting or ground improvement measures	• During jet grouting or ground improvement measures, the ground level monitored for signs of heave. • If detectable levels of heave are recorded, operations to be reviewed and ground treatment method revised to ensure no further ground movements occurred.	Neutral

Potential impact	Proposed mitigation	Significance following mitigation
New or existing development being put at risk from land instability	• Preliminary design includes a robust proposal for construction of the underpass to limit movement and deflections of the walls of the underpass.	Neutral
Risk of encountering and detonating unexploded ordnance	• Adhere to safe systems of work in accordance Explosive Ordnance Safety and Awareness briefings. • In areas of medium risk (or above), earthworks / piling to be carried out under supervision of specialist Explosive Ordnance Disposal (EOD), with use of magnetometer surveys and targeting of suspected anomalies, where necessary.	Neutral
Exposure to soils containing elevated concentrations of contaminants in localised areas of Made Ground (including Trinity Burial Ground)	• Site workers to use appropriate PPE and safe systems of work as outlined in the CEMP. This will include how contaminated materials are to be managed (Materials Management Plan), stored and disposed of to mitigate exposure (e.g. vehicle loads to be covered, roads to be kept clean, damping down of stockpiles to prevent airborne release of contaminants. • Validation sampling to verify excavated material meets specific criteria to ensure it is suitable for reuse or nominated treatment / disposal route. • Material from hotspot areas to be excavated and segregated and stored appropriately prior to off site disposal / treatment. • Adoption of dynamic risk assessments to identify remedial actions should unforeseen contamination be encountered during future ground investigation or construction. • Adoption of Trinity Burial Ground Clearance Methodology[266].	Neutral

[266] The Trinity Burial Ground Clearance Methodology will include specific environmental, health and safety controls required due to specific ground conditions and the exhumation of human remains, plus community and regulatory liaison requirements (e.g. living descendants, Holy Trinity Church, Hull City Council Environmental Health and Public Health England)

Potential impact	Proposed mitigation	Significance following mitigation
Exposure to asbestos fibres in localised areas of Made Ground	• Site workers to use appropriate PPE and safe systems of work as outlined in the CEMP. This will include how contaminated materials are to be managed (Materials Management Plan), stored and disposed of to mitigate exposure (e.g. vehicle loads to be covered, roads to be kept clean, damping down of stockpiles to prevent airborne release of contaminants. • Adherence to Control of Asbestos at Work Act. • Use of dust suppression systems to ensure any potential for fibre release is minimised. • Made ground materials to be subject to asbestos screening as part of validation analysis prior to reuse or disposal.	Neutral
Increased leaching of contaminants (e.g. hydrocarbons) from soils	• No re-use of impacted soils without appropriate treatment to ensure they are suitable for reuse without presenting a risk to controlled waters. • Controlled stockpile management. • Minimise areas of exposed excavation as far as practical.	Neutral
Release and migration of ground gas from the ground / groundwater	• Adoption of controlled work areas, use of intrinsically safe equipment, personal protective equipment, gas monitoring and suitable siting of any mobile offices, stores or welfare units as appropriate[267].	Slight Adverse
Generation of excavated materials classed as hazardous which cannot be re-used without pre-treatment	• Validation sampling to be undertaken to verify the waste classification of materials requiring disposal (using WM3). • This would include further Waste Acceptance Criteria analysis to determine suitability for material disposal.	Neutral

[267] Refer to range of guidance including DSEAR Implementation for the Waste Management Industry ESA ICoP 1, 2005; L138 DSEAR 2013 - Approved Code of Practice and Guidance, HSE 2013; Safe Work in Confined Spaces - Approved Code of Practice, HSE 2014

Potential impact	Proposed mitigation	Significance following mitigation
Release of contaminants within groundwater / run-off which may impact local water quality	• Piling methodology to be selected to minimise the potential for down-drag of contaminants. • A Foundation Works Risk Assessment (FWRA) to be undertaken in accordance with EA guidance[268] to ensure appropriate foundation solutions are designed and undertaken to mitigate risks to controlled waters. • Best practice methodologies to be implemented and outlined in the CEMP to control discharges to drains and run-off. • Only compliant discharges to sewer or surface water via consent / permit.	Neutral

Operation

12.7.5 The proposed mitigation measures to be implemented during operation are summarised in Table 12.8 below.

Table 12.8: Mitigation of potential impacts during operation

Potential impact	Proposed mitigation	Significance following mitigation
Piles act as preferential pathways for the downward migration of contaminants in groundwater	• Piling methodology and design to be selected to minimise the potential for piles to act as a continuing vertical pathway for migration of contaminants in groundwater. • A FWRA should be undertaken in accordance with EA guidance**Error! Bookmark not defined.** to ensure appropriate foundation solutions are designed and undertaken to mitigate risks to controlled waters.	Neutral
Release and migration of ground gas	• Ground gas protection measures to be installed (where	Neutral

[268] Piling into Contaminated Sites (2002) Environment Agency, Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention (2001) NC/99/73, Environment Agency

Potential impact	Proposed mitigation	Significance following mitigation
	appropriate) in accordance with UK guidance[269] • Any drainage vents and chambers will also require ground gas protection / venting.	
Direct contact of buried services and structures with aggressive contaminants in soils	• Selection of design of service ducts and materials in consideration of ground conditions where impacted soils are present. • All concrete to be specified in accordance with the recommendations published within Concrete in Aggressive Ground, Special Digest 1:2005, Third edition, BRE Construction Division.	Neutral

12.8 Predicted environmental effects

Construction

12.8.1 With appropriate mitigation measures in place, as outlined in Table 12.7, residual impacts in relation to geology and soils (including land contamination) during construction are considered to be slight adverse to neutral.

12.8.2 Measures for addressing any contaminated materials and ground gas encountered during construction (as identified in the recent site investigation or otherwise) will be outlined in Method Statements and included in the CEMP. Best practicable means will also be outlined in the CEMP and implemented during construction to ensure that impacts to geology and soils (including land contamination and ground gas) are mitigated.

Operation

12.8.3 With appropriate mitigation measures in place, as outlined in Table 12.8, residual impacts in relation to geology and soils (including land contamination and ground gas) during operation are considered to be neutral.

12.9 Conclusion

12.9.1 No sensitive geological or geodiverse receptors were identified which would be affected by construction or operation of the proposed Scheme.

[269] CIRIA C665 (2007) Assessing risks posed by hazardous ground gases to buildings and BS8485 (2007) Code of practice for the design of protective measures for methane and carbon dioxide gases for new buildings

12.9.2 Geotechnical risks that may have an impact on the soils and geological aspects of the environment (e.g. settlement, instability) have been identified. These will be managed (together with other geotechnical risks) in accordance with HD 22/08.

12.9.3 Areas of 'medium' risk due to the potential for unexploded ordnance (UXO) were identified in the far west and east of the Scheme area. Proposed mitigation measures are provided in Section 12.7.

12.9.4 Historic potentially contaminating activities within the Scheme area were identified and localised soil contamination recorded from the recent ground investigation. Peat and organic material within the natural superficial deposits were also recorded as generating elevated concentrations of ground gas. Proposed mitigation measures are provided in Section 12.7.

12.9.5 With the implementation of the relevant mitigation measures, the predicted environmental effects on soils and geology are considered to be neutral or slightly adverse.

12.9.6 As detailed in Section 13.2.6, reference should also be made to other sections of this report which address potential impacts from the creation of dust; land contamination on ecology, risk of flooding, changes to the water environment (hydrogeology and hydrology) and materials / earthworks.

Chapter 13. Materials

13.1 Executive summary

13.1.1 The assessment of the construction and operation impacts of the Scheme with regard to the use of materials and generation of waste was undertaken using methodology outlined in Volume 11 of the Design Manual for Roads and Bridges (DMRB), HA205/08 (August 2008) and Interim Advice Note (IAN) 153/11.

13.1.2 The Scheme would generate significant volumes of construction, demolition and excavation waste (CDEW), principally from the excavation of soils to form the underpass and slip roads at the existing Mytongate Junction. There is very limited potential for the re-use of CDEW within the Scheme due to the site setting constraints, limited areas of landscaping and the geotechnical unsuitability of site-won material.

13.1.3 The re-use of materials within the Scheme Site is likely to be restricted. Options for the re-use of materials off site (e.g. as restoration soils) should be fully considered by the Principal Contractor in accordance with the Construction Environmental Management Plan (CEMP) and Site Waste Management Plan (SWMP). An Outline Environmental Management Plan (OEMP) has been prepared for the Development Consent Order for the Scheme - see document reference TR010016/APP/7.3. An outline SWMP is provided at Volume 3, Appendix 13.2.

13.1.4 Total carbon emissions for materials required for the Scheme have been estimated based on assumptions at this Preliminary Design stage. Estimates indicate a high proportion of embodied carbon[270] for the Scheme is associated with bulk materials (over 90% of total) required for foundations, road construction, general backfill and structures.

13.1.5 With the implementation of the relevant mitigation measures, the predicted environmental effects in relation to materials are considered to be moderate adverse. This is not significant in terms of overall effects.

13.2 Introduction

13.2.1 Material resources are defined as materials and construction products needed for construction, improvement and major maintenance of the trunk road network. This includes primary raw materials, manufactured or recycled materials.

13.2.2 The Scheme would require significant quantities of both primary and secondary materials. The production, transport, handling, storage, use and disposal of these materials has the potential to result in environmental impacts.

[270] Carbon emissions released from the extraction, transport and manufacture of materials used in construction

13.2.3 Potential impacts associated with materials require consideration with regard to two main areas:

- use of material resources
- generation and management of waste

13.2.4 Waste will arise from two main sources; site materials (such as excavated soils or demolition waste); and excess materials brought to the site during construction and not used (damaged stock, surplus etc.). Waste is defined in the European Union Waste Framework Directive (EU WFD) 2008/98/EC[271] as "…*any substance or object which the holder discards or intends or is required to discard*".

13.2.5 Inert, non-hazardous and smaller volumes of hazardous waste[272] would be generated by the Scheme.

13.2.6 The Scheme Site includes the existing and the proposed A63 Castle Street, associated slip roads and side roads, the northern section of the Trinity Burial Ground, land required for the construction of pedestrian, cycle and disabled user bridges and the route of all proposed service diversions.

13.2.7 To avoid repetition, there is overlap with other sections of this Environmental Statement (ES) and reference should be made to the following chapters:

- creation of dust (refer to Chapter 6 Air quality)
- impacts to the water environment (refer to Chapter 11 Road drainage and the water environment)
- impacts of land contamination (refer to Chapter 12 Geology and soils)
- cumulative effects (refer to Chapter 16 Combined and cumulative effects)

13.3 Legislative, regulatory and policy background

European legislation

13.3.1 The EU WFD 2008/98/EC sets the basic concepts and definitions in relation to waste management. Article 4 of the revised Directive sets out five steps for dealing with waste, ranked according to environmental impact - the 'Waste Hierarchy'. Prevention, which offers the best outcomes for the environment, is at the top of the

[271] European Commission Waste Framework Directive 2008/98/EC

[272] EU WFD 2008/98/EC defines 'hazardous waste' as waste which displays one or more of the hazardous properties listed in Annex III of the directive (regarded as harmful to human health or the environment in the short or long term. Waste not displaying any of the hazardous properties listed in Annex III of the EU WFD 2008/98/EC would be considered 'non-hazardous waste'. Non-hazardous waste that does not undergo any significant physical, chemical or biological transformations would be considered 'inert waste'.

priority order, followed by preparing for re-use, recycling, other recovery and disposal, in descending order of environmental preference.

Figure 13.1: Waste hierarchy

Source: http://ec.europa.eu/environment/waste/framework/

National legislation and guidance

13.3.2 Various legislation is in place to regulate the management of waste and best practice guidance which promotes the sustainable use of materials and waste minimisation. Key legislation and guidance relevant for this Scheme is summarised in Table 13.1.

Table 13.1: Summary of key national legislation and guidance

Legislation / Guidance	Description
Waste (England and Wales) Regulations 2011 (as amended 2014)	Implements the EU WFD 2008/98/EC (transposing the Waste Hierarchy into UK law) and imposes a 'duty of care' on anyone who imports, handles, carries, treats, or disposes of waste in relation to the waste hierarchy, to ensure waste is dealt with appropriately through authorised means
Environmental Protection Act 1990, Part II, Section 34	Sets out the legal framework for 'duty of care'
Hazardous Waste (England and Wales) Regulations 2005 (as amended 2009)	Implements the Hazardous Waste Directive (91/689/EC), including the required controls and tracking of movements for all hazardous materials
Hazardous Waste (Miscellaneous Amendments) Regulations 2015	Covers the appropriate assessment of wastes and reflects a revised classification system for hazardous waste
Environment Permitting (England and Wales) Regulations 2010 (as amended)	Provides the framework for environmental permits and exemptions, including waste operations
Environment Agency (EA) (Standard Rules SR2015 No 39)*	Allows the storage and subsequently use of waste for the purposes of a recovery activity involving construction and / or reclamation, restoration or improvement of land

Legislation / Guidance	Description
Climate Change Act 2008	Provides a statutory framework for reducing greenhouse gas emissions and includes reduction targets
Government Construction Strategy, 2016-2020	Includes objective to encourage innovative sustainability solutions to reduce carbon where value can be demonstrated. The UK Government's Infrastructure Carbon Review in 2013 established how resource efficiency and carbon reduction can facilitate reduce costs
CL:AIRE Definition of Waste**	Where significant quantities of waste are being generated by a Scheme, materials may be managed in accordance with the DoW CoP. This enables materials to be defined as suitable for re-use and no longer considered waste, reducing the need for disposal
DEFRA Construction Code of Practice for the Sustainable Use of Soils on Construction Sites, September 2009	Provides detailed guidance on the use, management and movement of soils on site
Site Waste Management Plan (SWMP)	Legislation setting out the requirement for SWMPs was repealed in December 2013 although use a SWMP. The use of a SWMP is regarded as best practice and adopted by Highways England. A SWMP can improve environmental performance, manage potential environmental impacts, meeting regulatory commitments and help to reduce waste

* Use of waste in a deposit for recovery operation (Construction, reclamation, restoration or improvement of land other than by mobile plant)

** Development Industry Code of Practice V2, 2011 (DoW COP)

National planning policy

13.3.3 The National Planning Policy Framework (NPPF, March 2012) sets out how the planning system should facilitate the sustainable use of minerals and states that local planning authorities should *"take account of the contribution that substitute or secondary and recycled materials and minerals waste would make to the supply of materials, before considering extraction of primary materials, whilst aiming to source minerals supplies indigenously"*. The NPPF itself does not contain specific waste policies.

13.3.4 The Good Practice Guidance: Sustainable Design and Construction (August 2012) underpins the NPPF. Although it focuses on sustainable buildings and design, it promotes the use of sustainable construction techniques including the re-use and recycling of building materials and reducing carbon emissions.

13.3.5 The Waste Management Plan for England (WMPE, December 2013) sets the obligation to implement measures to ensure that at least 70% by weight of construction and demolition waste is subjected to material recovery by 2020.

13.3.6 The Waste Prevention Programme for England (WPPE, December 2013) is a requirement of the Waste Framework Directive (2008/98/EC) and sets objectives to help people and organisations make the most out of opportunities to save money by reducing waste.

13.3.7 The National Planning Policy for Waste (NPPW, October 2014) provides waste planning policies to support the NPPF, the WMPE and national policy statements for waste water and hazardous waste, or any successor documents.

13.3.8 The National Policy Statement for National Networks (NN NPS, December 2014) identifies the requirement to use natural resources and energy efficiently, produce less waste and use waste as a resource wherever possible.

Regional planning policy

13.3.9 The Yorkshire and Humber Plan, Regional Spatial Strategy to 2026 was revoked in February 2013. Development Plans across the region comprise the relevant Local Plan, as described in Section 13.3.10 below.

Local planning policy

13.3.10 The Hull Local Plan 2016-2032 was adopted in November 2017 and includes Policy 17- Energy efficient design which states that *"development should demonstrate how the design will reduce energy [and] this should include consideration of [….] construction materials of buildings"*.

13.3.11 The Joint Waste Local Plan for Hull City Council and East Riding of York Council (JWLP, 2004) serves to provide a clear guide to how and where waste produced in the joint plan area will be dealt with. An initial consultation to update the JWLP undertaken in 2008 but work on the new JWLP was suspended. The current JWLP has three key objectives:

- Identify future waste management needs by assessing how much waste will be produced up to 2014 and the capacity of existing facilities to deal with it.
- Promoting managing waste more sustainably in line with the Waste Strategy 2000 for England and Wales (superseded by WMPE).
- Protect people and the environment from the potential harmful effects of waste development.

13.3.12 The new JMLP would implement the Joint Sustainable Waste Management Strategy 2012 for Hull and East Riding, which sets out how the councils plan to manage waste produced in the area and improve the long-term sustainability of waste management. No date for adoption is currently given.

Highways England policy

13.3.13 The Memorandum of Understanding between the Environment Agency and the Highways Agency (November 2009) sets out the aim to adopt and implement standards for good practice in reducing waste, increasing recycling and increasing the use of recycled and recovered materials. The Highways Agency Procurement Strategy 2009 also sets targets for sustainable sourcing (25% of products used in construction projects by 2012), reduction of waste to landfill from construction and

demolition activities (50% reduction by 2012 compared to 2008) and increased recovery of non-hazardous construction and demolition waste (minimum of 70% by weight by 2020).

13.3.14 Highways England's Sustainable Development Strategy (April 2017) sets out the ambition to reduce the organisation's carbon footprint. This includes working with suppliers to reduce carbon emissions and identifying where efficiencies can be achieved through reducing fuel, energy and raw material consumption and by minimising waste.

13.3.15 Highways England's Environment Strategy (April 2017) sets the organisation's commitment to improve environmental outcomes and seek to help to protect, manage and enhance the quality of the surrounding environment. The strategy sits alongside and complements the Sustainable Development Strategy which covers carbon emissions and waste.

13.4 Study area

13.4.1 The study area for the assessment of Materials includes a 500m buffer zone either side of the A63 and is the same as that used in Chapter 12 Geology and soils. This aligns with the requirement to consider the nature of waste generated and the potential contamination. In addition, the location of local (up to 25km) and regional (up to 150km) waste management facilities and material suppliers has been considered.

13.5 Approach and methodology

Overview

13.5.1 The DMRB guidance on the assessment of potential environmental effects associated with materials is currently provided in Interim Advice Note (IAN) 153/11[273] and has been followed in the chapter. The methodology allows the identification of potential sensitive receptors which may be affected as a result of the Scheme and the development of appropriate mitigation measures to minimise potentially adverse effects or enhance beneficial effects.

13.5.2 Two levels of assessment (simple and detailed) are identified in IAN 153/11. Given the information that is available for the Scheme and the significant material movements proposed which are associated with the construction, potential environmental effects cannot be readily defined using a simple assessment. A detailed assessment was considered necessary to ensure that the assessment is robust and was undertaken following completion of the initial simple assessment.

[273] Highways England Interim Advice Note 153/11 Guidance on the Environmental Assessment of Material Resources. Available online at: http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian153.pdf

13.5.3 Information on the use of material resources and waste for the Scheme is reported using both the simple and detailed assessment reporting matrix and any mitigation measures outlined. The matrix has been completed for the following four main Scheme activities:

- Site remediation / preparation / earthworks
- Demolition
- Site construction
- Operation and maintenance of assets

13.5.4 Reports which provide relevant information on the potential classification of materials proposed to be generated as a result of the Scheme (such as excavated soils) are referenced within Chapter 12 Geology and soils.

Assessing significance

13.5.5 IAN 153/11 does not provide specific guidance on assessing the significance of the effect. The significance of potential impacts has therefore been reviewed based on professional judgement on the nature and magnitude of each impact in accordance with the principles set out in HA 205/08.

- Adverse or beneficial
- Permanent or temporary
- Direct or indirect
- Significant or an insignificant effect

13.5.6 With regards to the use of materials, estimates for embodied carbon and carbon emissions through the transportation of materials have been determined using the Highways England Carbon Emissions Calculation Tool (CECT), version 1.03[274]. This allows materials use to be quantified in terms of net volumes and carbon, allowing greater confidence in the detailed assessment of significance of the associated impacts.

13.5.7 The scale of magnitude of these impacts has then been assessed, depending on the quantity of materials required, associated total carbon emissions and sensitivity (value) of the material resource.

13.5.8 To assess the impacts from the generation of waste, the volumes of waste generated during construction have been estimated (as identified in Section 13.6.19), together with consideration of the capacity of regional waste

[274] Highways England Carbon Emissions Calculation Tool. Available online at: https://www.gov.uk/government/publications/carbon-tool

management facilities and the potential for re-use / recycling of waste either on or off site.

13.5.9 For the operation and on-going maintenance of the Scheme, the volumes and types of all material and waste to be generated are not known in detail. Potential impacts have been assessed using based on the currently available details for the Scheme.

13.5.10 The magnitude of impacts given in Table 13.2 have been used to assess the significance of effects associated with both material use and generation of waste.

Table 13.2: Magnitude of impacts

Magnitude of impact	Typical criteria descriptors
Major	Materials: > 40,000 tonnes CO_2e[275]
	Waste: Significant quantities of waste (or smaller quantities of Hazardous waste). Treatment and disposal options are limited, capacity is restricted and limited segregation, sorting, consideration of material re-use or recycling has been undertaken. Majority of waste is sent to landfill.
Moderate	Materials: 20,000 – 40,000 tonnes CO_2e
	Waste: Some segregation of waste takes place and recycled, sorted, composted or recovered at a recycling facility. Less than half of waste generated is sent to landfill.
Minor	Materials: 5,000 – 20,000 tonnes CO_2e
	Waste: All waste is segregated and primarily recycled, sorted, composted or recovered at a recycling facility. Some re-use of materials on site or off site at an appropriately licensed or registered exempted site. Volumes of waste sent to landfill are minimal.
Negligible	Materials: 1,000 – 5,000 tonnes CO_2e
	Waste: Waste is predominantly re-used on site or off site at an appropriately licensed or registered exempted site, with no waste going to landfill.
No change	Materials: < 1,000 tonnes CO_2e
	Waste: No net production of waste.

13.5.11 The scales of magnitude for materials in Table 13.2 have been used in the ES for other Highways England schemes such as M20 Junction 10A (2017).

13.5.12 Note that no beneficial effects have not been included in the 'magnitude of impacts' since the Scheme shall result in the net use of materials and generation of waste, with opportunities for re-use of site-won / recycled materials either on or off site regarded as a mitigation rather than a net environmental benefit.

[275] tonnes CO_2e = tonnes of carbon dioxide equivalent

13.5.13 Assessing the significance of a potential impact is also dependent on the sensitivity of the receptor. This is not specifically defined in IAN 153/11 and the sensitivity matrix given in Table 13.3 has been used.

Table 13.3: Environmental value and description

Value (Sensitivity)	Typical descriptors
Very High	Materials: Very scarce resource on an international and national scale.
	Waste: There is no or very limited capacity available at local or regional waste management facilities.
High	Materials: Scarce resource on a national scale.
	Waste: Limited capacity available at local or regional waste management facilities.
Medium	Materials: Readily available resource on a national scale.
	Waste: Capacity available at regional waste management facilities and limited capacity available locally.
Low	Materials: Readily available resource on a local and national scale.
	Waste: Capacity available at local and regional waste management facilities.
Negligible	Materials: Abundant local and sustainable resource.
	Waste: High capacity available at local waste management facilities.

13.5.14 The magnitude of predicted impacts and sensitivity (value) was used to assess the significance of potential environmental effects as described in HA 205/08.

Consultation

13.5.15 Environment Agency waste management data[276] for Yorkshire and Humber was consulted to review the future capacity of local waste management sites and whether there is sufficient capacity to deal with the proposed volumes of waste associated with the Scheme.

13.5.16 No external consultation has been carried out specifically for the assessment of materials.

Scope of assessment

13.5.17 The assessment of potential environmental effects has considered the volumes of materials used and wastes generated for the Scheme, the potential for the re-use, recycling and recovery of materials and likely capacity of waste management facilities.

[276] Waste management data for England 2016. Available online at:https://www.gov.uk/government/publications/waste-management-for-england-2016

13.5.18 Off site impacts relating to the extraction of raw materials, depletion of non-renewable resources and the manufacture of construction materials are excluded from the scope of IAN 153/11. Carbon emissions associated with the manufacture and transport of materials and waste (embodied carbon) have been considered.

13.5.19 Primary materials (virgin / manufactured), secondary materials (recycled) and waste have been considered, although the potential for use of secondary materials is constrained to some extent due to limited infill requirements or areas of landscaping. Volume estimates for domestic and office waste from contractor's compounds and welfare facilities are excluded, as well as energy and fuel consumption from site offices and operation of the network (such as lighting). Fuel estimates for the operation of fixed and mobile plant have been provided.

13.5.20 Whilst the selection of specific off site waste treatment facilities for recycling / recovery, exempted sites for re-use or disposal facilities for waste generated by the Scheme will be made during the detailed design, methods for transporting waste have been considered, taking into account possible peak traffic movements and existing traffic flows.

13.5.21 For the main excavation within Mytongate Junction and other bulk excavations, the total volume of spoil for disposal is estimated at 170,000m^3. Excavation rates are expected to vary from 500-750m^3 per day (depending on the area and depth) which could result in an estimated peak of between 50-75 vehicle wagon loads[277] in a day over 12 months.

13.5.22 To construct the underpass, significant amounts of cement for jet grouting (50,000 tonnes) are required to stabilise the ground and bentonite for the diaphragm wall construction and piling.

13.5.23 Slurry generated from the jet grouting / soil mixing activities is also expected to be around 100,000m^3 (estimated at 150 to 260m^3 per day) which would require treatment prior to removal from site due to high water content and the difficulty in handling saturated excavation material.

13.5.24 Treatment options for the slurry include rotary drying or lime treatment. Slurry would be treated within a nearby site compound and water recycled, where possible. Lime treatment would generate solids classed as hazardous waste and is not preferred.

13.5.25 For the operation and on-going maintenance of the Scheme, the significance of the effects from material use and generation of waste have been considered and a comparison made between existing operations and operations upon completion.

[277] Assuming average density of 2 tonnes/m^3 of excavated material and 20 tonne load capacity road wagons

Assumptions and limitations

13.5.26 The material volumes given are based on preliminary estimates (worst case) and may change at the Detailed Design stage. The assessment uses volumes estimated from interpretation of the results of the ground investigations undertaken to date (see Volume 3, Appendix 12.1 Ground contamination assessment) and is based on assumptions of ground conditions observed within the exploratory holes excavated.

13.5.27 The location of exploratory holes was limited by access and site constraints. Undetected areas of contamination may be present beyond the extent of the current ground investigation, which may be encountered during phases of future ground investigation or construction.

13.5.28 Estimates of the volumes of inert, non-hazardous and hazardous waste are based on a waste assessment of the 2014 and 2016 ground investigation soil results undertaken in accordance with the Environment Agency Technical Guidance WM3[278] and the anticipated ratios of made ground and natural soils to be excavated (refer to Volume 3, Appendix 12.1 Ground contamination assessment).

13.5.29 The re-use of CDEW on site is limited due to: site setting constraints; limited infill requirements or areas of landscaping; and geotechnical unsuitability of excavated soils including high organic matter and moisture content, low to very low strength of superficial deposits and likely sensitivity to vibration and settlement.

13.5.30 Any CDEW which is geotechnically or chemically[279] unsuitable for re-use will require disposal or treatment prior to any re-use off site.

13.5.31 The assessment allows the primary identification of materials with higher estimated carbon emissions. Focus should be placed on minimising the use and maximising the recycling and re-use of materials with higher carbon emissions. The estimates for carbon emissions have been determined using the Highways England CECT. This list of materials is not exhaustive and ‘best-fit’ entries have been used, where necessary.

13.5.32 The embodied carbon values for materials calculated by the CECT are typically from ‘cradle to gate’ i.e. from the point of extraction / production through to the arrival at a site.

13.5.33 For material transportation, an estimated average road transport distance of 40km has been assumed at this stage. This has been applied for all material types given the location of the Scheme Site close to the industrial Humber region and location of suppliers. Use of rail freight and shipping may reduce the carbon emissions

[278] EA/SEPA, Technical Guidance WM3, Guidance on the classification and assessment of waste, v1.1, May 2018.

[279] Due to the presence of soil contaminants at unacceptable concentrations.

from transportation of materials but has not been included since a worst-case has been assumed.

13.5.34 For the transportation and removal of waste for re-use / recycling off site, distances between 25km (local) and 150km (regional) have been assumed. Shipping may reduce carbon emissions from transportation but has not been included since a worst-case has been assumed.

13.5.35 The exhumation and reburial for human remains within the Trinity Burial Ground are not included in this chapter. Human remains are not considered a material or waste and would be handled ethically, in full accordance with conditions stipulated by the Diocese of York (as owners of the burial ground), the Burial Authority, Public Health England and appropriate measures requested by living descendants. For more details refer to Chapter 8 Cultural Heritage.

13.6 Baseline conditions (existing environment)

13.6.1 Baseline conditions with regards to materials includes a review of the capacity of available waste management facilities in the vicinity of the Scheme Site. The type and location[280] of waste handling facilities within the Yorkshire and Humber region have been identified as:

- Inert landfill: *Regional*
- Non-hazardous landfill: *Regional*
- Non-hazardous landfill with Stable Non-Reactive Hazardous Waste SNRHW cell: *Regional*
- Hazardous landfill: *Regional*
- Inert / construction waste treatment facility: *Regional*
- Metal recycling site: *Local*
- Hazardous waste transfer with treatment: *Local*
- Household / industrial / commercial waste transfer with treatment: *Local*
- Inert / non-biodegradable waste transfer with treatment: *Regional*

13.6.2 The Scheme is not due for completion until 2025, with the majority of waste being generated during construction in 2020 / 2022. CDEW would be the largest proportion of waste type generated for this Scheme. Statistics given in the Environment Agency Waste Management for England 2016 reports[276] (EA WME Reports 2016) indicate that landfill capacity is available for the disposal of inert and non-hazardous waste generated by the Scheme, if required. Landfill capacity will likely continue to decrease from these 2016 figures and the construction start date for the Scheme (2020).

[280] Local is <25 km and regional is 25-150 km from the Scheme

13.6.3 EA WME Reports 2016 indicate that the Yorkshire and Humber region has a total landfill capacity[281] of approximately 64 million m^3 compared to an average of 47 million m^3 across other regions. The report details the following remaining landfill capacities and life:

- Inert remaining capacity: 16.7 million m^3
- Non-Hazardous remaining capacity: 44.6 million m^3
- Hazardous remaining capacity: 2.5 million m^3
- Landfill life remaining (Non-Hazardous Wastes only): 9.9 years

13.6.4 EA report 2010[282] indicates that inert and non-hazardous CDEW is mostly deposited within the region. The EA WME Reports 2016 estimated that approximately 2 million to 2.5 million tonnes of inert and non-Hazardous CDEW waste has been disposed annually in Yorkshire and Humber between 2000 and 2016.

13.6.5 A high proportion of CDEW produced however does not reach permitted waste management facilities since large volumes of CDEW go to unregulated and exempted sites. Since exempted sites are not covered by the Environmental Permitting Regulations 2010, they are not required to submit waste returns and there is little information on throughput and capacity. A national survey from 2006 estimated that 4.3 million tonnes of CDEW was handled at exempted sites in Yorkshire and Humber, which was approximately half of all CDEW generated in the region. Capacity is therefore anticipated for exempted sites within the region to handle appropriate waste streams generated by the Scheme.

13.6.6 As reflected nationally, there is limited capacity for hazardous waste disposal. Hazardous CDEW is reported to be mostly deposited outside of the region. Consultation with the Environment Agency (January 2018) indicate there are two landfills in Yorkshire with SNRHW cells. Locally, Gallymoor landfill is located 30km to the north west at Market Weighton and regionally, Erin landfill is located 110km to the south west at Duckmanton. Limited local and regional capacity is therefore available for the disposal of hazardous waste generated by the Scheme.

13.6.7 Hazardous waste trends within the region are detailed within EA WME Reports 2016. The key recent trend reported is an overall decrease in disposal of hazardous waste to landfill between 2013 and 2016 (decreasing from 107,000 tonnes to 91,704 tonnes) alongside a general increase in the amount of hazardous waste sent for recovery, incineration with energy recovery and treatment.

13.6.8 Waste treatment and transfer capacity in the region is reported to be difficult to accurately measure but was estimated at 3.7 - 5.2 million tonnes in the

[281] Hazardous, Non-Hazardous with a SNRHW Cell, Non-Hazardous and Inert, excluding restricted facilities

[282] EA Waste Data Modelling Project: Yorkshire and Humber, GENE0910BTAY-e-e, September 2010

Environment Agency report 2010. Available regional capacity is therefore anticipated for handling waste streams generated by the Scheme at waste treatment and transfer facilities.

13.6.9 The Scheme would involve a range of activities during construction resulting in the use of materials and generation of waste. Such activities include:

- Site clearance and preparatory works
- Earthworks, including the excavation of approximately 7m depth of superficial deposits for construction of the underpass at Mytongate Junction
- Ground improvement in the form of a combination of deep soil mixing and jet grouting
- Dewatering of excavated soils and treatment of slurry from ground improvements and underpass construction
- Installation of foundations and embedded retaining walls including diaphragm walls, secant piles, sheet piles and tension piles
- Construction of bridges and other infrastructure
- Localised dewatering and containment of groundwater
- Re-routing of water main and installation of other utilities
- Piling and installation of diaphragm walling through organic-rich deposits

13.6.10 As described in Chapter 12 Geology and soils, the general geological sequence present beneath the Scheme Site has been reviewed through previous ground investigations.

13.6.11 The ground investigations incorporated sampling to assess the potential chemical suitability for re-use or disposal options of excavated soils (refer to Volume 3, Appendix 12.1 Ground contamination assessment).

13.6.12 The re-use of material on site is limited and as such, a balance between volumes of material excavated and needed on site for infilling (earthworks balance) is not possible. The potential options for the re-use of suitable material off site must therefore be considered.

13.6.13 An assessment in accordance with the Environment Agency's Technical Guidance WM3 was carried out to determine whether excavated materials for off site disposal would be classed as hazardous (refer to Volume 3, Appendix 12.1, Ground contamination assessment). Approximately 7% of soil samples analysed were identified as hazardous waste. These samples were generally recovered from shallow made ground (within 0.5m of ground level) from around Mytongate Junction. Localised samples were also assessed as hazardous waste due to the presence of asbestos containing materials (ACM). These materials would be managed in accordance with the CEMP to ensure potential risks are mitigated.

13.6.14 Hazardous materials must be segregated and disposed of to a landfill licensed to accept SNRHW or hazardous waste, if disposal is required. It may be possible through further sampling, assessment and segregation to reduce the quantity of hazardous waste generated during construction.

13.6.15 Approximately 93% of soil samples analysed were identified as non-hazardous and would generally be suitable for acceptance at an inert (subject to waste acceptance criteria) or non-hazardous landfill, if disposal is required.

13.6.16 Appropriate disposal routes would be identified by the Principal Contractor during construction and all waste materials / classifications confirmed by the receiving landfill prior to any disposal through additional testing and assessment.

13.6.17 There are a number of local and regional suppliers of aggregate and mineral infrastructure (such as asphalt, concrete and cement plants) as identified by the Humber Area Local Aggregate Assessment[283] and the East Riding and Hull Joint Minerals Local Plan update[284]. These include:

- Sand and gravel extraction sites – Brandesburton or North Cave. Within 30km of the Scheme
- Asphalt plant - Dairycoates, Hull. Within 10km of the Scheme
- Ready-mix concrete plant – South Cave. Within 25km of the Scheme
- Cement plant – South Ferriby. Within 25m of the Scheme
- Recycled aggregate processing plant – Leven. Within 25km of the Scheme
- Recycling centre – Foster Street, Hull. Within 5km of the Scheme
- Aggregate landing / storage facility – Queen Elizabeth Dock, Hull. Within 5km of the Scheme

13.6.18 There are no major sources of secondary aggregates in the East Riding and Hull region, the nearest reported source is British Steel at Scunthorpe, approximately 36km from the Scheme Site.

[283] Humber Area Local Aggregate Assessment, October 2017. Available online at: http://www2.eastriding.gov.uk/EasySiteWeb/GatewayLink.aspx?alId=683183

[284] East Riding and Hull Joint Minerals Local Plan, Aggregates Apportionment Background Paper (Update), April 2018. Available online at: http://www2.eastriding.gov.uk/EasySiteWeb/GatewayLink.aspx?alId=689120

Simple assessment

13.6.19 A Simple Assessment Matrix for materials[285] and waste arisings is given in Table 13.4 and Table 13.5. This lists the proposed materials required for the Scheme, together with quantity estimates.

[285] Based on the material types given in Series 200 to 5000 of the Manual of Contract Documents for Highway Works (Volume 1, Specification for Highway Works)

Table 13.4: Simple assessment of material resource use associated with the Scheme

Scheme activity	Material resources required	Quantities of material resources required*	Additional information
Site remediation / preparation / earthworks and site construction	Materials will be required relating to the following activities: • Ground improvement may take the form of a combination of deep soil mixing and jet grouting • Installation of foundations and embedded retaining walls including diaphragm walls, secant piles, sheet piles and tension piles • Construction of bridges and other infrastructure • Re-routing of water main and installation of other utilities • Piling and installation of diaphragm walling through organic-rich deposits • New road surfacing, lighting, signage, barriers, pavements etc	**Bulk Materials** • Asphalt, fill and aggregate: 175,000 tonnes • Reinforcement steel: 3,900 tonnes • Ready mix concrete: 16,000m^3 • Cement and binders (jet grout): 49,360 tonnes **Earthworks** • Imported top soil: 2,000 tonnes • Geotextiles: 150m^2 **Drainage** • Plastic, vitrified clay and precast concrete circular pipework: 3,700m • Precast concrete manholes and plastic inspection chambers: 130 no. • Precast concrete gully pots: 200 no. • Precast concrete channel: 2300m • Damp proof course and impermeable membrane: 4,400 m^2 **Road Pavements** • Kerb (pre-cast concrete): 3,000m • Road markings: 2 tonnes **Street Furniture**	Volumes are estimated on a worst case scenario (assuming no re-use of materials on site) using the preliminary design and likely to change during development of the detailed design.

Scheme activity	Material resources required	Quantities of material resources required*	Additional information
		• Traffic Signs: 340m • Cabinets, road lighting, cameras and columns: 300 no. • Plastic cable ducting and armoured cable: 17,600m • Galvanised steel handrail: 38 tonnes **Civils Structures and Retaining Walls** • Plywood formwork: 105m^3 • Steel sheet piles (retaining walls) and steelwork: 1,170 tonnes • Pre-cast concrete and steelwork: 1,000 tonnes • Bricks and blockwork: 63,600 no. **Fuel, Energy and Water** • Gas oil (red diesel), diesel, fuel oil: 389,000 litres • Mains water: 95,000m^3	
Demolition	Not applicable	Not applicable	
Operation and maintenance of asset	Materials likely to be required relating to the following activities: • Asphalt (road planings) • Steel (signage / fixtures)	Quantities are difficult to estimate over the lifetime of the Scheme but are anticipated to comprise less than 10% of those outlined above for construction.	

* Volume estimates are approximate based on the preliminary design only. Further breakdown of quantities provided in Volume 3, Appendix 13.1

Table 13.5: Simple assessment of waste arising as a result of the Scheme

Scheme activity	Waste arisings from the Scheme	Quantities of waste arising*	Additional information
Site remediation / preparation / earthworks, demolition and site construction	Waste may be generated from the following activities: • Site clearance and preparatory works (including tree / vegetation clearance, breakout of road surfacing and removal of existing road furniture, removal / dismantling of existing structures including the northern boundary wall of Trinity Burial Ground**, Earl de Grey public house, Myton Centre, Holiday Inn electricity substation and the Arco buildings (if the preferred main compound Option A implemented) • Earthworks, including the excavation of approximately 7m depth of superficial deposits for construction of the underpass at Mytongate • Ground improvement works (deep soil mixing and jet grouting) creating displaced soils and slurry by-product. • Installation of foundations and embedded retaining walls including diaphragm walls, secant piles, sheet piles and tension piles • Construction of bridges and other infrastructure • Localised dewatering and containment of groundwater • Re-routing of water main and installation of other utilities	**Quantified Waste** • Bulk material from excavation: 170,000 tonnes • Solids from treatment of slurry: 120,000 tonnes **Unquantified Waste** The following potential waste materials have not been quantified at this preliminary design stage: • Cleared vegetation • Water and fines from de-watering • Steel (road signage, barriers, temporary sheet piles and props) • Plastic (road furniture and pipework) • Concrete and brickwork (demolition arisings, pipework, piling waste, road base removal, block paving and paving slabs) • Aggregate (footway sub base). • Asphalt (road planings and footway surfacing) • Jet grout arisings • Pile arisings from bridge piles	Volumes are estimated on a worst case scenario (assuming no re-use of materials on site) using the preliminary design information and are likely to change during development of the detailed design. Capacity within local and regional waste treatment / disposal facilities and exempted sites to handle receive waste from the Scheme is anticipated. Specific locations shall be identified during detailed design.

Scheme activity	Waste arisings from the Scheme	Quantities of waste arising*	Additional information
	• Construction of site compound(s) / storage areas • Redundant services / additional drainage • Temporary props and sheet piles • Completion of new road including surfacing, lighting, signage, barriers, pavements etc.		
Operation and maintenance of asset	Waste may be generated from the following likely activities: • Road sweepings and gully clearing • Replacement signage and light fixtures • Landscape maintenance • Road debris / littering • Road resurfacing	Quantities of waste generated over the lifetime of the Scheme are difficult to estimate but are considered likely to comprise less than 10% of those generated during construction and will be associated with general maintenance and road surfacing works.	Compared to existing operations, there will be a higher requirement for material use for maintenance due to the increased assets and higher frequency of resurfacing anticipated for the proposed thin surface course system compared with the existing hot rolled asphalt on road pavements.

* Volume estimates are based on the preliminary design only and given to two significant figures

** Bricks from the existing boundary wall of Trinity Burial Ground would be retained and used in construction of the reinstated boundary wall (refer to Chapter 2 The Scheme, Section 2.6)

Detailed assessment

13.6.20 A detailed assessment has also been undertaken given the quantities of material resources required and waste likely to be generated from the Scheme and carbon emissions estimated using the Highways England CECT. Estimates for carbon emission are summarised in Table 13.6 below and included in Volume 3, Appendix 13.1.

Table 13.6: Estimated carbon emissions for materials

Materials - Estimated carbon emission tCO_2e[#]		
Embodied carbon	**Estimated road transport**	**Total**
63,360	**2,400**	**65,760**

[#] tCO_2e = tonnes of carbon dioxide equivalent. Rounded to nearest significant figure

13.6.21 A summary of the estimated carbon emissions from the transport of quantified waste off site either to a waste treatment facility for recycling / recovery, exempted site for re-use or disposal facility is given in Table 13.7. This has been estimated for hazardous, non-hazardous and inert waste.

13.6.22 There is also the potential for road planings to contain coal tar as a binder (i.e. road surfaces typically constructed pre-1980s). Road planings containing coal tar would likely require disposal as hazardous waste. If treated (e.g. by using a binding agent such as cold bitumen foam mix), coal tar based road planings are still considered as hazardous waste and their subsequent use in construction requires an environmental permit unless re-used in compliance with the conditions given in the Environment Agency Regulatory Position Statement[286].

Table 13.7: Estimated carbon emissions from the transport of waste

Waste type	Quantity (tonnes)	% for re-use / recycle on site*	% for re-use off site**	% for disposal off site	Estimated carbon emission tCO_2e[#]
Hazardous	12,400[287]	-	-	-	**160**
Non-hazardous and Inert	276,000	-	15%	85%	**4,080**
Total	**290,000**			**Total**	**4,240**

[286] Environment Agency Regulatory Position Statement The use of treated asphalt waste containing coal tar in construction operations. MWRP RPS 075, v3, July 2012

[287] Derived from assumption that ~7% of bulk material from excavation (~170,000 tonnes) may contain soil contaminants at concentrations above the hazardous property thresholds for hazardous waste according to EA Technical Guidance WM3

Percentages are approximate

* If waste is re-used on site, carbon emissions from transport are taken to be zero.

** If waste is re-used / recycled off site or sent for disposal (e.g. landfill), carbon emissions from transport are taken to be the same

tCO_2e = tonnes of carbon dioxide equivalent

13.6.23 The detailed assessment matrix is given in Table 13.8, which takes into consideration the magnitude of the impact and value (sensitivity) of the receptor. This assessment does not take into account any mitigation measures which will be implemented during construction and operation and are outlined in Section 13.7 below.

Table 13.8: Detailed assessment of the Scheme

Scheme activity	Potential impacts identified	Description / Assessment of the impacts			
		Nature	Magnitude	Sensitivity	Significance (without mitigation)
Site remediation / preparation / earthworks	Depletion of natural resources (i.e. use of materials for earthworks including aggregates, sheet piling)	Adverse, permanent, indirect	Major	Medium	Moderate or Large Adverse
	Energy / fuel consumption (embodied carbon) through manufacture of materials	Adverse, permanent, indirect	Major	Medium	Moderate or Large Adverse
	Release of contaminants to air (dust), land or the water environment due to handling / movement of materials and waste (including transport)	Adverse, temporary, direct	Moderate*	High*	Moderate or Large Adverse
	Demand on handling capacity of local and regional waste management and disposal facilities	Adverse, temporary / permanent, indirect	Moderate	Medium	Moderate Adverse
	Energy / fuel consumption (transport carbon emissions) through plant use and transportation of materials and waste	Adverse, permanent, indirect	Major	Medium	Moderate or Large Adverse
Demolition	Release of contaminants to air (dust), land or the water environment due to handling / movement of materials and waste (including transport)	Adverse, temporary, direct	Minor*	High*	Slight or Moderate Adverse
	Demand on handling capacity of regional waste management and disposal facilities	Adverse, temporary / permanent, indirect	Minor	Medium	Slight Adverse
	Energy / fuel consumption (transport carbon emissions) through plant use and	Adverse, permanent, indirect	Minor	Medium	Slight Adverse

Scheme activity	Potential impacts identified	Description / Assessment of the impacts			
		Nature	Magnitude	Sensitivity	Significance (without mitigation)
	transportation of materials for re-use / recovery and waste				
Site construction	Depletion of natural resources (e.g. aggregates, asphalt, concrete, steel, plastic)	Adverse, permanent, indirect	Major	Medium	Moderate or Large Adverse
	Energy / fuel consumption (embodied carbon) through manufacture of materials	Adverse, permanent, indirect	Major	Medium	Moderate or Large Adverse
	Release of contaminants to air (dust), land or the water environment and generation of noise due to handling / movement of materials and waste (including transport)	Adverse, temporary, direct	Moderate*	High*	Moderate or Large Adverse
	Demand on handling capacity of regional waste management and disposal facilities	Adverse, temporary / permanent, indirect	Moderate	Medium	Moderate Adverse
	Energy / fuel consumption (transport carbon emissions) through plant use and transportation of materials and waste	Adverse, permanent, indirect	Major	Medium	Moderate or Large Adverse
Operation and maintenance of asset	Depletion of natural resources (e.g. aggregates, asphalt, concrete, steel, plastic)	Adverse, permanent, indirect	Negligible	Medium	Slight Adverse
	Energy / fuel consumption (embodied carbon) through manufacture of materials	Adverse, permanent, indirect	Negligible	Medium	Slight Adverse
	Release of contaminants to air (dust), land or the water environment and generation of noise due to handling / movement of materials and waste (e.g. road sweeping)	Adverse, temporary, direct	Minor*	Medium*	Slight Adverse

Scheme activity	Potential impacts identified	Description / Assessment of the impacts			
		Nature	Magnitude	Sensitivity	Significance (without mitigation)
	Demand on handling capacity of regional waste management and disposal facilities	Adverse, temporary / permanent, indirect	Negligible	Low	Neutral
	Energy / fuel consumption (transport carbon emissions) through plant use and transportation of materials and waste	Adverse, permanent, indirect	Negligible	Medium	Slight Adverse

* The general criteria descriptions given in HA208/05 for assigning magnitude of impact and assessing significance have been used since those given in Table 13.2 and Table 13.3 are specific to material use and waste only

13.7 Mitigation

Construction

13.7.1 Proposed mitigation measures to be implemented during construction are summarised in Table 13.9.

Operation

13.7.2 Proposed mitigation measures to be implemented during operation are summarised in Table 13.10.

Table 13.9: Mitigation of potential impacts during Construction

Scheme activity	Potential impact	Proposed mitigation	How mitigation will be implemented	Significance following mitigation
Site Preparation Site Construction	Depletion of natural resources (i.e. use of materials for earthworks including aggregates, sheet piling)	• optimise material efficiency (e.g. use of standardised components / pre-fabricated materials, avoid use of hazardous materials) • prioritise use of secondary or recycled materials, with consideration of appropriate EA / WRAP Quality Protocols and regulatory position statement[288] • responsible sourcing of materials through the use of frameworks such as BES 6001: 2014[289] • adopt Design out Waste principles in accordance with WRAP best practice guidance[290] and employ appropriate design control methods • development and use of a Materials Logistics Plan (MLP) in accordance with WRAP best practice guidance[291] to manage material procurement, delivery, storage, handling use and disposal • development of SWMP to support MLP	MLP, SWMP	Moderate Adverse *[permanent, indirect]*
Site Preparation Site Construction	Energy / fuel consumption (embodied carbon)	• prioritise use of secondary or recycled materials • responsible sourcing of materials through the use of	MLP, SWMP	Moderate Adverse *[permanent,*

[288] E.g. Quality Protocol: Aggregates from inert waste, October 2013; Regulatory Position Statement: The regulation of materials being considered for development of an end of waste Quality Protocol

[289] Building Research Establishment (BRE) Framework Standard for the Responsible Sourcing of Construction Products, Issue 3 May 2014

[290] WRAP Designing out Waste: A design team guide for civil engineering ISBN 1-84405-434-9

[291] WRAP Material Logistics Plan Good Practice Guide, Dec 2007. ISBN: 1-84405-370-9

Scheme activity	Potential impact	Proposed mitigation	How mitigation will be implemented	Significance following mitigation
	through manufacture of materials	frameworks such as BES 6001: 2014 • employ CECT / or similar methodology to monitor total carbon emission of materials against Key Performance Indicators (KPIs)		*indirect]*
Site Preparation Demolition Site Construction	Release of contaminants to air (dust), land or the water environment and generation of noise due to handling / movement of materials and waste (including transport)	• best practice methodologies to be implemented and outlined the CEMP to control generation of dust, noise, discharges to land, drains and run-off • consider alternate options to road transport (e.g. feasibility assessment of pumping of grout and slurry waste where possible to reduce vehicle movements for the Scheme and material handling) • minimise distance for pumping of materials/slurry waste to as short a distance as possible to minimise the risk of blockages and line failures and avoid the need for booster pumps • treatment of slurry within a nearby site compound and water recycled (where possible), with water discharged to sewer or surface water under appropriate consent / permit and any non-compliant discharges collected and disposed of off site	CEMP	Slight Adverse *[temporary, direct]*
Site Preparation Demolition Site Construction	Demand on handling capacity of regional waste management and disposal facilities	• on site treatment of slurry / waste prior to removal from site to reduce volumes and difficulty in handling saturated excavation material • promote re-use, recycling or recovery of materials either on or off site • management of subcontractors to ensure they adhere to appropriate waste minimisation procedures • undertaking appropriate environmental validation to identify if subsoil is suitable for re-use (or nominated treatment / disposal route) and maximising re-use of excavated materials in accordance with DoW CoP	SWMP, MMP	Slight Adverse *[permanent / temporary, indirect]*

Scheme activity	Potential impact	Proposed mitigation	How mitigation will be implemented	Significance following mitigation
		• identify potential for re-use of CDEW at exempted or permitted sites subject to suitability (e.g. use as a landfill capping material in accordance with LFE6[292] and land spreading for soil improvement in accordance the Environment Agency regulatory position[293]) • minimise volumes of volumes of hazardous waste generated (e.g. rotary drying of slurry in preference to lime treatment, by excavation of any hotspots of soil contamination, segregation and stored appropriately prior to treatment; treatment of road planings for re-use in accordance with regulatory position statement[294]) • using soil improvement techniques to enhance soil engineering properties to increase potential for material to be re-used • waste segregation on site (including plastics, timber, steel, hazardous, general waste etc...) • use of KPIs to monitor progress of the Scheme including total waste volumes sent to or diverted from landfill • use of Materials Management Plan (MMP) to manage the use, treatment and placement of excavated materials (including re-use on / off site such as top soil / mulch or disposal)		

[292] Environment Agency, Guidance on using landfill cover materials, GEHO0409BPNI-E-E

[293] Environment Agency Regulatory Guidance Series No EPR13, Defining Waste Recovery: Permanent Deposit of Waste on Land, v1.0, 2010

[294] Environment Agency Regulatory Position Statement The use of treated asphalt waste containing coal tar in construction operations. MWRP RPS 075, v3, July 2012

Scheme activity	Potential impact	Proposed mitigation	How mitigation will be implemented	Significance following mitigation
Site Preparation Demolition Site Construction	Energy/fuel consumption (transport carbon emissions) through plant use and transportation of materials and waste	• prioritise use of local suppliers • consider alternate options to road transport (e.g. feasibility assessment of pumping of grout and slurry waste where possible to reduce vehicle movements for the Scheme and material handling) • minimise distance for pumping of materials/slurry waste to as short a distance as possible to minimise the risk of blockages and line failures and avoid the need for booster pumps • promote re-use of materials on site (e.g. retention of topsoil, use of mulch from vegetation clearance) • employ CECT/or similar methodology to monitor total carbon emission of materials against KPIs	MLP, SWMP	Slight Adverse *[permanent, indirect]*

Table 13.10: Mitigation of potential impacts during Operation

Scheme activity	Potential impact	Proposed mitigation	How mitigation will be implemented	Significance following mitigation
Operation and Maintenance	Depletion of natural resources (e.g. from maintenance activities such as asphalt re-surfacing)	• best practice methodologies from MLP/SWMP/CEMP to be implemented as outlined in the Handover Environmental Management Plan (HEMP)	HEMP	Neutral
	Energy / fuel consumption (embodied carbon) through manufacture of materials		HEMP	Neutral
	Demand on handling capacity of regional waste management and disposal facilities		HEMP	Neutral
	Energy / fuel consumption (transport carbon emissions) and through plant use and transportation of materials and waste		HEMP	Neutral

13.8 Predicted environmental effects

Construction

13.8.1 With appropriate mitigation measures in place as outlined in Table 13.9, residual adverse effects in relation to materials during construction are considered to be moderate adverse at worst. This is not significant in terms of overall effects.

13.8.2 Measures for addressing any material and waste management during construction will included in the MLP, SWMP and MMP which shall be referenced in the CEMP.

13.8.3 Best practicable means will also be given in the CEMP and implemented during construction to ensure that impacts from the generation of dust, noise, emissions to land or water are mitigated and waste is handled in accordance with current regulations. The OEMP for the Scheme is provided as a standalone document (reference TR010016/APP/7.3).

Operation

13.8.4 Compared to existing operations, there will be a higher requirement for material use for maintenance due to the increased assets and higher frequency of resurfacing anticipated for the proposed thin surface course system compared with the existing hot rolled asphalt on road pavements. However, with appropriate mitigation measures in place, as outlined in Table 13.9 and Table 13.10, residual effects in relation to materials during operation are considered to be neutral.

13.8.5 Measures for addressing any material and waste management during operation shall be referenced in the HEMP. This will then be implemented through the Environmental Management Plan of the Asset Support Contractor, responsible for the ongoing maintenance of the Scheme.

13.9 Conclusion

13.9.1 Total carbon emissions for materials required for the Scheme have been estimated based on a number of preliminary assumptions. Estimates indicate a high proportion of embodied carbon for the Scheme is associated with bulk materials (over 90% of total) required for foundations, road construction, general backfill and structures. Focus will be placed on managing the sourcing and use of materials where possible, through a MLP.

13.9.2 The responsible sourcing of materials will be considered through the use of frameworks such as BES 6001: 2014. BES 6001 provides criteria against which sustainable construction products can be assessed and used as part of the specification requirements for materials, where appropriate.

13.9.3 The Scheme would generate significant volumes of CDEW, principally from the excavation of soils to form the underpass and slip roads at the existing Mytongate Junction. There is very limited potential for the re-use of CDEW within the Scheme

due to the site setting constraints, limited areas of landscaping and the geotechnical unsuitability of material.

13.9.4 The re-use of materials within the Scheme is likely to be restricted. Options for the re-use of materials off site will be fully considered and minimising the generation of hazardous waste requiring disposal (e.g. by segregation of waste and avoiding use of techniques such as lime treatment of slurry waste which may generate volumes of hazardous waste).

13.9.5 The potential for re-use of CDEW at exempted or permitted sites is subject to suitability but may include use as a landfill capping material, soil improvement or landscaping schemes. Given the estimated peak vehicle trips to transport excavated materials, alternate potential options to road transport (e.g. feasibility assessment of using pumping to reduce vehicle movements) will be considered at the Detailed Design stage.

13.9.6 With the implementation of the relevant mitigation measures, the predicted environmental effects in relation to materials are considered to be moderate adverse (permanent, indirect).

13.9.7 As detailed in paragraph 13.2.7, reference should also be made to other chapters of the ES which address potential impacts from the creation of dust (Chapter 6 Air quality), impacts to the water environment (Chapter 11 Road drainage and the water environment) and from land contamination (Chapter 12 Geology and soils).

Chapter 14. People and communities

14.1 Executive summary

14.1.1 This chapter presents the effects of the A63 Castle Street Improvements on people and communities. It sets out the policy context for the topic, and the method that has been used to carry out the assessment. It describes the existing environment in the local area and provides a socio-economic statistical baseline. It outlines the potential effects, and the measures to help mitigate these effects. It also presents the significance of residual effects remaining after mitigation such as permanent land take at a number of locations, impacts on development land, altered community land and economic benefits including the creation of new jobs. The chapter is supported by Volume 3, Appendix 14.1 Socio economic profile and Volume 3, Appendix 14.2 Equality impact assessment.

14.1.2 In terms of the baseline, the Scheme is located in a central urban area of Hull with a large number of residential and commercial premises. Due to the urban nature of the Scheme and established patterns of development, there are a large number of residential dwellings located within the study area. The majority of residential dwellings are concentrated in an area on the north side of the Scheme, to the west of Mytongate Junction and to the east of Princes Quay.

14.1.3 There are also a number of businesses within the study area including retail, commercial leisure and recreation. Many of these commercial businesses are located in an industrial area south of the Scheme, accessed via Commercial Road, Ropery Street and St James Street.

14.1.4 There are also a number of community resources and community land including pocket parks, the Humber Docks and Trinity Burial Ground.

14.1.5 Effects are broken down into Construction and Operation Phases and are assessed against the following categories: demolition of private property and associated land take (residential and business), loss of land used by the community, community facilities, community severance, effects on development land and the local economy.

14.1.6 A number of mitigation measures are in place to minimise the adverse effects. These include replacement community land or reconfiguration of land use, the preparation of a construction environmental management plan (CEMP), a traffic management plan, consultation with land owners and businesses, and compensation.

14.1.7 Effects on private property during both construction and operation are considered to be neutral. There will be temporary and permanent effects on business property during construction and combined these are considered to be significant moderate adverse. No additional effects on business property is anticipated during the

operational stage. Effects on community land would be moderate adverse and therefore significant during construction and operation. Additional community land at the Myton Centre will be provided as compensation for land lost at the Trinity Burial Ground. There will be permanent adverse effects on moorings at Humber Dock Marina. Effects on development land are anticipated to be slight adverse and therefore not significant during construction, and moderate beneficial during the operational stage. Effects on economic development are considered to be slight beneficial (not significant) during construction and significant moderate beneficial during operation.

14.2 Introduction

14.2.1 This chapter presents the effects on people and communities that are anticipated in relation to the A63 Castle Street Improvements (the Scheme). The chapter is set out in the following sections:

- Legislative, regulatory and policy background
- Study area
- Approach and methodology
- Existing environment (baseline)
- Mitigation and predicted environmental effects
- Conclusion

14.2.2 The method has been informed by the Interim Advice Note 125/15 Environmental Assessment[295] (IAN 125/15) published by Highways England in October 2015 and the Design Manual for Roads and Bridges (DMRB) Volume 4, Section 3, Part 6 in August 2001, and Part 8 June 1993.

14.2.3 A separate Equality Impact Assessment (EqIA) has been prepared at Volume 3, Appendix 14.2 Equality Impact Assessment. This chapter should be read in conjunction with the EqIA.

14.3 Legislative, regulatory and policy background

14.3.1 This section provides an overview of the legislation, policy and guidance relevant to the Scheme, at the national, regional and local levels.

[295] Interim Advice Note 125/15 Environmental Assessment. Available online at: http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian125r2.pdf

International legislation and policy

European Parliament and Council of the European Union, 2014, Directive 2014/52/EU

14.3.2 The Environmental Impact Assessment (EIA) Directive requires an assessment of schemes likely to result in significant environmental effects to be conducted prior to the granting of planning consent. It sets out the requirement to assess the impacts on people. Article 3 states that the environmental impact assessment "*shall identify, describe and assess the direct and indirect effects of a project on population and human health*".

14.3.3 This is transposed into UK national law by the following:

- The Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 as amended for Nationally Significant Infrastructure Projects (NSIP)
- The Highways (Environmental Impact Assessment) Regulations 2007 for non NSIP projects

European Commission, Environmental Impact Assessment of Projects; Guidance on the preparation of the Environmental Impact Assessment Report (2017)

14.3.4 In 2017, the European Commission published a guidance document for EIA practitioners. For the socio-economic baseline, the guide recommends collecting data on demography, infrastructure facilities, economic activities and recreational users. The guidance includes an EIA report checklist.

National legislation and policy

National Planning Policy Framework, 2012

14.3.5 In March 2012, the government set out changes to the National Planning Policy Framework[296] (NPPF), to promote sustainable development in the planning system. The Framework outlines 12 Core Planning Principles (paragraph 17), which all developments and projects, such as this Scheme, should consider. With particular reference to this chapter, these include:

- The importance of empowering local people to shape their surroundings
- Driving sustainable economic development and supporting local strategies to improve health, social and cultural wellbeing for all (paragraphs 18 to 22)

14.3.6 Promoting sustainable transport (paragraphs 29 to 41), healthy communities (paragraphs 69 to 78) and plan making (paragraphs 150 to 157) are also relevant to this Scheme.

[296] Department for Communities and Local Government (2012), National Planning Policy Framework. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

National Policy Statement for National Networks, 2014

14.3.7 The National Policy Statement for National Networks (NN NPS) provides planning guidance for Nationally Significant Infrastructure Projects (NSIPs) and includes a number of relevant statements in relation to people and community (including private assets). NN NPS, Chapter 4, Assessment Principles, outlines health impacts, and states that projects should identify and assess any likely significant adverse health impacts. NN NPS, Chapter 5 includes a section on land use[297]:

- Paragraph 5.165 *"The Environmental Statement should identify existing and proposed land uses near the project (for example, where a planning application has been submitted), any effects of replacing an existing development or use of the site with the proposed project, or preventing a development or use on a neighbouring site from continuing. Applicants should also assess any effects of precluding a new development or use proposed in the development plan".*

- Paragraph 5.167 *"Applicants considering proposals which would involve building on open space, sports or recreational buildings and land should have regard to any local authority's assessment of need for such types of land and buildings"*.

The Localism Act, 2011

14.3.8 The Localism Act (2011)[298] introduces a wide range of measures to devolve greater powers to councils and communities. This further reinforces the policy commitment to improve local accountability and promote economic growth.

14.3.9 Part five of the Localism Act relates to community empowerment, with Chapter 3 relating to assets of community value. Part five of the Act relates to planning, with Chapter 4 containing provisions on consultation to be undertaken prior to applying for planning permission. Of specific relevance, is the Core Cities Amendment, found in Part one, Chapter 4, which allows local authorities in cities such as Hull to make the case for new powers to promote economic growth and to set their own distinct policies.

The Equality Act, 2010

14.3.10 The Equality Act (2010)[299] introduces a new public sector duty to consider reducing socio-economic inequalities in strategic decisions. The implementation of this duty involves ensuring that the design of projects does not create any

[297] Department for Transport (2014), National Policy Statement for National Networks. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/387223/npsnn-web.pdf

[298] Department of Communities and Local Government (2011) Localism Act 2011. Available online at: http://www.legislation.gov.uk/ukpga/2011/20/contents

[299] Government Equalities Office (2010) Equality Act 2010. Available online at: http://www.legislation.gov.uk/ukpga/2010/15/contents

inequalities. The people and communities assessment generally supports the principles of EqIA, enabling Highways England to demonstrate that it has fulfilled its duty in respect of environment assessment.

14.3.11 An EqIA has been prepared for the Scheme as a supporting document to the Environmental Statement. For details see Volume 3, Appendix 14.2.

UK Government's Sustainable Development Strategy, 2005

14.3.12 The UK government's Sustainable Development Strategy, entitled Securing the Future (2005)[300], established a goal to create Sustainable Communities with a strong focus upon securing quality of life for people and communities.

Local Growth: Realising Every Place's Potential, 2010

14.3.13 The 2010 White Paper Local Growth: Realising Every Place's Potential[301] outlines the government's role in empowering locally driven growth, encouraging business investment and promoting economic development. It sets out to ensure that everyone has access to the opportunities that growth brings and are able to fulfil their potential, through the establishment of Local Enterprise Partnerships (LEPs) to drive local economic development. The White Paper also sets out a requirement for local authorities to produce local development plans, which *"will establish the key strategic framework on infrastructure, deal with issues such as economic growth requirements, will be drawn up so they have regard to national policy, and will provide the basis for local planning decisions and planning by local communities".*

Investing in Britain's Future, 2013

14.3.14 Investing in Britain's Future[302] presents a detailed long term plan of investment into infrastructure projects in order to *"build, repair and renew"* Britain's key infrastructure, with the objective of rebalancing the British economy, enhance productivity and create more job opportunities. A key aspect of this strategy is to create transport and communications networks that connect people and businesses.

[300] Department for Environment, Food and Rural Affairs (2005) Securing the future: delivering UK sustainable development strategy. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69412/pb10589-securing-the-future-050307.pdf

[301] Department for Business Skills and Innovation (2010), Local growth: Realising every place's potential. Available online at: https://www.gov.uk/government/publications/local-growth-realising-every-places-potential-hc-7961

[302] HM Treasury (2013): Investing in Britain's future https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/209279/PU1524_IUK_new_template.pdf

Creating Growth, Cutting Carbon: Making Sustainable Local Transport Happen, 2011

14.3.15 The 2011 Sustainable Transport White Paper, Creating Growth, Cutting Carbon: Making Sustainable Local Transport Happen[303] is the government's primary national transport strategy document for local areas. It presents the government's vision for a transport system that is an engine for economic growth, but one that is also greener and safer and improves quality of life in our communities[304]. Transport's role in economic growth is hugely important – getting people to work and to services such as education and healthcare providers, as well to leisure activities and shops, is crucial to quality of life as well as to enhancing people's spending power.

Plan for Growth Report, 2011

14.3.16 Plans for the national economy are set out in the *Plan for Growth Report*[305] (2011), which aims to achieve strong, sustainable and balanced growth that is more evenly shared across the country and between sectors and industries.

Regional policy

14.3.17 At the sub regional level, the Humber Local Enterprise Partnership produces a Strategic Economic Plan which sets out the economic vision for the sub region and identifies key infrastructure projects that are planned, including the Scheme.

Humber Local Enterprise Partnership, Strategic Economic Plan 2014-2020

14.3.18 The 2014-2020 Humber Strategic Economic Plan (SEP)[306] is an integrated growth plan which builds upon the first Local Enterprise Partnership (LEP strategy, 'A Plan for the Humber'. The SEP sets out a 2020 vision for the city, and is structured around five strategic areas, which aim to encourage and deliver growth. The SEP identifies the need for further expansion of regional road infrastructure, to improve connectivity to labour markets and to provide an efficient transport network. The SEP identifies improvements to the Scheme as being of particular importance, stating that "*this improvement provides an opportunity to address severance issues within the city through a new pedestrian bridge over the Scheme connecting the waterfront area with the city centre, helping to maximise the benefit of the City of Culture designation*".

[303] Department for Transport (2011): Creating Growth, Cutting Carbon: Making Local Sustainable Transport Happen https://www.gov.uk/government/publications/creating-growth-cutting-carbon-making-sustainable-local-transport-happen

[304] Department for Business Skills and Innovation (2010): Local growth: Realising every place's potential. Available online at: https://www.gov.uk/government/publications/local-growth-realising-every-places-potential-hc-7961

[305] HM Treasury (2011) The Plan for Growth. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/31584/2011budget_growth.pdf

[306] Humber Local Enterprise Partnership (2014) Strategic Economic Plan 2014-2020. Available online at: http://www.humberlep.org/wp-content/uploads/2014/11/StrategicEconomicPlan.pdf

Local policy

Hull Local Plan (2016-2032)

14.3.19 At the local level planning is guided by the Development Plan for Hull. This is a suite of policy documents that set out the overall vision and plan for Hull. A key component of the Development Plan is the Hull Local Plan 2016 to 2032 which was adopted in November 2017.

14.3.20 Hull City Council (HCC) has recently adopted a new Hull Local Plan 2016-2032 that covers the period from 2016 to 2032[307]. The following policies are relevant to this assessment:

- Strategic Policy 11: Make Hull more attractive to residents, businesses and tourists
- Strategic Policy 12: Provide infrastructure that enables the predicted development and growth of Hull to happen
- Strategic Policy 25: Development, including transport improvements, should promote sustainable transport objectives
- Strategic Policy 29: New road schemes will be supported if they improve road safety; improve the environment; assist public transport or cyclists; improve accessibility including to employment areas; open up land for agreed development; and reduce congestion / pollution and improve air quality.

Hull City Plan, 2013

14.3.21 In 2013, the City Leadership Board, a joint private, public and third sector venture, launched the City Plan[308] to promote Hull as a visitor destination and a renewable energy hub. Delivered over a 10 year timeframe, the plan seeks to address the wellbeing of the local population, delivered through improved community safety schemes, the safeguarding of vulnerable adults and early intervention schemes.

14.3.22 Of particular importance to this assessment are the proposed development of a central cruise terminal and the regeneration of the Fruit Market area, which is being developed as Hull's digital and creative quarter. Following a £83.6 million investment, the area is intended to support 733 jobs, delivered between 2013 and 2024.

[307] Hull City Council (2016) Local Plan. Available online at: http://hullcc-consult.limehouse.co.uk/portal/localplan/adoption/hull_local_plan_adoption_statement

[308] City Leadership Board (2013) Hull City Plan. Available online at: http://cityplanhull.co.uk/

Hull Local Transport Plan, 2011

14.3.23 The third Local Transport Plan (LTP)[309] outlines HCC's transport aims and objectives for the period 2011 to 2026. LTP seeks to improve Hull's highway network, and outlines how improvements to the Scheme in particular will encourage city centre regeneration and wider job creation. The LTP seeks to develop an Area Wide Travel Plan for the city centre – the Scheme corridor, to encourage alternatives to motorised transport and reduce congestion and unnecessary journeys. It also looks to introduce green transport schemes across the city, including an upgraded cycle network.

Hull's Transport Asset Management Plan, 2013

14.3.24 Hull's 2013 Transport Asset Management Plan (TAMP)[310] was designed to provide the city with a safe, efficient and well-managed local transport network, which meets the wider goals of economic stability, growth and social well-being within Hull City. The TAMP is informed by Hull's City Plan and Transport Plan and covers a variety of assets including roads, footways and other paths, cycleways, highway bridges and other structures and car parks. As the Scheme interfaces with a large number of locally managed roads, improvements to the Scheme around Castle Street will need to support the objectives of the TAMP.

Area Action Plans for Holderness Road Corridor, Newington and St Andrew's and Kingswood, (2011, 2010, 2016)

14.3.25 Hull currently has three Area Action Plans (AAPs): Holderness Road (2011)[311], Newington and St Andrew's (2010)[312] and Kingswood (2016)[313]. These areas have been identified as priority areas for HCC, and vital in supporting the city's regeneration. The AAPs aim to contribute to the Hull Sustainable Community Strategy through:

- Increasing the quality, sustainability and choice of housing

[309] Hull City Council (2011) Hull Local Transport Plan 3 (2011-2026). Available online at: http://www.hullcc.gov.uk/portal/page?_pageid=221,161326&_dad=portal&_schema=PORTAL

[310] Hull City Council (2013) Transport Asset Management Plan 2013. Available online at: http://www.hullcc.gov.uk/pls/portal/docs/PAGE/HOME/COUNCIL%20GOVERNMENT%20AND%20DEMOCRACY/ABOUT%20HULL%20CITY%20COUNCIL/COUNCIL%20POLICIES%20AND%20PLANS/TRANSPORT%20AND%20STREETS%20STRATEGIES/TRANSPORT%20ASSET%20MANAGEMENT%20PLAN/TRANSPORT%20ASSET%20MANAGEMENT%20PLAN%20-%20NOVEMBER%202014.PDF

[311] Hull City Council (2011) Holderness Road Corridor Area Action Plan available on line at http://www.hullcc.gov.uk/pls/portal/docs/page/home/planning/planningper cent20policy/areaper cent20actionper cent20plans/holdernessper cent20roadper cent20corridor/holdernessroadcorridoraap_contentandsection1.pdf

[312] Hull City Council (2010) Newington & St Andrew's Area Action Plan. Available online at: http://www.hullcc.gov.uk/pls/portal/docs/page/home/planning/planningper cent20policy/areaper cent20actionper cent20plans/newingtonper cent20andper cent20stper cent20andrews/adoptedper cent20nasaper cent20aapper cent20document.pdf

[313] Hull City Council (2016) Kingswood Area Action Plan. Available online at: http://www.hullcc.gov.uk/pls/portal/docs/page/home/planning/planningper cent20policy/areaper cent20actionper cent20plans/kingswoodper cent20areaper cent20actionper cent20plan/kingswoodareaactionplan_september2016.pdf

- Providing good access to local community facilities, services and jobs
- Improving the environmental quality of Hull's neighbourhoods and enhancing existing public open spaces
- Empowering citizens and communities to manage their own neighbourhoods
- Maximising the opportunities for pedestrian and cycle access as part of road improvements

Strategic Housing Land Availability Assessment 2016

14.3.26 The Strategic Housing Land Availability Assessment (SHLAA)[314] for Hull establishes realistic assumptions about the availability, suitability and likely economic viability of land to meet the areas identified need for new housing. It follows the National Planning Policy Framework (NPPF) which states that the achievement of sustainable development, including the delivery of a wide choice of high quality homes should be provided. Guidance was given by the Department of Communities and Local Government on SHLAA production in July 2007. It requires authorities to:

- Identify specific, deliverable sites for the first five years of a plan that are ready for development, and to keep this topped up over-time in response to market information.
- Identify specific, developable sites for years six to ten, and ideally years 11 to15, in plans to enable the five-year supply to be topped up.
- Where it is not possible to identify specific sites for years 11 to 15 of the plan, indicate broad locations for future growth.
- Not include an allowance for windfalls in the first ten years of the plan.

14.4 Study area

14.4.1 This section sets out the study area that has been developed to inform this assessment. DMRB does not provide a set definition of the study area for assessing people and community effects. Therefore, based on professional judgement the study area has been set as described below.

- The area within 250m of the Scheme Site will be referred to as the Local Impact Area (LIA) and will be the primary study area for this topic. This includes all areas under temporary use including construction compounds and storage areas

[314] Hull City Council (2016), Hull Strategic Housing Land Availability Assessment (SHLAA) 2016 http://hullcc-consult.objective.co.uk/portal/planning/shlaa/shlaa16?pointId=1465372332696

- Wider socio-economic and community effects will be considered within a Wider Impact Area (WIA), which has been defined as the HCC boundary[315]

14.4.2 Volume 2, Figure 14.1 Local and wider impact areas illustrates the LIA and WIA.

14.5 Approach and methodology

Highways England and DMRB guidance

14.5.1 This assessment has been prepared according to the IAN 125/15, published by Highways England in October 2015 and the DMRB Volume 4, Section 3, Part 6 in August 2001, and Part 8 in June 1993. The methodology has been updated since the scoping report was published in March 2013 due to changes to the guidance provided in IAN 125/15.

14.5.2 The Highways England's IAN 125/15 sets out a structure for presenting the assessment of community effects of highways schemes. The IAN sets out the requirements for a new People and Communities chapter. This combines the Land Use (Part 6), Pedestrians, Cyclists, Equestrians and Community Effects (Part 8) and Vehicle Travellers (Part 9) in the current version of the DMRB Volume 4, Section 3. The guidance in the DMRB will be updated in line with the IAN although there is no expected publication date of issue. Pending these changes, the assessment of the impacts on the community will be carried out in line with the current DMRB guidance. This chapter covers the effects associated with social, community, business receptors.

14.5.3 Reference should be made to Chapter 15 Effects on all travellers for additional information. Effects on all travellers considers the levels of driver stress during construction and views from the road both during construction and operation. The assessment considers changes to Non Motorised User (NMU) amenities, journey length and journey experience during both construction and operation.

14.5.4 The areas covered by the DMRB that have been assessed are as follows:

- Demolition of private property and associated land take
- Loss of land used by the community
- Effects on development land

14.5.5 In addition to the requirements within the DMRB and the IAN 125/15, the assessment considers the following elements:

[315] Note: The location of the westernmost construction compound, which will require temporary land take, lies outside of the City of Hull and WIA boundary. The WIA remains focused on the City of Hull and has not been extended to include the whole of the East Riding of Yorkshire

- Community facilities: An assessment of the impact on the facilities and services that residents use within their communities, and on the separation of residents from these facilities (termed as severance). Community facilities include, but are not limited to, churches, parish halls, doctors' surgeries and schools. Commercial properties such as post offices, pubs, newsagents and general stores also provide services to the community

- Local economy: Impact on local businesses and on employment, directly and indirectly, as well as on wider economic effects. The assessment also considers access to key employment areas, services and facilities in the immediate and wider area

Scope of assessment

14.5.6 The Environmental Statement Scoping Report that was issued in March 2013 outlines the aspects of the assessment that have been scoped in. It also set out an overview of the methodology that would have been used. Given that the Scoping Report was prepared some time ago there have been a number of updates to the Scheme and the guidance in conducting assessments of people and community effects. The methodology used has been updated to align with the latest guidance.

14.5.7 The Scoping Report proposed that the community and private effects be scoped into the assessment and taken forward to the detailed assessment level. This was the precursor approach to the current people and communities assessment. It was scoped in due to potential adverse effects resulting from the worst case scenario of loss of private property and community land together with potentially significant improvements to community severance as well as wider economic benefits. These effects continue to be scoped in and are set out in this chapter. Due to the urban nature of Hull city centre, agricultural land has been scoped out.

14.5.8 Both direct and indirect people and community effects arising as a result of the construction and operation of the Scheme have been assessed.

Methodology for baseline data collection and consultation

Baseline data collection

14.5.9 The baseline provides the social and economic context for the Scheme and presents a snapshot of the relevant surrounding community and business receptors that are likely to experience any effects. Data has been gathered from public datasets including the 2011 National Census, and Annual Population Survey (2016-2017), 2016 Mid Year Population Estimates and 2016 Job Seekers Allowance published by the Office of National Statistics (ONS), as well as the Index of Multiple Deprivation which was published by the Department for Communities and Local Government (DCLG) in 2015.

14.5.10 The assessment of the demolition or other effects (including any associated land take) on private property is considered within the LIA but is focused on the area

within and immediately adjacent to the Scheme alignment. For this assessment, private property includes residential, industrial and commercial properties including businesses such as independent shops. Community facilities include schools, healthcare facilities and other community-focussed resources.

14.5.11 The assessment of loss of land or property used by the community or community facilities is also considered for the LIA but is again focused on the area within and immediately adjacent to the Scheme alignment, specifically within the LIA. Community land includes formal facilities such as parks, sports and recreation grounds, children's play areas, outdoor sports facilities, amenity spaces, allotments, cemeteries, and more informal facilities such as natural green spaces.

14.5.12 The assessment of effects on development land considers the effects of the Scheme on unimplemented planning permissions and development allocations within the LIA and WIA.

Consultation

14.5.13 Consultation was not carried out as part of the people and communities assessment. However, public consultation for the Scheme as a whole was undertaken in 2013 and 2017 and the consultation responses to these have been used to inform the assessment of potential significant effects. For more information relating to the consultation process, see the Consultation Report, document reference TR010016/APP/5.1.

14.6 Assessment of sensitivity, magnitude, and significance

Community receptors and resources

14.6.1 Community receptors include residents in the immediate area of the Scheme, local employers and businesses in the area, employees and job-seekers, particularly those who live locally.

14.6.2 Community resources include educational establishments, health facilities, recreational facilities, places of worship and public transport community resources.

Sensitivity of receptors

14.6.3 The sensitivity of receptors and resources is governed by their capacity to absorb proposed changes arising from the Scheme. It ultimately reflects their vulnerability to the impacts of the proposed activities and their access to additional or alternative resources of a similar nature. If a resource is frequently used, if few alternatives exist, or if receptors have limited capacity to absorb the changes arising from the Scheme, that receptor is considered to be sensitive to the changes. Criteria describing the sensitivity of receptors are identified in Table 14.1 below.

Table 14.1: Sensitivity of receptors

Sensitivity	Criteria guidance
High	An already vulnerable receptor with very little capacity and means to absorb changes. No alternative No alternative facilities, access arrangements or opportunities are available within an easily accessible distance. A highly or frequently accessed resource.
Medium	A non-vulnerable receptor with limited capacity and means to absorb changes. A limited range of alternative facilities, access arrangements or opportunities are available within an easily accessible distance. A moderately, or-semi-frequently accessed resource.
Low	A non-vulnerable receptor with sufficient capacity and means to absorb changes. A wide range of alternative facilities, access arrangements or opportunities are available within an easily accessible distance. An infrequently accessed resource.

Magnitude of impact

14.6.4 To assess the magnitude of an impact on these receptors and resources, each impact identified has been assessed in terms of the following indicators:

- Spatial scope – whether impacts are likely to be felt within the Scheme Site, within the LIA or WIA, or more widely
- Extent – how many people and community receptors are likely to be impacted
- Duration – whether the impacts would be temporary or permanent (see Chapter 5)
- Reversibility – whether the impact is permanent or temporary

14.6.5 Taking these indicators into consideration, and also mitigation measures that can be applied; the criteria are used as guidelines to assess the magnitude of each impact. This is described in more detail in Table 14.2 below.

Table 14.2: Magnitude

Magnitude	Criteria guidance
Major	• Affects receptors within the WIA and beyond (spatial scope). • Affects the well-being of many receptors (or the well-being of a few receptors in an acute way for an extended period) (extent). • Requires considerable intervention to return to the baseline (reversibility).
Moderate	• Affects either the well-being of receptors beyond the Scheme Site into the LIA (spatial scope).

Magnitude	Criteria guidance
	• Affects the well-being of a moderate number of receptors (extent). • May require some intervention to return to the baseline conditions (reversibility).
Minor	• Affects the well-being of a small number of receptors (extent). • Occurs exceptionally, mostly within the Scheme Site (spatial scope). • Baseline returns naturally or with limited intervention within a short timescale.
Negligible	• Localised to a specific location within the Scheme Site (spatial scope). • Unlikely to result in detectable impact on the well-being of people or a community resource (extent). • Considered to be a risk that is manageable with intervention. • Baseline remains consistent.
No change	• No change is expected.

14.6.6 Potential impacts do not have to satisfy all of the criteria guidelines within a particular category.

Significance of effect

14.6.7 Significance is a product of the magnitude of an impact and the sensitivity of the receptor or resource that is experiencing the impact. Each type of effect is then determined to be either significant or not significant, as shown at Table 14.3 below. The significant effects that arise are highlighted in grey.

Table 14.3: Significance of effects

Sensitivity of receptor	Magnitude of impact				
	No change	Negligible	Minor	Moderate	Major
High	Neutral	Slight	Moderate	Large	Large
Medium	Neutral	Slight	Slight	Moderate	Moderate
Low	Neutral	Neutral	Slight	Slight	Moderate

Limitations and assumptions

14.6.8 The spatial area used for the WIA was constrained by existing spatial boundaries used for publicly available socio-economic datasets.

14.6.9 The LIA is based on a 250m boundary from the outer limits of the Scheme, and not on distances via particular modes (such as walk times), by particular routes, or taking into account man-made and natural barriers (such as major roads, railway lines, or water courses). This is in order to capture all land, property and resources that are directly affected by the Scheme, and community facilities that may be indirectly affected. Severance impacts related to a change in travel times and distances is presented in Chapter 15 Effects on all travellers.

14.6.10 Information on community facilities in Section 14.7 has been primarily based on two site visits undertaken in January 2015 and July 2016, and supplemented by desk based research using scheme documentation, GIS software and directories of local services. As such, this should not be viewed as a complete list of services, rather an indication of provisions.

14.7 Existing environment (baseline)

14.7.1 The baseline provides a snapshot of the current situation in the LIA focusing on relevant surrounding community and business receptors that are likely to experience any effects and the social and economic context for the local and wider study areas.

Private property and associated land

Residential property

14.7.2 Due to the urban nature of the Scheme and the established patterns of development in the area there are a large number of residential dwellings located within the study area.

14.7.3 The majority of residential dwellings are concentrated in an area on the north side of the Scheme, to the west of Mytongate Junction and to the east of Princes Quay. The properties range from medium to high density consisting of a mixture of house types and flats, in both public and private ownership.

14.7.4 The layout of the adjacent residential areas is influenced by the alignment of the road corridor through the urban centre which may also impact the amenity of the residential areas and tends to form a ‘block’ pattern with continuous frontages following the local road layouts.

14.7.5 Table 14.4 below provides an overview of residential properties adjacent to the Scheme.

Table 14.4: Summary of residential properties adjacent to the Scheme

Residential properties	Housing description	Current means of access from Scheme
North of the Scheme		
Quantock Close*	High density, terraced housing, older buildings	No direct access
Neville Close*	High density, terraced housing with some 3-storey flats, older buildings	No direct access
Lovat Close*	High density, terraced, older buildings	No direct access
Bathurst Street*	High density, two high rise residential tower blocks	No direct access
Porter Street* (Wellington House)	High density, terraced, mixed use: business and flats	Police vehicles only

Residential properties	Housing description	Current means of access from Scheme
William Street (Melbourne House)	High density, high-rise residential tower blocks	No direct access
Cogan Street* (Sydney House and William Booth House)	High density, high-rise residential tower blocks	No direct access
Princes Dock Street	High density, mainly modern apartment blocks	Direct access
Dagger Lane* (Lisley Court)	Medium to high density, modern apartments and terraced housing	Exit only
Fish Street* (Trinity Court and Grammar School Yard)	Medium to high density, some modern terraced housing with apartment blocks	Direct access
Vicar Lane*	Medium to high density, some older housing and more modern apartments, smaller scale	Direct access
South Church Side*	Medium to high density, some older, larger apartments and commercial use	Direct access
South of the Scheme		
Humber Dock Street	Medium to high density modern apartments / commercial use	Exit only
Sewer Lane	High density, fairly modern apartments / commercial use, mainly recent developments	No direct access
Queen Street	High density, older smaller scale apartments / commercial use, generally older buildings	Direct access

*Leads to further residential properties on roads not listed in this report.

Businesses

14.7.6 In total, there are more than 2,000 business and / or commercial units within the LIA based on Ordnance Survey Address Base Plus Data[316]. Many of these commercial businesses are located in an industrial area south of the Scheme, accessed via Commercial Road, Ropery Street and St James Street. For more details refer to Volume 3 Appendix 14.1 Socio economic baseline.

14.7.7 There are retail businesses in the LIA. Princes Quay shopping centre (north of the Scheme) contains approximately 80 retail units, a cinema and a 1,000-space multi-storey car park. Kingston Retail Park (south west of Mytongate Junction) comprises around 15 large retail units and car parking. Further retail outlets (such as Maplin and American Golf) are located on Ferensway, north of Mytongate Junction.

14.7.8 The LIA also contains a mixture of commercial leisure and recreation assets, many of which support the local tourism sector. These include restaurants located at Hull

[316] This is based upon manual sorting of Ordnance Survey Address Plus Data, querying the data based on commercial categories.

Marina, small independent retailers and arts venues in the Fruit Market. Commercial tourist attractions include The Deep Aquarium located to the east of the mouth of the River Hull and Dinostar - the Dinosaur Experience - adjacent to the Fruit Market. Statistics from Visit Hull and East Yorkshire indicate that tourism in Hull is worth £260 million[317].

Community land and community facilities

Community land

14.7.9 Table 14.5 below outlines community land usage adjacent to the Scheme.

Table 14.5: Community land usage

Community Land	Details
Trinity Burial Ground	Trinity Burial Ground (7,000m^2) is located to the south side of Castle Street, and Mytongate Junction. Trinity Burial Ground is associated with Holy Trinity Church, and was in use between 1783 and 1860.
Parks / Pocket Parks	The three parks / pocket parks are relatively small in size; Jubilee Arboretum (2,255m^2) William Oak (1,334.9m^2) Great Passage Street (2,091.9m^2)

Community resources

14.7.10 The Scheme is located in Hull City Centre and the LIA contains numerous local amenities and community resources, including ten educational facilities, four churches, three public houses and seven medical facilities. A table of community resources in the LIA is included in Table 14.6 below.

Table 14.6: Community resources located in the LIAs

Community resource / receptor	Name of facilities	Location
Education	Adelaide Primary School & Nursery Octagon Nursery Victoria Docks Primary School East Riding College Bright Beginnings Day Nursery Northern Academy of Performing Arts Springfield Management Training Hull Trinity House School East Riding Training Solutions Portull Training Services	Walker Street Walker Street Victoria Dock St James Street Kingston Park Anlaby Road Land of Green Ginger Princes Dock Street Rugby Street Manchester Street
Medical	Elliott Chapel Health Centre	Hessle Road

[317] Visit Hull and East Yorkshire (date unknown) 'Tourism strategy 2015-2018'

Community resource / receptor	Name of facilities	Location
	Riverside Medical Centre Sydenham House Group Practice The Quays Medical Centre Sunshine House Health Central Children's Development and Respite Centre	Octagon, Walker Street Hessle Road Story Street Walker Street Ferensway Walker Street
Churches	Holy Trinity Church Danish Church of St Nikolaj Salvation Army Citadel Redeemed Christian Church of God	All to the north of the Scheme
Post Office	Lowgate Post Office Hull Post Office	Market Place Prospect Street
Community and municipal buildings	Hull Jobcentre Plus Osbourne Street Police Station William Booth House British Transport Police Station Magistrates' Court	Market Place Osbourne Street Hessle Road Prospect Shopping Centre, Hull Paragon Interchange Market Place
Recreational and leisure facilities	Hull Arena Mecca Bingo Marina Recreation Centre Lawsons Workout Gym Gymophobics Your Next Level Fitness Hustlers Pool Hall Superbowl UK Mosconi's Pool Hall St Pauls Boxing Club Hull Music Service Nuffield Health, Fitness & Wellbeing The Deep (aquarium) Albemarle Music Centre Octagon Fitness Centre Stevie Smith Boxing Academy Hull Saints Amateur Boxing Club North Humberside Pistol & Rifle Club Gym 24 Seven Occupational Fitness Ltd Hessle Skatepark	Kingston Street Anlaby Road Commercial Road Ropery Street Baker Street Livingstone Road Prospect Road Princes Quay Anlaby Road North Church Side Ferensway Kingston Park Tower Street Ferensway Walker Street Madeley Street West Dock Avenue Ropery Street Princes Quay Livingstone Road Livingstone Road
Cinemas	Reel Odeon Vue	Ferensway Kingston Park Princes Quay Shopping Centre

Community resource / receptor	Name of facilities	Location
Cultural and historical sites	Spurn Lightship Hands on History Museum Ferens Art Gallery Dinostar Dinosaur Experience The Humber Dock Marina Albert Dock Früit Trinity Burial Ground	Moored on Humber Dock Marina South Church Side Queen Victoria Square Humber Street Humber Dock Street Neptune Street Humber Street Market Place
Public houses	Whittington and Cat Green Bricks Frankies Vauxhall Tavern	Commercial Road Humber Dock Street Hessle Road
Care home	Hica Care Homes Hamshaw Court Care Home	Cambridge Street Wellsted Street
Retail facilities	Kingston Retail Park Princes Quay shopping centre Paragon shopping centre Saint Andrews Quay Retail Park	Kingston Street Princes Dock Ferensway Clive Sullivan Way

14.7.11 Volume 2, Figure 14.2 and Figure 14.3 show the location of the community resources within the LIA. Volume 2, Figure 14.4 and Figure 14.5 show the location of the business and commercial units within the LIA.

Community severance

14.7.12 The existing A63 creates severance between residents and community resources to the north and those to the south of the route. Several non-motorised routes cross the A63 within the study area and there are footways along both sides of the road.

14.7.13 There are three Public Rights of Way (PRoW) that connect directly to the A63. Route 23 begins at Minerva Pier, runs along the east side of Humber Dock Street and ends at the A63 Castle Street. Route 25 begins at the A63 Castle Street, runs along Princes Dock Street and ends at Whitefriargate. Route 24 runs west from Humber Dock Street along the southern edge of the Humber Dock Marina and along Wellington Street. However, they do not cross the A63.

14.7.14 The public crossings on the A63 are currently:

- Signalised pedestrian crossings at Porter Street, west of Princes Quay shopping centre, east of Princes Quay shopping centre and at Market Place.
- Uncontrolled crossings in vicinity of Spruce Road, and on Ferensway and Commercial Road arms of Mytongate Junction.

- Signal controlled Toucan crossings on A63 west of Mytongate Junction and A63 east of Mytongate Junction.
- Existing ramp on north side of A63 to access High Street and crossing under the A63.

14.7.15 Further details on PRoW and NMU routes are provided in the Chapter 15 Effects on all travellers. A map of these routes and the community facilities within the LIA is provided in Volume 2, Figure 14.6 Community resources and existing NMU routes in the LIA in the local area.

Development land

14.7.16 Table 14.7 below presents key sites of development land within the LIA. These have been extracted from the Hull City Plan, Hull Local Plan 2016 – 2032, Green Port Hull and Newington and St Andrews Area Action Plan documents. Some of these sites, such as the Fruit Market, are adjacent to the Scheme in the LIA, and others, such as Green Port Hull and Kingston Parklands are in the WIA and are reached via the Scheme. The likelihood of each of the sites being delivered has been derived from the Scheme Uncertainty Log that was prepared for the traffic modelling, and a review of local planning policy documents. This is set out in the table below.

Table 14.7: Development land in the LIA

Development	Likelihood
Hull Local Plan 2016 - 2032	
Priory Business Park – a 7.11ha site located in the Western Corridor area of Hull. Outline planning consent granted for offices, industrial, showrooms and distribution (B1 (business uses), B2 (general industrial uses), B8 (storage and distribution uses)).	Near certain
Fruit Market and Digital Quarter – a 2.7ha site with a mixed use allocation, including plans for 160 dwellings. An additional site, Fruit Market B, has plans for 109 dwellings.	Reasonably foreseeable
Humber Quays – a 1.71ha site with potential for 200 dwellings. Potential developments include: B1 offices, A1 / A3, Hotel, Residential Units.	Near certain
63-71 High Street – a 0.42ha site with potential for 100 dwellings.	Reasonably foreseeable
Albion Square – a site with the capacity for approximately 28,500m^2 gross retail floorspace. A1/A3 Residential	Reasonably foreseeable
Quay West – land around Myton Street, to the west of the Princes Quay Shopping Centre, an area slightly in excess of 2ha. Part of the area has planning approval for a live music venue.	Near certain
Hull City Plan	
Beverley Gate – redevelopment of public space around the historic gate located to the north of the Scheme.	Ongoing construction

Development	Likelihood
Hull Venue – a 3,500 seat capacity events complex located to the north of the Scheme. This will also involve the rebuilding of Osbourne Street carpark and the creation of public space on Myton Street.	Ongoing construction
Green Port Hull	
Queen Elizabeth Dock (North) - a 29.6 ha site located to the south of Hedon Road within the Enterprise Zone in East Hull. Proposed land use is B2	More than likely
Queen Elizabeth Dock (South) – a 20.3 ha site located to the south of Hedon Road in East Hull within the Enterprise Zone at the Eastern end of the city's waterfront. Proposed land use is B2	More than likely
Elba Street – 4.8 ha of land north of A1033 Hedon Road located in East Hull within the Enterprise Zone, close to the Queen Elizabeth Docks. Planning uses include B1, B2 and B8.	Reasonably foreseeable
Keystore – a 0.67ha site located east of the Scheme, within the Enterprise Zone and on the west side of Alexandra Dock. Currently used as a storage and distribution site. Planning uses include B1, B2 and B8.	Reasonably foreseeable
Kingston Parklands – a 4.03ha site of the former Hedon Road Maternity Hospital, located to the east of the Scheme. Situated in the Humber Estuary Enterprise Zone, planning uses include B1, B2 and B8.	Reasonably foreseeable
Riverside Quay – a 25ha site situated to the south of the Scheme. Potential uses include offshore wind terminal.	Reasonably foreseeable
Valetta Street – a 3.42ha site located to the east of the Scheme. Potential uses include B1, B2 and B8.	Reasonably foreseeable
Wyke Works – a 2ha site located opposite the Port of Hull, to the east of the A63. Site suitable for B1, B2 and B8 usages	Reasonably foreseeable
Rix & Kingston International Business Park – a 8.13ha site located opposite Queen Elizabeth Dock, currently used for caravan storage. Potential for B1, B2 and B8 usage.	Reasonably foreseeable
Newington and St Andrews Area Action Plan (Adopted February 2010)	
Residential development site within the Newington and St Andrews Area	Reasonably foreseeable
Retail frontage improvement along Hessle Road	Reasonably foreseeable

Socio-economic baseline

14.7.17 The LIA is located in the city centre of Hull. It has a relatively low residential population density, with a high proportion of the population of working age. The area has higher than average deprivation. A total of 88% of Lower Super Output Areas[318] (LSOAs) in the LIA are located in the most deprived quintile based on the Indices of Multiple Deprivation (IMD)[319]. There is a higher proportion of Job Seekers Allowance (JSA) claimants compared to the wider area and the national

[318] Geographic hierarchy designed to improve the reporting of small area statistics in England and Wales

[319] Department for Communities and Local Government (2015) Indices of Multiple Deprivation

average. Despite this, there are a large number of businesses operating in the area, largely due to its central urban location in the city.

14.7.18 A detailed socio-economic profile can be found at Volume 3, Appendix 14.1.

14.8 Mitigation and predicted environmental effects

14.8.1 This section sets out the assessment of the potential effects of the Scheme on people and communities and the mitigation measures that will be required. The assessment considers impacts on land use, community facilities, development land and the local economy.

14.8.2 Effects are divided into construction and operational effects.

Mitigation measures

Construction Environmental Management Plan

14.8.3 A Construction Environmental Management Plan (CEMP) would be implemented and would serve to mitigate some impacts on people and communities during the construction period.

14.8.4 The requirements for the CEMP are currently set out in an Outline Environmental Management Plan (OEMP), see document reference TR010016/APP/7.3. The CEMP, once developed, would include a community relations strategy

14.8.5 The CEMP will also identify complaints procedures including a 24 hour contact telephone number to be made available for the use of local residents, businesses and other sections of the community.

14.8.6 By keeping the local community informed, the procedures to be included in the final CEMP would help to mitigate against impacts to people and communities.

Temporary Traffic Management Plan

14.8.7 A Temporary Traffic Management Plan has been produced to ensure that the adverse impacts of traffic during construction are minimised. This is available in Volume 3, Appendix 15.2.

Consultation with land owners and businesses

14.8.8 Extensive consultation has been undertaken with local landowners and businesses affected by the Scheme. Details are provided within the Consultation Report, see document reference TR010016/APP/5.1.

14.8.9 The assessment has involved working closely with HCC regarding access to the Old Town and a strategy has been agreed with HCC on road closures, traffic routes and prioritisation, deliveries, refuse collection and emergency access.

14.8.10 Following consultation, adequate access to all local businesses would be maintained throughout the Construction Phase. This includes the Holiday Inn which expressed concern during consultation. The main point of access to the Holiday Inn would be closed and future access would be from Commercial Road. Access from Commercial Road would be maintained throughout the construction period.

Compensation for land owners

14.8.11 Compensation as mitigation has not been taken account of as part of this assessment, as claims would not be made (and any compensation paid or provided) until after the Scheme is completed. However, it remains that compensation is a possibility for affected parties and would serve to mitigate against adverse impacts to land use and housing (demolition of private property and associated land take).

14.8.12 Third parties with an interest in land associated with the Scheme are defined under section 44 of the Planning Act (PA) 2008 and include:

- Owners, tenants, lessees or occupiers of the land
- People with an interest in the land or with the power to sell, convey or release the land
- People who would or might be entitled to make a relevant claim for compensation as a result of the development going ahead. Matters taken into account in determining compensation for land acquisition include, but are not limited to:
- Loss of land
- Loss of income through activity (such loss of ability to use the land for a given purpose such as renting, shopping or leisure)
- Severance of services such as water supplies and other public or private utilities
- Severance of and injurious affection to the value of retained land
- Reasonable fees incurred in dealing with the claim for compensation

14.8.13 Highways England would refer any claims for compensation received during the relevant period of entitlement to their contracted Valuer. The Valuer would then validate the entitlement to compensation and carry out the negotiation of the compensation package with the land owner or their representative on Highways England's behalf. Compensation can be monetary and / or work, such as new fencing.

Replacement land or reconfiguration of land use

14.8.14 Where there is temporary and permanent land take required, for example from a car park or park, replacement land for temporary or permanent car parking and open space will be sought, alternatively reconfiguration of car parks will be considered as an option.

14.8.15 The proposed mitigation for individual sites is presented in Table 14.8 to Table 14.14.

Journey length and community severance

14.8.16 The mitigation measures for increased journey lengths which can lead to community severance are provided in Chapter 15 Effects on all travellers.

Effects during construction

14.8.17 During the Construction Stage, the following categories of effects have been assessed:

- Demolition of private property and associated land take
- Loss of land used by the community
- Community facilities
- Community severance
- Effects on development land
- Local economy

14.8.18 Construction is anticipated to take approximately five years. This would be carried out in phases, and as such not all sections of the road would be under construction for the full five-year period. Details can be found at Table 2.5: Construction phases and traffic management in Chapter 2 The Scheme.

Demolition of private property and associated land take

14.8.19 Table 14.8 below sets out the predicted environmental effects relating to private property and associated permanent and temporary land take.

14.8.20 Two options exist for the temporary location of the bentonite processing compound. Option A is located on the site of the current Arco Store and is the preferred option. Option B is on the current Staples, American Golf and Maplin site and is the alternative site should Option A be unobtainable. Buildings on the compound utilised would be demolished.

Table 14.8: Private property and associated land take – predicted effects

Potential impact	Proposed mitigation	Significance following mitigation
Construction compounds Seven temporary construction compound sites have been proposed for the Scheme, dependent upon site availability. The use of these sites as construction compounds would alter their usage for a period of up to five years. These construction compounds are set out below. (Note: Site 1 includes two options, A and B).		
1A. Arco Ltd Temporary land take at Arco Ltd (Option A): Option A would involve the site currently held by Arco Ltd being used as a bentonite farm / concrete batching plant / materials treatment / jet grouting compound. In this scenario, a total of 14,407m^2 temporary land take is likely to be required. This is the preferred site for the compound.	Where temporary land take would be required to enable construction works, reinstatement would follow once works are completed. The site would be returned in its current condition. Extensive consultation has been undertaken with local landowners and businesses affected by the Scheme.	The effect is considered to be slight adverse, not significant effect
Demolition of Arco building (Option A): If the Arco site is used for the bentonite compound the Arco building will be demolished.	There is a commitment to relocating the Arco business permanently to an appropriate new site. HCC are working closely with Arco to locate a new head office for their staff should Option A be taken. It is understood that the adjacent businesses would still be able to operate. Access to these businesses would need to be maintained and disruption minimised.	The demolition of the Arco building is considered to be a moderate adverse, significant effect.
Permanent land take at Arco Ltd (Option A): If the Arco site is used, it is anticipated that there will be approximately 3,501m^2 of permanent land take at Arco Ltd and 1,764m^2 of 'permanent rights' required.	A small amount of land take would be required, the need for mitigation beyond statutory compensation measures is limited.	The permanent land take is considered to be a slight adverse effect, which is therefore not significant.
Temporary land take at Staples site (Option A): Option A: If the Arco site is used, the Staples site would experience 71m^2 of temporary land take and the buildings would not be demolished.	The site would be returned in its current condition.	The temporary land take at the Staples site would result in a negligible, not significant effect.
Permanent land take at Staples site (Option A): A small amount of permanent land take (approximately 10m^2) would be required from the Staples site if the Arco site is used.	A small amount of land take would be required, the need for mitigation is limited.	The effect is considered negligible and not significant.

Potential impact	Proposed mitigation	Significance following mitigation
1B. Staples site Temporary land take at Arco Ltd (Option B): Option B would involve the Staples and American Golf site being used as the bentonite compound. If this site is used is used as the main compound, there would be a temporary land take of 8,814m^2 at the Arco site.	The site would be returned in its current condition.	The effect is considered to be slight adverse, not significant effect
Permanent land take at Arco Ltd (Option B): If the Staples site is used instead of the Arco site this would lead to 2,726m^2 of permanent land take from the Arco site and 1,374m^2 of 'permanent rights' would be required.	A small amount of land take would be required, the need for mitigation beyond statutory compensation measures is limited.	The effect is considered to be a slight adverse and not significant effect.
Temporary land take at Staples site (Option B): If Option B is selected, the Staples and American Golf site would be used as the Bentonite compound instead of the Arco site with a temporary land take of 8,814m^2.	The site would be returned in its current condition.	The effect is considered to be slight adverse, and therefore not significant
Demolition of buildings at Staples site (Option B): If the Staples site is used the buildings on the site would be demolished.	The Staples site has active businesses located on it which would need to be relocated if Option B goes ahead. There is a commitment to ensure that these businesses are relocated. It is understood that the adjacent businesses would still be able to operate. Access to these businesses would need to be maintained and disruption minimised.	The effect of the loss of the buildings for Staples and the American Golf store would be moderate adverse, and significant.
Permanent land take at Staples site (Option B): 10m^2 if the Staples site is used instead of the Arco site).	A small amount of land take would be required, the need for mitigation is limited.	The effect is considered negligible and not significant.
2. Wellington Street West Island Wharf This will be the main site offices / accommodation. The site area covers 19,100 m^2. Current land usage: Brownfield.	Brownfield site with limited current activity. The site would be returned in its current condition.	A slight adverse, not significant effect
3. A63 Eastbound Recovery Base (A63 layby eastbound to the north of St Andrews Quay) This will be used for recovery vehicles during construction).	This is highways land and would have limited community effect.	A slight adverse, and not significant effect

Potential impact	Proposed mitigation	Significance following mitigation
Current land usage: Highways		
4. A63 Westbound Recovery Base (A63 layby westbound to the west of Garrison Road roundabout) Proposed for vehicle recovery. Current land use: Highways	This is highways land and would have limited community effect.	A slight adverse, and not significant effect
5. Livingstone Road (South Humber Properties Ltd) This will be a materials compound. The site covers an area of 22,200 m^2. This is an industrial area and businesses could be affected. Current land usage: Industrial.	The site would be returned in its current condition. Disruption to businesses will need to be minimised. Consideration of the effect of construction activity and vehicles on surrounding businesses will be included in the CEMP.	A slight adverse, and not significant effect
6. Land south east of Mytongate Junction This is proposed as the site compound for works at Trinity Burial Ground. The site area covers 1,390 m^2 Current land usage: private grassland	This is grass land and would have limited adverse effect. Consideration of the effect of construction activity and vehicles on surrounding businesses will be included in the CEMP.	A slight adverse and not significant effect
7. Neptune Street Set Down This is proposed as use for the main compound for the construction of Princes Quay Bridge and then for vehicle recovery and traffic management. The site area covers 14,300 m^2 Current land usage: Brown field	The existing site is brownfield and the effects on the site will be limited. Consideration of the effect of construction activity and vehicles on surrounding businesses will be included in the CEMP.	Slight adverse, not significant effect
Additional private land and property effects:		
Temporary land take at the Myton Centre: Land take would be required at the Myton Centre of ,399m^2. It is proposed the site will be used as a temporary car park for contractor staff working. It will be used for the full 5-year construction period. Current land use: HCC property.	Once the Scheme is operational the site will be used as replacement public open space. The replacement public open space will mitigate the loss of land at the Trinity Burial Ground. Confirmation is required on whether a site for the council services operating out of the Myton Centre will be provided.	The temporary loss of land at the Myton Centre site is considered to be slight adverse and is therefore not significant.
Demolition of the Myton Centre: The Myton Centre would be demolished. It is proposed the site will be used as a temporary car park for contractor staff working. It will be used for the full 5-year construction period. Current land use: HCC property.	Confirmation is required on whether a site for the council services operating out of the centre will be provided.	The loss of the Myton Centre is considered to be a moderate adverse effect during construction and long term, and as such is significant.

Potential impact	Proposed mitigation	Significance following mitigation
Temporary land take at Holiday Inn Hotel: Land take of 5,509m^2 is required during construction to reconfigure the Holiday Inn estate for the construction of a retaining wall on the Scheme Site.	Adequate access to all local businesses would be maintained throughout the Construction Phase. This includes the Holiday Inn, which expressed concern about this issue during consultation. The main point of access to the Holiday Inn would be closed and future access would be from Commercial Road. Access from Commercial Road would be maintained throughout the construction period.	The effect is considered to be slight adverse and is therefore not considered to be significant.
Permanent land take at the Holiday Inn: It is anticipated that there will be approximately 2,249m^2 of permanent land take at the Holiday Inn site, primarily from land located in front of the hotel and permanent rights of 3,425m^2. This is likely to result in the loss of a small number of car parking spaces, as well as the hotel's drop-off coach and bus provision.	The hotel car park would be reconfigured to maximise capacity, and to compensate for the loss of car parking spaces. The roads in front of the hotel would be modified to allow coaches and buses to access the front of the building via the alternative Commercial Road access route.	The effect is considered to be slight adverse, which is therefore deemed not significant.
Temporary land take at Kingston Retail Park (Option A): It is anticipated that 6,737m^2 will be acquired for the project from the Kingston Retail Park under Option A (Arco). This would involve the loss of parking spaces impacting on retail outlets ability to trade.	The loss of parking has been minimised as far as possible, through considered redesign of the car park layout. Using parking in the vicinity of the Odeon Cinema to the south of the Kingston Retail Park as an overflow car park has been rejected by Kingston Retail Park.	A slight adverse effect, which is not considered to be significant.
Temporary land take at Kingston Retail Park (Option B): It is anticipated that 6,679m^2 will be acquired for the project from the Kingston Retail Park under Option B (Staples). This is very similar to the land loss if Option A is implemented. This would involve the loss of parking spaces impacting on retail outlets ability to trade.	The loss of parking has been minimised as far as possible, through considered redesign of the car park layout.	A slight adverse effect, which is not considered to be significant.
Permanent land take at Kingston Retail Park (Option A): 937m^2 likely to be acquired. Due to the constraints of the Scheme corridor, land-take from Kingston Retail Park is unavoidable. The Scheme footprint has been reduced as much as possible but operational and safety requirements dictate that some parking spaces would be permanently lost,	As above, the loss of parking has been minimised as far as possible, through considered redesign of the car park layout.	A slight adverse effect, which is not considered to be significant.

Potential impact	Proposed mitigation	Significance following mitigation
potentially impacting on the ability of the retail outlets located there to trade as before.		
Permanent land take at Kingston Retail Park (Option B): 889m^2 likely to be acquired permanently. Due to the constraints of the Scheme corridor, land-take from Kingston Retail Park is unavoidable. The Scheme footprint has been reduced as much as possible but operational and safety requirements dictate that some parking spaces would be permanently lost, potentially impacting on the ability of the retail outlets located there to trade as before.	As above, the loss of parking has been minimised as far as possible, through considered redesign of the car park layout.	A slight adverse effect, which is not considered to be significant.

Loss of land used by the community and community facilities

14.8.21 Table 14.9 below sets out the predicted environmental effects relating to loss of land used by the community and community facilities.

Table 14.9: Loss of land used by the community and community facilities - predicted effects

Potential impact	Proposed mitigation	Significance following mitigation
Temporary land take at Trinity Burial Ground: Temporary land-take of 5,108m^2 would be required at Trinity Burial Ground. During construction, is likely that the entire site would be closed to the public in order to facilitate the removal of monuments and exhumation of human burials. Therefore, for the purpose of this assessment, no access for the duration of the works is assumed as a worst-case scenario.	This impact and mitigation measures are explored in more detail in the Chapter 8 Cultural heritage.	The temporary loss of access to the Burial Ground for a period of up to five years (worst case), would cause an overall moderate adverse effect. This would be significant.
Permanent land take at Trinity Burial Ground: It is anticipated that there will be 2,632m^2 land take at the Trinity Burial Ground, and 393m^2 permanent rights, in the northern third of the burial ground. Trinity Burial Ground is valued as a green space in an urban area.	The mitigation strategy for the remaining area of Trinity Burial Ground involves retaining the remaining area as a public open space with displaced monuments and paths reinstated. The Scheme also intends to replace public space taken at Trinity Burial Ground with the creation of new public green space at the Myton Centre which will be	The replacement of the land with new public green space would lead to a reduced effect. There would be a slight adverse effect, which would not be significant.

Potential impact	Proposed mitigation	Significance following mitigation
	demolished. This replacement area would provide an informal green space with tree and shrub planting, timber seating, wayfinding signage and litter bins.	
Temporary loss of moorings at Humber Dock Marina: A total of approximately 8,463m^2 would be temporarily acquired. All the berths on the northern wall of the marina will be lost with the exception of the Lightship. This which will impact upon marina users and may impact Hull's overall maritime offer.	The moorings will be reconfigured to optimise the number of moorings available.	The loss of moorings is considered to be a moderate adverse effect due to the effect on the Marina and the local community that use it, and as such is significant. The temporary effect does not represent a significant additional effect over and above the permanent land take (see below).
Permanent loss of moorings at Humber Dock Marina: A total area of 3,362m^2 of permanent right would be required. All the berths on the northern wall of the marina will be lost with the exception of the Lightship. This which will impact upon marina users and may impact Hull's overall maritime offer.	The moorings will be reconfigured to optimise the number of moorings available.	The loss of moorings is considered to be a moderate adverse effect due to the effect on the Marina and the local community that use it, and as such is significant.
Relocation of the Spurn Lightship: The Spurn Lightship will be relocated to a temporary position and closed to the public in the worst-case scenario over 5 years. It is proposed the Spurn Lightship would be relocated alongside the eastern quay wall in the south east corner of Humber Dock Marina.	Following construction, the Spurn Lightship would be repositioned north west of its current location in Humber Dock Marina.	The temporary closure and relocation of the Lightship would have a slight adverse but not significant effect.
Permanent land take at William Oak Park: The park will lose an area of approximately 58m^2. The environmental design proposals for William Oak Park include the realignment of the tiled boundary wall, required to accommodate the combined footway / cycleway, an internal footpath and shrub planting. This construction work is likely to alter community access to the park.	A new area of community land approximately 400m^2 in size would be created at Cogan Street and William Street where the two existing roads are to be stopped up.	Because the space will be re-provided, a slight adverse effect is anticipated. This is not expected to be significant.
Permanent land take at the Jubilee Arboretum: This area would experience a temporary	The CEMP would ensure that the works footprint is minimised as far as possible to mitigate	The community would experience no change to its function or access. An

Potential impact	Proposed mitigation	Significance following mitigation
loss of 196m^2 of community land during construction works. However, the majority of the arboretum would remain untouched by the works. Access from William Street could be affected by the temporary car park.	against land use impacts, minimising the disruption to the park and ensuring access is maintained to residential properties. The environmental design for the park would see the current hedgerow retained and new amenity grassland and bulbs planted beyond the hedge line, together with replacement trees to screen the Scheme. Benches would also be provided. An area of 35m^2 of the Park will be retained within the permanent land take boundary.	overall slight adverse effect is anticipated, which is not expected to be significant.
The Earl de Grey public house: This would be dismantled.	Mitigation and effect are identified in the Chapter 8 Cultural heritage.	The significance of the loss of land is assessed in the Chapter 8 Cultural heritage.

Community severance

14.8.22 The effects of the Scheme on community severance during construction are presented in Table 14.10 below. Chapter 15 Effects on all travellers identifies three NMU routes that are likely to experience significant adverse effects due to the Scheme with increased journey times, or a change in the physical length of journey. The effect of this on access to community facilities has been assessed. The NMU route numbers link to those used in the Chapter 15 and assessment of significance is based on the NMU assessment. No additional ratings have been included here to avoid double counting of significant effects. For more details on the NMU assessment please refer to Chapter 15.

Table 14.10: Community severance – predicted effects

Location[320]	Nature of activity	Effect on community severance	Significance of effect after mitigation
Location 1: Footways running alongside the A63	During construction, temporary diversions are likely to be required whilst works are undertaken to upgrade the footway to a combined footpath / cycle path, which would result in significant journey time increases.	There are a number of community facilities to the north and the south of the A63. Increased journey times for NMUs' using the route could impede access to these facilities. For example Princes Quay shopping centre (which includes	Based on the proximity of the location to community resources, the increases in journey time for NMUs, is likely to result in an adverse significant effect. This is no change from the significance rating on journey length from that

[320] See Figure 14.2 and Figure 14.3 Community resources in the LIA, sheets 1 and 2. The numbers also link to the location numbers in ES Chapter 15 Effects on all travellers.

Location[320]	Nature of activity	Effect on community severance	Significance of effect after mitigation
		various leisure facilities) as well as a local surgery is located close to the north of the Scheme where there is a pedestrian crossing point.	provided in Chapter 15 Effects on all travellers.
Location 2: Hessle Road (north side)	As for the footways both sides of the A63 (see Location No. 1).	See above	See above
Location 3: Northeast, southeast and southwest sides of Mytongate Junction	During construction, temporary diversions are likely to be required whilst works are undertaken to upgrade the footway to a combined footpath / cyclepath. East / west movements for NMUs would be maintained throughout the construction period through these diversions. However, Significant effects upon NMUs due to increased journey time since the crossing at Mytongate west and east would also be closed with a diversion in place, and from reduced journey experience due to the presence of construction activities.	The increase in journey times will affect NMUs accessing the community facilities in the surrounding area including: the medical centre on Myton Street, leisure facilities, educational centres and a church increasing their journey lengths, though the facilities will still be accessible.	Due to the increased journey lengths affecting the time it would take to access surrounding community facilities, the effect would be adverse and significant. This is no change from the significance rating on journey length from that provided in Chapter 15 Effects on all travellers.

Development land

14.8.23 The effects of the Scheme on development land during the construction period are presented in Table 14.11.

Table 14.11: Development land – predicted effects

Potential impact	Proposed mitigation	Significance following mitigation
The Humber Quay: This would experience temporary land take during construction, is identified as a key development site in the Hull Local Plan. The use of the land during this period would put on hold the use of the land for longer term developments. The duration of this land take is likely to be up to five years.	Any associated disruption would be minimised through the Construction Environmental Management Plan (CEMP) and Traffic Management Plan (TMP). Minimise the length of time required to use the site for construction works and ensure that the site is left in the same condition prior to the Scheme.	Slight adverse and therefore not significant effect.

Local economy

14.8.24 Table 14.12 sets out the predicted environmental effects relating to the local economy.

Table 14.12: Local economy - predicted effects

Potential impact	Proposed mitigation	Significance following mitigation
Direct employment from construction activity: A scheme of this scale will require a construction workforce to deliver it. For the duration of the construction process there will be a number of construction workers on the Scheme Site. If the employees are hired from the LIA or WIA, this could have a slight impact on employment in these areas. Staff numbers are estimated to be in the range of 100 to 200 operatives, but not all would be working continually for the full five-year period. It is expected that most staff would work during the typical hours of day time construction, although it is possible that some activities, for example piling operations, would be carried out in longer 12-hour shifts. Where possible, there would be a preference to employ staff from the local area, but this is dependent on availability of suitable personnel locally, including for specialised roles or activities. Provision of accommodation for non-local workforce has not been considered, and any requirement is unlikely to present a significant change to the demand for accommodation in the area.	No mitigation measures have been identified for this impact.	At present, employment data indicates that there are proportionally fewer economically active people in Hull compared to both the national average and the regional average for Yorkshire and the Humber. The addition of new construction jobs locally would therefore result in a slight beneficial effect, but would not be significant.
Temporary economic activity from construction: It is anticipated that there would be a very minor temporary impact on the local economy as a result of these construction workers using some local retail outlets and services during the construction period. This is mostly likely to benefit nearby hospitality and catering establishments around mealtimes. The Scheme has	No mitigation measures have been identified for this impact.	This temporary economic activity will result in a slight beneficial effect, but it would not be significant.

Potential impact	Proposed mitigation	Significance following mitigation
also indicated that local hotels and 'bed and breakfasts' will be used for workforce accommodation.		
Disruption to access to economic centres during construction: The Scheme is a key route connecting people to businesses located in the Scheme economic corridor, Hull city centre and the Port of Hull. During construction, it is anticipated that there will be up to five years of service diversion, involving periods when the Scheme is required to run with narrow lanes and / or a narrowed central reserve. This is likely to affect access to city centre and other businesses.	These temporary impacts would be managed through a CEMP and a Traffic Management Plan.	The overall effect is likely to be slight adverse, and is not therefore considered to be significant.
Disruption to commercial operation and access: If the preferred use of Arco (Option A) as the bentonite compound, there will be disruption to businesses in the LIA due to construction works and limited access along Castle Street to Spruce Road. This may affect the ability of businesses to operate as normal. Up to five years of service disruptions may result in disrupted customer access, potentially affecting trade and reducing custom to these businesses. If the Staples (Option B) is selected as the bentonite compound, access between Spruce Road and the A63 would remain open.	If Option A is utilised, a link road would be constructed between Spruce Road and Lister Street as a replacement and permanent access for local businesses. Access between the A63 and Spruce Road would be maintained for construction purposes and permanently closed at the end of the works. Footpaths are proposed on either side of the new link road with an NMU diversion proposed along Lister Street to ensure the safety of the public.	The effect on businesses is considered to be slight adverse, based on the effect being temporary, confined to the local study area and affecting a relatively small number of receptors. This is not considered to be significant.
Disruption to business at the Holiday Inn Hotel: There is likely to be disruption to business at the Holiday Inn as a result of construction works: A retaining wall would be constructed between the westbound diverge slip road and the grounds of the Holiday Inn and Trinity Burial Ground to the south. The Holiday Inn expressed concern that the sight, noise and vibration associated with	Traffic and transport impacts would be managed through both a CEMP and a Traffic Management Plan. The CEMP would include measures to mitigate some of the issues highlighted by the Holiday Inn. This would include restrictions on noisy and disruptive night time and weekend working. Where possible, this would ensure that the interests of residents	As the CEMP may not be able to mitigate all disturbance experienced during construction, the effect is likely to be slight adverse. It is therefore considered to be not significant.

Potential impact	Proposed mitigation	Significance following mitigation
construction would negatively affect guest bedrooms, conference rooms, diners and visitors to the hotel. The congestion and lane closures as a result of the construction would be a disruption to customer, staff and supplier access, particularly during busy or event periods. Access to the hotel from the Scheme would be closed during construction on safety grounds. Temporary land take from the hotel is considered in the land take impacts section above.	and businesses are protected.	

Operation

14.8.25 During the Operation Phase, the following categories of effects have been assessed:

- Demolition of private property and associated land take
- Loss of land used by the community
- Community facilities
- Community severance
- Development land
- Local economy

Demolition of private property and associated land take

14.8.26 No additional demolitions of private property or land take are required during the Operation Phase.

Loss of land used by the community and community facilities

14.8.27 Table 14.9: Loss of land used by the community and community facilities - predicted effects sets out the predicted environmental effects relating to loss of land used by the community and community facilities.

Community severance

14.8.28 The community facilities that are likely to be affected by community severance caused by changes to the NMU routes including a permanent change to journey length or time have been identified in Table 14.13.

14.8.29 This builds upon the NMU assessment provided in Chapter 15 Effects on all travellers. Only sites that have significant adverse or significant beneficial effects have been included here.

Table 14.13: Community severance – operational effects

Location[321]	Impact on community severance	Proposed mitigation and significance following mitigation
Location 9: Increase of 330m for the journey from the existing NMU crossing location on Market Place to Queen Street, travelling via the ramped access to High Street and under the A63.	The increase in journey length will have a community severance effect on local facilities increasing NMU journey time to leisure facilities such as the St Pauls boxing club, the medical centre on Myton Street, the Hull Minster Holy Trinity Church, a post office, amongst other city centre facilities.	The effect of increasing the journey length on severance is significant adverse. This represents no change from the significance rating in Chapter 15, Effects on all travellers.
Location 10: Market Place – east / west signal controlled crossing. Signal controlled crossing would be removed and replaced with an uncontrolled crossing	The removal of the signal-controlled crossing would make it harder for vulnerable groups to cross the road affecting their access to the community facilities identified above.	The effect of increasing the journey length on severance is significant adverse. This represents no change from the significance rating in Chapter 15 Effects on all travellers.
Location 19: No access between the A63 and Humber Dock Street. Combined cycleway and footway provided along the A63 (3m wide at this location). Ramped access to Princes Quay Bridge also provided in this location.	There are leisure facilities in the Princes Quay shopping centre located close to the site that would have improved access for vulnerable users due to the proposed ramped access.	The effect of improving access on severance is beneficial significant. This represents no change from the significance rating in Chapter 15 Effects on all travellers.

Development land

14.8.30 Once operational there would be no further adverse effects on development land. The Scheme is likely to improve access to sites of development land located in the WIA and support the success of employment land. Examples include development land to the east of the Scheme, around the Port of Hull, including the Keystore and Wyke Works sites. This is likely to bring about a moderate beneficial impact, which is considered significant.

Local economy

14.8.31 Table 14.14 below sets out the predicted environmental effects relating to the local economy during the Operation Phase.

[321] See Volume 2 Figure 14.2 and Figure 14.3 Community resources in the LIA

Table 14.14: Local economy - predicted effects

Potential impact	Proposed mitigation	Significance following mitigation
Employment and GVA: Using Mott MacDonald's own economic impact model, the Scheme was assessed to have the potential to support the delivery of 583 net additional jobs, producing £24.7m of net additional GVA per annum, within the Hull and Humber economy.[322]	None	The magnitude of this effect is likely to be beneficial. The job creation is in an area with comparatively high levels of unemployment and worklessness (as detailed in the baseline section above). The impact on job creation is considered to be moderate beneficial and significant.
Permanently altered access to the Holiday Inn: Access to the Holiday Inn would be changed permanently by the Scheme, as the current direct drop off / pick up access from the Scheme would be closed. This access to the hotel is used primarily by coaches. Alternative access would be provided via an entrance on Commercial Road. The changes in access may cause some confusion, for example to returning guests who had previously used the Scheme entrance. However, over time users would adapt and new staff and guests would be less affected, as they would have no experience of the current arrangement.	Adequate advanced signage on the Scheme and at the Mytongate Junction would mitigate against the changes in access. While not all of the hotel's concerns have been resolved, two key requirements were to ensure that the Scheme would continue to allow for a large coach to access the hotel, and the loss of parking spaces would be mitigated. Discussions regarding the reconfiguration of the entrance and parking are ongoing.	The impact on Holiday Inn is considered to be adverse. However, the changes to access are not considered to affect the ability of the hotel to do business and should not substantially impact the user experience. As such, the adverse effect is slight and not significant.
Alterations to access to businesses reached via Spruce Road: Access from the Scheme via Spruce Road to businesses (including Arco Ltd, Kingston Retail Park service yards, ATS Euromaster and Armstrong Hydraulic Services) will be restricted following completion of the Scheme. This may impact upon the ability to trade, and affect customer access.	Alternative access will be provided via St James Street, and although restricted, access via Spruce Road will still be maintained.	This alteration to access is likely to have a slight adverse effect, with is considered not significant.
Increased north / south movement: The creation of upgraded pedestrian and cycle	None	The increased footfall is likely to generate new custom for restaurants,

[322] MMSJV (2018) Technical Note - A63 Castle Street Improvements Wider Economic Benefits

Potential impact	Proposed mitigation	Significance following mitigation
crossings is likely to increase movement from the city centre (north of the Scheme) to the Fruit Market and Marina area (south of the Scheme). This increased footfall will benefit local businesses located in the area.		cafes and shops located in the Fruit Market area. This effect on businesses is considered to be slight beneficial, and therefore not significant.

14.9 Conclusion

14.9.1 This chapter has assessed the potential effects of the Scheme for People and Communities with a focus on land use, community and development land, community facilities, and the local economy. The assessment has drawn upon guidance presented within DMRB Volume 11, Section 3, Part 6 Land Use, DMRB Volume 11, Section 3, Part 8, Pedestrians, Cyclists, Equestrians and Community Effects, the Highways England's IAN 125/15 on environmental assessment and professional judgement. A summary of the significant effects of the Scheme on People and Communities is presented in Table 14.15 and Table 14.16. The significance ratings are based on the methodology set out in section 14.6.

14.9.2 Chapter 15 Effects on all travellers shows effects on drivers and NMUs during construction and operation. During construction, for drivers, there would be some deterioration in the existing view and an adverse effect on stress. During operation, the effect on views from the road for vehicle travellers is considered to be adverse on opening of the road in 2025. There would also be very little change in driver stress as a result of alterations to average peak traffic flow. During construction, for NMUs it is anticipated that there may be an increase in journey length and a deterioration in journey experience. Once operational, the Scheme may result in some adverse effects for NMUs because of the changes to amenity and increase in journey length. No effects are considered significant.

14.9.3 Reference should also be made to the following document for additional associated information:

- Volume 2, Appendix 14.1 Socio economic profile
- Volume 2, Appendix 14.2 Equality impact assessment
- Chapter 16 Combined and cumulative effects including 'in combination' climate effects and a summary of health impacts

Table 14.15: Summary of significant effects following mitigation - temporary effects

Category	Potential impact	Significance
Private property and associated land take	Temporary land take for construction compound: Option A and Option B: Arco site	Option A: Slight adverse, not significant Option B: Slight adverse, not significant
	Temporary land take for construction compound: Option A and Option B: Staples site	Option A: Slight adverse, not significant Option B: Slight adverse, not significant
	Temporary land take for construction compound: Wellington Street West Island Wharf	Slight adverse not significant
	Temporary land take for construction compound: A63 Eastbound Recovery Base (A63 layby eastbound to the north of St Andrews Quay	Slight adverse, not significant
	Temporary land take for construction compound: A63 Westbound Recovery Base (A63 layby westbound to the west of Garrison Road roundabout)	Slight adverse, not significant
	Temporary land take for construction compound: Livingstone Road (South Humber Properties)	Slight adverse, not significant
	Temporary land take for construction compound: Land south east of Mytongate Junction	Slight adverse, not significant
	Temporary land take for construction compound: Neptune Street Set Down	Slight adverse, not significant
	Temporary land take at the Myton Centre	Slight adverse, not significant
	Temporary land take at Holiday Inn	Slight adverse, not significant
	Disruption to business due to the temporary land take of car parking at the Kingston Retail Park	Slight adverse, not significant
Loss of land used by the community and community facilities	Disrupted visitor access to Spurn Lightship due to its relocation	Slight adverse, not significant
	Temporary land take at Trinity Burial Ground	Moderate adverse, significant
Development land	Humber Quay	Slight adverse, not significant
Community severance	Location 1: Footways running alongside the A63	Adverse significant effect (no change from Chapter 15 Effects on all travellers)
	Location 2: Hessle Road (north side)	Adverse significant effect (no change from Chapter 15 Effects on all travellers)

Category	Potential impact	Significance
	Location 3: Northeast, southeast and southwest sides of Mytongate Junction	Adverse significant effect (no change from Chapter 15 Effects on all travellers)
Local economy	Direct employment from construction activity	Slight beneficial, not significant
	Temporary economic activity from construction	Slight beneficial, not significant
	Disruption to access to economic centres during construction	Slight adverse, not significant
	Disruption to businesses in the LIA due to construction works	Slight adverse, not significant
	Disruption to business at the Holiday Inn	Slight adverse, not significant

Table 14.16: Summary of significance of effects following mitigation - permanent effects

Category	Potential impact	Significance
Private property and associated land take	Permanent land take at Arco Ltd site	Option A: Slight adverse, not significant Option B: Slight adverse not significant
	Demolition of the buildings on the Arco Ltd site	Option A: moderate adverse, significant Option B: No impact
	Permanent land take at Staples site	Option A: Slight adverse, not significant Option B: Slight adverse, not significant
	Demolition of the buildings on the Staples site	Option A: No impact Option B: moderate adverse, significant
	Permanent land take at Kingston Retail Park	Slight adverse, not significant
	Demolition of the Myton Centre	Moderate adverse, significant
	Permanent land take at Myton Centre	Slight adverse, not significant
	Permanent land take at the Holiday Inn	Slight adverse, not significant
Loss of land used by the community and community facilities	Land take at Trinity Burial Ground	Slight adverse, not significant
	Loss of moorings at Humber Dock Marina	Moderate adverse, significant
	Permanent land take at Trinity Burial Ground	Slight adverse, not significant

Category	Potential impact	Significance
	Permanent land take at William Oak Park	Slight adverse, not significant
	Permanent land take at Jubilee Arboretum	Slight adverse, not significant
Development land	Development sites within the WIA	Moderate beneficial, significant
Community severance	Location 9: Increase of 330 m for the journey from existing NMU crossing location on Market Pace to Queen Street	Adverse significant (no change from the Chapter 15 Effects on all travellers)
	Location 10: Market Place east / west signalled controlled crossing	Adverse significant (no change from the Chapter 15 Effects on all travellers)
	Location 19: No access between the A63 and Humber Dock Street	Adverse significant (no change from the Chapter 15 Effects on all travellers)
Local economy	Job creation and GVA generated	Moderate beneficial, significant
	Permanently altered access to the Holiday Inn	Slight adverse, not significant
	Alterations to access to businesses reached via Spruce Road	Slight adverse, not significant
	Increased north / south movement	Slight beneficial, not significant

Chapter 15. Effects on all travellers

15.1 Executive summary

15.1.1 This chapter presents the effects of the A63 Castle Street Improvements Scheme on all travellers. It sets out the policy context for the topic, and the method that has been used to carry out the assessment.

15.1.2 In undertaking the assessment, effects on vehicle travellers have been addressed in terms of the change in the view from the road and the impact on driver stress (frustration, fear of potential accidents and route uncertainty). This is considered during construction and once the scheme is operational. The assessment also addresses changes to non-motorised user (NMU) amenities, journey length and journey experience during construction and operation.

15.1.3 Temporary closures and diversions during construction will result in increases to journey length and times for vehicle travellers and NMUs. This will also cause some deterioration in the existing view for vehicle travellers. Traffic management and speed restrictions during construction could result in delays to journey time, leading to increased driver stress within the area. Construction effects on NMUs, driver stress and views from the road are considered to be slight adverse.

15.1.4 Provisions for NMUs as part of the operational scheme include new combined footway and cycleway facilities, pedestrian, cycle and disabled user bridges at Porter Street and Princes Quay, signalised crossings at Mytongate Junction and a reconfigured ramp from the A63 to High Street. This will have the benefit of separating NMUs from vehicle traffic, however, some adverse effects will be experienced through changes to cycle routes, footpaths and public rights of way and increases in journey length for some routes.

15.1.5 Predictions of driver stress with and without the scheme have identified very little change in driver stress during operation. However, upgrades to Mytongate Junction and the removal of crossings across the A63 would slightly reduce driver stress along the A63 Castle Street resulting in a benefit for vehicle travellers. Some changes to existing views from the road as a result of the introduction of new highways infrastructure would also be anticipated for vehicle travellers. However, the scheme would not alter the overall balance of features and elements that comprise the existing view of the surrounding townscape for vehicle travellers. Effects on NMUs and views from the road are also considered to be slight adverse during operation, and slight beneficial for driver stress.

15.2 Introduction

15.2.1 This chapter considers the effect of the A63 Castle Street Improvements (the Scheme) on all travellers. This comprises vehicle travellers travelling on the A63 Castle Street and the local road network, and NMUs actively using existing and

proposed footpaths, crossings, cycleways or desire lines within the vicinity of the Scheme. In accordance with the Design Manual for Roads and Bridges (DMRB Volume 11 Section 3 Parts 8 and 9[323], the assessment of effects upon vehicle travellers considers levels of driver stress during construction and once the Scheme is operational, as well as views from the road along the A63, both during construction and operation. The assessment of effects upon NMUs considers changes to NMU amenities, journey length and journey experience during both construction and operation.

15.2.2 This chapter should be read in conjunction with the following Figures and Appendices:

- Volume 2, Figure 15.1: This drawing identifies existing NMU routes within the study area for the Scheme
- Volume 2, Figure 15.2: This drawing identifies the proposed closures to NMU routes and the new NMU facilities to be installed as part of the Scheme
- Volume 3, Appendix 15.1: This document provides the assessment of driver stress during operation
- Volume 3, Appendix 15.2: This is the temporary traffic management plan for the Scheme[324] which has informed this assessment

15.3 Legislative, regulatory and policy background

National Policy

National Policy Statement

15.3.1 The *National Policy Statement for National Networks* (NN NPS)[325] confirms its commitment to providing people the opportunity to choose sustainable transport modes. It expects applications to identify opportunities to invest in infrastructure where communities (including pedestrians and cyclists) appear to be severed by the road network. It also expects applications to address historic problems, by designing and delivering schemes taking into account accessibility requirements for all, including disabled users.

15.3.2 Paragraph 4.8.1 states *"As described in the relevant sections of this NPS, where the proposed project has likely significant environmental impacts that would have*

[323] DMRB Volume 11, Section 3, Part 8 and Part 9. Available online at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3.htm, accessed 10/02/2017.

[324] Virtus (2015) A63 Castle Street Improvements Temporary Traffic Management Plan

[325] Department for Transport (2015) National Policy Statement for National Networks. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/387223/NNNPS-web.pdf

an effect on human beings, any environmental statement should identify and set out the assessment of any likely significant adverse health impacts".

15.3.3 Paragraph 4.82 states *"The applicant should identify measures to avoid, reduce or compensate for adverse health impacts as appropriate. These impacts may affect people simultaneously, so the applicant, and the Secretary of State (in determining an application for development consent) should consider the cumulative impact on health"*.

15.3.4 Paragraph 5.165 states *"The applicant should identify existing and proposed land uses near the project, any effects of replacing an existing development or use of the site with the proposed project or preventing a development or use on a neighbouring site from continuing. Applicants should also assess any effects of precluding a new development or use proposed in the development plan. The assessment should be proportionate"*.

15.3.5 Paragraph 5.166 states *"Existing open space, sports and recreational buildings and land should not be developed unless the land is surplus to requirements or the loss would be replaced by equivalent or better provision in terms of quantity and quality in a suitable location. Applicants considering proposals which would involve developing such land should have regard to any local authority's assessment of need for such types of land and buildings".*

15.3.6 It is also worth noting the importance of the Equalities Act 2010 which requires decision making to have regard to the desirability of reducing socio-economic inequalities.

National Planning Policy Framework

15.3.7 In March 2012, the government set out changes to the National Planning Policy Framework[326], to promote sustainable development in the planning system. The framework outlines 12 Core Planning Principles (paragraph 17), which all developments and projects, such as this Scheme, should consider. These principles should underpin both plan-making and decision-taking. With particular relevance to this chapter, these include:

- Building a strong and competitive economy (Chapter 1)
- Supporting a prosperous rural economy (Chapter 3)
- Promoting sustainable transport (Chapter 4)
- Promoting healthy communities (Chapter 8)

[326] Communities and Local Government (2012) National Planning Policy Framework. Available online at: http://webarchive.nationalarchives.gov.uk/20180608095821/https://www.gov.uk/government/publications/national-planning-policy-framework--2

- Protecting green belt land (Chapter 9)
- Conserving and enhancing the natural environment (Chapter 11)
- Plan-making (Paragraphs 150 to 185, pages 37 to 44)

Local

15.3.8 The following Local Planning Policies are of relevance to the Scheme.

Hull Local Plan

15.3.9 Hull City Council (HCC) adopted the Hull Local Plan 2016-2032[327] on 23 November 2017 which will be used to guide development in the city up to 2032. This replaces the 'Saved Hull Local Plan (2000)' and is similar to the existing plan in format but will cover a wider range of plans. Relevant policies include:

- Policy 25 – Sustainable Travel: Development, including transport improvements, should promote sustainable transport objectives. It should have minimal impact on the environment and public health where possible.
- Policy 29 - New roads and road improvements: New road schemes will be supported if they improve road safety; improve the environment; assist public transport or cyclists; improve accessibility including to employment areas; open up land for agreed development; and reduce congestion / pollution and improve air quality.
- Policy 36 Walking, Cycling and Powered Two-Wheelers: includes the A63 Castle Street foot and cycle bridge in the proposals map as part of this policy.

Hull City Plan

15.3.10 In 2013 the City Leadership Board launched the Hull City Plan[328] 2013-2023, which largely forms the sustainable growth strategy for Hull over the next 10 years. One of the five priorities within the Plan is to harness all of Hull's assets to become the UK's leading energy city. This includes the promotion of green transport schemes, including an upgraded cycle network and smart cards, allowing passengers to travel on any city bus.

[327] Hull Local Plan 2016 to 2032. Available online at: http://www.hull.gov.uk/resident/planning-and-building-control/local-plan

[328] Hull City Plan 2013 to 2023. Available online at: https://cmis.hullcc.gov.uk/cmis/Portals/0/City%20Plan%20_Community%20Strategy_%20May13%20v04.pdf

HCC Rights of Way Improvement Plan

15.3.11 HCC Rights of Way Improvement Plan[329] 2009-2019 was developed as a result of national legislation, specifically the Countryside and Rights of Way Act 2000. The Plan considers key priorities to be fulfilled during the period of 2009 to 2019, whilst working with the community and other partners. The priorities to be fulfilled within the period are:

- To improve connectivity within the Public Right of Way (PRoW) network
- Ensure PRoWs are properly signposted and clear of obstructions
- Improve accessibility through improved surface quality, safer crossing, etc.
- To utilise the council website and publications more effectively to improve awareness of the PRoW network and promote its benefits
- To produce maps to further enhance public information of PRoWs
- To provide more interpretation on selected routes
- To clearly identify and publicise the information regarding creation and modification of PRoWs

Hull Cycling Strategy

15.3.12 Hull's Cycling Strategy[330] 2003 intends to build on the tradition of cycling within the city and boost usage through increasing the number of cycle networks. Although this strategy targeted changes for 2010, it still forms part of HCC's transport plans.

Hull's Highway Infrastructure Asset Management Plan

15.3.13 Hull's Highway Infrastructure Asset Management Plan (HIAMP)[331] 2016 aims to help inform investment decisions to help maintain the transport network. The Plan was developed because current funding levels were not considered enough to keep all of Hull's transport assets in 'as new' condition. Transport assets include carriageways, footways and cycleways, highway structures and bridges, street lighting, street furniture and signs and highway land. The HIAMP sets out what assets exist what condition they're in, and what is likely to be needed in the future.

[329] HCC Rights of Way Improvement Plan 2009 to 2019. Available online at: http://www.hullcc.gov.uk/pls/portal/docs/PAGE/HOME/TRANSPORT%20AND%20STREETS/TRAVEL/PUBLIC%20RIGHTS%20OF%20WAY/APPENDIX_A_MAPS_OF_EXISTING_PROWS_NUMBER_16TO20.PDF

[330] Hull Cycling Strategy 2003. Available online at: http://www.hullcc.gov.uk/pls/portal/docs/PAGE/HOME/COUNCIL%20GOVERNMENT%20AND%20DEMOCRACY/ABOUT%20HULL%20CITY%20COUNCIL/COUNCIL%20POLICIES%20AND%20PLANS/TRANSPORT%20AND%20STREETS%20STRATEGIES/CYCLING%20STRATEGY/CYCLING_STRATEGY_2003.PDF

[331] Highway Infrastructure Asset Management Plan 2016. Available online at: http://www.hull.gov.uk/visitor/footpaths-and-roads/highway-infrastructure-asset-management-plan

Health and Wellbeing Strategy

15.3.14 The Health and Wellbeing Strategy[332] 2014-2020 has been developed to take account of all of Hull's assets and challenges. It incorporates The City Plan, Hull 2020 and Joint Strategic Needs Assessment and aims to tackle health inequalities and improve health and wellbeing. The strategy sets out how people can work together to reduce health inequalities and improve people's health and describes HCC's objectives and how these will be achieved.

15.4 Study area

15.4.1 No definition of a study area for Effects on all travellers is specified in the DMRB, and therefore the study area used for this chapter has been defined through professional judgement, based on the type and scale of the Scheme and the context of the surrounding area.

15.4.2 The assessment takes into account all vehicle and NMU traffic that uses, meets or crosses the Scheme Site extents in the baseline situation, and examines how that traffic would be affected during and after construction of the Scheme. It considers all NMU amenities, side roads and also all roads that may subsequently impact on driver stress up to 250m from the Scheme extents.

15.4.3 The Scoping Report[333] stated that the study area for views from the road would be determined as part of the landscape assessment and extend 500m either side of the existing A63 carriageway within the extents of the Scheme. However, whilst this Environmental Statement (ES) chapter will draw on the findings of the landscape assessment, this chapter's study area for views from the road will take into account visual impacts from the section of A63 that would be upgraded but does not extend to 500m either side. This is in line with the methodology described in DMRB Volume 11 Section 3 Part 9, Chapter 2. This study area is considered appropriate and will ensure that effects on views from the road for vehicle travellers are assessed in full.

15.5 Approach and methodology

Scope of the assessment

15.5.1 Detailed guidance as to how this assessment should be undertaken has yet to be formally published, and therefore as outlined in the Scoping Report this ES considers 'Effects on all Travellers'. This chapter incorporates the former 'Vehicle Travellers' topic and relevant parts of the 'Pedestrians, Cyclists, Equestrians and Community Effects' topic, to ensure that the interests of all road users are given

[332] Health and wellbeing strategy 2014-2020. Available online at: http://www.hullcc.gov.uk/portal/page-_pageid=221,1027695&_dad=portal&_schema=PORTAL

[333] Scoping Report available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/244110/a63-castle-street-hull-es-scoping-report.pdf

equal weight. As guidance was never published on 'Effects on All Travellers', the approach set out in this report is based on professional judgement, drawing on guidance from the following DMRB Chapters, as well as guidance provided in Highways England Major Projects' Instructions 'Environmental Impact Assessment: Implementing the Requirements of 2011/92/EU as amended by 2014/52/EU (EIA Directive) (MPI 57-052017):

- Volume 11 Section 3 Part 8, Pedestrians, Cyclists, Equestrians and Community Effects (note that the Community Effects / Community Severance element is included within Chapter 14 People and Communities)
- Volume 11 Section 3 Part 9, Vehicle Travellers

15.5.2 Following the guidance contained within these two DMRB Chapters, the overall approach for the assessment of 'Effects on all Travellers' will consider the following:

- The effect of the Scheme on vehicle travellers. The two effects considered in the assessment are changes in the view from the road for drivers and passengers, and driver stress.
- The effect of the Scheme upon NMUs as a result of changes to the local road network, footpaths, crossings and cycleways. NMUs include pedestrians, equestrians and cyclists, as well as users with mobility issues. The assessment considers changes in journey length, the provision of new amenities such as PRoWs and cycleways, and journey experience as a result of the Scheme and associated traffic changes on affected routes.

Vehicle travellers

View from the road

15.5.3 The view from the road considers the extent to which travellers, including drivers, are exposed to the different types of scenery through which a route passes. The DMRB states that there are four categories of view. These should be used when assessing travellers' ability to see the surrounding landscape:

- No view – road in deep cutting or contained by bunds, environmental barriers or structures
- Restricted view – frequent cuttings or structures
- Intermittent view – road generally at ground level but with barriers at intervals
- Open view – view extending over many miles, or only restricted by existing landscape features

15.5.4 As described in Section 15.3.3 above, the assessment of views from the road draws on the Landscape and Visual Impact Assessment (LVIA) that has been

undertaken for the Scheme, see Chapter 9 Landscape. It considers the predicted changes in the nature of views that travellers would experience during construction, and after the opening of the new road.

15.5.5 The nature of future views from the existing A63 Castle Street have been assessed for the Scheme during construction, and once operational. Operational effects have been assessed for both the first year after opening (2025) and 15-years following completion of the Scheme (2040) to take account of the establishment of the soft landscape mitigation measures. The assessment of the view from vehicles is based upon a 120 degree arc of view, which approximates to the view that a traveller can generally appreciate whilst seated in a vehicle. However, in reality the situation is more complex, particularly for passengers who may have a wider range of view such as users of public transport (buses). This approach recognises that travellers tend to appreciate their surroundings in a general sense rather than focusing in detail upon any one feature or direction.

15.5.6 The assessment considers where any change in views are beneficial (where there would be a shift in category from no view to restricted, intermittent or open view); adverse (where there would be a shift in category from open view towards intermittent, restricted or no view) or neutral (no change in view category). The assessment includes a consideration of the changes in traffic levels on affected routes.

Driver stress

15.5.7 Driver stress is defined for the purpose of the environmental assessment as the adverse mental and physiological effects that may be experienced by a driver traversing a road network[334]. Factors influencing the level of stress include road layout and geometry, junction frequency, speed and flow per lane. Taken together, these factors can induce in drivers the feelings of discomfort, annoyance, frustration or fear, culminating in physical and emotional tension that detracts from the value and safety of a journey.

15.5.8 Affected routes, along with average flows and speeds during peak periods, and subsequent driver stress levels are presented in Volume 3, Appendix 15.1.

15.5.9 The DMRB considers that driver stress has three components: frustration, fear of potential accidents and route uncertainty:

- Frustration is caused by a driver's inability to drive at a speed consistent with their own wishes in relation to the general standard of the road. Frustration increases as speed falls in relation to roadworks, or to difficulties in overtaking slower moving traffic. Congestion can lead to frustration by creating a situation in which the driver does not feel in control.

[334] Refer to DMRB Volume 11 Section 3 Part 9 Vehicle Travellers, Chapter 3: Driver Stress

- The main factors leading to fear of potential accidents are the presence of other vehicles, inadequate sight distances and the likelihood of pedestrians, particularly children, stepping into the road. Other factors include inadequate lighting, narrow roads, roadworks and poorly maintained road surfaces. Fear of potential accidents is highest when speeds, flows and the proportion of heavy goods vehicles (HGVs) are all high.

- Route uncertainty is caused primarily by signing that is inadequate for the individual's purposes. It will not normally be possible to assess the size of this factor unless a consensus has already appeared on the adequacy of existing signing practice at a specific site. Good design and layout of signs can go a long way towards eliminating this cause of stress from new road schemes.

15.5.10 In accordance with the DMRB Volume 11, Section 3, Part 9, a three-point descriptive scale (Low, Moderate or High) has been used to describe driver stress during both construction and operation, alongside a qualitative description of the predicted impact of the Scheme, for all routes within the study area. For the operational assessment, this is supported by considering traffic flows and speeds, using the criteria shown in Table 15.1 and Table 15.2 below.

15.5.11 For driver stress, the magnitude of change is derived from changes to traffic flows and average journey speeds (km/h) for the design year (2040) during morning (AM) and afternoon (PM) peak hours, utilising Average Annual Weekly Traffic (AAWT) data. Conclusions have been drawn as to whether driver stress would be different with the Scheme in place or without the Scheme in place in the design year. A qualitative discussion regarding potential changes to driver frustration and fear of potential accidents is also presented for the operational stage. See Tables 15.1 and 15.2 below for more details.

15.5.12 The construction stage assessment has been undertaken by applying professional judgment based on available information regarding the likely presence of traffic management and construction plant, which would influence driver frustration and fear of potential accidents. Professional judgement has been applied to establish whether driver stress would increase or decrease, which will inform the overall significance of effects.

Table 15.1: Driver stress from traffic flow for dual-carriage way roads (DMRB 11.3.9, table 2)

Average peak hourly flow per lane, in flow units/1 hour	Average journey speed km/hr		
	Under 60	60-80	Over 80
Under 1,200	Moderate (urban area)	Moderate	Low
1,200 – 1,600	High	Moderate	Moderate
Over 1,600	High	High	High

Table 15.2: Driver stress from traffic flow for single-carriage way roads (DMRB 11.3.9, table 3)

Average peak hourly flow per lane, in flow units/1 hour	Average journey speed km/hr		
	Under 50	50-70	Over 70
Under 600	Moderate (urban area)	Moderate	Low
600-800	High	Moderate	Moderate
Over 800	High	High	High

Non–motorised users

15.5.13 The assessment of impacts of the Scheme on NMUs has been undertaken using the guidance contained within the DMRB Volume 11, Section 3, Part 8: Pedestrians, Cyclists, Equestrians only, and by applying professional judgement. The assessment examines the likely detriment or improvement to NMU journeys, considering changes to journey length and changes to NMU amenity.

15.5.14 Amenity is defined within the DMRB as the relative pleasantness of a journey. It is concerned with the degree and duration of people's exposure to traffic and the impact of the road itself, such as from noise, air quality and visual intrusion associated with the Scheme. The assessment identifies effects to amenity as changes to journey experience and quality. This can arise from traffic flow changes for NMU routes that run immediately adjacent to the Scheme or cross the Scheme; any improvements to existing NMU routes or where NMU routes have been created where none previously existed, and also any changes to barriers from traffic e.g. provision of new NMU bridges. In addition, the assessment identifies where there would be an enhancement or reduction to NMU amenities through the provision or reduction in footpaths, cycleways and dedicated crossings.

15.5.15 The study area for this assessment includes all NMU amenities (identified as footpaths, cycleways and PRoWs) that are located within 250m of the Scheme Site. Due to the limited nature of construction stage information for effects upon NMUs, construction stage effects have been limited to a qualitative discussion regarding potential effects due to temporary closures or diversions, and the effect of construction upon journey experience. In addition, a qualitative discussion of the effects of the construction compounds upon NMU amenities has been undertaken.

15.5.16 There are no bridleways located within the study area for the Scheme. The Scoping Report identified that given the urban nature of the Scheme and the lack of evidence of equestrian use, no further assessment of equestrian use would be undertaken for the Scheme. This is supported by the NMU surveys which were undertaken as part of the effect upon NMUs assessment (see 15.5.17 below), where no equestrians were recorded. Equestrians are therefore excluded from the significance criteria presented below.

15.5.17 To inform the assessment of operational effects upon NMUs within the study area, NMU surveys were conducted at eight different locations along the existing A63. Surveys were initially undertaken on a week day and weekend day in May and September 2013 to ascertain the number of NMUs using the main access routes along the Scheme.

15.5.18 However, following a 3-year time elapse since the 2013 NMU surveys and changes to the Scheme design it was decided that additional NMU surveys should be undertaken to inform the Scheme during 2016. These additional surveys were also undertaken at the same locations as before on a weekday and weekend day in September and then again to coincide with Hull's Freedom Festival, which took place between 2nd and 4th September 2016. Origin destination surveys were also undertaken in an additional location in the vicinity of Market Place and Queen Street roads during September 2016. To inform a judgement of the potential effect of the Scheme on vulnerable groups, the surveys identified the numbers of able bodied persons, wheelchair users, cyclists, children, old aged pensioners and persons with prams. The survey results are provided in Table 15.5 to Table 15.8.

15.5.19 In the absence of specific DMRB guidance, impacts have been assessed as being beneficial, adverse or neutral, based upon professional judgement and supported by a qualitative description. This approach is explained in Chapter 5 Environmental Impact Assessment process. Factors that have been specifically considered in the assessment include:

- Changes to journey length
- Changes to journey experience either through the provision or reduction in footpaths, cycleways and crossings
- Changes to journey amenity through traffic flow changes on a road that a person may be required to navigate. Traffic flow increases and decreases are based upon forecasts for the opening year (2025) and the percentage change in traffic levels between the Do Minimum (without the Scheme) and the Do Something (with the Scheme) for affected routes, using the AADT value. Where this comparison was not possible, due to new and removed links (i.e. links only present in one scenario or the other) a qualitative statement has been deduced using AADT opening year traffic data.

Assessment of value / sensitivity

15.5.20 Pending publication of further DMRB guidance, there is no agreed method of measuring the value or sensitivity of receptors considered in this assessment. Where appropriate, the assessment therefore makes use of the established criteria presented within the DMRB Volume 11, Section 2, Part 5, as well as that contained within the DMRB Volume 11, Section 3, Parts 8 and 9 (where relevant). Where it is not possible to do so, a qualitative assessment has been made, using professional judgement.

Assessment of magnitude

15.5.21 There is no agreed scale for which the magnitude of effects on all travellers can be measured at present. This assessment will therefore apply the criteria presented within the DMRB Volume 11, Section 2, Part 5, as well as that contained within the DMRB Volume 11 Section 3, Parts 8 and 9 as appropriate, and professional judgement will be applied where this is not possible.

Assessment of significance

15.5.22 Taking into account the value and sensitivity of all travellers and the assets which are used by them, and the magnitude of impacts of the Scheme, the significance of effects will be described as beneficial, adverse (either significant or not significant) and neutral.

Consultation

15.5.23 There has been no specific consultation in relation to the effects on all travellers chapter. However, the assessment methodology has taken account of consultation responses of the Environmental Statement Scoping Report, provided as part of a Scoping Opinion (TR010016/APP/6.10) as appropriate.

15.5.24 The respondent bodies that made comments in respect of the effects on all travellers were HCC and the Marine Management Organisation (MMO). In summarising these comments, the Secretary of State (SoS) considered that effects on vehicle travellers due to construction activity and traffic management measures are likely to be of importance, and that these effects should be taken into account when defining the study area.

15.5.25 The SoS considered that, sufficient information on the proposals for traffic management during construction, location of construction compounds and access routes, timescales and hours of working, with a full assessment made of the impacts to all travellers during the construction phase should be included. These issues have been included within this ES chapter by extending the study area for vehicle travellers to the A63 Castle Street, and all routes that fall within a 250m buffer of the Scheme. Construction stage effects for vehicle travellers have been fully assessed, making use of all available construction stage information, see Section 15.7.

15.5.26 The SoS also considered that severance, to include increased pedestrian and cyclist journey times, and the ease of use of the new proposed footbridges by all travellers are factors that should be considered within the environmental assessment. Severance is considered within Chapter 14 People and Communities and therefore, the severance effect upon pedestrian and cyclist journey times is not addressed within this chapter. However, changes to journey length for NMUs and changes to NMU facilities and amenities is considered as part of the assessment upon NMUs presented within this chapter.

15.5.27 Project level consultation was undertaken with the community and wider public in 2013 and 2014. This consultation is discussed further in Chapter 4 of this ES and also the Scheme's Consultation Report (TR010016/APP/5.1).

Consultation with the Hull Access Improvement Group

15.5.28 Consultation with Hull Access Improvement Group (HAIG) has been undertaken separately in relation to the potential effects of the Scheme upon NMUs, and to identify any design and mitigation options that may help to minimise adverse effects or enhance beneficial effects for NMUs. HAIG has previously commented that they consider the Scheme to be favourable towards vehicle drivers, with NMUs (especially pedestrians) neglected. Regarding the proposed pedestrian footbridge designs, the group specifically asked that accessibility and usability for people with disabilities be taken into account above the appearance of the bridge. In order for the Scheme design to accommodate the needs of the visually impaired, HAIG requested during consultation that footbridges have double handrails in a contrasting colour, and that footbridge light levels are uniform and not patchy. These measures have been included within the design of footbridges for the Scheme. Additional comments raised by HAIG have been addressed within the Scheme design. These have included the provision of ramped, as well as stepped, access to footbridges and ensuring that all footbridges are designed to be compliant with the Equalities Act 2010[335]. Additional mitigation and design measures are also detailed within Section 15.6.

Limitations and assumptions

15.5.29 Published guidance relating to the assessment of the effects on all travellers is not available. As a result, the assessment incorporates two of the 'old' DMRB topics, and also draws upon best practice and professional judgement. The Community Effects (Community Severance) element of the DMRB Volume 11 Section 3 Part 8, Pedestrians, Cyclists, Equestrians and Community Effects is included within Chapter 14 People and Communities.

15.5.30 Construction stage traffic movement assumptions have been based on discussions with the Contractor. However, no information is currently available to determine the likely level of construction traffic associated with the Scheme to be expected upon the A63 Castle Street and connecting roads that may also be affected by construction traffic. In addition, construction plant movements are not identified within the traffic model for the Scheme. Potential compound locations have been identified, and it is therefore assumed that construction plant would be present on roads connecting the A63 Castle Street with these compound locations, although the likely level of construction plant movements per day is unknown. There are also a number of knowledge gaps in the traffic management information and also for NMU provisions during construction. The ES has been

[335] Equalities Act 2010. Available online at: http://www.legislation.gov.uk/ukpga/2010/15/contents

based on the A63 Castle Street Improvement Temporary Traffic Management Plan (Virtus, 2015) which can be found in Volume 3, Appendix 15.2.

15.5.31 An Uncertainty Log was produced as part of the traffic model for the Scheme, which includes a number of confirmed or near certain developments for the Hull area which would generate additional traffic on the existing network. The inclusion of these developments means that some traffic increases or decreases may not be a direct result of the construction phase of the Scheme. Consequently, for some locations where impacts to driver stress and NMUs are likely to occur as a result of changes to traffic flows, the impact (beneficial or adverse) may not be fully attributable to the Scheme.

15.6 Existing environment

Vehicle travellers

Views from the road

15.6.1 Vehicle travellers presently experience generally intermittent views into the surrounding urban areas whilst travelling along the Scheme corridor. Table 15.3 Views from the A63 (described west to east), summarises these existing views along the Scheme corridor. A more descriptive narrative is also presented below.

15.6.2 At the western end of the study area between Ropery Street and Mytongate Junction, the road lies at the existing ground level, channelled through the surrounding townscape. Views are possible to the north of the A63 into the mixed scale residential areas between the verge-side trees. Views to the south of the A63 are intermittent and restricted by verge-side screening vegetation into Central Orbital Trading Park. On the approach to Mytongate Junction views are possible to the south into the Kingston Retail Park area. The alignment of the carriageway through Mytongate Junction prevents distant views along the carriageway for both westbound and eastbound travellers.

15.6.3 At Mytongate Junction, views are interrupted to the north towards Ferensway and to the south down Commercial Road by the two areas of vegetation growing on either side of the roundabout. Views are also interrupted by the large number of road signs and barriers in this cluttered area.

15.6.4 Between Mytongate Junction and the Princes and Humber Docks there are intermittent views south of the road towards the large mature trees within Trinity Burial. There are also intermittent views to the north of the carriageway into the Myton Street Quay West new retail development. The listed Castle Buildings and former Earl de Grey public house, which are currently boarded up, are prominent alongside the A63 in what is otherwise an ordinary area of townscape quality.

15.6.5 Between Princes Dock and Humber Dock the view becomes more open, with attractive views to the south over the Humber Dock Marina and the waterfront

developments in this location. The red brick listed Warehouse No. 6 to the north of the carriageway by Princes Dock Street is a prominent feature.

15.6.6 Between Princes Dock Street and Fish Street the road is at ground level and channels between the surrounding good quality residential area and office developments restricting views to along the road corridor only. The residential areas north of the carriageway form a uniform appearance allowing only glimpsed views north along the side roads that link into Castle Street. This contrasts with the open and partly derelict areas to the south of the carriageway around Finkle Street. Views south are partially screened by a brick wall but it is still possible to see the upper areas of the Fruit Market warehouses beyond.

15.6.7 At the junction between Market Place and Queen Street, the built areas alongside the road open out allowing intermittent views north along Market Place towards the listed King William III statue and south along Queen Street towards the warehouses of the Fruit Market. When travelling east, it is possible to see the road rising up towards the Myton Bridge. When travelling west, views are channelled along the A63 corridor to the docks and over to the derelict Fruit Market areas.

15.6.8 The elevated section of Myton Bridge provides extensive open views over the flat city centre when travelling west. Views are possible north along the River Hull corridor and northwest towards the tower of Holy Trinity Church. Open views are possible south towards 'The Deep' and the Hull Tidal Barrier and to the Fruit Market area to the southwest.

Table 15.3: Views from the A63 (described west to east)

Location	View from the A63
Hessle Road (A63, between Ropery Street and Mytongate Junction, including the junction)	Intermittent view: views from this section of the A63 are channelled along the linear urban 'transport corridor'. A wide grass verge and a length of managed hedgerow softens the highway boundary. The road is generally at ground level, but with barriers and intervals. Travelling east, an avenue of established trees set within low shrub planting and amenity grass create a green corridor, helping to visually separate the route from built form to the north and south. At the Mytongate Junction, views are interrupted to the north towards Ferensway and to the south down Commercial Road by the two areas of vegetation growing on either side of the roundabout, resulting in an intermittent view along these roads. The mature trees on the two central islands prevent views on a north-south axis from Ferensway to Commercial Road, and the vegetation and the orientation of the junction prevents views in an east-west direction along the line of the A63.
Castle Street (A63 between the Mytongate Junction and Vicar Lane)	Restricted to intermittent view: the majority of built form in this location is set back from the road itself with a wide footway visible. The road is generally at ground level. To the western end, the road is enclosed by the vegetation of Trinity Burial Ground on the southern side and buildings to the north. The mature trees of the burial ground act as an attractive feature providing a mature green structure within this urban corridor. The burial ground also acts as a visual screen between the road and the Railway Dock area with its surrounding residential developments to the south of the road. To the north side of the A63 is a semi mature strip of evergreen hedgerow planting with trees growing within. This forms a green barrier to pedestrians between the road and the retail car parking areas beyond.

Location	View from the A63
	The character of the road corridor changes between Humber Dock and Princes Dock with clearer through views. There are attractive extensive views to the south over the Humber Dock Marina and the surrounding buildings for vehicle travellers. There is also a mounded earth bank along the north wall of Humber Dock (between the A63 and the Dock) containing flag poles and lighting columns retained by a modern dock wall on the A63 side, which result in an intermittent but not unattractive view for vehicle travellers. To the north of the road corridor, views are possible to Princes Dock and the Princes Quay shopping centre. The fountains that form a feature within the dock are less visible from the road than the adjacent pedestrian areas. The A63 dual carriageway becomes more enclosed between Humber Dock Street and Market Place. The A63 is channelled between the small scale urban housing to the north and the Trinity Court office developments to the south, reinforcing the linear nature of the road corridor and offering a restricted view. The road is urban in character with large areas of hard surfacing and pedestrian barriers and crossing points. This is only slightly softened by the trees running alongside Marina Court to the south.
Garrison Road (A63; from Vicar Lane to the Myton Bridge)	Intermittent to open view: travelling east, the A63 rises above grade as it prepares to travel over the River Hull. The A63 itself is a dominant feature here, its height allowing more open views across rooftops and tree canopies particularly to the south. The A63, adjoining roads, and surrounding areas open out around the Market Place Junction, while the A63 is elevated towards the Myton Bridge to cross the River Hull. As the road rises and heads east over the Myton Bridge, extensive and open views are possible in all directions. Moving west, far reaching and open views over the flat city centre are possible, and views are north along the River Hull corridor and northwest towards the tower of Holy Trinity Church are also afforded. Open views are possible south towards 'The Deep' and the Hull Tidal Barrier and to the Fruit Market area to the southwest when travelling in both directions.

Driver stress

15.6.9 For travellers using the existing A63, current traffic flows and the presence of signalised junctions at both Mytongate and Market Place, as well as signalised pedestrian crossings at three other locations, result in low traffic speeds, congestion and poor journey time reliability. This contributes to the frustration element of driver stress.

15.6.10 The existing Mytongate Junction and its approaches have been considered to cause: high level driver frustration and route uncertainty as a result of the layout of the junction; low traffic speeds in relation to the design speed of the approach roads; high levels of congestion (particularly during peak periods) and difficulties for travellers in entering the circulatory flow on the roundabout.

15.6.11 Drivers approaching Mytongate Junction from the west and wishing to turn right onto Commercial Road are required to enter the left-hand lane on approach to the junction and go around the roundabout. No right-hand turn is possible from the main A63 carriageway. This is considered to contribute to route uncertainty. There is also the potential for fear of potential accidents with drivers attempting to change lanes at the 'last minute'.

15.6.12 Drivers are faced with the difficulty of merging with the circulatory traffic on the roundabout, which is considered to contribute to fear of potential accidents. This fear may be worsened by potential contact with pedestrians. Pedestrian crossings along the main alignment of the A63 also contribute to driver frustration since flows are interrupted and vehicle travellers may not be able to travel at a speed consistent with their wishes in relation to the design speed of the road.

15.6.13 The A63 is the designated strategic route to the Port of Hull for HGVs, and almost all port traffic passes along the A63 at this location which can result in stress for other vehicle travellers.

15.6.14 Overall, driver stress is considered to be high for vehicle travellers using the existing A63 route and moderate for those routes that immediately intersect the A63 Castle Street and provide access to the city centre. Roads that intersect the A63 include Ferensway, High Street, Market Place and Anlaby Road.

Non-motorised users

15.6.15 Hull city currently contains approximately 38km of fragmented PRoW, and 1,530km of existing footways. HCC's Rights of Way Improvement Plan has identified that there are a number of issues with existing PRoWs, including inefficient signing, poor maintenance, obstructions, poor quality surfaces and a lack of public information relating to the routes.

15.6.16 Table 15.4 Existing NMU amenities within the Scheme study area, identifies existing PRoWs, footpaths and cycle routes that either intersect or are within 250m of the Scheme. These existing routes are also illustrated on Volume 2, Figure 15.1. Existing non-motorised use routes with the study area (refer to the target numbers below). Crossings of the A63 at un-designated locations (i.e. desire lines) are not considered as part of this assessment, since designated crossing points (controlled and uncontrolled) are provided and crossing outside of these locations is restricted by guard rails along the footway and central reserve. Given the urban nature of the area, footways in residential areas (predominantly to the north of the Scheme and industrial areas to the south of the Scheme) have been excluded from this assessment.

Table 15.4: Existing NMU amenities within the Scheme study area (refer also to Volume 2, Figure 15.1)

Location no.	Location description	Type / description
1	A63 - Footways both sides of the A63 (except southbound between Spruce Road and St James Street).	Footway
2	Hessle Road (North side).	Footway and cycle route
3	Northeast, southeast and southwest sides of Mytongate Junction.	Footway and cycle route
4	A63 pedestrian crossing adjacent to Porter Street – signal controlled.	Designated crossings (controlled)

Location no.	Location description	Type / description
5	Mytongate west crossing – signal controlled, toucan crossing.	Designated crossing (controlled)
6	Mytongate east crossing – signal controlled, toucan crossing.	Designated crossing (controlled)
7	A63 crossing adjacent to Princes Dock West – signal controlled, pedestrian only.	Designated crossing (controlled)
8	A63 crossing adjacent to Humber Dock Street – signal controlled, pedestrian only.	Designated crossing (controlled)
9	Market Place and Queen Street Junction – signal controlled, pedestrian only across the A63.	Designated crossing (controlled)
10	Market Place – east / west signal controlled crossing.	Designated crossing (controlled)
11	Queen Street – east / west signal controlled crossing.	Designated crossing (controlled)
12	High Street – footway under the A63 prior to Myton Bridge (European Path 8).	Designated crossing (underbridge)
13	A63 crossing adjacent to Spruce Road / Kingston Retail Park – uncontrolled crossing.	Designated crossing (uncontrolled)
14	Pedestrian crossing on Ferensway on the approach to the A63.	Designated crossing (uncontrolled)
15	Pedestrian crossing on Commercial Road on the approach to the A63	Designated crossing (uncontrolled)
16	FP28 – Alongside Albert Dock.	PRoW
17	Pedestrian crossing over private access to the Holiday Inn.	Designated crossing (uncontrolled)
18	Pedestrian crossing over Princes Dock Street.	Designated crossing (uncontrolled)
19	Uncontrolled designated crossing over Humber Dock Street.	Designated crossing (uncontrolled)
20	Uncontrolled designated crossing over Dagger Lane.	Designated crossing (uncontrolled)
21	Uncontrolled designated crossing over Fish Street.	Designated crossing (uncontrolled)
22	Uncontrolled designated crossing over Vicar Lane.	Designated crossing (uncontrolled)
23	FP23 - along the eastern side of Princes Dock Street.	PRoW
24	FP24 - Eastern side of Humber Dock Street.	PRoW
25	FP25 - West from Humber Dock street along the southern edge of the Humber Dock and along Wellington Street.	PRoW
26	Recommended cycle route linking European path No. 8 with Humber Street, Wellington Street, and Commercial Road.	Recommended cycle route (HCC)
27	On road cycle lane passing along English Street.	On road cycle lane
28	On Road National Cycle Route 65 running along St Lukes Street and then passing along Anne Street and Carr Lane.	On road cycle lane

Location no.	Location description	Type / description
29	On road cycle lanes on all approaches to the Anlaby Road / Ferensway Junction.	On road cycle lane
30	FP 11- Passing along the eastern bank of the River Hull and Old Harbour.	PRoW
31	On road cycle lane passing along a stretch of Tower Street, as it passes under the A63.	On road cycle lane
32	FP12 – Linking Tower Street with South Bridge Road.	PRoW
33	Pedestrian Crossing on Rawling Way (new).	Designated crossing (controlled)
34	On road cycle lane running along High Street, Liberty Lane and Lowgate.	On road cycle lane
35	Off road cycle track over the River Hull.	Cycle track
36	FP26 – Passing between James Street and alongside the length of Albert Dock to the west.	PRoW

Non-motorised user counts

15.6.17 NMU surveys were first undertaken for the Scheme during 2004 and 2009 (refer to Table 13.1 of the Scoping Report). Due to the time elapsed NMU further surveys were undertaken during May and September 2013. The counts in September 2013 were undertaken to coincide during the annual Hull Freedom Festival, which is Hull's annual celebration of the Arts, and it is centred on the Fruit Market area of the City. The four-day event is focussed on art, dance, music and entertainment, attracting artists from across Europe. The popularity of this event was reflected in the NMU counts for September 2013, which were substantially higher than the May 2013 counts, particularly for the weekend.

15.6.18 In addition to the NMU counts, questionnaires were also completed by a number of NMUs using the routes during the May 2013 survey. Origin-destination information was gathered, as well as an indication of the main reason for undertaking their trip.

15.6.19 Supplementary NMU surveys were carried out in 2016 following changes to the Scheme design and as a result of the time which had elapsed since the previous NMU surveys. These additional surveys followed the same methodology as the 2013 survey and were all carried out for a period of 12 hours between 7am and 7pm at nine locations, so the data could be used as a comparison with the previous 2013 counts. The 2016 NMU surveys were undertaken on the 2 and 3 September to coincide with the Freedom Festival and then again on the 9 and 10 September (a weekday and weekend day) to reflect the 'normal' baseline conditions for NMUs. The results of the surveys are summarised in the baseline mean data for NMUs shown as Table 15.5 to Table 15.8.

15.6.20 Two survey methods were used to collect the results during 2016: video footage to record the number of individual pedestrians, children, old persons, cyclists and wheelchair users at eight locations; and interviews which were also undertaken in

the vicinity of Market Place and Queen Street to provide origin and destination information for NMU journeys as well as the reason of their trips.

15.6.21 The survey results for at the Market Place and Queen Street site have been excluded from Table 15.5 to Table 15.8 to ensure that data is consistently displayed and analysed in this chapter. Origin destination surveys were undertaken in this location rather than individual counts which utilise video recordings.

Table 15.5: Baseline mean data for NMUs 2 September 2016 – weekday coinciding with the Freedom Festival

NMUs	Number of individuals counted						
	Pedestrian	Children	Vulnerable	Cyclist	With pram	Wheelchair user	Total
Location							
Porter Street	160	0	2	29	1	0	192
Spruce Road	16	0	0	0	0	0	16
Mytongate West	1,493	172	18	93	72	6	1,854
Mytongate East	603	24	7	38	11	2	685
Princes Dock West	1,161	69	2	39	18	4	1,293
Princes Dock East	4,102	292	19	83	93	12	4,601
High Street	57	2	0	5	0	0	64
Myton Street	342	19	2	191	7	1	562

* Vulnerable users are identified as the elderly and mobility impaired. Wheelchair users are identified separately

Table 15.6: Baseline mean data for NMUs 3 September 2016 – weekend day coinciding with the Freedom Festival

NMUs	Number of individuals counted						
	Pedestrian	Children	Vulnerable	Cyclist	With pram	Wheelchair user	Total
Location							
Porter Street	69	0	0	10	0	0	79
Spruce Road	12	0	0	0	0	0	12
Mytongate West	1,446	147	5	37	74	2	1,711

NMUs	Number of individuals counted						
	Pedestrian	Children	Vulnerable	Cyclist	With pram	Wheelchair user	Total
Location							
Mytongate East	449	31	5	17	11	1	514
Princes Dock West	1,412	73	1	14	23	2	1,525
Princes Dock East	12,543	850	6	65	369	35	13,868
High Street	47	9	0	1	3	1	61
Myton Street	386	22	1	77	13	0	499

* Vulnerable users are identified as the elderly and mobility impaired. Wheelchair users are identified separately.

Table 15.7: Baseline mean data for NMUs 9 September 2016 – 'normal' weekday

NMUs	Number of individuals counted						
	Pedestrian	Children	Vulnerable	Cyclist	With pram	Wheelchair user	Total
Location							
Porter Street	148	7	0	38	0	0	193
Spruce Road	13	0	0	1	0	0	14
Mytongate West	1,310	26	1	80	63	6	1,486
Mytongate East	510	5	5	49	13	1	583
Princes Dock West	931	4	4	33	17	1	990
Princes Dock East	1,799	19	22	50	55	10	1,955
High Street	25	0	2	7	0	0	34
Myton Street	261	2	0	199	7	0	469

* Vulnerable users are identified as the elderly and mobility impaired. Wheelchair users are identified separately.

Table 15.8: Baseline mean data for NMUs 10 September 2016 – 'normal' weekend day

NMUs	Number of individuals counted						
	Pedestrian	Children	Vulnerable	Cyclist	With pram	Wheelchair user	Total
Location							
Porter Street	62	5	0	13	0	0	80
Spruce Road	18	1	0	1	0	0	20
Mytongate West	1,284	114	1	33	46	0	1,478
Mytongate East	383	22	1	15	5	1	427
Princes Dock West	792	27	5	15	15	2	856
Princes Dock East	1,417	106	15	40	39	3	1,620
High Street	27	2	2	0	0	0	31
Myton Street	199	21	0	60	9	0	289

* Vulnerable users are identified as the elderly and mobility impaired. Wheelchair users are identified separately.

15.6.22 Of the 6,263 interviews collectively conducted on the 2 and 3 September 2016, 2,568 (41%) of NMUs were travelling from or to the Freedom Festival to either work or take part in the event. Other key reasons for journeys during the two days included travelling to and from work (749 NMUs, 12%) or home (459 NMUs, 7.3%), shopping (679 NMUs, 10.8%), experiencing the city (459 NMUs, 7.3%) and for leisure (192 NMUs, 3.1%).

15.6.23 In all, 3,533 interviews were undertaken over the 9 and 10 September 2016, far fewer than the previous two NMU surveys, when numbers were far higher due to the Freedom Festival. Over the course of the 9 and 10 September, 767 of those interviewed (21.3%) were shopping, whilst 550 NMUs were traveling for work (15.6%), home (474, 13.4%) or a day out (218, 6.2%). A noteworthy number of NMUs were also travelling along the heritage trail (178, 5%).

15.7 Mitigation

Construction

15.7.1 A Construction Environmental Management Plan (CEMP) will be prepared by the appointed Contractor and implemented during construction. The CEMP will ensure that the construction of the Scheme is undertaken in as sensitive a manner as possible with regards to all travellers. The requirements for the CEMP are currently set out in a draft outline Environmental Management Plan (OEMP) (refer

to TR010016/APP/7.3). The OEMP indicates that the CEMP would include a Community Relations Strategy, ensuring that communication with the general public will be managed and maintained prior to and during all construction works. It is expected that most staff would work during the typical hours of day time construction, although it is possible that some activities, for example piling operations, would be carried out in longer 12 hour shifts. The Scheme will be delivered in accordance with the Considerate Constructors Scheme[336], and will ensure that local residents, businesses and other sections of the community are kept informed about the Scheme. This will include local road users and NMUs.

15.7.2 Traffic management would be the main measure for minimising effects upon vehicle travellers during the construction period. From discussions with the appointed Contractor, it is clear that a phased approach for traffic management and works sequencing would be adopted for the full duration of construction. The phased approach ensures that whilst there may be temporary delays in one location along the Scheme, this would normally be offset by reduced activities in another location, ensuring that delays are kept to a minimum. As a principle, two lanes of traffic would be retained in each direction during the construction period. Narrow lanes would be put in place on the A63 for a temporary period. All diversion routes and road closures would be sign posted clearly to minimise driver stress derived from driver frustration and route uncertainty. Construction would be undertaken in a phased approach and further details on this are provided within Chapter 2 The Scheme, Section 2.9 of the ES.

15.7.3 It is proposed that footways either side of the A63 would be closed during construction, as the Contractor considered it to be unsafe for NMUs to be present within the vicinity of Mytongate Junction whilst works are ongoing. Therefore, a diversion would be implemented throughout construction, which would allow for east to west movements for NMUs. This would direct NMUs to the north of Mytongate across Ferensway. The diversion routes would alter phase by phase as NMU provisions are installed and would minimise the effects on journey lengths and time increases for NMUs. Further detail on proposals for NMUs during construction can be found in the A63 Castle Street Improvements Temporary Traffic Management Plan, (refer to Volume 3, Appendix 15.2).

15.7.4 A temporary at-grade road crossing is anticipated to be provided close to the existing Porter Street crossing, which would be closed once the new pedestrian, cycle and disabled user bridge at Porter Street has been opened. To the east of Mytongate Junction, existing signalised crossings close to Humber Dock Street and at Market Place would be maintained until phase 3, whilst improvements would be made to High Street for NMUs (as detailed in 15.6.8 below) during phase

[336] The Considerate Constructors Scheme is a non-profit making, independent organisation founded in 1997 by the construction industry to improve its image. Construction sites, companies and suppliers voluntarily register with the Scheme and agree to abide by the Code of Considerate Practice, designed to encourage best practice beyond statutory requirements. The Code of Considerate Practice commits those sites, companies, and suppliers registered with the Scheme to care about appearance, respect the community, protect the environment, secure everyone's safety and value their workforce.

0. The new pedestrian, cycle and disabled user bridge at Princes Quay is anticipated to open at the start of phase 4 which would be a permanent solution. A free 'shuttle bus' service would also be provided during construction, and this would pick up and drop off NMUs at predetermined locations either side of the A63 and would also include wheelchair access facilities.

Operation

15.7.5 Measures to minimise adverse effects upon vehicle travellers and NMUs have been considered within the design of the Scheme, with new NMU crossings and footpaths identified on the NMU provisions drawing (refer to Volume 2, Figure 15.2). the Scheme would be designed to current Highways England and Department for Transport (DfT) standards with regards to visibility, road surfacing and road signing. This would ensure that journey quality is improved from the existing situation through road resurfacing, and route uncertainty would be minimised by the provision of adequate signing.

15.7.6 A combined footway and cycleway would be provided on both sides of the A63, along its length. This is shown on Volume 2, Figure 15.2. The shared facility would generally be 3m wide, however there are some locations where space is restricted and the width would be reduced to a minimum of 2m as follows:

- between Castle Buildings and Princes Quay car park, on the north side of the A63 (for approximately 55m)
- in front of Warehouse No. 6 (Ask Restaurant) on the north side of the A63 (for approximately 25m)
- in front of Humber Dock, Holiday Inn and Trinity Burial Ground on the south side of the A63 (for approximately 400m)
- adjacent to Kingston Retail Park and in front of Arco on the south side of the A63 (for approximately 450m)

15.7.7 Specific NMU crossing facilities would be provided as follows:

- a pedestrian, cycle and disabled user bridge at Porter Street (see Chapter 2 The Scheme, Section 2.6)
- signalised crossings at Mytongate Junction
- a pedestrian, cycle and disabled user bridge at Princes Quay (see Chapter 2 The Scheme, Section 2.6)
- a ramp from the A63 to High Street (see Chapter 2 The Scheme, Section 2.6)

15.7.8 The existing signalised pedestrian crossings at Market Place would be removed and pedestrians and cyclists would use a ramp from the A63 to access High Street

to take them under the A63. The ramp would be realigned and the visibility for NMUs would be further improved by removing existing dense vegetation. On the south side of the A63, pedestrians and cyclists would be routed along Blackfriargate. This would also be improved for NMUs with a new combined footway and cycleway with vegetation clearance to improve visibility. Users would re-join the A63 either via Queen Street or by continuing along Blanket Row and Humber Dock Street.

15.7.9 It would also be possible for NMUs to cross other side roads, as is the case at present. With the exception of Mytongate Junction, crossings of side roads would be uncontrolled. Casual crossing of the A63 by NMUs would be prevented by a barrier within the central reservation and provision of pedestrian guard rail in footways or nearside verges at high-risk locations.

15.8 Predicted environmental effects

Construction

Views from the road

15.8.1 During construction, views for vehicle travellers within the study area may be interrupted by construction plant, stock piles and construction infrastructure within the works area. This assessment considers the impacts that are temporary, such as from the presence of construction plant and materials. Impacts associated with permanent infrastructure elements that form part of the final Scheme once construction has been completed, are included under the operational effects assessment. Table 15.9 Construction – views from the road assessment, presents the assessment of potential effects for vehicle travellers passing along the A63 (divided into three sections) during construction works. The assessment assumes that all locations would experience temporary effects for the full duration of the construction period. However, since the construction stage would be phased, the assessment presents the worst-case scenario for each location.

15.8.2 Overall, the contribution of construction plant and materials to traveller views is unlikely to result in the total loss of view for any affected route. The presence of construction plant, and foreground views of construction materials, in addition to traffic management, would result in some deterioration in the existing view for vehicle travellers throughout the full construction period, and a restricted view of the surrounding landscape / townscape in some locations. Due to the temporary intrusion of construction plant and materials into traveller views, these effects are considered to be adverse not significant.

Table 15.9: Construction – views from the road assessment

Location	Existing view	View during construction	Commentary	Impact
Hessle Road (A63 between	Intermittent view	Restricted view	Travelling east, there would be direct views of construction. This would include views of works to create footways and cycleways on either side of the Scheme,	Adverse not significant

Location	Existing view	View during construction	Commentary	Impact
St James Street and the Mytongate Junction, including the junction)			as well as soft landscaping. On Hessle Road, the most notable feature would be the construction of the Porter Street Bridge which would span the A63. During construction, views would include the movement and presence of machinery on site including a crane which will be visible from a distance. Materials storage and the presence of traffic management would also form part of the view in this location. Further east towards the Mytongate, the magnitude of change would increase as the junction undergoes complete remodelling. Considerable earthworks would be visible, in addition to general construction activity and plant. Despite the change in view being set in the context of an already fragmented view and existing highway corridor of the A63, the works would form a dominant feature within the view, resulting in the temporary deterioration in views of the surrounding townscape.	
Castle Street (A63 between the Mytongate Junction and Vicar Lane)	Restricted to intermittent view	Restricted view	Views from Castle Street would not only include works such as widening within the road corridor itself, but also construction works within the surrounding landscape. For example, works at Trinity Burial Ground to the south of the Scheme, as well as soft landscaping works to the north would clearly be seen from this location. There would also be middle to foreground views of the construction of the Princes Quay Bridge, which would provide a gateway feature for vehicle travellers. Large scale machinery including a crane would be visible in addition to general construction work activities and storage of materials, resulting in an overall restricted view of the surrounding townscape.	Adverse not significant
Garrison Road (A63 from Vicar Lane to the Myton Bridge)	Intermittent to open view	Intermittent view	Vehicle travellers would be afforded direct views of the construction of both footway and cycleways to the north and south of the Scheme, as well as soft landscaping works including tree planting and grass seeding. There would also be foreground views of machinery and storage of materials, in addition to traffic management, during the changes to the Market Place junction. Given the nature of the works in an already fragmented and busy view, it is considered that the construction works would be perceptible but not alter the overall balance of	Adverse not significant

Location	Existing view	View during construction	Commentary	Impact
			features and elements that comprise the existing view for vehicle travellers.	

Driver stress

15.8.3 During the construction phase, the need to travel through road works may result in temporary short-term delays on the A63 as a result of traffic management and construction plant movement. This could lead to additional driver frustration to that which is already experienced. The presence of HGVs and other plant, and route uncertainty caused by temporary diversions, may also contribute to driver stress. In addition, traffic management on the A63 may result in congestion on existing routes, through the addition of HGVs, or from vehicle travellers choosing to divert to the local road network rather than pass through the road works.

15.8.4 Table 15.10 Construction stage impacts for motorised users (driver stress), shows affected routes where temporary construction works are likely to impact upon levels of driver stress, based on available information included within the Temporary Traffic Management Plan (refer to Volume 3, Appendix 15.2) and additional information provided by the Contractor. Construction works would be carried out in a phased approach, over a five-year period (refer to Chapter 2 The Scheme, Section 2.9). Roads situated within 250m, and not included within this assessment, would not be directly affected by the Scheme and therefore, whilst there may be temporary increases in driver stress throughout construction due to congestion and an increase in route uncertainty with diversions in place in part across the Scheme extents, the overall change in stress when compared to the baseline would be minimal. The residual driver stress column identifies the actual level of driver stress during construction, which is compared with the existing baseline situation.

15.8.5 It is anticipated that the Scheme would result in additional driver stress for the full duration of the construction period. This is due to the presence of temporary traffic management and speed restrictions, and the presence of slow moving construction plant and HGVs, resulting in driver frustration. Narrow lanes and temporary vehicle crash barriers, as well as the presence of construction site personnel, would also contribute to an enhanced fear of potential accidents throughout the construction period. In some locations, route uncertainty is likely to increase for a short period, due to the temporary or permanent closure of through roads. However, this would only be for a temporary period, and route uncertainty would reduce once vehicle users are used to the new access arrangements, with alternative direction signs in place. In addition, the provision of diversion signs and advanced warning information, to be disseminated through the Scheme's Communication Strategy, would minimise route uncertainty, and therefore this would not be substantially worse than for the current situation.

15.8.6 Whilst existing levels of driver stress are already high for the A63 Castle Street, construction activities would introduce additional frustration, fear of potential

accidents and some route uncertainty during the works. As a result, vehicle travellers would be likely to experience increased levels of driver stress during construction. On balance, the additional driver stress as a result of construction activities would result in an overall adverse not significant effect for vehicle travellers within the study area.

Table 15.10: Construction stage impacts for motorised users (driver stress)

Route	Frustration	Fear of potential accidents	Route uncertainty	Driver stress change
A63 – Hessle Road to Myton Bridge	For the majority of the construction period, traffic management would be in place on the A63 on the approach to the Mytongate Junction east and west of the junction, with narrow lanes (no wider than 3.25m) and temporary 30mph speed restrictions in place. Temporary closures would be required for the A63 during phase 0 to enable the installation of crossings, for which diversions would be put in place. Moderate to high levels of driver frustration due to congestion caused by slow-moving traffic, particularly during peak times, are anticipated. This would be worse than the existing situation.	Narrow lanes would contribute to increased fear of potential accidents for vehicle travellers, as would the presence of construction vehicles. This would be worse than the existing situation. Pedestrian crossings would be temporarily closed during construction, and a temporary crossing would be provided at Porter Street. A free recovery service would be provided.	Closures would be required during phase 0 to enable the installation of crossings, which would be likely to cause a temporary increase in route uncertainty. Following this, two running lanes in either direction would be maintained at all times, under speed restrictions, which would ensure that no diversions would be required for phase 1 onwards.	Increase in driver stress although stress levels would remain high as per the baseline.
A63 – Mytongate Junction	Driver frustration is anticipated to be high for the full duration of the works at the Mytongate Junction, due to the presence of construction vehicles, slow moving traffic and narrow lanes (no wider than 3.9m). Closures would be required for the A63 during phase 0 to enable the installation of crossings. Traffic would not be able to make a right-hand turn at the junction between phases 1 and 6, whilst Ferensway south (between Mytongate and Osborne Street) has the potential to be temporarily closed, although signed diversions would be put in	Narrow lanes would contribute to increased fear of potential accidents for vehicle travellers, as would the presence of construction vehicles. This would be worse than the existing situation.	Closures would be required for the A63 during phase 0 to enable the installation of crossings, whilst the right hand turning off the Mytongate Junction would not be available and Ferensway south closed between phases 1 and 6. Narrow lanes would be put in place throughout construction, whilst diversions would be maintained and fully signposted for the right hand turning closure at the junction, therefore ensuring that whilst worse than the existing situation, route uncertainty is minimised.	Increase in driver stress although stress levels would remain high as per the baseline.

Route	Frustration	Fear of potential accidents	Route uncertainty	Driver stress change
	place along Rawling Way and Anlaby Road. Significant delays are anticipated at Mytongate Junction between phase 4 and 7, whilst the junction is reconfigured, with additional changes to the signal times.			
Rawling Way to Anlaby Road	Drivers frustration is anticipated to increase on these roads during construction, with traffic diverted along these roads due to the closures at Mytongate and along Ferensway to Osborne Street. This is likely to result in temporary congestion, particularly at peak times.	No change from the baseline is anticipated.	During construction, it is expected that route uncertainty would moderately increase while vehicle travellers become familiar with the revised route. This would reduce throughout construction, as drivers become used to the alternative access arrangements.	High whilst closures are in place at Mytongate Junction and Ferensway, reducing to moderate for the remainder of construction as per the baseline.
Ferensway	Traffic management and signalised traffic controls would be in place for most of the construction period at the Mytongate Junction, resulting in increased driver frustration on the approach to the junction. There is potential for closures to be required between Anlaby Road and Mytongate Junction during the later phases of construction, which would require a diversion route between Anlaby Road and Rawling Way. Queuing traffic would be expected on the approach to the Mytongate Junction on Ferensway as a result of construction related congestion on the A63, which would contribute to additional frustration on the southbound carriageway.	A reduction in fear of potential accidents would occur between Mytongate and Osborne Street, with the removal of NMUs and traffic during phases 1 and 6. However north of Osborne Street, vehicle flows are likely increase which could result in an increased fear of potential accidents, particularly with NMUs present in these locations.	Closures would be required along Ferensway between Mytongate and Osborne Street, between phases 1 and 6. Diversions would be maintained and fully signposted for closure, with traffic diverted along Anlaby Road and Rawling Way.	High whilst there are closures at Mytongate Junction and Ferensway, reducing to moderate for the remainder of construction.

Route	Frustration	Fear of potential accidents	Route uncertainty	Driver stress change
Clive Sullivan Way	No works would be undertaken along Clive Sullivan Way, and traffic management measures would not be required.	No change from the baseline is anticipated.	No closures or diversions required. Route uncertainty remains the same as the existing situation. No change.	No change to existing moderate driver stress.
St James Street	Access to the A63 would be restricted from St James Street during construction for vehicle travellers. Alternative access would be provided from the A63 Hessle Road via Spruce Road to Arco Ltd, Kingston Retail Park service yards, ATS Euromaster and Armstrong Hydraulic Services and would remain as the permanent situation once the Scheme has been completed. Whilst traffic management is in place, driver frustration would increase from the existing situation due to the presence of construction plant and speed restrictions.	No change from the baseline is anticipated.	During construction, it is expected that route uncertainty would moderately increase while vehicle travellers become familiar with the revised route. This would reduce throughout the construction period, as drivers become used to the alternative access arrangements.	Moderate once access restrictions are put in place reducing to low for the remainder of construction, as per the baseline.
Spruce Road	Spruce Road would be altered from through access for all vehicles to deliveries only during phase 1 of the construction period, with closed access during this stage. Alternative access for all other vehicles would be provided via the Mytongate Junction, and this would remain as the permanent situation once the Scheme has been completed. Whilst traffic management is in place, driver frustration would temporarily increase from the existing situation	No change from the baseline is anticipated.	During construction, it is expected that route uncertainty would moderately increase while vehicle travellers become familiar with the revised route. This would reduce throughout construction, as drivers become used to the alternative access arrangements.	Moderate once access restrictions are put in place reducing to low for the remainder of construction, as per the baseline.

Route	Frustration	Fear of potential accidents	Route uncertainty	Driver stress change
	due to the presence of construction plant and speed restrictions.			
Waverley Street	Access to the A63 would be closed from Waverley Street during phase 1 of the construction period for vehicle travellers, although alternative means of access would be provided. This would remain as the permanent situation on completion of the Scheme. Whilst traffic management is in place, driver frustration would increase from the existing situation due to the presence of construction plant and speed restrictions.	No change from the baseline is anticipated.	During construction, it is expected that route uncertainty would moderately increase while vehicle travellers become familiar with the revised route. This would reduce throughout construction, as drivers become used to the alternative access arrangements.	Moderate once access restrictions are put in place reducing to low for the remainder of construction, as per the baseline.
Commercial Road	Commercial Road would remain open for the duration of the construction period. Traffic management and signalised traffic controls have potential to be put in place for the majority of the construction period at the Mytongate Junction, resulting in some low level additional driver frustration.	No change from the baseline is anticipated.	No closures or diversions required. Route uncertainty remains the same as the existing situation. No change.	Low as per the baseline.
Myton Street	Access from the A63 to Myton Street would be maintained throughout the construction period. Traffic management on the A63 through the roadworks may result in some slight additional levels of driver frustration for those accessing Myton Street.	No change from the baseline is anticipated.	No closures or diversions required. Route uncertainty remains the same as the existing situation. No change.	Low as per the baseline.
Humber Dock Street	Access for vehicle travellers to and from Humber Dock Street from the	No change from the baseline is anticipated.	During construction, it is expected that route uncertainty would moderately	Moderate on closing of Humber

Route	Frustration	Fear of potential accidents	Route uncertainty	Driver stress change
	A63 would be closed on completion of the Scheme. Additional driver frustration associated with the presence of construction plant and speed restrictions whilst these works are completed is anticipated.		increase while vehicle travellers become familiar with the revised route. This would be temporary, and would reduce throughout construction.	Dock Street, reducing to low as per the baseline.
Princes Dock Street	Access to and from the A63 for Princes Dock Street would change to a left in one-way in only up to Whitefriargate. Posterngate would become one-way between Princes Dock Street and Zebedee's Yard, but remain a two way up to Trinity House Lane. There would be no change to parking provision on Princes Dock Street. Additional driver frustration associated with the presence of construction plant and speed restrictions whilst these works are completed is anticipated.	No change from the baseline is anticipated.	It is expected that route uncertainty would moderately increase while vehicle travellers become familiar with the revised route, which would involve a one-way system. This would be temporary and reduce throughout construction.	Change from low in baseline to moderate – on access changes from the a63.
Dagger Lane	Access for vehicle travellers to and from Dagger Lane would be closed during the construction period, and this would remain as the permanent solution. Alternative access to the A63 would be maintained to the east via Market Place. Additional driver frustration associated with the presence of construction plant and speed restrictions whilst these works are completed is anticipated. Dagger Lane would also change from a one-way road to a two-way road which would reduce frustration.	No change from the baseline is anticipated.	It is expected that route uncertainty would moderately increase while vehicle travellers become familiar with the revised route. This would be temporary, and would reduce throughout construction. Alternative access to the A63 would be maintained to the east via Market Place.	Moderate on closing of dagger lane, reducing to low in the latter stages of construction, as per the baseline.

Route	Frustration	Fear of potential accidents	Route uncertainty	Driver stress change
Fish Street	Access to and from the A63 would be closed from Fish Street during the construction period, and this would remain as the permanent solution. Additional driver frustration associated with the presence of construction plant and speed restrictions whilst these works are completed is anticipated.	No change from the baseline is anticipated.	It is expected that route uncertainty would moderately increase while vehicle travellers become familiar with the revised route. This would be temporary, and would reduce throughout construction.	Moderate on closing of fish street. Low in the latter stages of construction as per the baseline.
Vicar Lane	Access to and from the A63 would be closed from Vicar Lane during the construction period. Additional driver frustration associated with the presence of construction plant and speed restrictions is anticipated.	No change from the baseline is anticipated.	It is expected that route uncertainty would moderately increase while vehicle travellers become familiar with the revised route. This would be temporary and reduce throughout construction.	Moderate on closing of vicar lane. Low in the latter stages of construction, as per the baseline.
Market Place	The majority of the works at Market Place would be completed during phases 1 and 3 of the construction period. Market Place would remain open for the duration of the construction period. During this period, additional driver frustration would be expected for vehicle travellers using this junction, due to the presence of traffic management and likely congestion. This would reduce to pre-construction levels for the remainder of the construction period, when works would be concentrated on the A63.	The existing NMU crossing points would be removed during phase 1 of construction. This may result in a low-level increase in fear of potential accidents until motorists and NMUs become accustomed to the new crossing.	No closures or diversions required. Route uncertainty remains the same as the existing situation. No change.	Moderate during phase 1 of construction, reducing to low for the remainder of construction, as per the baseline.
Queen Street	Queen Street would remain open for the duration of the construction period, although traffic management would be in place	The existing NMU crossing points would be removed during phase 1 of construction. This may result in a low-level increase in fear of	No closures or diversions required. Route uncertainty remains the same as the existing situation. No change.	Moderate during phase 1 of construction, reducing to low for

Route	Frustration	Fear of potential accidents	Route uncertainty	Driver stress change
	during phase 1 to enable the amendments to pedestrian crossings and slip-roads in this location. During this period, driver frustration would be expected for vehicle travellers, due to the presence of traffic management and likely congestion. For the remainder of construction, traffic management would be in place due to ongoing construction on the main A63 carriageway, which would result in reduced levels of driver frustration.	potential accidents until motorists and NMUs become accustomed to the new crossing.		the remainder of construction, as per the baseline.
William Street - Cogan Street	During construction the proposed works would encroach on to William Street and Cogan Street, requiring the streets to be closed for through traffic, and creating two cul-de-sacs. Additional driver frustration would be anticipated whilst these works are completed.	No change from the baseline is anticipated.	It is expected that route uncertainty would moderately increase while vehicle travellers become familiar with the revised route. This would be temporary and reduce throughout construction.	Moderate on closure of two streets to through traffic Low in the latter stages of construction, as per the baseline.
South Church Side	South Church Side would be reinstated as a two-way road during construction to allow for vehicles to egress from Vicar Lane and Fish Street onto Market Place and would result in a decrease in frustration. However, a priority system would be installed on this road during construction to manage vehicle movements between South Church Side and Fish Street, as there would be insufficient width on the bend to accommodate two-way	No change from the baseline is anticipated.	No closures or diversions required. Route uncertainty remains the same as the existing situation. No change.	Low, as per the baseline.

Route	Frustration	Fear of potential accidents	Route uncertainty	Driver stress change
	traffic. This would increase frustration amongst drivers.			
North Church Side	The carriageway on North Church Side would be raised to be flush with the footways to create a shared space arrangement, which would enable larger vehicles to access from Princes Dock Street.	Potential increase in fear of potential accidents, with NMUs and vehicles using the same surface.	No closures or diversions required. Route uncertainty remains the same as the existing situation. No change.	Low, as per the baseline.

Non-motorised users

15.8.7 Construction stage effects on NMUs have been assessed for the main NMU journeys identified within the study area. Impacts during construction may include the temporary closure or diversion of existing NMU routes and crossing points, resulting in increased journey lengths and reduced journey experience. The presence of construction plant and construction operations may also have a negative effect upon journey quality and experience, resulting in a reduction in amenity for some NMUs. In addition, some NMUs may be deterred from making non-essential journeys as a result of construction activities. The assessment is presented in Table 15.11 below and has been based on the A63 Castle Street Improvement Temporary Traffic Management Plan (refer to Volume 3, Appendix 15.2).

15.8.8 During construction, it is anticipated that there would be some adverse effects for NMUs due to potential changes in journey lengths and times, and also changes in journey experience, with closures to some routes and crossing points across the A63. Mitigation such as the provision of a free 'shuttle bus' and signed diversion routes would minimise effects for NMUs. All temporary routing for NMUs around the work site would be clearly signed and would comprise flexible surfacing. In addition, all NMU diversions are anticipated to be fenced, braced and fitted with high visibility strips to aid visibility at night for pedestrians and cyclists. Signs would be erected requesting that pedestrians use the designated routes only.

15.8.9 All of the above measures would minimise disturbance and disruption to NMU journeys, and for some NMU routes identified within the study area, the effects of the Scheme would be Neutral since there would be no change to journey length or journey quality. Nonetheless, the presence of construction plant, and construction noise and dust during works would detract from the quality of journey for pedestrians and cyclists making use of NMU routes and crossings within the works extents, having an adverse effect upon the amenity value of these routes. When combined with increases in journey times as a result of temporary diversions, on balance construction stage effects for NMUs is considered to be adverse not significant for the full duration of construction.

Table 15.11: Construction stage (temporary) effects for the main NMU journeys

Location no.[337]	Commentary	Impact
1	During construction, temporary diversions are likely to be required whilst works are undertaken to upgrade the footway to a combined footpath / cycleway, which would result in a significant effect due to journey time increases and also a reduction in journey experience / amenity due to	Adverse significant

[337] Refer to Table 15.4 Existing NMU amenities within the Scheme study area and Volume 2, Figure 15.1 Existing non-motorised user routes within the study area

Location no.[337]	Commentary	Impact
	the presence of construction plant and construction noise / dust for the full duration of construction.	
2	As for the footways both sides of the A63 (see Location no. 1).	Adverse significant
3	During construction, temporary diversions are likely to be required whilst works are undertaken to upgrade the footway to a combined footpath / cycleway. East / west movements for NMUs would be maintained throughout the construction period through these diversions. However, there would be Significant effects upon NMUs due to increased journey time since the crossing at Mytongate west and east would also be closed with a diversion in place, and from reduced journey experience due to the presence of construction activities.	Adverse significant
4	The current proposals for this location comprise a temporary at grade crossing to be installed close to the existing crossing, which will be closed during construction of the new Porter Street Bridge. This would ensure that journey times remain similar to the baseline for this location. Whilst there may be some temporary adverse effects upon journey quality due to the presence of construction activities for the Porter Street Bridge, the effects upon NMUs would be minimised and these effects are likely to be adverse not significant at worst. On completion of the Porter Street Bridge during phase 2, the crossing would be closed and access for NMUs would be via the new bridge. This would be the permanent solution and is considered as part of the operational stage assessment.	Adverse not significant
5	Temporary diversions are likely to be required whilst works are undertaken, with the only crossing points of the A63 at Porter Street throughout construction and to the east of Princes Quay. Therefore, journey time increases and also a reduction in journey experience / amenity due to the presence of construction plant and construction noise / dust are likely for the full duration of construction.	Adverse significant
6	As for Mytongate West Crossing (see Location no. 5).	Adverse significant
7	Footways would be closed either side of the A63 for the first 3 phases during construction, and diversions would be put in place for NMUs. A reduction in journey experience / amenity due to the presence of construction plant and construction noise / dust is anticipated for the full duration of construction. The crossing between Princes Quay and Holiday Inn is therefore anticipated to be temporarily closed whilst these diversions are in place. It is worth noting that the crossing adjacent to Humber Dock Street would remain open until the end of phase 2, which would allow for NMU movements across the A63. During phase 3 NMUs would temporarily be required to cross the A63 either opposite Porter Street or using the underpass at High Street. Princes Quay Bridge is anticipated to be in operation at the start of phase 4, which would allow for NMU movements across the A63. This would be the permanent solution in this location, and the effects of this are therefore considered within the operational assessment.	Adverse significant (until the end of phase 3)
8	The crossing adjacent to Humber Dock Street is anticipated to remain open for the first 2 phases of construction, which would ensure that journey times are unaffected. During phase 3 the signal controlled crossings at Humber Dock Street and Market Place are anticipated to be closed, and NMUs diverted towards the underpass at High Street, which would result in a temporary significant effect due to journey time increases. Princes Quay Bridge is anticipated to be in operation at the start of phase 4, which would allow for NMU movements across the A63,	Adverse not significant

Location no.[337]	Commentary	Impact
	and would minimise effects on NMUs. This would be the permanent solution in this location, and the effects of this are therefore considered within the operational assessment.	
9	During the first two phases of construction, access across the A63 at Market Place / Queen Street for NMUs would be maintained by use of the existing pedestrian crossing. Works to upgrade the High Street underpass, with the provision of CCTV, new lighting and the clearance of verge side vegetation for the ramped access from Market Place, would be undertaken during phase 0, as well as the provision of a new combined footway / cycleway along Blackfriargate. Once these upgrades are in place, the NMU crossing over the A63 would be closed with no access across the carriageway allowed due to the provision of the permanent concrete barrier. For the rest of the construction period, the arrangement would be maintained through the operational phase; the effects upon NMUs are therefore considered within the operational stage assessment.	Adverse not significant
10	During the first two phases of construction, access across the Market Place junction for NMUs would be maintained by use of the existing pedestrian crossing. Works to upgrade the High Street underpass, with the provision of a new NMU access route linking the Market Place junction with the High Street underpass, would be undertaken during this period. Once these upgrades are in place, the signalised crossing over Market Place would be closed. For NMUs, the change during construction would be adverse not significant at worst for the first 3 months. For the rest of the construction period, the arrangement would be the permanent solution, and the effects upon NMUs are therefore considered within the operational assessment.	Adverse not significant
11	As with the Market Place crossing, during the first two phases of construction, access across the Queen Street junction is anticipated to be maintained by use of the existing pedestrian crossing. Once upgrades to the High Street, as well as the provision of a new combined footway / cycleway along Blackfriargate are in place, the signalised crossing over Queen Street would be closed. The change during construction would be adverse not significant at worst for the first three months. For the rest of the construction period, the arrangement would be the permanent solution.	Adverse not significant
12	The desire line running under the A63 at High Street would be maintained for the majority of the construction period, as per the permanent solution at this location. These effects are discussed under the operational stage assessment. However, during phase 0 (approximately 15 months), works to upgrade the existing footway under the A63, turning it into a combined footway / cycleway and undertaking vegetation clearance for improved access to the ramped approach to High Street from the A63 would be completed. In addition, a combined footway / cycleway would be provided along Blackfriargate. During this period, NMUs would be diverted across the existing crossing of the A63 at Market Place / Queen Street, or for those already on High Street, to the footpath on the other side of the road. Those making use of this NMU route would therefore experience a temporary, slight change to the existing situation from diversions and increase in journey length and reduction in journey quality. Some NMUs may also be deterred from making non-essential journeys during this period or find alternative routes.	Adverse not significant
13	The uncontrolled crossing adjacent to Spruce Road would be closed at the start of construction, while traffic management is put in place. This is	N/A

Location no.[337]	Commentary	Impact
	the permanent solution, and effects are therefore discussed as part of the operational stage assessment.	
14	The construction footprint for the Scheme does not extend beyond the Mytongate Junction along Ferensway, and as a result effects upon NMU routes would be limited to the immediate intersection with Mytongate from Ferensway. The existing footway on either side of Ferensway on the approach to Mytongate would be maintained throughout the full duration of construction, with a dedicated NMU crossing over Ferensway to allow for east / west movement.	No change
15	The currently known construction sequencing does not identify whether or not temporary closures or diversions would be required for this uncontrolled NMU crossing. The footways to the east and west of Mytongate Junction would be diverted throughout construction. It is likely that there would be a temporary diversion / closure whilst the junction upgrades are undertaken, although east / west movement for NMUs would be maintained throughout the construction period. Minor effects upon NMUs due to increased journey time and reduced journey experience / amenity from construction noise and dust are therefore anticipated.	Adverse not significant
16	No change to journey times or effect upon journey experience or amenity for this footpath for the full duration of construction.	No change
17	The pedestrian crossing and access to the Holiday Inn would be permanently closed as part of the improvements for the Scheme. Upgrades to the existing footway along the A63 to provide a continuous combined footway cycleway would be the permanent solution and is therefore considered within the operational stage assessment. However, some temporary adverse effects would be expected for NMUs in this location due to localised diversions and reduced journey quality / amenity from construction noise and dust.	Adverse not significant
18	The crossing over Princes Dock Street would be maintained for much of the construction period. Temporary short-term local diversions may be required whilst footpath / cycleway upgrades are undertaken, resulting in a slight increase in journey time and reduction in journey experience due to construction activities.	Adverse not significant
19	It is anticipated that the uncontrolled crossing over Humber Dock Street would be closed until the start of phase 4 for construction, with the footway running eastwards closed for this period. Therefore, temporary local diversions are likely to be required which would result in a slight increase in journey time and reduction in journey experience and the amenity value of this route due to construction noise and dust, and as NMUs are diverted around the works.	Adverse not significant
20	The A63 footway would be maintained in some form in this location for the majority of the construction period, with this existing crossing maintained. A short-term diversion or closure of the footway may be required whilst Dagger Lane is stopped up during the advanced works phases of construction, with minimal disturbance.	Adverse not significant
21	As for Dagger Lane (see Location no. 20).	Adverse not significant
22	As for Dagger Lane (see Location no. 20).	Adverse not significant
23	No change to journey times or effect upon journey experience or amenity for this footpath for the full duration of construction.	No change

Location no.[337]	Commentary	Impact
24	No change to journey times or effect upon journey experience or amenity for this footpath for the full duration of construction.	No change
25	No change to journey times or effect upon journey experience or amenity for this footpath for the full duration of construction.	No change
26	There would be no direct effect upon this recommended cycle route through diversions or closures, and no effect upon journey times.	No change
27	No change to journey times or effect upon journey experience or amenity for this footpath for the full duration of construction.	No change
28	No change to journey times or effect upon journey experience or amenity for this footpath for the full duration of construction.	No change
29	There would be no direct effect upon cyclist amenity in this location for the full duration of the construction period. The temporary presence of some potential construction traffic and increased congestion on Ferensway due to construction works may result in a slight increase in journey time and reduction in journey experience for cyclists.	Adverse not significant
30	No change to journey times or effect upon journey experience or amenity for this footpath for the full duration of construction.	No change
31	There would be no direct effect upon this cycle route for the full duration of the construction period. The temporary presence of some potential construction traffic and increased congestion due to construction works may result in a slight increase in journey time and reduction in journey experience due to construction noise and dust effects.	Adverse not significant
32	No change to journey times or effect upon journey experience or amenity for this footpath for the full duration of construction.	No change
33	No change to journey times or effect upon journey experience or amenity for this footpath for the full duration of construction.	No change
34	Works to upgrade the High Street underpass, with the provision of CCTV, new lighting and the clearance of verge side vegetation for the ramped access from Market Place would be undertaken during phase 0, as well as the provision of a new combined footway / cycleway along Blackfriargate. However, whilst there would a temporary slight reduction in journey experience due to construction noise and dust effects, journey times are unlikely to change.	Adverse not significant
35	No change to journey times or effect upon journey experience or amenity for this footpath for the full duration of construction.	No change
36	No change to journey times or effect upon journey experience or amenity for this footpath for the full duration of construction.	No change

Construction compounds

15.8.10 The need for construction compounds has been identified for the Scheme (see Section 2.9.12). It is anticipated that the location of these may result in some adverse effects for vehicle travellers and NMUs during the construction period only. The presence of construction plant, stock piles and construction infrastructure within the site compounds would result in slight visual intrusion for vehicle travellers on adjacent roads. Construction plant may also cause additional driver frustration for vehicle travellers due to the temporary presence of slow moving HGVs. The presence of site personnel walking to and from the compounds for these locations, which are within close proximity of the works site, may also contribute to an increased fear of potential accidents for vehicle travellers. A slight

increase in driver stress is therefore likely due to the temporary presence of construction compounds during construction, resulting in adverse effects on vehicle travellers. This is considered to be not significant.

15.8.11 The presence of HGVs and other construction plant on roads adjacent and connecting to the site compounds may result in some adverse effects upon NMUs due to a reduction in journey quality. This would be as a result of construction plant generating noise and dust and due to NMUs perceiving the route to be less safe than the existing situation. The provision of the site compounds would not require any additional closures or diversions to NMU routes to those described in the construction assessment above (refer to location 1 in Table 15.11, although it is worth noting that NMU diversions would be required either side of the A63 whilst the footway is upgraded (refer to location 1 in Table 15.13 for information on permanent effects for NMUs). The location of the compounds and the presence of HGVs and additional construction plant on adjacent roads would not substantially alter the overall assessment of construction stage effects for NMUs; on balance these are considered to be adverse but not significant.

Operation

15.8.12 The predicted long-term impacts of the Scheme for both vehicle travellers and NMUs are identified below at Table 15.12 Operation – views from the road. This includes those impacts that would continue in or after the design year, with both beneficial and adverse impacts identified. Mitigation identified within Section 15.6 (operational stage) has been taken into account within the assessment of effects.

Views from the road

Table 15.12: Operation – views from the road

Location	Existing view from the road	View from road with the Scheme (operation)	Commentary	Impact
Hessle Road (A63 between St James Street and the Mytongate Junction, including the junction)	Intermittent view	Intermittent to no view (where road would pass through cutting at Mytongate Junction)	During operation, the first notable change to the surrounding townscape features whilst travelling along Hessle Road would come from the introduction of the Porter Street Bridge structure in the west, followed by the moderate scale change in the existing road layout at Mytongate. Moving east, the A63 would start to fall below existing grade and pass under Ferensway at Mytongate. The Mytongate overbridge structure would form a dominant feature in the direct line of sight for vehicle travellers passing along Hessle Road and turning north onto Ferensway at this point, resulting in a restricted view in year 1. This would be softened by the introduction of tree and shrub	Year 1 Adverse Year 15 Adverse

Location	Existing view from the road	View from road with the Scheme (operation)	Commentary	Impact
			planting, which whilst offering a limited benefit during year 1, would have matured by year 15 after opening. At the point at which the A63 passes under the Mytongate Junction in a new cutting, there would be a total loss of the existing intermittent view (no view) for vehicle travellers from year 1, so that overall, it would be expected that there would be a reduction in the visual experienced for vehicle drivers.	
Castle Street (A63 east of Mytongate Junction to Vicar Lane)	Restricted to intermittent view	Restricted to intermittent view	The road would be at ground level, with intermittent views of the surrounding townscape and intervening landscape features, resulting in little change in views for vehicle travellers. However, travelling west, Princes Quay Bridge would become a dominant feature in the view, providing a visual gateway across the A63. Given its large footprint and height, the bridge would be viewed by vehicle travellers from some distance, forming a noticeable feature in the view both in the opening year and at year 15 and restricting the existing intermittent views of the surrounding landscape and over the Humber Dock. Given the nature of the existing view, which is restricted by townscape elements as vehicle travellers move east from the new Princes Quay Bridge location, it is considered that the new bridge would not substantially alter the overall balance of features and elements that comprise the existing view for vehicle travellers.	Year 1 Adverse Year 15 Adverse
Garrison Road (A63 from Vicar Lane to the Myton Bridge)	Intermittent to open view	Intermittent to open view	During operation, new features associated with the Scheme would not be particularly notable in the most part. the Scheme would be perceptible, but not alter the overall balance of features and elements that comprise the existing view for vehicle travellers. Existing intermittent to open views of the surrounding landscape / townscape would be maintained. There would be a small visual change in the cycle and footways viewed by vehicle travellers, which although not a major change, may be viewed as an improvement to the general character of the area.	Year 1 No change Year 15 No change

Location	Existing view from the road	View from road with the Scheme (operation)	Commentary	Impact
			Little else in the view would have changed by Year 15, so that only a very small part of the Scheme would be discernible.	

View from the road - summary

15.8.13 The Scheme would result in some change to existing views due to the introduction of new highways infrastructure, particularly where new pedestrian, cycle and disabled user bridges would be constructed. This would result in a restricted view of the surrounding landscape / townscape where some intermittent views previously existed. In addition, where the A63 would be in a cutting at the Mytongate Junction, views for vehicle travellers would be altered from existing intermittent views to no view for vehicle travellers, where the road is within a deep cutting. However, it is considered that the Scheme would not alter the overall balance of features and elements that comprise the existing view of the surrounding townscape and further reaching views for vehicle travellers. On opening in 2025, the effect of the Scheme upon views from the road for vehicle travellers is considered to be not significant. Some adverse effects where the road would pass in cutting at Mytongate would be expected. By year 15, some landscape planting along Hessle Road would soften the built form and structures associated with the Scheme, but would not substantially alter existing views for vehicle travellers. The overall effect upon views from the road for vehicle travellers would therefore remain as adverse for the Mytongate cutting, but would be not significant.

Driver stress

15.8.14 Volume 3, Appendix 15.1 identifies the key routes within the study area that would be affected by changes to traffic flows as a result of the Scheme. The effect of changes to driver stress have been determined according to the criteria presented within Table 15.1 and Table 15.2 of this ES chapter. Driver stress has been assessed be analysing changes to traffic flows and average journey speeds (km/h) for the design year (2040) during morning (AM) and afternoon (PM) peak hours, utilising Average Annual Weekly Traffic (AAWT) data.

15.8.15 A summary of the assessment presented in Volume 3, Appendix 15.1 is provided below, applying the three-point scale (Low, Moderate or High). This is because available research evidence does not recommend the use of finely graded assessments of driver stress.

15.8.16 A qualitative description of predicted impacts of the Scheme has also been included, which addresses driver frustration and fear of potential accidents. Since the new road lay-out is to be designed in accordance with Highways England's and DfT's current standards for road signing, it is unlikely that route uncertainty

would be a contributing factor to driver stress once the Scheme is operational. As such, this aspect has not been considered further within the assessment of operational stage driver stress.

15.8.17 On balance, driver frustration along the A63 Castle Street is not predicted to substantially change as a result of the Scheme. High vehicle flows would be likely with or without the Scheme in place in the design year (2040) and average speeds are predicted to be similar in either scenario during peak periods. However, new NMU provisions as part of the Scheme, including the pedestrian, cycle and disabled user bridges at Porter Street and Princes Quay and closures to a number of signalised and uncontrolled crossing of the A63 would be likely to reduce the fear of potential accidents amongst vehicle travellers, which would subsequently improve driver stress.

15.8.18 In the wider study area, on balance, levels of driver stress are not expected to be substantially different with or without the Scheme in 2040, with several improvements predicted, such as along Anlaby Road and a number of deteriorations predicted including Commercial Road. This is largely due to changes in traffic flows, given the urban nature of the area. The overall effect upon driver stress along the A63 and within the study area is considered to be beneficial – not significant, taking into account the minimal changes in driver frustration, reduction in the fear of potential accidents and minimal changes in route uncertainty during the first 15 years after the opening of the Scheme.

Driver stress for the A63 Castle Street

15.8.19 Traffic flows for 2040 indicate that levels of driver stress would predominantly be Moderate for the majority of the existing A63 Castle Street in the design year (2040) with the Scheme. Eighteen flow links associated with the A63 and Mytongate Junction indicate high levels of driver stress, whilst 25 links predict moderate levels of driver stress for vehicle travellers. Traffic data suggests that driver stress would be high on a greater number of links without the Scheme in 2040, with 33 links indicating high levels of driver stress and 23 demonstrating moderate levels of driver stress.

15.8.20 Starting in the west, driver stress would be moderate or high with and without the Scheme, although traffic flow increases and lower average speeds predicted during peak periods would be expected with the Scheme in 2040. Along A63 Hessle Road, driver stress is predicted to be predominantly high with or without the Scheme in place, although the provision of on / off slips would see a reduction in driver stress to moderate with the Scheme in place in 2040. The improvements in driver stress with the Scheme would largely be due to the new split level Mytongate Junction which would improve flows and reduce congestion. It is also worth considering that without the Scheme in place, traffic signals at existing pedestrian crossings in the vicinity of Porter Street would continue to interrupt traffic flows, resulting in high driver stress from driver frustration. The introduction of Porter Street Bridge and removal of the traffic signals would relieve driver

stress. Furthermore, the provision of new barriers would ensure that pedestrians would be unable to cross the road at grade such as at the uncontrolled crossing of the A63 opposite Kingston Retail Park, reducing the fear of potential accident experienced by vehicle travellers and minimising driver stress.

15.8.21 At Mytongate Junction, driver stress experienced by vehicle travellers would largely be moderate, with or without the Scheme in place. Without the Scheme, traffic flows would be interrupted by traffic signalling at the junction, causing driver stress. However, the provision of the new grade-separated Mytongate Junction, would allow traffic to flow freely along the A63 and would carry traffic over the A63 between Ferensway and Commercial Road, which would see an improvement in driver stress. Driver frustration caused by congestion and vehicles being unable to travel at consistent speeds would be reduced, whilst vehicle travellers' fear of potential accidents would also reduce with the Scheme in place, due to the removal of a previously complicated road layout at Mytongate Junction, at which pedestrians could cross the road at grade.

15.8.22 Moving east from Mytongate Junction, driver stress would largely be high with and without the Scheme in place. With the Scheme in place, in general there would be an increase in traffic flows, particularly between Princes Quay and Garrison Road. However average speeds during peak times would be very similar with and without the Scheme in place. The provision of the Princes Quay Bridge would minimise the likelihood of pedestrians walking into the road and subsequently reduce travellers' fear of potential accidents. Free flowing traffic with the Scheme in place would also reduce driver frustration.

Driver stress for local roads within the study area

15.8.23 The delivery of the Scheme is likely to alter driver stress experienced by vehicle travellers, primarily due to changes in average flows and speeds during peak hours. With the exception of Ferensway and the Daltry Street / Rawlings Way Roundabout beneath the A63 Clive Sullivan Way, all roads within the study area are single carriageway roads with an average journey speed of less than 50km/hr.

15.8.24 To the south and west of the A63 Castle Street, driver stress would be moderate with or without the Scheme. This is with the exception of Daltry Street, where in part driver stress would be high with or without the Scheme, and also for Commercial Road where driver stress is predicted to be high with the Scheme for a portion of the road, but moderate without the Scheme. In addition, there would be a slight increase in traffic flows for roads to the southern extents of the Scheme, with the Scheme in place and also a decrease in average speeds during peak times, along roads including Daltry Street, Commercial Road, High Street, Kingston Street and Queen Street, which would cause an increase in driver frustration. Conversely, there would also be traffic flow decreases and also average speed increases with the Scheme in place along Jackson Street, English Street and Neptune Street and Daltry Street, which would see an improvement in driver frustration.

15.8.25 To the north of the A63 Castle Street, driver stress experienced by vehicle travellers would again largely be moderate with or without the Scheme, although driver stress would be high along Anlaby Road and Rawling Way. Driver stress is predicted to increase from moderate to high along Market Place due to flow increases and average speed decreases during peak hours. This could be due to the Dagger Lane, Fish Street and Vicar Lane / A63 connections being stopped up with the Scheme in place, diverting a greater proportion of traffic along Market Place. Driver stress would decrease along these roads with the Scheme in place with traffic no longer using these roads from the A63. A decrease in driver frustration is predicted along Anlaby Road, Rawling Way, Walker Street, Porter Street and Osborne Street.

15.8.26 For vehicle travellers using side roads included in the traffic model, located to the north and south of the Scheme, and also connecting to the A63, the fear of potential accidents is unlikely to change with or without the Scheme. This is because NMUs would still be able to utilise uncontrolled crossings.

15.8.27 On completion of the Scheme, vehicle travellers would no longer be able to access the A63 or turn off the A63 from a number of side roads. Signing would be provided for all revised route options, thus minimising route uncertainty. The majority of vehicle travellers would be familiar with the revised lay-out established during the construction stage.

Non-motorised users

15.8.28 The predicted permanent effects of the Scheme on the existing NMU network and pedestrian and cyclist journeys that may be affected by the Scheme are included within Table 15.13 Permanent impacts of the Scheme on NMUs. Traffic flow increases and decreases are based upon forecasts for the opening year (2025) and the percentage change in traffic levels between the Do Minimum (without the Scheme) and the Do Something (with the Scheme) for affected routes, using the AADT value. Where this comparison was not possible, due to new and removed links (i.e. links only present in one scenario or the other) a qualitative statement has been deduced using AADT opening year traffic data.

15.8.29 In addition to Table 15.13 a discussion is included of the potential effects of the Scheme for NMUs during the annual Freedom Festival which takes place in September each year and is focussed around the derelict Fruit Market area of the City, to the south of the A63.

15.8.30 Provisions for NMUs within the Scheme include:

- upgrading the existing footway north of the A63 to a combined footway and cycleway and the footway to the south of the A63 for the length of the Scheme
- new signal controlled crossings at Mytongate Junction where a pedestrian mode in the signalling sequence would be included

- the removal of vehicle traffic from some routes, such as Humber Dock Street and the intersection of Dagger Lane, Fish Street and Vicar lane with the A63

15.8.31 The existing amenity of the footpath under the A63 on High Street would be upgraded, with the provision of improved sightlines, ensuring that NMU safety has been taken into account through design. All of these measures would benefit NMUs making journeys within the study area. However, the Scheme would result in the removal of six at grade signalised crossings and one uncontrolled crossing at Spruce Road. These will be replaced with two pedestrian, cycle and disabled user bridges, one upgraded existing underpass and NMU amenities on the proposed Mytongate Junction bridge, resulting in adverse effects for some users, and benefits for others. Volume 2, Figure 15.2 presents proposed NMU provisions for the Scheme.

15.8.32 Significant adverse effects would be experienced in four locations and not Significant adverse effects have been assessed in 10 locations, predominantly due to journey length and time increases and also increases in traffic flows reducing amenity. These effects would be partially offset through the provision of upgraded NMU infrastructure, such as the combined footway and cycleway and new NMU crossings. Eight NMU routes within the study area would experience no change. Beneficial effects would also be experienced for thirteen of the 36 NMU amenities identified within the Scheme study area; where there would either be a reduction or removal in traffic where NMUs are also present, and where new facilities would be provided as part of the Scheme.

As a result, whilst overall effects are considered to be adverse for NMUs, these effects are considered to be not significant.

Table 15.13: Permanent impacts of the Scheme on NMUs

Location[338]	Change in journey length	Change in facilities	Change in opening year (2025) AADT traffic flow	Commentary	Impact
1	No change	Combined footway and cycleway provided for the Scheme length, north of the A63, generally 3m wide. To the south of the A63, a footway would be provided for the Scheme length, largely 2m wide.	N/A – All NMU crossings across the A63 Castle Street are listed separately below.	The provision of a combined footway and cycleway for the full length of the Scheme to the north of the A63, and footway to the south, would be considered beneficial for NMUs, as the new pavement has potential to improve journey quality. A minor deterioration in the quality of the facility to the north of the A63 is anticipated for visually impaired users and those with mobility restrictions due to the shared space with cyclists. However, the width of the shared facility would be maximised, where possible, thus reducing potential conflict between different NMU groups and amenity. The provision of guard rails at high risk nearside verge locations would further improve amenity for NMUs.	Beneficial not significant
2	No change	The combined footway and cycleway would be reinstated.	N/A – The combined footway and cycleway would be separated from traffic.	This combined footway and cycleway would be reinstated following completion of the Scheme. The provision of guard rails at high risk nearside verge locations would improve amenity for NMUs.	Beneficial not significant
3	No change	The combined footway and cycleway would be reinstated.	N/A – The combined footway and cycleway would be separated from traffic. Guard rails would be provided on nearside verges at high risk locations.	The combined footways and cycleways situated around the current Mytongate Junction would be reinstated following completion of the Scheme. The provision of guard rails at high risk nearside verge locations would improve amenity for NMUs.	Beneficial not significant
4	Increase of 100m using the ramped access for the new Porter Street	The existing signal controlled crossing would be removed and replaced with a pedestrian, cycle	N/A - NMUs would be separated from traffic with the provision of a new bridge.	The replacement of the signal controlled crossing at this location with a bridge suitable for pedestrians, disabled users and cyclists would result in the separation of NMUs from vehicle traffic which would be beneficial with regard for amenity and would remove any vehicle-NMU conflict,	Adverse not significant

[338] Refer to Table 15.4 and Volume 2, Figure 15.2

Location[338]	Change in journey length	Change in facilities	Change in opening year (2025) AADT traffic flow	Commentary	Impact
	Bridge. 10m increase for NMUs able to use the stepped access.	and disabled user overbridge.		improving safety. Journey times may slightly decrease, with NMUs no longer needing to wait at traffic lights. However, the removal of a dedicated at grade crossing and provision of a replacement NMU bridge would result in a minor journey length increase for users of the ramped access (cyclists, those with prams and wheelchair users, etc). There would also be additional inconvenience associated with grade changes for some users, particularly those with mobility constraints, the elderly and the very young. The new bridge would however, be designed to comply with the Equalities Act 2010, minimising adverse impacts for users with mobility constraints. NMU surveys identified no wheelchair users at this location, whilst three of the surveys identified no vulnerable users. However, three vulnerable users (elderly persons and those with prams) were recorded for an NMU survey on the 2 September 2016 which represented 1.6% of NMUs for this survey day. Taking this into account, vulnerable users would be unlikely to be disproportionately affected by the Scheme.	
5	Increase of 120m for journeys across the A63, using the new Mytongate bridge.	Signal controlled crossing of the A63 removed. Replaced with signal controlled crossing for the new Mytongate bridge. Combined footpath and cycleway provided across the bridge.	Traffic data for Mytongate West indicates potential flow increases with the Scheme.	The removal of this at grade controlled crossing and replacement with additional signalised crossings over the Mytongate Junction would result in a minor increase in journey length for all NMUs. There would also be additional inconvenience associated with grade changes for some users, particularly those with mobility constraints, the elderly and the very young. A potential increase in traffic flows would also result in a deterioration in amenity for NMUs.	Adverse not significant
6	Increase of 160m for journeys across the A63, using the new Mytongate bridge.	Signal controlled crossing of the A63 removed. Replaced with signal controlled crossing for the new Mytongate	Traffic data at Mytongate East indicates potential flow increases with the Scheme.	Minor increase in journey lengths for all NMUs as a result of the grade separation across the A63. There would also be additional inconvenience associated with grade changes for some users, particularly those with mobility constraints, the elderly and the very young. A potential increase in traffic flows would also result in a deterioration in amenity for NMUs.	Adverse not significant

Location[338]	Change in journey length	Change in facilities	Change in opening year (2025) AADT traffic flow	Commentary	Impact
		bridge (both sides). Combined footpath and cycleway provided across the bridge.			
7	Increase of 250m for diversion from existing crossing.	Signal controlled crossing removed. Replaced with pedestrian, cycle and disabled user bridge, with ramped access.	N/A - NMUs would be separated from traffic with the provision of a new bridge suitable for pedestrians, cyclists and disabled users.	NMU surveys for a 'normal' weekday and weekend day indicate that changes to this crossing would affect approximately 1,000 NMUs on a weekday, and 850 NMUs at the weekend. The Princes Quay Bridge would replace this existing crossing. Cyclists, those with prams and wheelchair users would be inconvenienced by the new ramped access due to grade changes, as well as the elderly and the very young. There would be a moderate increase in journey length for NMUs when compared with the distance to use the existing signal controlled crossing. Wheelchair users and those with other mobility constraints (including those with prams) could be disproportionately affected by the Scheme in this location. Pedestrian counts show that these user groups make up less than 5.7% of NMU activity ('normal' September 2016 counts) and therefore the scale of impacts on these user groups would be minimised. Furthermore, the bridge would separate NMUs from vehicle traffic, improving amenity and reducing waiting times associated with the current signalised crossing. NMUs would be able to cross the road at their leisure, therefore reducing the severity of adverse impacts related to journey length increases.	Adverse not significant
8	Increase of 650m for diversion from existing crossing.	Signal controlled crossing removed. Replaced with pedestrian, cycle and disabled user bridge, with ramped access which would be a gateway feature.	N/A - NMUs would be separated from traffic with the provision of a new bridge.	Recorded NMU activity is high for this crossing, with approximately 1,950 crossings on a 'normal' weekday, and 1,620 for a 'normal' weekend day. The crossing would be replaced with the Princes Quay Bridge, which would separate NMUs from vehicle traffic, and reduce waiting times associated with the signalised crossing. These benefits would relieve the adverse impacts for some users associated with additional inconvenience for cyclists, those with prams and wheelchair users etc. due to the need to navigate a bridge where a previous at grade crossing was provided. In addition,	Adverse significant

Location[338]	Change in journey length	Change in facilities	Change in opening year (2025) AADT traffic flow	Commentary	Impact
				the existing crossing connects PRoW numbers 23 and 25, across the A63. Access to the bridge would be via a ramped access which diverts NMUs off this desire line, and would result in a major increase in journey length of approximately 650m to reach the same destination on Humber Dock Street for those using the ramped access, although this would be less for those who are able to use the stepped access. Pedestrian counts show that mobility impaired user groups make up to 10% of NMU activity ('normal' September 2016 counts) and consequently these NMUs would be disproportionately affected by the Scheme in this location.	
9	Increase of 330m for the journey from the existing NMU crossing location on Market Place to Queen Street, travelling via the ramped access to High Street and under the A63.	Signal controlled crossing removed. Ramped access upgrades between the A63 and High Street. NMUs would be diverted along the A63 underpass at High Street underneath the A63, then along a new combined footway and cycleway at Blackfriargate.	N/A – new route would use the existing underpass on High Street. Traffic flows haven't been predicted along Blackfriargate.	The removal of the existing at grade signal controlled crossing facility for north / south movements between Market Place and Queen Street would result in a moderate increase in journey length of 330m for NMUs, as the closest crossing of the A63 to would be the A63 underpass at High Street. However, some redistribution of NMU activity is likely, with increased use of High Street associated with the underpass upgrades, and also Princes Quay Bridge, potentially reducing NMU flows at Market Place / Queen Street. The provision of the bridge at Princes Quay and upgrades to the underpass at High Street would minimise impacts relating to amenity for NMUs. However, the removal of the signalised crossing is considered to be a degradation to existing facilities.	Adverse significant
10	No change	Signal controlled crossing would be removed and replaced with an uncontrolled crossing.	Increases (69%) for traffic moving from the A63 along Market Place northbound with the Scheme. Decreases (37%) for traffic converging between Market Place southbound and the A63 with the Scheme.	The removal of the controlled crossings for east / west movement on Market Place would result in a degradation of the existing facilities, leading to an adverse impact for all NMUs and a Significant reduction in amenity. NMUs would be forced to wait for a break in traffic flows from vehicles passing on and off the A63 to Market Place, where increases are predicted for traffic travelling northbound along Market Place. This places NMUs in greater direct conflict with vehicle traffic, which would be substantially worse for vulnerable users such as the visually impaired and those with mobility constraints.	Adverse significant

Location[338]	Change in journey length	Change in facilities	Change in opening year (2025) AADT traffic flow	Commentary	Impact
				However, the design of the slip roads (including sight lines) in this location, coupled with the predicted traffic flow changes have been thoroughly assessed from a road safety perspective, and it has been confirmed that removing the crossing at this location would not result in an increased safety risk for NMUs. As a result, whilst adverse impacts are predicted due to the loss of the facility and increased inconvenience for NMUs, the change with the Scheme in place is considered to be acceptable from a safety perspective.	
11	No change	Signal controlled crossing would be removed and replaced with an uncontrolled crossing.	Increases (14-62%) for traffic converging between the A63 and Queen Street with the Scheme.	The removal of the controlled crossing for east / west movement on Queen Street and replacement with an uncontrolled crossing would result in a degradation of the existing NMU facilities and a Significant reduction in amenity for NMUs. Following completion of works NMUs would be required to cross two single carriageway roads, with increases in traffic traveling westbound on to the A63 from Queen Street.	Adverse significant
12	No change.	Upgrades to ramp between the A63 and High Street and vegetation removed to increase visibility for NMUs.	N/A – new route would use the existing underpass on High Street and NMUs would not have to cross.	This existing facility would be upgraded with the Scheme in place, improving NMU journey experience. Access to the underpass via a ramped path from Market Place would be improved, with the addition of a footway and cycleway which is set back from the A63 providing direct access and sight-lines with the removal of existing dense vegetation to the underpass from Market place. A combined footpath / cycleway would be provided on Blackfriargate. There would be no change in journey length for existing users.	Beneficial not significant
13	Increase of 410m for the journey across the A63, using the Mytongate bridge.	Uncontrolled crossing removed. NMUs would be diverted to the footway and cycleway over the Mytongate bridge.	Traffic data for the A63 here indicates a negligible flow change with the Scheme.	This uncontrolled NMU crossing would be removed with the Scheme. NMUs would have to divert via the Mytongate crossing of the A63, which would be the closest crossing available. A moderate increase in journey times is anticipated for all NMUs as a result of the removal of this crossing. However, the crossing is currently uncontrolled and without the Scheme in place NMUs would be traversing of flows exceeding 16,000 AADT (2025) which would be severely dangerous, whilst NMU counts for the 9 and 10 September	Adverse not significant

Location[338]	Change in journey length	Change in facilities	Change in opening year (2025) AADT traffic flow	Commentary	Impact
				2016 suggest low usage (14 crossings during weekdays, and 20 at weekends), thus reducing the scale of impacts.	
14	No change	Uncontrolled crossing removed and replaced with a signalised crossing.	Traffic data for Ferensway indicates a potential flow increase with the Scheme.	The existing uncontrolled crossing on Ferensway would be replaced with a pedestrian mode in the signalling sequence for the traffic lights at the junction with the new Mytongate bridge. With consideration for traffic flows without the Scheme (more than 5,000 AADT in 2025), the improvement in amenity is considered to be minor beneficial. This provision would result in reduced potential for accidents, whilst maintaining an at-grade crossing.	Beneficial not significant
15	No change	Uncontrolled crossing removed and replaced with a signalised crossing.	Traffic data for the crossing at Commercial Road indicates a potential flow increase with the Scheme.	The existing uncontrolled crossing on Commercial Road would be replaced with a pedestrian mode in the signalling sequence for the traffic lights at the junction with the new Mytongate bridge. With consideration for traffic flows without the Scheme (more than 3,500 AADT in 2025), the improvement in amenity is considered to be beneficial not significant. Whilst some slight increase in journey times may be experienced for some NMUs whilst they wait for the pedestrian sequence, on balance, the provision of a controlled crossing would be of benefit for the majority of NMUs due to improved safety, and there would be no increase in journey length.	Beneficial not significant
16	No change	No change.	N/A – off road	No change to the existing NMU amenity, journey length or journey experience.	Neutral
17	No change	Vehicular access stopped up. NMU access maintained. With the combined footway and cycleway to the south of the A63.	Vehicle traffic removed.	The removal of vehicle access at this location, whilst maintaining access for NMUs for the Holiday Inn, would be of benefit for NMUs by removing the potential for conflict with vehicular traffic, and subsequently improving amenity through the continuation of the combined footway and cycleway.	Beneficial not significant
18	No change	No change.	Flow increases (63%) with the Scheme,	No change to the existing NMU amenity or journey length. Flow increases are predicted along Princes Dock Street with the Scheme which would result in degradation to amenity for NMUs, however, a one-way system would be implemented as	Adverse not significant

Location[338]	Change in journey length	Change in facilities	Change in opening year (2025) AADT traffic flow	Commentary	Impact
			although all traffic would be northbound.	part of the Scheme, allowing for northbound traffic only which would minimise impacts on NMUs, particularly for the visually impaired.	
19	No change	No access between the A63 and Humber Dock Street. Combined cycleway and footway provided along the A63 (3m wide here). Ramped access to Princes Quay Bridge also provided in this location.	Vehicle traffic removed.	The uncontrolled crossing in this location would be removed as Humber Dock Street would be stopped up to vehicle travellers. The combined footway and cycleway along the A63 would be continued in this location. With consideration for traffic flows without the Scheme along Humber Dock Street (1,163 AADT in 2025), which would be removed with the Scheme and the high levels of NMUs in this area (1,950 crossings on a 'normal' weekday, and 1,620 for a 'normal' weekend day), the removal of NMU-vehicle conflict and improvement to amenity in this location is considered to be significant beneficial. Additional benefits would also arise for NMUs due to upgrading the existing NMU crossing, improving journey experience.	Beneficial significant
20	No change	Dagger Lane stopped up. Combined cycleway and footway provided along the A63.	Vehicle traffic removed.	The uncontrolled crossing in this location would be removed as Dagger Lane would be stopped up to vehicle travellers. The combined footway and cycleway along the A63 would be continued in this location. This would result in a benefit for NMUs due to upgrading the existing NMU crossing, removal of NMU – vehicle conflict and a subsequent improvement in amenity.	Beneficial not significant
21	No change	Fish Street stopped up. Combined cycleway and footway provided along the A63.	Vehicle traffic removed.	The uncontrolled crossing in this location would be removed as Fish Street would be stopped up to vehicle travellers. The combined footway and cycleway along the A63 would be continued in this location. This would result in a benefit for NMUs due to upgrading the existing NMU crossing, removal of NMU – vehicle conflict and a subsequent improvement in amenity.	Beneficial not significant
22	No change	Vicar Lane stopped up. Combined cycleway and	Vehicle traffic removed.	The uncontrolled crossing in this location would be removed as Vicar Lane would be stopped up to vehicle travellers. The combined footway and cycleway along the A63 would be continued in this location. This would result in a benefit for NMUs due to upgrading the existing NMU crossing, removal of	Beneficial not significant

Location[338]	Change in journey length	Change in facilities	Change in opening year (2025) AADT traffic flow	Commentary	Impact
		footway provided along the A63.		NMU – vehicle conflict and a subsequent improvement in amenity.	
23	No change	No change.	Flow increases (63%) with the Scheme, although all traffic would be northbound.	No change to the existing NMU amenity or journey length. Flow increases are predicted along Princes Dock Street with the Scheme which would result in degradation to amenity for NMUs, however, a one-way system would be implemented as part of the Scheme, allowing for northbound traffic only which would minimise impacts on NMUs, particularly for the visually impaired.	Adverse not significant
24	No change	No change.	Vehicle traffic removed with no through access from Humber Dock Street to the A63.	FP23 would be maintained on completion of the works and therefore no changes to journey length or experience would be anticipated. However, Humber Dock Street would be disconnected from the A63, minimising conflict between NMUs and vehicle traffic and subsequently improving amenity.	Beneficial not significant
25	No change	No change	Road not included in the traffic model.	No change to the existing NMU amenity or journey length. This road was not considered in the traffic model and therefore an at worst adverse not significant impact is considered for potential degradation in amenity.	Adverse not significant (at worst)
26	No change	No change	With the Scheme, flow increases for southbound traffic and along Queen Street (25 - 83%) and negligible flow changes for northbound traffic.	No change to the existing journey length or experience. Amenity is unlikely to alter, with flow increases and decreases balancing impacts for different sections included in the traffic model of High Street and Humber Street.	Neutral
27	No change	No change	Flow decreases (35-79%) predicted with the Scheme.	No change to the existing journey length or experience, although a slight improvement in amenity would result from traffic flow decreases on English Street.	Beneficial not significant
28	No change	No change	Traffic increases (42%) westbound and decreases (46%) eastbound along Osborne Street, west of Ferensway. Decreases (43%) eastbound at	No change to the existing journey length or experience. Amenity is unlikely to alter, with flow increases and decreases balancing impacts for different sections included in the traffic model of Ferensway, Osborne Street, Anne Street and Carr Lane.	Neutral

Location[338]	Change in journey length	Change in facilities	Change in opening year (2025) AADT traffic flow	Commentary	Impact
			Osborne Street and increases westbound (3%) east of Ferensway. Decreases along Anne Street (3 - 17%) and no change for Carr Lane.		
29	No change	No change	Increases (30%) along Ferensway south of the junction. Decreases (2-25%) north of Ferensway, eastbound traffic west of Ferensway and both directions to the east.	No change to the existing journey length or experience. Amenity is unlikely to alter, with flow increases and decreases balancing impacts for different sections included in the traffic model of Ferensway.	Neutral
30	No change	No change	N/A – off road	No change to the existing NMU amenity, journey length or journey experience.	Neutral
31	No change	No change	Road not included in the traffic model.	No change to the existing NMU amenity or journey length. This road was not considered in the traffic model and therefore an at worst Adverse not significant impact is considered for potential degradation in amenity.	Adverse not significant (at worst)
32	No change	No change	N/A – off road	No change to the existing NMU amenity, journey length or journey experience.	Neutral
33	No change	No change	Flow decreases (1-25%) predicted with the Scheme.	No change to the existing journey length or experience, although a slight improvement in amenity would result from traffic flow decreases on Rawling Way.	Beneficial not significant
34	No change	No change	Increases (3-31%) on different sections of liberty lane and southbound along High Street. 29- 101% flow increases predicted along Lowgate. Decreases predicted along Liberty Lane and High Street (1-23%).	No change to the existing journey length or experience. Amenity is likely to decrease on balance, with a greater number of flow increases than decreases.	Adverse not significant

Location[338]	Change in journey length	Change in facilities	Change in opening year (2025) AADT traffic flow	Commentary	Impact
35	No change	No change	N/A – off road	No change to the existing NMU amenity, journey length or journey experience.	No change not significant
36	No change	No change	N/A – off road	No change to the existing NMU amenity, journey length or journey experience.	No change not significant

Impacts during the Freedom Festival

15.8.33 The surveys undertaken for NMUs in September 2016 clearly illustrate the effect the Freedom Festival has on NMU movement. For the weekend counts, NMU activity increased by a factor of approximately four times when the Freedom Festival was happening, from a total of 4,801 recorded NMU crossings for the 'normal' weekend day on the 10 September, to 18,269 for the weekend count in September. The surveys also clearly demonstrate that the majority of users are focussed around the controlled crossing locations of Princes Dock West and Princes Dock East, with over 15,000 of counts made at those two crossings.

15.8.34 The Scheme design includes the Princes Quay Bridge, which would be situated between the existing crossings located to the east and west of Princes Dock Street, which it would replace. It would form the main crossing point for the majority of festival goers during this period. The design of this bridge has taken the increased NMU numbers for the festival period into account, and subsequently, the bridge deck would be widened from the 2m standard (DMRB Volume 2, Part 8 Design Criteria for Footbridges), to 5m to accommodate high NMU activity. Due to the increased width of the bridge and as NMUs will be separated from vehicle traffic (they would not need to wait for traffic signals prior to crossing the road), the replacement of two at grade crossings by the pedestrian, cycle and disabled user bridge at Princes Quay is considered to be beneficial when compared to the existing situation during the Festival period.

15.8.35 The Market Place crossing would be closed for NMUs with the implementation of the Scheme. However, the High Street underpass would be improved, with a new ramped access provided from Market Place to High Street, and complimentary measures such as the inclusion of CCTV and lighting. Nonetheless, the changes associated with the Scheme are likely to result in an increase in journey time and length for the majority of NMUs wishing to cross the A63 at this location, particularly those making their way to the Freedom Festival site within the Fruit Market, and also less able users. The effect of this increase in journey distance (the new distance would be approximately 330m greater than the existing crossing), would be negligible for cyclists, but for those with mobility constraints and for pedestrians, it would result in an adverse effect. This would be slightly offset by the provision of the upgraded alternative option, which would separate NMUs from fast flowing traffic on the A63. Even so, when compared to the existing situation, effects are likely to be adverse for NMUs wishing to access the Freedom Festival at this location.

15.9 Conclusion

15.9.1 This chapter has assessed the potential effects of the Scheme for all travellers, including levels of driver stress and views from the road for vehicle travellers, and NMUs using the network of footpaths and cycleways within the study area. The assessment has drawn upon guidance presented within the DMRB Volume 11,

Section 3 Part 8, Pedestrians, Cyclists, Equestrians and Community Effects, and the DMRB Volume 11 Section 3 Part 9, Vehicle Travellers, as well as professional judgement.

15.9.2 Overall, construction activities and the presence of construction plant and materials would result in some deterioration in the existing view for vehicle travellers for a temporary period. However, it is considered that the construction works would be perceptible but not alter the balance of features and elements that comprise the existing view for vehicle travellers. The change from the baseline is considered to be minor adverse. It is therefore considered that during the construction stage, there would be an adverse not significant impact upon vehicle travellers from changes to the view from the road.

15.9.3 Once the Scheme is operational, the effect upon views from the road for vehicle travellers is considered to be adverse on opening of the road in 2025. There would be some change to existing views due to the introduction of new highways infrastructure. Where the road would be in cutting through the Mytongate Junction, there would be no view for vehicle travellers, resulting in a significant change in this location only. By year 15, some landscape planting along Hessle Road would soften the built form and structures associated with the Scheme. However, the Scheme would not alter the overall balance of features and elements that comprise the existing view of the surrounding townscape for vehicle travellers. The effect upon views from the road for vehicle travellers would therefore remain as adverse by year 15. Effects are considered as adverse not significant for both the opening year, and at year 15.

15.9.4 During construction, the change in driver stress for affected routes is considered to be adverse. This is due to the presence of temporary traffic management and speed restrictions, resulting in driver frustration and route uncertainty. The presence of construction plant may also result in elevated levels of driver stress from fear of potential accidents. However, traffic management would be implemented for the full duration of the construction period, and levels of driver stress would subsequently be managed through the provision of direction signs and by ensuring that two lanes of running traffic would be kept open in each direction throughout the construction period. Whilst adverse, existing driver stress is considered to be high for the study area, particularly on the A63 between Hessle Road and Garrison Road, and as a result, the change from the baseline is considered to be not significant.

15.9.5 Once the Scheme is operational, there would be very little change in driver stress between the Do Something and Do Minimum scenarios for the design year in 2040 for the A63 Castle Street, as a result of alterations to average peak traffic flow. However, upgrades to the Mytongate Junction and the removal of pedestrian crossings would minimise levels of driver stress from driver frustration and fear of potential accidents for vehicle travellers. It is therefore likely that overall, the Scheme would result in a slight reduction in driver stress for the A63 Castle Street,

resulting in a benefit for vehicle travellers making use of the A63. Overall effects are considered to be not significant.

15.9.6 For NMUs during construction, it is anticipated that there would be some residual adverse effects while temporary closures and diversions are in place, resulting in an increase in journey length and a deterioration in journey experience. There would also be a deterioration in the amenity value of routes due to the presence of construction plant and construction noise. Measures to minimise adverse effects for NMUs would be implemented by the Contractor during construction. This would include temporary diversions for NMUs around the work site to be clearly signed and phased, with alternative access arrangements maintained through the full construction period; and all NMU diversions would be hard surfaced, and fenced, braced and fitted with high visibility strips to aid visibility at night for pedestrians and cyclists. In addition, a Community Relations Strategy would be implemented, and the Scheme delivered in accordance with the Considerate Constructors Scheme. With these measures in place, the balance of effects during construction is considered to be adverse but not significant for NMUs.

15.9.7 Once the Scheme is operational, some adverse effects would be experienced for NMUs due to the changes to amenity and increase in journey length. The removal of at grade crossings and their replacement with pedestrian, cycle and disabled user bridges would have the benefit of separating NMUs from vehicle traffic. However, this would increase journey length and inconvenience some NMUs, particularly those with mobility constraints. However, adverse effects would be partially offset through the provision of upgraded facilities such as the combined footway and cycleway on either side of the A63, new signal controlled crossings at Ferensway and Commercial Road, and the removal of vehicle traffic from some routes. These measures would be of benefit to NMUs making journeys within the study area. The overall effects are considered to be adverse at worst, and not significant.

Chapter 16. Combined and cumulative effects

16.1 Executive summary

16.1.1 The assessment of combined and cumulative effects of the Scheme brings together the principal findings of each of the previous topics of the Environmental Statement (ES) in order to identify and assess possible combined effects, and potential cumulative effects of the Scheme in association with 'other developments' with that may overlap the zones of influence (ZOI).

16.1.2 Combined and cumulative effects are defined as effects which can result from multiple actions on receptors over time and are generally additive or interactive in nature. Cumulative effects can also be considered as impacts resulting from incremental changes caused by other past, present or reasonably foreseeable actions together with the Scheme.

16.1.3 The assessment methodology for combined effects involves the identification of impact interactions associated with the Scheme upon separate environmental receptors, in order to better understand the overall environmental effect of the Scheme.

16.1.4 For cumulative effects, incremental changes likely to be caused by 'other developments' together with the Scheme are identified. Twenty-six 'other developments' were shortlisted within the study area that have the potential to coincide with the Construction and Operation Phases of the Scheme. Developments shortlisted have to meet both of the following criteria:

- Has a certainty of more than likely or higher
- Has an overlapping ZOI with the Scheme

16.1.5 The potential cumulative effects of the Scheme with each of these 'other developments' was assessed to avoid or mitigate against significant adverse effects.

16.1.6 Overall, the Scheme is assessed to have a moderate adverse combined residual environmental effect for both the Construction and Operation Phases. This is due to the identified, localised adverse effects of the Scheme on medium value receptors; Trinity Burial Ground (as a heritage asset, Project Landscape Character Area (PLCA) and Site of Nature Conservation Interest (SNCI)), Humber and Railway Docks PLCA, and Humber Dock Marina UK Biodiversity Action Plan (UKBAP) priority habitat. However, these residual combined effects are not anticipated to contribute beyond that of the effects identified in the preceding environmental chapters.

16.1.7 The residual cumulative effects during Construction and Operation Phases of the 'other developments' shortlisted with the Scheme are anticipated to be moderate adverse. The residual cumulative effects of the Scheme with the other shortlisted developments are not anticipated to contribute beyond that of the effects identified in the preceding environmental chapters. No additional action is deemed to be required beyond the mitigation specified in the preceding ES chapters.

16.1.8 The potential for impacts on health from the Scheme have been considered in the ES. This chapter details potential health impacts, how these have been considered within the preceding chapters of this ES and summarises significance.

16.1.9 Also included in this chapter is an assessment to ascertain the effects of climate change in combination with the effects of the Scheme. This determined that there is the potential for in-combination impacts on ecological receptors, both positive (longer growing season for hedgerow habitats created) and negative (additional stress to less resilient habitats / species that are being affected by the scheme). Additionally, there is the potential for in-combination effects regarding other disciplines, however after mitigation none of these are considered to be significant.

16.2 Introduction

16.2.1 This chapter presents the assessment of combined and cumulative effects for the A63 Castle Street Improvements. This assessment draws upon the guidance provided within the DMRB Volume 11 Section 2 Part 5: Assessment and Management of Environmental Effects[339] and the recently published Planning Inspectorate 'Advice Note Seventeen: Cumulative Effects Assessment[340]'.

16.2.2 Combined and cumulative effects result from multiple actions on receptors over time and are generally additive or interactive (synergistic) in nature. They can also be considered as effects resulting from incremental changes caused by other past, present or reasonably foreseeable actions together with the Scheme, identified as:

- Combined effects from a single project (the inter-relationship between different environmental factors).

[339] The Highways Agency (2008) Design Manual for Roads and Bridges Volume 11, Section 2, Part 5 'Assessment and Management of Environmental Effects'.

[340] The Planning Inspectorate (2015) Advice Note Seventeen: Cumulative Effects Assessment relevant to nationally significant infrastructure projects. Available online at: http://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2015/12/Advicenote-17V4.pdf

- Cumulative effects from different projects (with the project being assessed).

16.2.3 A summary of potential health impacts from the Scheme are provided separately to the combined and cumulative effects conclusions.

16.2.4 An assessment of in-combination climate change impacts (ICCI) has been carried out to evaluate the potential effects of climate change on the effects of the Scheme. Each discipline was required to review their existing impact assessment against a future climate baseline for the city / region to determine if there are any likely in-combination impacts due to climate change. Where present these are outlined in Tables 16.10 and 16.11, if additional mitigation was deemed necessary this is also noted.

16.3 Legislative, regulatory and policy background

16.3.1 The requirement to address the combined and cumulative effects of a project is set out in Article 5(1) of the Environmental Impact Assessment (EIA) Directive[341]. With respect to Nationally Significant Infrastructure Projects (NSIP) under the Planning Act 2008 (as amended), the requirements of the EIA Directive are implemented through the Infrastructure Planning (EIA) Regulations 2009 ('the EIA Regulations')[342].

16.3.2 The need to consider cumulative effects in planning and decision making is set out in planning policy, in particular the National Policy Statement for National Networks (NN NPS)[343]; Paragraph 4.16 states that "*When considering significant cumulative effects, any Environmental Statement should provide information on how the effects of the applicant's proposal would combine and interact with the effects of other development (including projects for which consent has been granted, as well as those already in existence)*".

16.4 Study area

Combined effects

16.4.1 The study area for the assessment of combined effects for the Scheme reflects the study areas, (also termed as the spatial ZOI), identified within

[341] Environmental Impact Assessment (EIA) Directive (85/337/EEC) as amended by the Council Directives 97/11/EC and 2003/31/EC and codified by 2011/92/EU

[342] Infrastructure Planning (Environmental Impact Assessment) Regulations 2009. Available online at: http://www.legislation.gov.uk/uksi/2009/2263/contents/made

[343] Department for Transport (2014) National Policy Statement for National Networks: Presented to Parliament pursuant to Section 9 (8). Available online at https://www.gov.uk/government/publications/national-policy-statement-for-national-networks

relevant topic chapters of the ES, ranging from 200m (for Air quality) to 2km (for Ecology and nature conservation).

Cumulative effects

16.4.2 The study area for the identification of 'other developments' for inclusion in the assessment of cumulative effects has been influenced by 2 separate study areas that have been combined to produce 1 overall study area. These are as follows:

- A combined study area of the topic tailored ZOI (maximum 2km) for both the Construction and Operation Phases around the Development Consent Order (DCO) boundary for the Scheme
- The traffic model

16.4.3 The study area used for the assessment of cumulative effects during both construction and operation reflects the combined area of the individual ZOI of the topic chapters, outlined in Table 16.1. The ZOI have also been represented graphically in Volume 2, Figures 16.1 to 16.17. The ZOI for Materials have not been included, due to the difficulties associated with presenting the ZOI for this topic graphically i.e. due to a wider study area identified in Chapter 13 Materials considers the management of waste also including the relevant materials and waste facilities.

16.4.4 The ZOI is measured from the construction and operational boundary of the scheme.

16.4.5 The assessment of cumulative effects has been undertaken on a topic-by-topic basis, with the assessment of 'other developments' in combination with the Scheme only undertaken where the ZOI for the same topic chapter overlap.

16.4.6 Further information on the study areas for the technical assessments are found within each of the technical Chapters 6 to 15 in the ES.

Table 16.1: ZOI summary table for the Scheme

Discipline topic	Phase	ZOI (unless stated otherwise distances are from DCO red line boundary)
Air Quality	Construction	• 200m, and • 50m from the routes used by construction vehicles up to 500m from the Scheme.
	Operation	Existing baseline and future committed developments are included in the traffic data used for the assessment in Chapter 6 Air quality. Therefore, no assessment for operation has not been undertaken in this chapter.

Discipline topic	Phase	ZOI (unless stated otherwise distances are from DCO red line boundary)
Cultural Heritage	Construction and Operation	• 500m for designated / non-designated historic buildings and landscapes, including Conservation Areas, and • 200m for designated / non-designated archaeological assets
Landscape	Construction and Operation	400m has been applied due to the built-up, urban context of the Scheme Site
Ecology and Nature Conservation	Construction and Operation	• 2km Designated sites (statutory and non-statutory), UKBAP Priority habitats and Protected species – bats, breeding and wintering birds, fish, aquatic mammals • 500m Protected species – great crested newts (not present) • 250m Protected species – reptiles and otters • 100m Habitats – scattered trees, hedgerows, standing water (Princes Dock, Humber Dock marina, Railway dock), invasive species, ephemeral / short perennial • 30m Protected species – terrestrial invertebrates, aquatic invertebrates, badger (not present) • 0m Habitats of negligible significance – amenity grassland, scrub, semi-improved grassland, tall ruderal, introduced shrub, buildings
Geology and Soils	Construction and Operation	500m from all locations where physical works and ground disturbance would take place
Materials	Construction and Operation	N/A
Noise and vibration	Construction	100m and any additional areas where the calculated noise levels from the works exceeds baseline noise levels by 5dB or more (subject to thresholds)
	Operation	1km and any additional any sensitive receptors where road traffic noise level would increase or decrease by at 1dB LA10 18hr or more on opening or 3dB in the long term
Effects on all Travellers	Construction and Operation	250m
People and communities	Construction and Operation	250m
Road drainage and the water environment	Construction and Operation	• 1km for surface waterbodies • 350m for groundwater as this is the maximum extents of the A63 Castle Street Improvements

16.5 Assessment methodology

Combined effects

16.5.1 The assessment methodology for combined effects identifies interactions of potential effects between environmental topics anticipated with the Scheme.

The methodology for the assessment of combined effects follows the DMRB Volume 11 Section 2 Part 5: Assessment and Management of Environmental Effects[344].

16.5.2 Single receptors / resources are identified where the combined action of a number of different environmental topic-specific activities have a residual effect. Combined effects of moderate adverse or beneficial and above are considered significant. Those that do not score as significant are still considered worthy of note.

Cumulative effects

16.5.3 The assessment methodology for cumulative effects identifies incremental changes likely to be caused by 'other developments' within the ZOI of the Scheme. For this assessment, and in accordance with the Planning Inspectorate 'Advice Note Seventeen: Cumulative Effects Assessment' 'other development' is taken to include plans and projects.

16.5.4 This assessment follows the methodology outlined in Advice Note Seventeen, which provides guidance for 4 stages of CEA:

- Stage 1: Establish the ZOI and a long list of other developments
- Stage 2: Identify a shortlist of other development for the assessment
- Stage 3: Information gathering
- Stage 4: Assessment

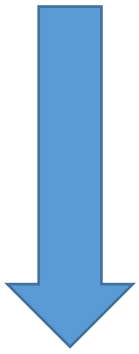
16.5.5 As part of establishing the ZOI within Stage 1, the assessment of cumulative effects has been based on the traffic scenarios included in the traffic model, ensuring that only the developments included in the traffic model falling within these scenarios have been assessed for the Scheme.

16.5.6 Characteristics likely to give rise to significant cumulative effects, or likely to give rise to a cumulative effect have also been considered in this assessment as recommended by the Planning Inspectorate 'Advice Note Seventeen: Cumulative Effects'.

16.5.7 The developments are grouped into tiers, reflecting the likely degree of certainty attached to each development, with Tier 1 being the most certain, as shown in Table 16.2. Tier 3 developments are least certain and most likely to have limited publicly available information to inform assessments.

344 The Highways Agency (2008) Design Manual for Roads and Bridges Volume 11, Section 2, Part 5 'Assessment and Management of Environmental Effects'

Table 16.2: Tiering of developments

Tier	Likely degree of certainty	
Tier 1	• Under construction* • Permitted Application(s), whether under the Planning Act 2008 or other regimes, but not yet implemented. • Submitted application(s) whether under the Planning Act 2008 or other regimes but not yet determined.	Decreasing level of detail likely to be available 
Tier 2	• Projects on the Planning Inspectorate's Programme of Projects where a Scoping Report has been submitted.	
Tier 3	• Projects on the Planning Inspectorate's Programme of Projects where a Scoping Report has not been submitted. • Identified in the relevant Development Plan (and emerging Development Plans – with appropriate weight being given as the move closer to adoption) recognising that much information on any relevant proposals will be limited. • Identified in other plans and programmes (as appropriate) which set the framework for future development consents / approvals, where such development is reasonably likely to come forward.	

* where other projects are expected to be completed before construction of the proposed NSIP and the effects of those projects are fully determined, effects arising from them should be considered as part of the baseline and may be considered as part of both the construction and operational assessment.

16.5.8 In addition to the tier system, the traffic model includes scoping criteria that was used to decide which developments should be included within the traffic model, based on the certainty of outcome shown in Table 16.3.

16.5.9 In order to align with the traffic model, the cumulative effects assessment includes only those developments that are considered as being 'Near Certain' and 'More Than Likely'.

Table 16.3: Certainty of outcome and development status

Certainty of outcome	Development status
Near Certain: The outcome will happen or there is a high probability of it occurring.	• Intent announced by proponent to regulatory agencies. • Approved development proposals. • Projects under construction.
More Than Likely: The outcome is likely to happen but some uncertainty.	• Development application within the consent process and in accordance with the development plan.
Reasonable Foreseeable: The outcome may happen but significant uncertainty.	• Identified within a development plan and, although not directly associated with the project, may occur if the project is implemented.

Certainty of outcome	Development status
Hypothetical: There is considerable uncertainty whether the outcome would ever happen.	• Conjecture based upon currently available information. • Discussed on a conceptual basis. • One of a number of possible inputs in an initial consultation process.

16.5.10 Rather than reporting every interaction, the methodology for the assessment of cumulative effects concentrates on the main significant effects and aims to differentiate between permanent or temporary, positive or negative and other existing or more than likely / near certain major developments.

16.5.11 Where significant cumulative effects beyond those identified as residual effects from the Scheme in isolation, have been identified, additional mitigation would be recommended.

Significance criteria

16.5.12 The assessment of significance of the combined and cumulative effects has been determined in accordance with the significance criteria contained in Table 2.1 of DMRB Volume 11, Section 2, Part 5 (HA 205/08). Typically, the greater the environmental sensitivity or value of the receptor or resource, and the greater the magnitude of impact, the greater the effect. Consequently, a highly valued resource suffering a major detrimental impact would result in a very large adverse effect.

16.5.13 For the purpose of the cumulative effects assessment, the value of a resource and magnitude of impact is determined according to the criteria set within the preceding chapters of the ES. The significance of effect is then carried forward from preceding environmental chapters to enable an assessment of combined significance, as well as to identify the significance of cumulative effects with other developments. Typical descriptors of cumulative significance are included in Table 16.4 which reflects the approach. The overall significance is determined with mitigation included. Where an effect is moderate or above (adverse or beneficial), it is deemed to be significant.

Table 16.4: Combined and cumulative effects significance definitions[345]

Significance category	Typical descriptors of effect
Very large (adverse or beneficial)	Where the balance of the effects of the Scheme or combined effects of the Scheme in association with other existing or more than likely / near certain future major development upon an

[345] Based on Table 2.3 of DMRB Volume 11 Section 2 Part 5 HA 205/08

Significance category	Typical descriptors of effect
	individual or collection of environmental receptors would be very highly significant (positive or negative). Effects would be: • Permanent and far reaching for receptors of very high value.
Large (adverse or beneficial)	Where the balance of the effects of the Scheme or combined effects of the Scheme in association with other existing or more than likely / near certain major future developments upon an individual or collection of environmental receptors would be highly significant (positive or negative). Effects would be: • Permanent and far reaching for receptors of high value. • Localised for a receptor of very high value. • Temporary for receptor of very high value.
Moderate (adverse or beneficial)	Where the balance of the effects of the Scheme or combined effects of the Scheme in association with other existing or more than likely / near certain major future developments upon an individual or collection of environmental receptors would be significant (positive or negative). Effects would be: • Permanent and far reaching for receptors of medium value. • Localised for receptors of high value. • Temporary for a receptor of high value.
Slight (adverse or beneficial)	Where the balance of the effects of the Scheme or combined effects of the Scheme in association with other existing or more than likely / near certain major development upon an individual or collection of environmental receptors would be noteworthy but not significant (positive or negative). Effects would be: • Permanent and far reaching for receptors of low value. • Localised for receptors of medium value. • Temporary for a receptor of medium value.
Neutral	Where the positive or negative effects of the Scheme or the combined effects of the Scheme in association with other existing or more than likely / near certain future major developments would balance.

16.5.14 Significance descriptors have also been aligned with the considerations included within the Planning Inspectorate 'Advice Note Seventeen: Cumulative Effects'. Consideration is given to the following:

- The duration of effect, i.e. will it be temporary or permanent
- The extent of effect, e.g. the geographical area of an effect
- The type of effect, e.g. whether additive (loss of 2 pieces of woodland of 1ha, resulting in 2ha cumulative woodland loss) or synergistic (2 discharges combine to have an effect on a species not affected by discharges in isolation)
- The frequency of the effect
- The value and resilience of the receptor affected

- The likely success of mitigation

Consultation

16.5.15 An EIA Scoping Report was produced in 2013[346] and the Planning Inspectorate produced a Scoping Opinion (see document reference TR010016/APP/6.9) the same year. The scope of this chapter reflects comments received from both the Planning Inspectorate and relevant consultees.

16.5.16 Shortlist methodology and results have been agreed with Hull City Council (HCC).

Limitations and assumptions

16.5.17 There are several general assumptions and limitations associated with the assessment. Professional judgement was used based on currently available information. There may be additional major developments proposed following the submission of the ES.

16.5.18 Where a proposed development has not been assessed for certain environmental topics, a cautious assumption has been made as to the likely significance of environmental effect. This is based on an understanding of the local area, as well as the predicted environmental effects identified in assessments for developments located close by. In these cases, a desktop study has been undertaken and a 'worst-case' 'most likely' approach adopted.

16.5.19 For developments anticipated to have significant effects on the environment the local planning authority should determine whether the project is of a type listed in Schedule 1 or Schedule 2 as per the Town and Country Planning (EIA) Regulations[347]:

- *if it is listed in Schedule 1 an Environmental Impact Assessment is required in every case*
- *if the project is listed in Schedule 2, the local planning authority should consider whether it is likely to have significant effects on the environment.*

16.5.20 For the 'other developments' listed in the uncertainty log, the proposals are emerging and inherently have a limited degree of certainty. It should be

[346] Highways Agency (2013) A63 Castle Street Improvements, Hull Environmental Statement Scoping Report

[347] Infrastructure Planning (Environmental Impact Assessment) Regulations 2009. Available online at: http://www.legislation.gov.uk/uksi/2009/2263/contents/made

understood that there is potential for change in these developments after this document has been submitted.

16.5.21 Where a development with 'more than likely' uncertainty or above are absent from the local planning authority and the Planning Inspectorate portal (i.e. Tier 3) it is assumed that the development(s) are not likely to have significant effects on the environment, therefore Neutral effects have been assigned for these projects.

16.5.22 Assessment of likely significant environmental effects will differ slightly across the 'other developments' as a result of assessments being undertaken by multiple parties with variations in professional opinion. In addition, some assessments may have taken a balanced approach to the assessment of effects, whilst other assessments may take a worst-case approach.

16.5.23 When the construction start and finish dates are not available for the other developments, it has been assumed that either part or all of the Construction Phase will fall within the Scheme Construction Phase (March 2020 to May 2025), reflecting a worst–case scenario approach.

16.6 Existing environment

Combined effects

16.6.1 The baseline for each environmental topic is described in detail in the preceding Chapters 6 to 15 for each of the relevant environmental topics assessed in the ES.

16.6.2 Receptors / resources identified to have effects recorded in multiple environmental chapters from the Scheme have been sub-divided into 3 groups:

- Cultural features
- Residential property
- Community amenity and businesses

16.6.3 Within these groups, individual receptors or groups of receptors affected across multiple environmental chapters are considered. The connection between key receptors within these groups and the ES chapters are detailed in Table 16.5.

Table 16.5: Receptors / resources

Receptor / resource	Key receptors	ES chapter(s)
Cultural features	Trinity Burial Ground	Cultural heritage, Landscape, Ecology and nature Conservation, People and communities, and Effects on all travellers.
Community amenity and businesses		
Residential property	Quantock Close, The Lodge, Porter Street, Hessle Road: St Alfred Street to Ropery Street, A63 Castle Street: Dagger Lane to Fish Street, A63 Castle Street: Fish Street to Vicar Lane, Magistrates' Court and Holiday Inn.	Noise, People and communities, and Effects on all travellers.

Cumulative effects

16.6.4 As part of Stage 1, numerous 'other developments' in relation to the Scheme have been identified using HCC's interactive map system, Draft Local Plan[348], the Uncertainty Log[349], and a review of the Planning Inspectorate website. These developments have been identified in Table 16.6.

16.6.5 As part of Stage 2 (see Section 16.5 Assessment methodology), the long list of 'other developments' identified in Stage 1 had been reduced to a shortlist using inclusion / exclusion criteria described above.

16.6.6 Volume 3, Appendix 16.1 Stage 2 Screening and Appendix 16.2 Short list: development type build on the information given in Table 16.6 listing the long list of proposed developments identified at Stage 1, and shows the screening process undertaken to develop the Stage 2 shortlist including:

- Land use type
- Uncertainty of the development drawn from the uncertainty log
- Interaction of the developments with environmental topic ZOI

16.6.7 Volume 2, Figures 16.1 to 16.17 show the 'other developments' identified in this assessment, contained within the shortlist, and in the context of environmental discipline's respective ZOI.

16.6.8 All developments with the following criteria were screened out and the rest were included in the shortlist at Stage 2:

[348] Hull City Council, Hull Draft Local Plan 2016-2032. Available online at: http://www.hull.gov.uk/resident/planning-and-building-control/local-plan

[349] The Uncertainty Log is a list of future developments used by the traffic specialist to predict traffic flows in and around the Scheme

- A certainty of outcome of 'reasonably foreseeable' or 'hypothetical'
- Had no overlapping ZOI with the Scheme

16.6.9 Of the 49 developments on the long list, 26 were shortlisted.

Table 16.6: Developments identified at Stage 1 and the inclusion of developments in the shortlist at Stage 2

ID	Long list of 'other developments' identified at Stage 1	Uncertainty	Shortlist of 'other developments' identified at Stage 2
1	Humber Quays	Reasonably foreseeable	No
2	Fruit Market	Residential units, near certain. B1 more than likely. Remainder, Reasonably foreseeable	Yes
3	Myton Street	Leisure D1 / D2 near certain. Hotel more than likely, and retail reasonably foreseeable	Yes
4	East Bank	Reasonably foreseeable	No
5	Albion Square	Residential part of development near certain	Yes
6	Trinity Quays	Reasonably foreseeable	No
7	18 Ferensway (former Lexington Avenue)	Near certain	Yes
8	UTC, John Street	Near certain	Yes
9	Alexandra Dock - LDO	Near certain	Yes
10	Queen Elizabeth Dock (North) - LDO	More than likely	No
11	Queen Elizabeth Dock (south) - LDO	More than likely	Yes
12	Keystore	Near certain	Yes
14	Burma Drive - Phase 2	Near certain	Yes
15	Elba Street	Reasonably foreseeable	No
16	Valletta Street	Reasonably foreseeable	No
19	Paul LDO	More than likely	No
22	Newington and St Andrews	Near Certain	Yes
23	Calvert Lane	More than likely	Yes
26	St. Andrews Dock	Reasonably foreseeable	No
27	Fenners Marfleet Avenue	Near certain	Yes
28	Marfleet Lane (On land west of Marfleet Lane)	Reasonably foreseeable	No
30	Holderness Road (AAP) - Refer to HCC Website	Near Certain	Yes
31	Reckitts (Extension)	Near Certain	Yes

ID	Long list of 'other developments' identified at Stage 1	Uncertainty	Shortlist of 'other developments' identified at Stage 2
32	Siemens training facility	More than likely	Yes
33	Rix Road / Stoneferry Road	Reasonably foreseeable	No
34	KIBP, Hedon Road	Reasonably foreseeable	No
35	St. Mark's Street	Reasonably foreseeable	No
36	Ashcourt	Reasonably foreseeable	No
37	East End Priory Park	More than likely	Yes
38	Priory Park	More than likely	Yes
39	Banner Court	More than likely	Yes
40	Indivior	Reasonably foreseeable	No
41	Arco	Reasonably foreseeable	No
42	Priory Park	More than likely	Yes
43	Freightliner Rd (Cavaghan & Gray)	Hypothetical	No
44	Wassand Street / Walcott Street	Reasonably foreseeable	No
45	King William House	Near certain	Yes
46	West Bank Local Plan Ref 398	Reasonably foreseeable	Yes
47	West Bank Local Plan Ref 399	More than likely	No
48	West Bank Local Plan Ref 400	More than likely	Yes
49	Lidl Freightliner Road	Near certain	No
50	Littlefair Road	More than likely	Yes
51	Land south of Hedon Road, SE Marfleet Rabt	Reasonably foreseeable	Yes
52	Foster Street (former FCC)	Reasonably foreseeable	Yes
53	Chapman Street	Reasonably foreseeable	No
54	Former Police Station	Near certain	Yes
55	Kingston Parklands Business Park	Near certain	Yes
56	Former Bird's Eye	Reasonably foreseeable	Yes
57	National Grid site	Reasonably foreseeable	No

16.7 Predicted environmental effects

Combined effects

16.7.1 The predicted environmental effects for both Construction and Operation Phases of the Scheme are taken into consideration with the inclusion of any proposed mitigation from the preceding chapters of the ES. Table 16.7

provides details of how these effects have been combined as a result of their individual significance on receptors.

16.7.2 No receptors / resources were predicted to experience a significant combined effect as a result of the Scheme for the environmental topics; Air quality, Road drainage and the water environment, Geology and soils, and Materials.

16.7.3 High value receptors have been identified within the preceding chapters as having permanent residual significant effects from the Scheme, these include:

- Trinity Burial Grounds (as a heritage asset, PLCA and SNCI)
- Humber and Railway Docks PLCA
- Humber Dock Marina UKBAP priority habitat
- Properties within Humber Floodplain

16.7.4 Significant effects as a result of the Scheme are have been identified in the preceding chapters of the ES; Noise and vibration, Cultural heritage, Landscape, Ecology and nature conservation, Road drainage and the water environment and People and communities (shown in Table 16.7).

16.7.5 Climate change has been identified as a potential significant impact on the S41 Priority habitat in Trinity Burial Ground. However, due to the uncertainty inherent in climate change this cannot be defined as so and therefore not included as part of the assessment.

16.7.6 These effects, both temporary and permanent, are not considered to be wide reaching. As a result, the Scheme is considered (as per Planning Inspectorate guidance shown in Table 16.4) to have moderate adverse combined effect.

Table 16.7: Significance of combined effects

Receptor	Cultural features		Residential property		Community amenities and business	
	Construction	Operation	Construction	Operation	Construction	Operation
Air quality	-	-	Not significant adverse	Not significant adverse	Not significant adverse	Not significant adverse
Noise and vibration	Negligible increase	Not significant	Significant adverse	Significant adverse to significant beneficial	Minor increase	Not significant
Cultural heritage	Large adverse	Large adverse	-	-	Large adverse	Large adverse
Landscape	Large adverse landscape	Large adverse	Moderate adverse landscape	Significant adverse and	Large adverse landscape	Large adverse

Receptor	Cultural features		Residential property		Community amenities and business	
				beneficial visual		
Ecology and nature conservation	Large adverse	Large adverse	-	-	Large adverse	Large adverse
Road drainage and the water environment	-	-	-	-	Large / very large beneficial to very large adverse	Large / very large beneficial to very large adverse
Geology and soils	No significant adverse or beneficial residual effects					
Materials	No significant adverse or beneficial residual effects					
People and communities	Moderate adverse	Moderate adverse	-	-	Moderate adverse	Moderate adverse
Effects on all travellers	No significant adverse or beneficial residual effects					
Overall Significance of Combined Effects	Moderate adverse					

Cumulative effects

16.7.7 Only those developments that have been included in the shortlist (Stage 2) have been brought through to the assessment of cumulative effects, which represents Stages 3 and 4 of the methodology.

16.7.8 All of the shortlist developments are Tier 3. Tier 3 developments are defined as least certain to be developed, and most likely to have limited publicly available information to inform assessments. Therefore, a 'very high level' assessment is appropriate as per the Stage 4 of the methodology outlined by the Planning Inspectorate.

16.7.9 For both construction and operation impacts related to the other developments, the traffic model for the proposed Scheme has taken into account future committed developments and has informed the following aspects of the EIA reported in the ES. Therefore, potential cumulative environmental impacts of traffic changes are incorporated within these assessments and no supplementary assessment is required for the following chapters:

- Chapter 6 Air quality
- Chapter 7 Noise and vibration
- Chapter 11 Road drainage and the water environment:
  - Water quality of receiving watercourses
  - Drainage design

- Chapter 15 Effects on all travellers:
  - Non-motorised users such as pedestrians and cyclists
  - Driver stress

16.7.10 For the 'other developments' scoped into the assessment, all are absent from the local planning authority and the PINS portal. It is therefore reasonable to assume that these developments are unlikely to have significant effects on the environment.

16.7.11 The types of developments in the shortlist have also been considered (see Volume 3, Appendix 16.2). None are perceived to have significant effects. Therefore, no additional effects are anticipated over and above that identified in the preceding chapters of this Scheme and neutral effects have been assigned for these projects.

16.7.12 There are both permanent and temporary effects, identified in the preceding environmental chapters, associated with the Construction and Operation Phases of the Scheme. No very high value receptors are considered to be significantly affected by the Scheme.

16.7.13 High value receptors have been identified within the preceding chapters as having permanent residual significant effects from the Scheme, these include:

- Trinity Burial Ground (as a heritage asset, PLCA and SNCI)
- Humber and Railway Docks PLCA
- Humber Dock Marina UKBAP priority habitat

These effects are contained within the footprint of the Scheme and not considered to be wide reaching. As a result, the Scheme is considered (as per the Planning Inspectorate guidance shown in Table 16.4) to have moderate adverse cumulative effect.

Overall, the effects of the Scheme in association with other existing or more than likely / near certain major future developments upon an individual or collection of environmental receptors would be moderate adverse for both Construction and Operation Phases.

16.8 Conclusion

16.8.1 The assessment for combined effects involved the identification of impact interactions associated with the Scheme upon separate receptors / resources. The methodology for the assessment of combined effects followed DMRB Volume 11 Section 2 Part 5: Assessment and Management of Environmental Effects.

16.8.2 In summary, the residual combined effect during the Construction and Operation Phases of the Scheme is not anticipated to contribute beyond that of the effects identified in the preceding environmental chapters. The Scheme has localised adverse effects for receptors of medium value, therefore the overall combined effect is moderate.

16.8.3 The assessment for cumulative effects has involved the identification of incremental changes likely to be caused by a shortlist of 'other developments' and the Scheme itself. This assessment has followed the methodology outlined in the recently published Planning Inspectorate 'Advice Note Seventeen: Cumulative Effects Assessment'.

16.8.4 The residual cumulative effects during the Construction and Operation Phases of the Scheme with of all of the 'other developments' are not anticipated to contribute beyond that of the effects identified in the preceding environmental chapters. The Scheme has localised adverse effects for receptors of medium value, therefore the overall cumulative effect is moderate.

16.9 Summaries of health impacts

16.9.1 The potential for impacts on health from the Scheme are outlined in Table 16.8 below. The table relates identified potential health impacts to relevant text within the preceding chapters of the ES and summarises significance.

Table 16.8: Summaries of health impacts

Consideration	Relevant chapter	Conclusion
Contaminated land	Chapter 12 Geology and soils	No significant adverse residual impacts identified within the ES chapter. No anticipated additional action required beyond the mitigation specified in the ES chapter.
Driver stress	Chapter 15 Effects on all travellers	Whilst existing levels of driver stress are already high for the A63 Castle Street, construction activities would introduce additional frustration, fear of potential accidents and some route uncertainty during the works. As a result, vehicle travellers would be likely to experience increased levels of driver stress during construction. On balance, the additional driver stress as a result of construction activities would result in an overall adverse not significant effect for vehicle travellers within the study area. Once the Scheme is operational, there would be very little change in driver stress between the Do Something and Do Minimum scenarios for the design year in 2040 for the A63 Castle Street, as a result of alterations to average peak traffic flow. However, upgrades to the Mytongate Junction and the removal of pedestrian crossings would minimise levels of driver stress from driver frustration and fear of potential accidents for vehicle travellers. It is therefore likely that overall, the Scheme would result in a slight reduction in driver stress for the A63 Castle Street, resulting in a benefit

Consideration	Relevant chapter	Conclusion
		for vehicle travellers making use of the A63. Overall impacts are not considered to be significant.
NMU	Chapter 15 Effects on all travellers	For NMU during construction, it is anticipated that there would be some residual adverse effects while temporary closures and diversions are in place, resulting in an increase in journey length and a deterioration in journey experience. There would also be a deterioration in the amenity value of a route due to the presence of construction plant and construction noise. Measures to minimise adverse effects for NMU would be implemented by the Contractor during construction. This would include temporary diversions for NMU around the work site to be clearly signed and phased, with alternative access arrangements maintained through the full construction period; and all NMU diversions to be hard surfaced, and fenced, braced and fitted with high visibility strips to aid visibility at night for pedestrians and cyclists. In addition, a Community Relations Strategy would be implemented, and the Scheme delivered in accordance with the Considerate Constructors Scheme. Scheme delivered in accordance with the Scheme delivered in accordance with the Considerate Constructors Scheme. With these measures in place, the balance of effects during construction is considered to be adverse but not significant for NMU. Once the Scheme is operational, some adverse effects would be experienced for NMU due to the changes to amenity and increase in journey length. The removal of at grade crossings and their replacement with pedestrian, cycle and disabled user bridges would have the benefit of separating NMU from vehicle traffic. However, this would increase journey length and inconvenience some NMU, particularly those with mobility constraints. However, adverse effects would be partially offset through the provision of upgraded facilities such as the combined footway and cycleway on either side of the A63, new signal controlled crossings at Ferensway and Commercial Road, and the removal of vehicle traffic from some routes. These measures would be of benefit to NMU making journeys within the study area. The overall effects are considered to be adverse at worst but not significant.
Amenity	Chapter 14 People & communities	Temporary amenity land take includes: • Jubilee Arboretum (approx. 196m2); and • William Street Pocket Park (approx. 56m²). As the space at Jubilee Arboretum and William Street will be re-provided and there is no change in function, a slight adverse effect is anticipated. This is not expected to be significant. Permanent land take at Trinity Burial Ground. The loss of approximately a third of the land is considered to be a large adverse significant effect.
Noise	Chapter 7 Noise and vibration	The daytime construction works would produce significant adverse effects where the works in the vicinity of receptors which exceed the threshold values extend beyond a period

Consideration	Relevant chapter	Conclusion
		of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months. In the case of night time works, although limited in scope, there is also a risk of temporary disturbance due to works at the closest receptors. In the long term the number of dwellings experiencing an increase with the Scheme (4,486) is lower than would experience and increase in the long term in the Do Minimum scenario (5,483). The Scheme therefore has a net benefit. Significant adverse changes with the Scheme in the opening year (an increase of 1dB or greater) would occur at 693 residential dwellings and significant beneficial changes in noise levels (a decrease of 1dB or greater) would occur at 332 dwellings. Significant adverse changes with the Scheme in the design year (an increase of 3dB or greater) would occur at 39 residential dwellings and significant beneficial changes (a decrease of 3dB or greater) would occur at 111 dwellings. Without the Scheme, 21 dwellings would experience significant adverse changes in the design year but no dwellings would experience significant benefits. Overall the Scheme in the long term provides a net benefit with respect to significant effects due to changes in noise level.
Air quality	Chapter 6 Air quality	The Scheme is expected to lead to an increase in traffic along the A63 between Daltry Street and Market Place which is located in the Hull AQMA. However, the Scheme reduces traffic congestion on several stretches of roads in the AQMA, including in areas where the annual mean NO2 objective is currently exceeded and expected to be still be exceeding in the Opening Year Do Minimum scenario. The reduced congestion and therefore improved vehicle speeds is predicted to remove these exceedances of the NO2 objective, and no new exceedances of the AQOs are predicted as a result of the operation of the Scheme. Furthermore, the Scheme is not expected to affect compliance with the European Union (EU) Directive on ambient air quality. Therefore, the air quality impact associated with the Operation Phase is considered not significant.
Local economy	Chapter 14 People & communities	Direct employment and temporary economic activity from Construction Phase of the Scheme is assessed to have slight beneficial effects. This is not considered to be significant. During operation, the Scheme was assessed to have the potential to support the delivery of 583 net additional jobs, producing £24.7m of net additional Gross Value Added per annum, within the Hull and Humber economy. This is considered to be moderate beneficial and significant. Disruption to access to economic centres in anticipated during both construction and operation. The overall effect is likely to be slight adverse, therefore not significant.

Consideration	Relevant chapter	Conclusion
Water quality	Chapter 11 Road drainage and the water environment	The scale of accidental spillages in relation to the water is unlikely to impact river quality and assessed as negligible, and is therefore not significant.
Flood risk	Chapter 11 Road drainage and the water environment	Alteration of flood flow routes at the Humber floodplain. Mitigation includes emergency procedures in case of pump failure or extreme flooding event. This ranges from major beneficial to major adverse depending on the location, source of flooding and return period of event.

16.10 Effects of climate change on the Scheme

16.10.1 The potential effects of climate change on the Scheme are outlined in Tables 16.10 and 16.11. To carry out this task, each discipline was required to review their existing impact assessment against the future climate baseline to determine if there are likely to be any additional impacts due to the projected impacts of climate change.

16.10.2 The future climate baseline was produced using data from the UK Climate Projections for 2009[350] high emissions scenario. This data source and emissions scenario was used in line with National Policy Statement paragraph 4.41 which states that "*Where transport infrastructure has safety critical elements and the design life of the asset is 60 years or greater, the applicant should apply the UK Climate Projections 2009 (UKCP09) high emissions scenario (high impact, low likelihood against the 2080 projections at the 50% probability level)*".

16.10.3 A high-level climate assessment considered the impact of the Scheme on carbon emissions during the construction. Construction activities will lead to increased emissions of Greenhouse Gas (GHG). Estimates indicate a high proportion of embodied carbon for the Scheme is associated with bulk materials (over 90% of total) required for foundations, road construction, general backfill and structures.

16.10.4 The Materials Logistics Plan and Construction Environmental Management Plan (CEMP) will include several measures intended to minimise the emissions from construction materials, plant and construction traffic as far as possible. An outline Environmental Management Plan is submitted with the DCO application at document reference TR010016/APP/7.3.

16.10.5 It is anticipated that the Scheme will lead to an increase in GHG emissions over the 60-year operating appraisal period, compared to projections without

[350] UK Climate Projections. 2009. Available online at: http://ukclimateprojections.metoffice.gov.uk/

the Scheme. High level assessment indicated this would be less than 5% of the GHG emissions reported from Hull's Category A roads in 2015.

Table 16.9: Future climate baseline for the 2080s (based on UKCP09 high emissions scenario, the 50th percentile)

Climatic condition	Climate observations for Yorkshire and the Humber (including Hull)
Temperature	Average summer temperature is projected to increase by 3.3°C, and average winter temperature is projected to increase by 3.0°C.
Rainfall	Average summer rainfall rate is projected to decrease by 23%, whereas the average winter rainfall rate is projected to increase by 15%. Annual mean precipitation is projected to remain static.
Wind	Climate projections for wind are more uncertain than those for temperature and precipitation, due to inherent difficulty in modelling future wind conditions. However, overall an increase in extreme weather including wind is projected[351].

* Source: UKCP09 Climate Projections

Climate change effects on ecology and nature conservation

16.10.6 The potential effects of climate change on receptors have been considered, including whether the Scheme would affect the resilience of the receptors to adapt to the effects of climate change. Due to the complex and numerous impacts and receptors in combination for ecology and nature conservation, this has been presented in a separate table at Table 16.11.

16.10.7 All other disciplines are presented in Table 16.10 Effects of climate change on the Scheme.

[351] UK Climate Change Risk Assessment (2017). Available online at: https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-2017

Table 16.10: Effects of climate change on the Scheme

Discipline	In-combination climate effect and cause	Proposed additional mitigation
Chapter 6 Air quality	No in-combination climate effects envisaged.	N/A
Chapter 7 Noise and vibration	Reduced attenuation of road noise during operation due to air absorption and temperature inversions.	None required as the additional impact is not considered significant.
	Increased road traffic noise during winter as the road surface remains wetter for longer due to greater levels of precipitation. Road noise increases when the carriageway is wet.	
Chapter 8 Cultural heritage	Increased threat to buried archaeology caused by soil saturation in winter and shrinkage during dry spells.	None required as the additional impact is not considered significant.
	Increased potential of impacts to buried archaeology due to changes to soil chemistry caused by increased winter precipitation.	
	An increased possibility of impact to the historic fabric of buildings, due to: • An increased potential of extreme events • Fungal / plant growth and insect infestation associated with temperature rises • Soil shrinkage which may lead to building subsidence, structural deformation and collapse in the most severe cases	
Chapter 9 Landscape	Rising temperatures increasing the prevalence of pests and diseases.	Monitoring of the landscape scheme and suitable replacement planting or the introduction of changes to the maintenance regime should plant species fail because of this effect.
	Increased threat to the viability of plants due to: • Rising temperatures; • Increased winter precipitation • More frequent extreme events (i.e. drought / floods)	
Chapter 10 Ecology and nature conservation	Climate change effects on ecology and nature conservation are considered separately in Table 16.11	
	Rising sea levels and wave height has significant effects on the flooding in Hull. Sea levels are predicted to increase by 1.125m between 2011 and 2125 and wave heights are expected to increase by 10%. When incorporating climate change impacts into the	As outlined in Chapter 11 Road drainage and the water environment.

Discipline	In-combination climate effect and cause	Proposed additional mitigation
Chapter 11 Road drainage and the water environment	flood risk predictions for the 1 in 200-year return period wave overtopping from the River Humber, the area of the flooding extends well beyond the boundaries of the Scheme reaching depths of up to 1.20m in the study area.	
	The extent of the flooding under climate change has increased northwards and westwards as compared to the baseline model prediction. Under the climate change scenario flood water completely fills the underpass and begins to flood west along Castle Street.	
	Increased intensity of recharge events to the superficial deposits, which could therefore increase groundwater levels and potentially the risk of groundwater mounding and flooding up-gradient of the underpass and possibly also other structures	N/A
Chapter 12 Geology and soils	Forecast increase in temperature and possible windy conditions, may lead to increased erosion of exposed soils and fugitive dust emissions.	None required as the additional impact is not considered significant.
	Forecast increases in winter precipitation may lead to increased volumes of water flowing through soil and potentially contaminated material, increasing the potential for mobilisation and contaminant migration.	
	Risk of flooding and increased precipitation may cause soluble contaminants that were previously located within the unsaturated zone to be mobilised, which could then migrate towards a sensitive receptor.	
	Increased winter precipitation has the potential to cause overflowing / overtopping of below ground structures, releasing contaminants that were previously contained.	
	Increased winter precipitation could cause a rise in the groundwater table, which has the potential to increase the migration of soil gas vapours through the soil profile and risk of accumulation in confined spaces.	
Chapter 13 Materials	Extreme weather events and wind speeds may increase expected wind loads on bridge structures and damage to structures.	Mitigated through the design process by the effective choice of construction materials.
	Increased wind may result in more salt-spray and impact on materials from corrosion.	
Chapter 14 People and communities	An increased risk of surface and tidal flooding within Hull impacting local resident and businesses.	Consideration given in Chapter 11 Road drainage and the water environment.

Discipline	In-combination climate effect and cause	Proposed additional mitigation
Chapter 15 Effects on all travellers	Frustration or fear from traffic jams or road closures / diversions due to extreme weather events or flooding.	All proposed diversions and road closures would be sign posted clearly.
	Climate impacts can affect pedestrians through direct exposure in open spaces as well as impacts such as spray from passing vehicles.	A network of dedicated footpaths, and cycle routes that are segregated from vehicle traffic is included within the Scheme design.

Table 16.11: In-combination climate impacts on ecology and nature conservation

Ecological receptor	Valuation	Baseline climate change potential effects	Climate change in-combination with the Scheme
Trinity Burial Ground SNCI Trinity Burial Ground NERC S41 Priority habitat 'Deciduous woodland'	County / unitary authority area National	Reduction in tree growth and health due to soil moisture deficit in drier summers. Reduced tree stability due to limited root depth in response to greater fluctuations in water table. Increase in pests and disease due to warmer climate allowing expansion of range and reduced winter mortality. Earlier leafing and subsequent negative effect on spring-flowering ground-flora species due to increased winter and spring temperatures. Decreased health and growth and increased mortality of drought intolerant tree species, in particular beech, birch and sycamore, due to increased summer temperatures and decreased summer rainfall. Adverse effect on biodiversity associated with these species e.g. epiphytes etc (Defra, 2010). Higher prevalence of pests and diseases due to warmer temperatures increasing range of suitable climate (Bracknell Forest Council, 2015; NERC, 2015).	The Scheme will impact Trinity Burial Ground SNCI, reducing its area by a third. Climate change impacts (drought, higher temperatures) may further impact the remaining area, which will be more vulnerable due to its reduced size. This could potentially be significant on the S41 Priority Habitat, however due to the uncertainty inherent in climate change this cannot be defined as so.

Ecological receptor	Valuation	Baseline climate change potential effects	Climate change in-combination with the Scheme
		Adverse effect on reproductive success of some species due to warmer winter as winter chill is necessary for flower or seed development[352]. Changing rainfall patterns, in combination with rising temperatures, are Climate likely to increase stress to trees, due to a possible increase in extreme events such as drought in summer and waterlogging in winter. This may affect the health of trees directly, through damage to roots for example, or indirectly through increased susceptibility to pests and diseases[353].	
Scattered amenity trees	Local	As Trinity Burial Ground SNCI above	The Scheme will increase the number of scattered amenity trees to be planted during operation. By 2080, the trees would have matured before long-term changes in climate have established. Since the trees will be established before the greatest impacts of climate change (drought) become apparent in the 2080s, climate change is not anticipated to have a negative effect on the amenity trees.
Ephemeral / short perennial – Site compound at Wellington Street Island Wharf; site	Local	Increase in plants colonising bare ground after drier summers. Increased risk from drought to plants flowering at end of summer due to drier summers.	Ephemeral habitats in the site compounds would have succeeded to more permanent habitats such as scrub and woodland if left unmanaged. The site compounds may also be developed upon.

[352] Ray et al. 2010. Climate Change Impacts and Adaptation in England's Woodlands. The Forestry Commission. Available online at: https://www.forestry.gov.uk/pdf/FCRN201.pdf/$file/FCRN201.pdf

[353] Joint Nature Conservation Committee. (JNCC). (2011). UK Biodiversity Action Plan; Priority Habitat Descriptions. BRIG (ed. Ant Maddock) 2008. (Updated 'HF 201). Available online at: http://jncc.defra.gov.uk/PDF/UKBAP_PriorityHabitatDesc-Rev2011.pdf

Ecological receptor	Valuation	Baseline climate change potential effects	Climate change in-combination with the Scheme
Compound at Livingstone Road.		Community composition changes due to change in growth rates and thus competitive interactions[354].	Any ephemeral habitat that is created close to the Scheme is not anticipated to be impacted by climate change as it will become established before the greater impacts of climate change are felt in the 2080s.
Hedgerows - Site compound at Livingstone Road; A63 eastbound recovery base and Staples site; car park site at the Myton Centre.	Local	Increased annual average temperature and longer growing Season leading to a changing composition of wildlife in hedgerows. Warmer winters and fewer frost events resulting in the winter chill requirements of berry species not being met. Reduced bud, flower and fruit production will affect food resources for wildlife. Drier summers will lead to drought and increased mortality and die-back of certain hedgerow tree species, such as beech. Drought stress will increase trees' susceptibility to pests and diseases. Wetter winters and flooding will cause water logging of soils and erosion. Woody species exposed to prolonged flooding in the growing season will be at risk of dying. The winter trimming of hedgerows will become more difficult in some areas due to wet ground conditions. Winter trimming is preferred to autumn trimming to ensure berries and fruits are available for birds and other species. Wet soil conditions could cause damage to soil structure, leading to increased die-back of hedgerow trees.	Operation of the Scheme will see a greater length of hedgerows being replaced than was removed with a diverse range of species, particularly those that are adapted to a range of climactic conditions. In combination with climate change effects, the Scheme would have beneficial impacts upon hedgerow habitats and reduce the effects of climate change.

[354] Natural Environment Research Council (NERC). (2015). Implications of Climate Change for SSSIs and Other Protected Areas. Biodiversity Report Card Paper 4. Available online at: https://nerc.ukri.org/research/partnerships/ride/lwec/report-cards/biodiversity-source04/

Ecological receptor	Valuation	Baseline climate change potential effects	Climate change in-combination with the Scheme
		Increase in storm frequency and high winds leading to loss of mature and veteran hedgerow trees. In combination of the above leading to increased occurrence of insect pests and pathogens and potential loss or significant reduction in populations of key hedgerow tree species[355].	
Terrestrial Invertebrates - Trinity Burial Ground SNCI; site compounds at Wellington Street Island Wharf, Livingstone Road and Neptune Street	Local	Change in community composition due to species geographical range altering. Change of habitat requirements due to increased temperatures; species found in areas of short vegetation may move to areas of taller vegetation where there is more shade. Earlier emergence and flight periods leading to longer reproductive season due to warmer temperatures[356]. General increase in species diversity due to warmer temperatures[357].	Operation of the Scheme will see the permanent loss of Trinity Burial Ground thereby reducing the amount of habitat available for terrestrial invertebrates. In combination with climate change, no additional impacts are predicted on invertebrates supported by ephemeral habitat as it will be established before the greater impacts of climate change are felt in the 2080s.
Birds – Main site; Trinity Burial Ground SNCI; site compounds at land south east of	Local	Adverse effects on survival and breeding of ground-feeding species due to lower rainfall in summer decreasing soil moisture. Likely increase in diversity and community composition changes due to warming.	The permanent loss of Trinity Burial Ground during operation of the Scheme will reduce the amount of habitat for this receptor leading to an adverse impact upon bird species of local value. In combination

[355] Natural England. (nd). Hedgerows. Climate Change Adaptation Manual Evidence to support nature conservation in a changing climate. Available online at: http://publications.naturalengland.org.uk/publication/5629923804839936

[356] Bracknell Forest Council. (2015). A review of the potential impacts of climate change on the Bracknell Forest Biodiversity Action Plan. Available online at: https://www.bracknell-forest.gov.uk/sites/default/files/documents/bap-review-climate-change-impacts.pdf

[357] Natural Environment Research Council (NERC). (2015). Implications of Climate Change for SSSIs and Other Protected Areas. Biodiversity Report Card Paper 4. Available online at: https://nerc.ukri.org/research/partnerships/ride/lwec/report-cards/biodiversity-source04/

Ecological receptor	Valuation	Baseline climate change potential effects	Climate change in-combination with the Scheme
Mytongate Junction, A63 eastbound recovery base, Arco site and Staples site; car park site at the Myton Centre		Adverse effect on small birds due to increased winter and spring rainfall adversely affecting food availability, energy expenditure and chick mortality. Adverse effect on migratory birds due to warmer temperature causing earlier peak in insect populations which may occur prior to migratory species arrival. (Bracknell Forest Council, 2015).	with climate change effects, the Scheme would have beneficial impacts upon hedgerow habitats and climate change will reduce the effects on this receptor.
Birds - Site compounds at Neptune Street, Wellington Street Island Wharf and Livingstone Road	International	Earlier arrival of summer migrant birds due to warmer temperatures. Wintering of wildfowl further north due to warmer temperatures. Increased prey for birds as warmer temperatures may increase numbers of small mammals. Decrease in prey for birds relying on invertebrates associated with wet conditions due to warmer temperature and drier summers. Effects on migrant species populations due to changes in timing of natural events, migration routes and wintering sites. Increased risk of mortality for ground-nesting birds due to increased rainfall and flooding. (NERC, 2015).	Bird species that the Humber Estuary is designated for were surveyed in the ephemeral habitats in the site compounds. Climate change is not expected to have any impacts on the ephemeral habitats as they will be established before the greater impacts of climate change are felt in the 2080s. Therefore, climate change is predicted to have no additional impact on this receptor.
Bats – All areas	Local	Reduced hibernation period and associated effects on spring body condition, survival rates, breeding success and food availability due to warmer winters. Decrease in food source due to drier springs and summers and associated lower abundance of insects.	The permanent loss of Trinity Burial Ground during operation of the Scheme will reduce the amount of a major foraging resource and potential roosting habitat for this receptor leading to an adverse impact upon bats. Climate change is not expected to increase this impact so no in-combination effects are predicted. Additionally, climate change will have a positive effect upon hedgerow habitats that

Ecological receptor	Valuation	Baseline climate change potential effects	Climate change in-combination with the Scheme
		Timing of food availability, reproduction and development[358]	provide bat foraging resource and reduce the effects on this receptor.
Notable species (hedgehogs) – Terrestrial areas	Local	Decrease of food in springs and summers due to warmer drier weather reducing availability of earthworms for young. Reduced hibernation period and subsequent body condition, survival rates and breeding success due to warmer winters. (Bracknell Forest Council, 2015); NERC, 2015).	Overall, the permanent loss of Trinity Burial Ground during operation of the Scheme will reduce the amount of suitable habitat for this receptor leading to an adverse impact upon hedgehogs. In combination, the effects of climate change on hedgehogs in the rest of the habitats and site compounds on site will not be increased by the Scheme. Additionally, climate change will have a positive effect upon hedgerow habitats that provide hedgehog resource and reduce.

[358] Sherwin, H. A., Montgomery, W. I., Lundy, M. G. (2013). The impact and implications of climate change for bats. Mammal Review. Vol 43. Issue 3. 171-182

Chapter 17. Summary of Environmental Statement findings

17.1 Introduction

17.1.1 This chapter summarises the findings of the impact assessments reported in this Environmental Statement (ES). Likely significant effects are tabulated in Table 17.1. Topic specific impact assessments are presented in detail in Volume 1, ES Chapters 6 to 16.

17.1.2 Potential impacts of the Scheme have been identified by considering the change that the Scheme would cause from the baseline conditions.

17.1.3 To assist in the understanding of the summary findings a number of assessment fundamentals are outlined below.

17.2 Significance of effects

17.2.1 The significance of environmental effects is largely defined by reference to two key factors:

- the ‘value’ or ‘sensitivity’ of the receptor
- the ‘magnitude’ or ‘scale’ of the impact

17.2.2 All the environmental assessments are based on the application of published, topic-specific guidance found in Volume 11 of Highways England’s Design Manual for Roads and Bridges (DMRB), Highways England’s Interim Advice Notes (IANs) or other appropriate guidance. All chapters detail the appropriate guidance used in their environmental assessments. In most cases, effects are defined according to the following broad descriptors:

- ‘Adverse’ or ‘Beneficial’ (they are undesirable effects, or they represent an improvement over the baseline situation)
- ‘Construction’ or ‘Operational’ (caused by the construction of the Scheme, or by the operation of the Scheme after opening)
- ‘Direct’ or ‘Indirect’ (they are caused by the Scheme itself, or are ‘those that alter the character, behaviour or functioning of the affected environment because of encroachment of the Scheme impacts over a wider area or timescale’ (DMRB Volume 11, Section 2, Part 5))
- ‘Short-term’ or ‘Long-term’ (they are felt for less than 15 years, or they would still be felt 15 years after construction and beyond)

- ‘Temporary’ or ‘Permanent’ (they are felt for a limited period of time, for example during the proposed five-year construction period or they would be felt indefinitely)

- ‘Significant’ or ‘Not Significant’

17.2.3 Volume 1, Chapter 5 Environmental Impact Assessment (EIA) Process describes the general approach to the environmental assessment for each topic. For most topics, the significance of an effect is defined in 5 categories (Neutral, Slight, Moderate, Large and Very Large). With the addition of the terms ‘Adverse’ or ‘Beneficial’ the categories can be applied as a balanced nine-point scale (Neutral; Slight Adverse; Moderate Adverse; Large Adverse; Very Large Adverse; Slight Beneficial; Moderate Beneficial, Large Beneficial and Very Large Beneficial).

17.2.4 In this assessment, all effects that are ‘Moderate’ or above are deemed ‘Significant’.

17.2.5 Certain topics in this assessment have used a different approach to assessing the level of significance in accordance with discipline specific best practice guidance or based on professional judgement of the assessor. The specific approach applied to each environmental topic is fully described in the relevant assessment in Volume 1, ES Chapters 6 to 16.

17.2.6 In all cases, the assessment is based on the worst case scenario principle noted in Volume 1, Chapter 5 The EIA Process and the individual topic chapters where relevant.

17.3 Mitigation

17.3.1 Measures to mitigate the effects of the Scheme have been identified and included within Volume 1, ES Chapters 6 to 16. Mitigation measures have also been included in the Register of Environmental Actions and Commitments (REAC) which forms Annex B of the Outline Construction Environmental Management Plan (OCEMP), (document reference TR010016/APP/7.3). These mitigation measures have been taken into account in the assessment of residual effects for each topic.

17.4 Residual effects

17.4.1 Following implementation of mitigation, the environmental effects envisaged to remain are referred to as residual effects. These are described in each topic chapter.

17.4.2 Some design features and mitigation measures may result in an environmental improvement. In these instances, the residual effect is recorded as ‘Beneficial’.

17.5 Summary of environmental effects

17.5.1 Table 17.1 below summarises the significance of the likely residual environmental effects remaining after mitigation has been applied. The significance of the residual effect is detailed if it is identified as being ‘Moderate’, ‘Large’ or ‘Very Large’ beneficial or adverse.

Table 17.1: Summary table

Description of effect	Adverse / Beneficial	Construction / Operation	Temporary / Long term	Proposed mitigation	Significance of residual environmental effect after mitigation
Chapter 6 Air quality					
No significant adverse or beneficial residual effects					
Chapter 7 Noise and vibration					
Operational road traffic noise: +3dB or greater increase in the design year due to changes in traffic flows with the Scheme at 39 residential and 2 other noise sensitive receptors (41 in total).	Adverse	Operation	Long Term	• Thin surface course applied to all new carriageway surfaces	Significant adverse - but 20 of these receptors would have been subject to such an increase even if the scheme did not go ahead
Operational road traffic noise: +1dB or greater increase in the design year due to changes in traffic flows with the Scheme which also exceed SOAEL at 182 residential receptors.	Adverse	Operation	Long Term	• Thin surface course applied to all new carriageway surfaces	Significant adverse - however overall fewer properties would experience noise levels greater than SOAEL due to the Scheme compared to without.
Operational road traffic noise: -3dB or greater decrease in the design year due to changes in traffic flows with the Scheme at 111 residential and 13 other noise sensitive receptors (124 in total).	Beneficial	Operation	Long Term	• Thin surface course applied to all new carriageway surfaces	Significant beneficial - no receptors would experience significant beneficial effects if the scheme did not go ahead
Chapter 8 Cultural heritage					
Effects on archaeological remains					
Adverse effect on the Trinity Burial Ground and its setting caused by the construction of the Mytongate Junction and retaining wall. This will remove 43% of the burial ground and associated archaeological remains. There will be additional adverse	Adverse	Construction and Operation	Temporary - during the proposed 5 year construction period and long term	• Archaeological excavation prior to and during excavation under a Scheme design in order to record, investigate and report archaeological remains. • Positive landscape design of the remainder of the Trinity Burial Ground. • Replacement of public space taken at Trinity Burial Ground	Significant - large adverse (Construction / long term) Significant - moderate adverse (Operation / long term)

Description of effect	Adverse / Beneficial	Construction / Operation	Temporary / Long term	Proposed mitigation	Significance of residual environmental effect after mitigation
effects during operation caused to the setting of the surviving 57% of the burial ground.				with the creation of new public green space at the Myton Centre which will be demolished.	
Effects on historic buildings					
Adverse temporary effects on the setting of the Statue of King William, Warehouse No 6, Castle Buildings, Princes Dock and Humber Dock during construction caused by noise and visual impacts.	Adverse	Construction	Temporary - during the proposed 5 year construction period and long term	• Controls imposed on construction activities through the Code of Construction Practice (CoCP) or Construction Environmental Management Plan (CEMP).	Significant - moderate adverse
Adverse effect on the setting of the Old Town conservation area caused by noise and visual impacts during construction and permanent change to the layout of the road and at-grade crossings leading to reduced interconnectivity between the north and south of the conservation area.	Adverse	Construction	Temporary - during the proposed 5 year construction period and long term	• Controls imposed on construction activities through the CoCP or CEMP • Improved interconnectivity created by the Princes Quay Bridge and upgrading of the existing crossing points at the Mytongate Junction and the underpass beneath Myton Bridge.	Significant - moderate adverse
Adverse permanent effect on the Earl de Grey public house (Grade II listed) caused by dismantling.	Adverse	Construction and Operation	Long Term	• Archaeological recording in advance of dismantling.	Significant - major adverse
Chapter 9 Landscape					
Effects on landscape features: Trees within Trinity Burial Ground (which do not lie within the footprint of the proposed infrastructure but which would be removed to enable the chosen approach to the disinterment of graves prior to the construction of the Scheme to be undertaken)	Adverse	Construction	Long term	• Recognised good practice in construction	Significant – large adverse
Effects on landscape features: Trees within the A63 corridor and Trinity Burial Ground (i.e. the additional trees affected by the footprint of the infrastructure rather than the	Adverse	Construction and Operation	Long term	• Tree planting as part of the proposed landscape scheme	Significant – large adverse

Description of effect	Adverse / Beneficial	Construction / Operation	Temporary / Long term	Proposed mitigation	Significance of residual environmental effect after mitigation
disinterment activity during construction)					
Effects on Project Landscape Character Area 4: Trinity Burial Ground	Adverse	Operation	Long term	• Tree planting and hard and soft landscaping as part of the proposed landscape scheme	Significant – large adverse
Visual effects on representative viewpoint 2: Myton Centre	Beneficial	Operation	Long term	• The proposed hard and soft landscape scheme including the introduction of a new public open space on the site of the former Myton Centre comprising: high quality paving, the relocation of the existing playground; tree and shrub planting including semi-mature species, lighting and seating opportunities	Significant – large beneficial
Visual effects on representative viewpoint 6: South of Mytongate	Adverse	Operation	Long term	• The proposed hard and soft landscape scheme	Significant - moderate adverse
Effects on visual receptors RR34 Kingston Wharf, RR36 The Wittington and Cat & RR38 The Ellerman Wilson Warehouse	Adverse	Operation	Long term	• The proposed hard and soft landscape scheme	Significant - moderate adverse
Effects on visual receptors RR9 The Manor, RR10 numbers 25-35 Brisbane Street and numbers 176-198 Porter Street and OSR1 Jubilee Arboretum	Beneficial	Operation	Long term	• The proposed hard and soft landscape scheme including the introduction of a new public open space on the site of the former Myton Centre comprising: high quality paving, the relocation of the existing playground; tree and shrub planting including semi-mature species, lighting and seating opportunities	Significant – moderate beneficial
Chapter 10 Ecology and nature conservation					
Trinity Burial Ground Site of Nature Conservation Interest (SNCI and UKBAP Priority habitat – permanent loss of one third of total area and temporary loss up to 7/8 of site including 40 mature trees.	Adverse	Construction and Operation	Long term	• Protection of retained trees with root protection areas. • Lighting during construction at night directed away from remaining trees.	Significant - major adverse
Humber Dock Marina UKBAP Priority habitat standing water; intertidal substrate foreshore (man-made) – permanent loss of small area under piling footprint	Adverse	Construction and Operation	Long term	• Habitat cannot be replaced.	Significant - major adverse

Description of effect	Adverse / Beneficial	Construction / Operation	Temporary / Long term	Proposed mitigation	Significance of residual environmental effect after mitigation
Chapter 11 Road drainage and the water environment					
Humber Floodplain: Changes in flood flow routes due to alteration of ground elevations. Potential effects on conveyance of flow.	Both adverse and beneficial	Construction and Operation	Temporary - during the proposed 5 year construction period and long term	• CEMP to include emergency procedures to evacuate construction footprint in the event of extreme flooding. • Temporary pumping arrangements within CEMP to discharge flood waters to sewer or surface waters subject to consent, only compliant water to be discharged to Humber Estuary, non-compliant water collected and discharged off-site. • Underpass drainage designed for 1 in 100-year, plus 30% allowance for climate change, rainfall event. • Emergency procedures in case of pump failure or extreme flooding event.	Significant – large / very large beneficial to very large adverse
Chapter 12 Geology and soils					
No significant adverse or beneficial residual effects					
Chapter 13 Materials					
No significant adverse or beneficial residual effects					
Chapter 14 People and communities					
Demolition of building on the Arco site (Option A only)	Adverse	Construction	Temporary - during the proposed 5 year construction period and long term	• The business would be relocated permanently to a new site.	Significant - moderate adverse
Demolition of the buildings on the Staples site (Option B only)	Adverse	Construction	Temporary - during the proposed 5 year construction period and long term	• The businesses would be relocated permanently to a new site.	Significant - moderate adverse
Demolition of the Myton Centre	Adverse	Construction	Long term	• This site will be used as replacement public open space after the construction is complete.	Significant - moderate adverse
Permanent loss of moorings at Humber Dock Marina	Adverse	Construction	Long term	• The moorings will be reconfigured to optimise the number of moorings available.	Significant - moderate adverse
Job creation and Gross Value Added (GVA)	Beneficial	Operation	Long term	• None	Significant - moderate beneficial

Description of effect	Adverse / Beneficial	Construction / Operation	Temporary / Long term	Proposed mitigation	Significance of residual environmental effect after mitigation
Development Land – facilitating development at development land sites within the WIA	Beneficial	Operation	Long term	• None	Significant - moderate beneficial
Chapter 15 Effects on all travellers					
No significant adverse or beneficial residual effects					
Chapter 16 Combined and cumulative					
Combined and cumulative effects during the Construction and Operation Phases of the Scheme are not anticipated to contribute beyond that of the effects identified in the preceding environmental chapters.					

17.6 Conclusion

17.6.1 There would be no significant adverse or beneficial residual effects as a result of the Scheme for air quality, geology and soils, materials and effects on all travellers.

17.6.2 In terms of operational road noise, 41 noise sensitive receptors would experience significant adverse residual effects of +3dB or greater. However 20 of these receptors would have been subject to such an increase even if the Scheme did not go ahead. Significant adverse residual effects are expected where increases of +1dB or greater in road traffic noise levels and where noise levels also exceed Significant Observed Adverse Effect Level (SOAEL) for 182 residential properties in the design year. However, whilst individual properties would experience significant adverse increases above SOAEL, overall fewer properties would experience noise levels greater than SOAEL due to the Scheme compared to without.

17.6.3 With the implementation of the Scheme, changes in road traffic noise are predicted to result in significant beneficial impacts at 124 noise sensitive receptors in the long term. Without the implementation of the Scheme, there would be no receptors with significant beneficial impacts.

17.6.4 It is anticipated that there would be significant adverse residual effects on some cultural heritage assets as a result of the Scheme. This includes temporary and long term significant adverse residual effects to Trinity Burial Ground archaeological remains and its setting. Significant major adverse residual effects will also arise from the dismantling of the Earl de Grey public house. In addition, temporary and long term significant adverse effects are predicted on the setting of the Old Town conservation area, the Statue of King William, Warehouse No. 6, Castle Buildings, Princes Dock and Humber Dock.

17.6.5 Within Trinity Burial Ground it is expected that the residual effects on landscape features arising from construction and after operation would be significant large adverse due to the loss of trees. Significant large adverse residual effects would also be expected as a result of tree removal requirements arising from disinterment methods. In addition, the landscape character of Trinity Burial Ground would experience significant large adverse residual effects.

17.6.6 The landscape assessment concludes that moderate adverse residual effects would occur to receptors in viewpoint 6 with significant moderate adverse residual effects experienced by three individual residential receptors located in close proximity to the Trinity Burial Ground. Significant moderate beneficial residual effects would be experienced by those receptors represented by the Myton Centre viewpoint 2. Two individual residential receptors and one open space receptor located in close proximity to the proposed green space at the Myton Centre would also experience significant moderate beneficial residual effects.

17.6.7 The ecology and nature conservation resource of the Scheme study area would experience significant temporary and residual major adverse effects. This results from the loss of one third of Trinity Burial Ground Site of Nature Conservation Interest and UKBAP Priority habitat and the significant tree removal required. In addition, the Humber Dock Marina UKBAP Priority habitat will lose a small area of habitat which cannot be replaced.

17.6.8 The road drainage and the water environment assessment concludes that there would be temporary and long term effects to the Humber Floodplain which would be both significant large to very large beneficial and very large adverse. It is expected that temporary and long term effects on the groundwater supply/quality for the Chalk aquifer would be neutral. Superficial deposits would experience significant slight to moderate adverse effects during construction only and would not be long term.

17.6.9 In terms of the people and communities assessment, significant effects on private residential property are not anticipated. There are temporary and permanent effects on businesses during construction which are considered to be moderate adverse with a residual significant effect. Effects on community land would be moderate adverse and significant during the construction stage. No additional effects would be anticipated during the operational stage however significant residual long term effects would remain due to the loss of moorings and loss of the Myton Centre.

17.6.10 Effects on development land are anticipated to be temporary slight adverse and not significant during construction, with a significant moderate beneficial effect in the longer term. Effects on economic development are considered to be slight beneficial during the construction stage and moderate beneficial during operation with long term significant benefits.

Glossary

Glossary term	Description
µg	Micrograms – i.e. a millionth of a gram. The symbol used at the beginning is the Greek letter 'mu'
Abatement notice	A notice that can be served by a local authority if they are satisfied that a noise problem amounts to a statutory nuisance.
Above Ordnance Datum (AOD)	Ordnance Datum is the standard measure of sea level in the UK, from which all heights are measured for mapping purposes
Advance Directional Sign (ADS)	A type of road sign used to give directional information to road users on the approach to junctions.
Aggressive chemical environment for concrete (ACEC)	Where chemical attack of buried concrete needs to be considered, the aggressive chemical environment for concrete is derived from Table A.2 of British Standard BS 8500-1:2006+A1:2012 Concrete.
Air absorption	Acoustic absorption refers to the process by which a material, structure, or object takes in sound energy when sound waves are encountered, as opposed to reflecting the energy.
Air Pollution Information System (APIS)	The UK Air Pollution Information System (APIS) provides a searchable database and information on pollutants and their impacts on habitats and species.
Air Quality Action Plan (AQAP)	Local authorities have a statutory duty to prepare an AQAP to identify how they will reduce emissions identified within the AQMA as quickly as possible, while avoiding undue impact on the motorist.
Air Quality Management Area (AQMA)	Local planning authorities are obliged to declare an AQMA in any area where there are, or are expected to be, exceedances of the relevant Air Quality Objectives. The authority declaring an AQMA is obliged to prepare a management plan to prevent or remove any such exceedances.
Air Quality Objective (AQO)	Targets set in the UK Air Quality Strategy, which represent specific concentrations of certain pollutants in the air. The concentrations vary from pollutant to pollutant, and there may be more than one AQO for each pollutant, depending on the method and timescale of measurement. The AQOs are intended to represent the concentration of any pollutant below which no effects on human health would be expected to occur, even in the most vulnerable individuals. If the concentration of any one pollutant goes above the level set in the AQO, an 'exceedance' is said to occur.
Air Quality Standard Regulations	Set by the Air Quality Standards Regulations 2010, which implement the 'limit values' set by European law (under the Directive on Ambient Air Quality and Clean Air for Europe – 2008/50/EC). The Air Quality Standards are generally the same as the relevant AQOs.
Air Quality Strategy (AQS)	The Air Quality Strategy (AQS) establishes the UK framework for air quality improvements. The air quality objectives in the AQS are a statement of policy intentions and policy targets. As such, there is no legal requirement to meet these objectives, although local authorities are also required to work towards achieving the AQS objectives.
Airborne noise	Airborne sound (or airborne noise) is sound that is transmitted through the air.
Alluvium	A deposit of clay, silt, and sand left by flowing floodwater in a river valley or delta, typically producing fertile soil.
Amenity	The pleasantness or attractiveness of a place' (Oxford Dictionary of English). Visual amenity is therefore the contribution of views towards the pleasantness or attractiveness of a place. The degree of visual amenity therefore varies between locations according to the quality of views available.
Anno Domini (AD)	"In the year of (our) Lord" shortened to AD or A.D. is used to refer to the years after the birth of Jesus.

Glossary term	Description
Annual Average Daily Traffic (AADT)	Represents the daily average number of vehicles using a particular section of the network for all days of the week within the month, averaged across the whole year.
Annual Average Weekly Traffic (AAWT)	Average of traffic flows for all weekdays (Monday to Friday) within the month, averaged across the whole year
Application Site	The extent of the development area for which Development Consent is being sought.
Aquifer	Water is present almost everywhere underground, but some geological formations are impermeable – meaning that water can hardly flow through them – and some are permeable – they contain fine holes that allow water to flow. Permeable formations that contain groundwater are known as aquifers.
Aquitard	An aquitard is a geologic formation or stratum that lies adjacent to an aquifer and that allows only a small amount of liquid to pass. If the water level - and thus the pressure - drops enough, water is slowly squeezed out of the large clayey layers - called aquitards - that more or less seal the aquifer, and an aquifer's compression becomes irreversible.
Archaeological Data Service (ADS)	The Archaeology Data Service is an open access digital archive for archaeological research outputs. The ADS carries out research, most of which focuses on resource discovery, cross-searching and interoperability with other relevant archives in the UK, Europe and the United States of America.
Archaeological Deposit Model	A method of identifying the character and degree of survival of buried archaeological remains over a specified area without necessarily excavating the whole area. A deposit model uses the results of previous excavations and other intrusive archaeological investigations to estimate the nature of the archaeology over a wider area.
Archaeological evaluation	A limited programme of non-intrusive and/or intrusive fieldwork which determines the presence or absence of archaeological features, structures, deposits, artefacts, or ecofacts within a specified area or site (IfA, 2009, Standard and guidance for archaeological field evaluation, 2).
Archaeological trial trenching	The excavation of a small sample of an area of potential archaeological interest, to confirm whether archaeological remains are actually present and obtain more information about them. This information is used to inform the impact assessment and the design of mitigation
Archaeology	The study of human history and prehistory through the excavation of sites and the analysis of artefacts and other physical remains.
Area of Search	An ‘Area of Search’ refers to an area selected for mineral exploration, for example, for use as aggregate
Area of Potential Concern (APC)	In contaminated land assessment, this is an area of soil or groundwater which may have been contaminated from historical use e.g. soil underlying a former gas works. The assessment of looks at whether the area has been contaminated, the extent of any contamination both laterally and with depth, and whether the contamination presents a hazard to potential users of the land or the environment.
Assessment of Implications on European Sites (AIES)	The process by which information on the implications of a NSIP development on European habitats, under the Conservation of Habitats and Species Regulations 2017 (Habitats Regulations) is systematically collected, assessed, reported, publicised and taken into account. Also known as a Habitats Regulation Assessment (HRA) for non-Highways England schemes.
Association of Noise Consultants (ANC)	The ANC is a trade association for acoustic, noise and vibration consultancy practices in the UK.
Atmospheric Dispersion Modelling System (ADMS)	A software programme used to model air pollution problems associated with networks of roads.
Attenuate / Attenuation	Any method used to control or slow down the rate of discharge of water drained off the road into local watercourses, to avoid the risk of causing floods.
At grade	On the same level i.e. an at grade pedestrian crossing would be one where the road lies at the same level as the pedestrian crossing.

Glossary term	Description
Automatic Urban Rural Network (AURN)	The AURN is the UK's largest automatic monitoring network and is the main network used for compliance reporting against the Ambient Air Quality Directives. It includes automatic air quality monitoring stations measuring oxides of nitrogen (NO_x), sulphur dioxide (SO_2), ozone (O_3), carbon monoxide (CO) and particles (PM_{10}, $PM_{2.5}$). These sites provide high resolution hourly information which is communicated rapidly to the public, using a wide range of electronic, media and web platforms.
Baseline	In EIA, 'baseline conditions' are the environmental conditions in existence just before the occurrence of an impact - i.e. they are the conditions that would be affected.
Benefit Cost Ratio (BCR)	The benefit cost ratio (BCR) is a representation of the amount of benefit being bought for every £1 of cost to the public purse - the higher the BCR the greater the benefit for every £1 spent. The BCR of a scheme is the discounted sum of all the future benefits divided by the discounted sum of the future cost and is represented by the formula - BCR = PVB / PVC - where PVB is the Present Value of Benefits and PVC is the Present Value of Costs. If the scheme returns a positive BCR value greater than 2, the scheme is said to provide good value for money on economic grounds. The benefits used to calculate a BCR include journey time savings, vehicle operating cost savings and accident savings. (If these increase as a result of the Scheme then there will be a dis-benefit). These savings are often split between consumer users, business users and public service vehicles. Benefits can also include savings resulting from the maintenance of roads after the implementation of the scheme when compared to the Do Minimum scenario. Costs include the construction costs of the scheme, which include capital costs of the scheme, land costs, supervision, etc. Costs during construction are also included. The costs also include costs to the government such as loses from indirect taxes. Benefits and costs are derived for a 60 year appraisal period. In order to compare costs and benefits that occur at different times throughout the appraisal period, discounting is employed to reduce these values back to a present value year which is currently 2002. This is based on the principal that society in general prefers goods and services now rather than at some point in the future.
Bias Adjustment	Diffusion tubes are a useful low-cost method for indicative monitoring of ambient nitrogen dioxide (NO^2) concentrations. However, diffusion tubes are affected by several sources of interference which can cause substantial under or overestimation (often referred to as 'bias') compared to the chemiluminescent analyser (defined within Europe as the reference method) Any such 'bias' is a problem in any situation where diffusion tube results are to be compared with air quality objectives. As a result, adjustments are applied to the diffusion tubes to account for this bias
Biodiversity	The variety of life on earth.

Glossary term	Description
Biodiversity Action Plan (BAP)	The UK Biodiversity Action Plan was produced in 1994 with an overall goal *"to conserve and enhance biodiversity within the U and contribute to the conservation of global; biodiversity through all appropriate mechanisms"*. The UK Biodiversity Steering Group was set up to prepare a detailed plan of action to achieve these objectives. There are now 45 national Habitat Action Plans and 391 Species Action Plans. The UK Biodiversity Steering Group recommended the production of Local Biodiversity Action Plans, which should have two main objectives – to reflect and help implement the national priorities identified in the UK Action Plans, and to identify and address local priorities and local distinctiveness. The Hull Biodiversity Action Plan shows how to conserve the biodiversity within Hull and contribute to improving biodiversity on a global scale. It also attempts to link up with the biodiversity plans of the wider Humber sub-Region. Highways England has produced a Biodiversity Action Plan which aims to help manage and enhance England's Strategic Road Network. This network stretches across England and covers an area of 25,000 hectares, including approximately 8,500 miles of road. The BAP contains a number of objectives and actions to protect a wide range of protected habitats including species rich grasslands, woodlands and wetlands; and supports and impacts upon a number of rare and protected animals and plants including barn owls, peregrine falcons, dormice, rare orchids and other wild plants.
Braided Stream	Braided streams occur in rivers with large sediment load. Braided rivers have a channel that consists of a network of small channels/streams separated by small and often temporary islands called aits or eyots.
British Geological Survey (BGS)	The British Geological Survey (BGS) is a partly publicly-funded body which aims to advance geoscientific knowledge of the United Kingdom landmass and its continental shelf by means of systematic surveying, monitoring and research.
Bronze Age	The Bronze Age is a period of time that occurred roughly between 3000 BC and 2500 BC.
Bund	A linear bank or mound usually built of earth.
Calculation of Road Traffic Noise (CRTN)	A computer model used to calculate the noise levels at any given location, identifying the contribution to that noise made by traffic.
Carbon dioxide equivalent (CO_2e)	The Kyoto Protocol defines six main greenhouse gases which cause climate change. Each gas has a different global warming potential. The mass of each gas emitted is commonly given as a carbon dioxide equivalent (CO_2e) to simplify reporting and to allow direct comparison of total impacts from all sources. CO_2e is commonly referred to as 'carbon'.
Carbon Emissions Calculation Tool (CECT)	The Highways England Carbon Emissions Calculation Tool (CECT), version 1.03, allows materials use to be quantified in terms of net volumes and carbon, allowing greater confidence in the detailed assessment of significance of the associated impacts.
Cartographic	The art or technique of making maps.
Catchment area	A drainage basin or catchment basin is an extent or an area of land where all surface water from rain, melting snow or ice converges to a single point at a lower elevation, usually the exit of the basin, where the waters join another body of water, such as a river, lake, reservoir, estuary, wetland, sea, or ocean.
Central reserve	The area that separates the two sides of a motorway/dual carriageway.
Chartered Institute of Ecology and Environmental Management (CIEEM)	A professional body for ecologists and environmental managers.

Glossary term	Description
City Centre Area Action Plan (CCAAP)	The CCAAP was published in February 2009 as part of the LDF to outline how the future development of the city centre would be taken forward. Due to the continuing impact of the recession, including the effects of the public sector funding cuts and possible changes to regional planning policies HCC formally withdrew the CCAAP on 15 July 2010 to allow the council to reassess how future development would be taken forward.
Clean Air Zone (CAZ)	CAZs are areas where there is a focus on improving air quality by reducing emissions.
Compliance Risk Road Network (CRRN)	To determine the study area for the compliance risk assessment, the local air quality study area is compared to the compliance risk road network in the Pollution Climate Mapping (PCM). A compliance risk road network (CRRN) is then defined where the two networks intersect, which then forms the basis for the assessment of compliance risk.
Compulsory Purchase Order (CPO)	Local authority procedure that allows the compulsory acquisition of land.
Conceptual Site Model (CSM)	The CSM forms the basis to investigate potential pollutant linkages via a source-pathway-receptor model.
Congestion Reference Flow (CRF)	The CRF of a link is an estimate of the Annual Average Daily Traffic (AADT) flow at which the carriageway is likely to be congested at peak periods on an average day.
Conservation Area	Areas of special architectural or historic interest, the character or appearance of which is desirable to preserve or enhance. Other features may contribute to the appearance of a conservation area such as trees or other buildings.
Construction Environmental Management Plan (CEMP)	A plan prepared by a contractor before the start of construction work detailing 'environmental aspects' that may be affected by the construction work and management methods to prevent or mitigate any such effects.
Consultation Report	A report forming part of the Development Consent Order application, reporting on the statutory consultation held.
Continuous flight auger	A technique used in construction to create a deep concrete foundation.
Contractor	The organisation that will undertake the construction of the works.
Cultural heritage	Cultural heritage is the legacy of physical artefacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations.
Cultural Heritage Liaison Group (CHLG)	Established with representatives from Historic England, Hull City Council (HCC) and Humber Archaeology Partnership (HAP) to ensure all are kept up to date with the Scheme and views are represented from members on approaches and methodologies to matters affecting cultural heritage interests.
Decibel (dB)	A measure of noise. Not on a linear scale i.e. 2 dB is 10 times as loud as 1dB, and 3 dB is 10 times as loud as 2 dB, and so on.
Delivery Partner	A delivery partner can be defined as a partner organisation with a client for project and programme delivery. The delivery partner is not typically part of the design and construction supply chain, but a partner to the client.
Deposit Model	In the field of archaeology, a deposit model is a method of identifying the character and degree of survival of buried archaeological remains over a specified area without necessarily excavating the whole area.
Dewatering	Construction dewatering describes removal or draining groundwater or surface water from a construction site by pumping or evaporation. On a construction site, this dewatering may be implemented before subsurface excavation for foundations, shoring, or cellar space to lower the water table.
Determining Authority	The relevant governing authority e.g. the Planning Inspectorate.
Development	The carrying out of building operations, engineering operations, mining operations or other operations in, on, over or under land or the making of any material change in the use of any buildings or other land.

Glossary term	Description
Development Consent Order (DCO)	The consent that the Planning Inspectorate can grant for construction of a Nationally Significant Infrastructure Project, under the Planning Act 2008 (as amended by the Localism Act).
Development Plan Document (DPD)	See Local Development Framework.
Diaphragm Wall	A diaphragm wall is a structural concrete wall constructed in a deep trench excavation, either cast in situ or using precast concrete components. Diaphragms walls are often used on congested sites, close to existing structures, where there is restricted headroom, or where the excavation is of a depth that would otherwise require the removal of much greater volumes of soil to provide stable battered slopes.
Differential Global Positioning System (GPS) (see also GPS)	Differential GPS (DGPS) is essentially a system to provide positional corrections to GPS signals. DGPS uses a fixed, known position to adjust real time GPS signals to eliminate errors. An important point to note is that DGPS corrections improve the accuracy of position data only.
Diffusion tube monitoring	Diffusion tubes are widely used in the UK for indicative measurement of ambient concentrations of nitrogen dioxide (NO_2) in the context of Local Air Quality Management.
Do minimum	A hypothetical scenario used to provide a realistic comparison of the effects of the scheme. The do minimum scenario includes any changes to the highway infrastructure that would occur even if the scheme did not go ahead, and any other developments in the surrounding area that would influence the movement of traffic and would occur independently of the Scheme.
Do something	The presence of the proposed scheme is referred to as the do something scenario. In EIA, the likely significant environmental effects need to be defined for the do minimum and do something scenarios in the baseline year and a future year, or series of future years depending on the environmental topic.
Drift Geology	In the UK, the term drift is commonly used to describe any deposits of quaternary or recent age.
Drinking Water Protected Areas (DrWPA)	Drinking Water Protected Areas (DrWPA) are, within the Water Framework Directive, where raw water is abstracted from rivers and reservoirs. Raw water needs to be protected to ensure that it is not polluted which could lead to additional purification treatment. To do this water companies and the Environment Agency identify raw water sources that are 'at risk' of deterioration which would result in the need for additional treatment. These zones are areas where the land use is causing pollution of the raw water. Action is targeted in these zones to address pollution so that extra treatment of raw water can be avoided.
Drinking Water Protected Areas Safeguard Zone	Safeguard Zones are one of the main tools for delivering the drinking water protection objectives of the Water Framework Directive. To do this Safeguard Zones are identified for any raw water sources that are 'at risk' of deterioration which would result in the need for additional treatment. These zones are areas where the land use is causing pollution of the raw water. Action is targeted in these zones to address pollution so that extra treatment of raw water can be avoided. Safeguard Zones are a joint initiative between the Environment Agency and water companies.
Dwelling	A building or place of residence.
Early Contractor Involvement (ECI)	A form of contract for major construction projects, in which the contractor is involved earlier than under a traditional contract, to ensure their contribution to relevant decision-making during the pre-construction phases.
Earthworks	The moving of soil/rock to reconfigure the topography of a site

Glossary term	Description
Ecological Clerk of Works (ECoW)	An Ecological Clerk of Works (ECoW) is an environmental or construction professional with direct responsibility for monitoring compliance on site with regard to ecological legislation, policy or mitigation. In particular the ECoW would have knowledge of protected species and undertake monitoring requirements at sensitive receptors such as a protected watercourse, or at static sensitivities such as Badger setts or more transient features such as nesting birds to ensure impacts from work activities are minimised. The ECoW may also prepare compliance reports for clients and stakeholders and advisory reports for site managers/staff and provide advice to contractors on the delivery of agreed mitigation measures.
Ecology	Ecology is the study of the distribution and abundance of organisms, the interaction between organisms, the interaction between organisms and their environment, and structure and function of ecosystems.
Embodied Carbon	The amount of carbon in materials which is released from material extraction, transport, manufacturing and related activities. This may be calculated from cradle to (factory) gate, cradle to (installation) site or from cradle to grave (final point of disposal).
Environment Agency	The public body within England responsible for: • regulating major industry and waste • treatment of contaminated land • water quality and resources • fisheries • inland river, estuary and harbour navigations • conservation and ecology The Environment Agency are also responsible for managing the risk of flooding from main rivers, reservoirs, estuaries and the sea.
Environmental Constraints Plan	A plan/drawing showing the environmental features present, that need to be/have been taken into account when designing a scheme.
Environmental Impact Assessment (EIA)	EIA is a procedure required under the terms of European Union Directives 85/337/EEC and 97/11/EC on assessment of the effects of certain projects on the environment. The procedure is a means of drawing together, in a systematic way, an assessment of a project's likely significant environmental effects. This helps to ensure that the importance of the predicted effects, and the scope for reducing them, are properly understood by the public and the relevant competent authority before it makes its decision.
Environmental Noise Directive (END)	This EU Directive provides a common basis for European Member States to prioritise action and develop measures for the control of environmental noise with regards to annoyance and sleep disturbance.
Environmental Permitting Regulations (EPR)	The Environmental Permitting Regulations (EPR) 2010 aims to protect groundwater and surface waters from pollution by controlling the inputs of potentially harmful and polluting substances. The Regulations implement the WFD and the Groundwater Daughter Directive 2006. The EPR replaced the Groundwater Regulations and those parts of the Water Resources Act (WRA) 1991 that relate to the regulation of discharges to controlled waters (including groundwater).
Equality, Diversity and Inclusion Tool (EDIT)	The Equality, Diversity and Inclusion sifting Tool (EDIT) helps project managers, designers and lead engineers to make evidence-based and informed decisions about their scheme, supporting the appropriate consideration of EDI issues in project design and development.
Ephemeral	A plant or animal that exists for a short period of time.
Estuarine habitat	Habitats associated with estuaries which include salt marshes, mangrove forests, mud flats, tidal streams, rocky intertidal shores, reefs, and barrier beaches.

Glossary term	Description
European Landscape Convention (ELC)	The European Landscape Convention of the Council of Europe promotes the protection, management and planning of the landscapes and organises international co-operation on landscape issues.
Examining Authority	The person(s) appointed by the Secretary of State (SoS) to assess the Development Consent Order application and make a recommendation to the SoS.
Explosive Ordnance Disposal (EOD)	The detection, evaluation, rendering safe, recovery and disposal of unexploded ordnance.
Faculty	Under English ecclesiastical law, permissions for the works within Trinity Burial Ground (which is consecrated) will be sought through a Faculty (The Faculty Jurisdiction Rules 2015), which is issued by the Diocese of York.
Flood Alert Area	Within a Flood Alert Area, the Environment Agency issues flood alerts to residents or businesses when flooding is possible and recipients of these alerts should prepare for flooding. Flood alerts cover larger areas than flood warnings and are issued more frequently.
Flood Estimation Handbook (FEH)	The Flood Estimation Handbook (FEH) and its related software offer guidance on rainfall and river flood frequency estimation in the UK. Flood frequency estimates are required for the planning and assessment of flood defences, and the design of other structures such as bridges, culverts and reservoir spillways.
Flood Warning Area	Within a Flood Warning Area, the Environment Agency issues flood warnings to residents or businesses when flooding is expected and recipients of these warnings are urged to take immediate action.
Funerary monuments	This is a list of types of funerary monument, a physical structure that commemorates a deceased person or a group. The term encompasses cenotaphs (‘empty tombs’), tomb-like monuments which do not contain human remains; and communal memorials to the dead (such as war memorials), which may or may not contain human remains.
Gaol	A place for the confinement of people accused or convicted of a crime (Old spelling of Jail).
Geographic Information System (GIS)	Digital maps and information that help make decisions and solve problems.
Geology	The study of the solid earth, the materials of which it is composed (principally rocks) and the processes by which they evolve.
Geomorphology	The study of landforms, their processes, form and sediments at the surface of the Earth.
Geophysical Survey	Ground-based physical sensing technique used for archaeological imaging or mapping.
Geotechnical	A geotechnical investigation is carried out to determine the geology of the site. Geotechnical investigations are performed by engineers or geologists to obtain information on the physical properties of soil and rocks around a site. Geotechnical investigation is a process in which the physical qualities of a site are evaluated in order to determine if the site is suitable and safe for the proposed purpose.
Glaciolacustrine deposits	Sediments deposited into lakes that have come from glaciers are called glaciolacustrine deposits. These lakes include ice margin lakes or other types formed from glacial erosion or deposition. Sediments in the bedload and suspended load are carried into lakes and deposited.
Global Positional System (GPS)	The Global Positioning System (GPS) is a satellite-based navigation system made up of at least 24 satellites. GPS works in any weather conditions, anywhere in the world, 24 hours a day, with no subscription fees or setup charges. The U.S. Department of Defense (USDOD) originally put the satellites into orbit for military use, but they were made available for civilian use in the 1980s.
Grade I Listed Building	Buildings are of exceptional interest, sometimes considered to be internationally important.
Grade II Listed Building	Buildings are nationally important and of special interest.
Grade II* Listed Building	Buildings are particularly important buildings of more than special interest.

Glossary term	Description
Grade separation	This is the process of aligning junctions where two or more roads coincide at different heights (known as grades) to minimise disruption of traffic and allow free flow movements as the roads cross over each other. Typical examples are junctions on motorways.
Grading out	Reducing the gradient of the slope away from the road to integrate it with the natural topography.
Greenfield runoff	The rate of discharge that would be expected from an area of un-developed land with entirely soil-covered, permeable surfaces. Such areas release water into watercourses much more slowly than areas with hard, impermeable surfaces.
Greenhouse Gas Emissions	Greenhouse gases (GHGs) are gases that absorb reflected energy from the sun, warming the Earth's atmosphere. They are recognised as contributing to climate change and are named as: carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, HFCs, and PFCs.
Ground flora	Small, non-woody plants growing at ground level within the wood, such as primroses, bluebells, celandine, etc.
Ground Investigation (GI)	The ground investigation is the most fundamental part of the site investigation to establish suitability for construction involving intrusive work such as trial pits and boreholes and which may include geophysical survey (GS), and soil and rock laboratory testing (LT) services .
Groundwater	Groundwater is the largest available reservoir of fresh water. Water falls as rain and snow onto the land; a proportion of this rainfall soaks into the soil. Once the needs of plant roots and soil moisture have been satisfied, the remaining water continues its journey downward to rock layers beneath the soil. These underground rock layers have the capacity to let water flow through them, either through large cracks and openings in the rock, or through tiny inter-connected spaces between individual rock grains. The water contained in these rocks is groundwater; and these bodies of rock are known as aquifers.
Guidelines for Landscape and Visual Impact Assessment (GLVIA)	A set of guidelines for the stated purpose, published jointly by IEMA and the Landscape Institute. The abbreviation GLVIA3 is used to infer the third edition.
Habitats Regulation Assessment (HRA)	The formal requirement to carry out a HRA is set out within Article 6 of the EC Habitats Directive 1992, and transposed into British law by the Conservation of Habitats & Species Regulations 2017. The purpose of the HRA is to identify any aspects of the Scheme that would have the potential to cause a likely significant effect on Natura 2000 or European sites (Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites), (either in isolation or in combination with other plans and projects), and to identify appropriate avoidance and mitigation strategies where such effects were identified.
Handover Environmental Management Plan (HEMP)	A plan prepared by the Contractor at the end of the scheme, before handing the scheme over to Highways England for long-term maintenance. The HEMP sets out the long-term maintenance and management works required to ensure the continued long-term effectiveness of the environmental mitigation measures and to prevent unexpected environmental impacts during the operation of the Scheme.
Headspace screening	Used as a preliminary screening tool to assess the concentration of volatile organic compounds (VOC) of a soil sample using a portable photo-ionisation detector (PID). A clean jar is half filled with soil, covered with aluminium foil and sealed. The headspace is allowed to equilibrate and the PID probe then inserted through the foil to record a total VOC concentration for headspace.
Heavy Duty Vehicle (HDV)	Heavy Duty Vehicles (HDVs) are a sum of Heavy Goods Vehicles (HGVs) and buses.
Heavy Goods Vehicle (HGV)	Term in the UK for goods vehicles over 3.5 tonnes Gross Vehicle Weight (GVW)

Glossary term	Description
Hedgerow	Any boundary line of trees or shrubs over 20m long and less than 5m wide at the base, where any gaps between the trees or shrub species are less than 20m wide (Defra, 2007).
Hibernacula	The place/structure/shelter chosen by an animal for hibernation
Highways England	Highways England is the public body that operates, maintains and improves England's motorways and major A roads.
Historic England	The public body that looks after England's historic environment, championing and protecting historic places, and helping people understand, value and care for them.
Historic Environment Record (HER)	A database maintained by individual counties or local authorities, containing records of archaeological sites, historic buildings and other aspects of the historic environment.
Historic landscape character types	Historic landscape character types are distinctive and repeated combinations of components defining generic historic landscapes such as 'ancient woodland' or 'parliamentary enclosure'. The types used in this study were defined based on evidence from historic maps and other sources.
Humber Strategic Economic Plan (SEP)	The Strategic Economic Plan (SEP) is the Humber Local Enterprise Partnership's overarching plan for growth through to 2020, setting the overall context and priorities for other more detailed plans and strategies that help to achieve our three key ambitions for the Humber.
Hydrocarbons	An organic compound of hydrogen and carbon which is the chief component of oil and petroleum.
Hydrostatic (pressure)	The pressure equivalent to that exerted on a surface by a column of water of a given height.
Impermeable	A surface which water cannot pass through and soak into the underlying ground. This means that all of the water will flow rapidly off the surface. In the case of a highway, it will flow rapidly off the road surface into the highway drainage system.
Intellectual Property	Intellectual property is a category of property that includes intangible creations of the human intellect, and primarily encompasses copyrights, patents, and trademarks. It also includes other types of rights, such as trade secrets, publicity rights, moral rights, and rights against unfair competition. The main purpose of intellectual property law is to encourage the creation of a wide variety of intellectual goods. To achieve this, the law gives people and businesses property rights to the information and intellectual goods they create, usually for a limited period of time.
Institute of Environmental Management and Assessment (IEMA)	A professional body for environmental managers and EIA professionals.
Institute of Field Archaeologists (IFA)	A professional body for archaeologists.
Interim Advice Note (IAN)	Guidance published by Highways England to modify/update guidance given within DMRB, in advance of the permanent replacement of the relevant sections of DMRB.
Iron Age	A period of time between 1200BC and 53BC.
Joint Waste Local Plan (JWLP)	The Joint Waste Local Plan (JWLP) 2004 for Hull City Council and East Riding of York Council serves to provide a clear guide to how and where waste produced in the joint plan area will be dealt with.
Landform	The combination of slopes and elevation that produce the form of the land.
Landscape Character Assessment (LCA)	This is the process of identifying and describing variation in character of the landscape. LCA documents identify and explain the unique combination of elements and features that make landscapes distinctive by mapping and describing character types and areas. The purpose of this process is to aid the formulation and implementation of planning policies relating to the landscape.

Glossary term	Description
Lead Local Flood Authority (LLFA)	Lead Local Flood Authorities (unitary authorities or county councils) are responsible for developing, maintaining and applying a strategy for local flood risk management in their areas and for maintaining a register of flood risk assets. They also have lead responsibility for managing the risk of flooding from surface water, groundwater and ordinary watercourses.
Lens	A 'lens' in this context is a geological deposit that is thick in the middle and thinner near its edges, usually limited in extent and either occurring within a more extensive deposit or sandwiched between two more extensive deposits.
Light Detection And Ranging (LIDAR)	Also referred to as laser scanning. The technology is not new but the relatively recent integration with differential GPS (DGPS) and inertial measurement data has provided a step change in the accuracy of airborne sensors over the last few years. The laser scanning unit is mounted either in a pod below a helicopter or through a hole in the fuselage of fixed wing aircraft. The laser source emits light pulses towards a rotating mirror which re-directs the pulses down in a scanning pattern. This pattern can either be a simple side-to-side motion or in some systems as a helical spiral. The frequency of laser pulses emitted was typically in the range from 5000 to 55,000 per second but the latest systems are now operating at up to 100,000 pulses per second. The pulses are returned to a receiver in the sensor after reflecting back from both the ground surface and objects above ground such as structures, trees and buildings. Pulse travel times are recorded and the distance from the sensor to the scanned object or ground surface can then be determined using speed of light calculations. As the exact position of the sensor is known from DGPS and inertial data the xyz co-ordinates of each point of reflection can be derived.
Light Duty Vehicle (LDV)	Gasoline vehicles up to 3500kg Gross Vehicle Weight (GVW),
Limit value	The concentration of certain specific pollutants in the air that are not to be exceeded, under the Air Quality Standards that implement the European Directive on Ambient Air Quality and Clean Air for Europe – 2008/50/EC.
Link	A 'link' is the stretch of road between two junctions. For major strategic routes such as motorways, the volume of traffic along a link remains constant along its whole length, because traffic can only join or leave at the junctions. For many other roads this is not the case, because traffic can join or leave at other access points such as private properties, businesses, etc
Lithic	Containing abundant fragments of previously formed rock i.e. a lithic sandstone.
Local Authority Pollution Prevention Control (LAPPC)	Under which local authorities are responsible for granting permits for, and regulation of, industrial activities in category A(2) or B as defined in the Environmental Permitting (England and Wales) Regulations 2010.

Glossary term	Description
Local Development Framework (LDF)	Local planning authorities must prepare a local plan known as a Local Development Framework (LDF) which includes Development Plan Documents (DPDs). These are very important when deciding planning applications. Independent planning inspectors must look at all DPDs that local authorities in England prepare for an examination. The examination is the last stage of the process for producing a DPD. The process should have fully involved everyone who has an interest in the document and they should have had the chance to comment. The LDF also includes Supplementary Planning Documents (SPDs), which expand polices set out in DPDs or provide additional detail; a Statement of Community Involvement; the Local Development Scheme (which sets out the programme for the production of documents) and the Annual Monitoring Report. Within the local planning authority's LDF, DPDs must be 'sound' (section 20 of the Planning and Compulsory Purchase Act 2004) both in terms of their content and the process by which they are produced. They must also be founded on a robust and credible evidence base.
Local Enterprise Partnership (LEP)	In England, local enterprise partnerships (LEPs) are voluntary partnerships between local authorities and businesses set up in 2011 by the Department for Business, Innovation and Skills to help determine local economic priorities and lead economic growth and job creation within the local area. They carry out some of the functions previously carried out by the regional development agencies which were abolished in March 2012.
Local Flood Risk Management Strategy (LFRMS)	A Local Flood Risk Management Strategy sets out how a local authority plans to manage local flood risk, as required by the government's Flood and Water Management Act 2010. It brings together information on flooding and identifies ways of managing risk in partnership with the relevant Risk Management Authorities
Lower Explosive Limit (LEL)	The lowest concentration in air at which a gas or vapour will explode upon ignition.
Lowest Observed Adverse Effect Level (LOAEL)	Below this level, there is no detectable effect on health and quality of life due to noise.
Made Ground	Ground created by infilling an area with material taken from elsewhere; typically reworked soils, rubble, gravel, sand or former waste material e.g. ash.
Mesolithic	A period of time between 20,000 to 10,000 years ago.
Mitigate	Actions that can avoid or reduce adverse impacts.
Modelling	Various processes involving the generation and management of digital representations of physical and functional characteristics of places.
National Character Area (NCA)	Landscape Character Areas defined at a national level by Natural England.
National Heritage List (NHL)	The Historic England National Heritage List for England is an up to date, register of all nationally protected historic buildings and sites in England - listed buildings, scheduled monuments, protected wrecks, registered parks and gardens, and battlefields.
National Network National Policy Statement (NN NPS)	The NPS for National Networks (NN NPS) sets out *"the need for, and the Government's policies to deliver development of nationally significant infrastructure projects on the national road and rail networks"*.
National Planning Policy Framework (NPPF)	A statement of central government guidance on planning policy, replacing the previous system of topic-specific Planning Policy Statements (PPS) and Planning Policy Guidance Notes (PPG) for use in England.
National Planning Policy Guidance (NPPG)	The National Planning Practice Guidance (NPPG) is a web-based resource which brings together planning guidance on various topics into one place. It was launched in March 2014 and coincided with the cancelling of the majority of Government Circulars which had previously given guidance on many aspects of planning.

Glossary term	Description
National Planning Policy for Waste (NPPW)	The National Planning Policy for Waste (NPPW, October 2014) provides waste planning policies to support the NPPF, the WMPE and national policy statements for waste water and hazardous waste, or any successor documents.
National Policy Statement (NPS)	National Policy Statements (NPS) are produced by Government. They give reasons for the policy set out in the statement, and must include an explanation of how the policy takes account of Government policy relating to the mitigation of, and adaptation to, climate change.
Nationally Significant Infrastructure Project (NSIP)	Nationally Significant Infrastructure Project - any infrastructure project that is deemed, according to the criteria set in the Planning Act 2008 (as amended), to be nationally significant. Such projects are authorised through a new statutory process that requires an application for a DCO, rather than either a conventional planning application or the traditional model through the publication of Statutory Orders and the holding of Public Inquiries.
Natura 2000	In Europe, the Natura 2000 network of protected areas is the centrepiece of EU nature and biodiversity policy, established under the Habitats and Birds Directives.
Natural England	A public body responsible for the protection of the natural environmental and landscape in England and the management of National Nature Reserves (NNR) and Sites of Special Scientific Interest (SSSI).
Neolithic	A period of time between 10,000 to 6,000 years ago.
Night Noise Guideline (NNG)	Guidelines for the threshold of night noise exposure indicated by L night as defined in the Environmental Noise Directive (2002/49/EC), L night value of 40 dB should be the target of the night noise guideline (NNG) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly.
Nitrate Vulnerable Zone (NVT)	Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution. They include about 58% of land in England. The Department for Environment, Food and Rural Affairs (Defra) reviews NVZs every 4 years to account for changes in water pollution. NVZs for 2017 to 2020 started on 1 January 2017. They include new areas of NVZs, and exclude areas that have been de-designated.
Noise Action Plan	Noise action plans provide a framework to manage environmental noise and its effects. They also aim to protect quiet areas in agglomerations (large urban areas) where the noise quality is good.
Noise Contour	A noise contour is a line on a map that represents equal levels of noise exposure.
Noise Important Area (NIA)	The Noise Action Plan identifies these areas where the population affected by the highest noise levels from major roads are located according to the results of strategic noise maps.
Noise Measurement Survey	A noise measurement survey is conducted in an environment with a sound level meter to establish whether noise is likely to be harmful.
Noise Policy Statement for England (NPSE)	Issued by the Department for the Environment, Food and Rural Affairs (DEFRA) in 2010, its purpose is to promote *"good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."*

Glossary term	Description
Noise Propagation Model	Modelling is a means of estimating noise for a specific set of conditions, including for example: • An approximation of the noise source or sources for which associated environmental noise levels are of interest; • An approximation of the physical environment through which noise will transmit from the noise source(s) to the location or region of interest. This includes the ground terrain, the built environment, and atmospheric condition (e.g. wind, temperature, humidity); • An approximation of the way in which sound will travel from the input noise source(s) via the input physical environment to the received location or region of interest.
Non-Motorised User (NMU)	Pedestrians, cyclists, disabled users and equestrians.
NO_2 Nitrogen dioxide	A chemical pollutant emitted from vehicle exhausts.
NOx	Oxides of nitrogen which include NO (Nitrogen oxide) and NO2 Nitrogen dioxide.
Nuisance	Nuisance is concerned with the protection of the environment and the protection of a person's use of his/her own land and land over which there is public right of way.
Oblique (angle of view)	An angled view rather than a direct view, in which features would be less noticeable.
Office for National Statistics (ONS)	The Office for National Statistics is the executive office of the UK Statistics Authority, a non-ministerial department which reports directly to the UK Parliament. It is responsible for collecting and publishing statistics related to the economy, population and society at national, regional and local levels. It also conducts the census in England and Wales every 10 years.
On line widening	The widening of an existing carriageway, making use of temporary traffic management measures to segregate construction activity and ongoing traffic movement.
Opening Year	The year following the handover of the Scheme to the client.
Operational Period	The period where the Scheme is completed and is open to the public for its intended use.
Peak Particle Velocity (PPV)	Ground vibration is measured in terms of Peak Particle Velocity (PPV) with units in mm/s or mm/s-1 Particle velocity is the velocity of a particle (real or imagined) in a medium as it transmits a wave. The SI unit of particle velocity is the metre per second (m/s). In many cases this is a longitudinal wave of pressure as with sound, but it can also be a transverse wave as with the vibration of a taut string.
Perched groundwater	Groundwater occurring in a saturated zone separated from the main body of groundwater by unsaturated rock.
Perennial	Having a life cycle of more than two years.
Photo-Ionization Detector (PID)	A Photo-Ionization Detector (PID) is used to assess the presence of volatile organic vapours in soil samples, potentially as a result of hydrocarbon fuel or other volatile organic contaminants.
Physical Agents	Physical agents are sources of energy that may cause injury or disease. Examples include Noise, Vibration, Optical Radiation and Electromagnetic Fields.
Piling	The process required to construct foundations by inserting material into the ground to create a secure base
Planning Inspectorate	The work of the Planning Inspectorate includes processing planning and enforcement appeals; holding examinations into local plans and community infrastructure levy charging schedules; and a wide variety of other planning related casework.
Plant	Construction machinery and equipment.
PM 10	Particulate matter with a diameter of 10 micrometres or less – a pollutant emitted from vehicle exhausts.

Glossary term	Description
Pollutant Linkage	This is the potential linkage between a pollutant source (i.e. hazard) and a sensitive receptor via a viable environmental pathway. The degree of significance of a pollutant linkage depends on a number of factors including the hazardous nature of the source, the type of exposure pathway (such as direct contact with contaminants) and the sensitivity of the receptor.
Pollution Climate Mapping (PCM)	The Pollution Climate Mapping (PCM) model is run by Defra and a collection of models designed to fulfil part of the UK's EU Directive (2008/50/EC) requirements to report on the concentrations of particular pollutants in the atmosphere. It is used to produce background maps 1x1 km grids of pollutant concentrations for the UK.
Polycyclic Aromatic Hydrocarbon (PAH)	These are a group of organic chemicals, commonly found in material or substances which have been burnt. Many PAHs are known carcinogens and are ubiquitous in the environment, occurring naturally in some hydrocarbon mixtures deriving from minerals, such as coal or petroleum. They are also generated in some industrial processes and, for example, produced during coking, tar distillation and smelting.
Principal Aquifer	Strata that has high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage and may support water supply and/or river base flow on a strategic scale.
Prehistoric	Pertaining to the time or a period prior to recorded history.
Preliminary Environmental Information (PEI)	Information that the applicant must publicise before carrying out consultation of the community in advance of applying for a DCO, if the scheme concerned is subject to a requirement for EIA.
Project Control Framework (PCF)	Highways England's project management life cycle for Major Projects.
Public Open Space (POS)	Open space of public recreational value, including not just land and parks, but also inland bodies of water such as rivers, canals, lakes and reservoirs which offer important opportunities for sport and outdoor recreation.
Public Right of Way (PRoW)	Includes public footpaths, bridleways and restricted byways.
Public Sector Equality Duty (PSED)	The Public Sector Equality Duty (PSED) requires public bodies to have due regard to the need to eliminate discrimination, advance equality of opportunity and foster good relations between different people when carrying out their activities.
Public Works	Public facilities and improvements financed by the government for the public good to include hospitals, bridges, highways, and dams.
Pulverised Fuel Ash (PFA)	A by-product of pulverised fuel (typically coal) fired power stations. The fuel is pulverised into a fine powder, mixed with heated air and burned. The resultant material is used as engineering fill and as a component for concrete. The blocks are lightweight and have excellent thermal insulation properties.
Ramsar	The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.
Receptor	The 'receptor' is the existing environmental feature that would be affected by an impact – for instance, the population of a protected species, or a specific archaeological site, or the occupants of a residential property.
Registered Parks & Gardens	The English Heritage 'Register of Historic Parks and Gardens of special historic interest in England', established in 1983, currently identifies over 1,600 sites assessed to be of national importance.
Remediation	The removal of pollution or contaminants from environmental media such as soil, groundwater, sediment, or surface water.
Resonances	The reinforcement or prolongation of sound by reflection from a surface or by the synchronous vibration of a neighbouring object.
Riparian	Relating to wetlands adjacent to rivers and streams.
Roman Period	Period in time of around 500BC and 476 AD.
Road Investment Strategy (RIS)	The first 'Road investment strategy' (RIS 1) from 2015 to 2020, outlines a long-term programme for England's motorways and major roads with the stable funding needed to plan ahead.

Glossary term	Description
Routine runoff	Water draining from the road surface into nearby watercourses whenever it rains, which tends to wash contaminants from the road surface into the nearby watercourses.
Scheduled Monument (SM)	A scheduled monument is a nationally important historic building or site that is included in the Schedule of Monuments for legal protection kept by the Secretary of State for Digital, Culture, Media and Sport. The regime is set out in the Ancient Monuments and Archaeological Areas Act 1979. Historic England takes the lead in identifying sites in England which should be placed on the schedule.
Scoping Opinion	See Scoping Report.
Scoping Report	Regulation 10 of the EIA Regulation allows developers to obtain a formal (scoping) opinion from the relevant planning authority on what should be included in the Environmental Statement (ES). This ensures that the local planning authority, or the Secretary of State and the relevant consultees can consider the scheme and the likely impacts at an early stage and to focus the EIA process on those which are relevant. At the conclusion of this scoping stage, the decisions are brought together in a Scoping Report.
Scrub habitat	Scrub is an intermediate habitat between herbaceous vegetation (e.g. grassland, heathland and fen) and woodland, which is the climax plant community in most areas. It normally develops in areas with little or no use or management, especially grazing or cutting.
Severance	The separation of residents from facilities and services in their community. The separation may be a physical barrier, e.g. fence, or a perceived barrier, e.g. busy road, which hinders or deters the movement of vulnerable users or requires a significant reorganisation of their activities. Severance may also relate to animals unable to cross the road e.g. when solid crash barriers are used
Significant Observed Adverse Effect Level (SOAEL)	The noise level above which significant adverse effects on health and quality of life occur.
Site of Community Importance (SCI)	Sites of Community Importance (SCIs) are established under the European Union Habitats Directive (92/43/EEC). Article 1(k) of the Habitats Directive defines an SCI as *"a site which, in the biogeographical region or regions to which it belongs, contributes significantly to the maintenance or restoration at a favourable conservation status of a natural habitat type or of a species and may also contribute significantly to the coherence of Natura 2000, and/or contributes significantly to the maintenance of biological diversity within the biogeographic region or regions concerned"*. Sites of Community Importance (SCIs) are the pre-requisite step for establishing Special Areas of Conservation (SACs).
Site of Nature Conservation Interest (SNCI)	Also known as a Site of Importance for Nature Conservation (SINC) this is a designation used by local authorities in the UK for sites of substantive local nature conservation value.
Site of Special Scientific Interest (SSSI)	A statutory designation under the Wildlife and Countryside Act 1981 (as amended), protecting nationally important wildlife sites, habitats and geological sites.
Site Waste Management Plan (SWMP)	A plan which specifies how waste generated throughout the construction works will be managed and volumes estimated. This includes minimisation, storage, segregation, re-use and final disposal of wastes generated.
Sites and Monuments Record (SMR)	Also known as Historic Environment Records, information relating to the historic environment which may be held by County Councils, District Councils or Unitary Authorities.
Special Area of Conservation (SAC)	Strictly protected sites designated under the EU Habitats Directive, representing internationally important, high-quality conservation sites that significantly contribute to conserving the 189 habitat types and 788 species identified in Annexes I and II of the Directive (as amended).

Glossary term	Description
Special Protection Area (SPA)	A designation under the European Union Directive on the Conservation of Wild Birds under which Member States of the EU have a duty to safeguard the habitats of migratory birds and certain particularly threatened birds. Potential SPAs are termed pSPAs.
Soil screening values	Used to compare the results from the chemical analysis of soil samples in the assessment of land contamination. Derived from ecotoxicological and exposure data, screening values may vary depending on the land use scenario and specific exposure pathways. Generic Assessment Criteria (GAC) assuming a commercial land use has been used to assess potential impacts to human health for this Scheme.
Solid Geology (Bedrock)	This comprises the native consolidated rock underlying the surface soils or drift deposits.
Source-Pathway-Receptor model	A conceptual site model used to investigate the potential pollutant linkages whereby source(s) of contamination (or hazard) are identified which could present a risk to a receptor (e.g. construction worker, groundwater). The source and receptor must be linked by a viable exposure pathway to be considered as a pollutant linkage.
Source Protection Zone (SPZ)	The Environment Agency have defined Source Protection Zones (SPZs) for groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk. The maps show three main zones (inner, outer and total catchment) and a fourth zone of special interest, which we occasionally apply, to a groundwater source. The Environment Agency use the zones in conjunction with their Groundwater Protection Policy to set up pollution prevention measures in areas which are at a higher risk, and to monitor the activities of potential polluters nearby.
Standard Occupational Classification (SCO)	Across a wide variety of statistical sources and for many different functions, the SOC provides a common classification of occupational information. It has been adopted by most government departments and agencies responsible for the production of occupationally classified information or the processing of occupational data.
Statement of Community Consultation (SoCC)	A statement published by the proposer of a Nationally Significant Infrastructure Project (NSIP), detailing how they intend to consult the community about their project before applying for a DCO. Required under the Planning Act 2008 as amended by the Localism Act 2011.
Strategic Flood Risk Assessment (SFRA)	Local planning authorities are required to carry out a strategic flood risk assessment (SFRA) to assess flood risk in the local area, and the risks to and from surrounding areas. This is a requirement of the National Planning Policy Framework (NPPF) which requires that Local Plans should be supported by a Strategic Flood Risk Assessment (SFRA).
Supplementary Planning Document (SPD)	See Local Development Framework.
Tall ruderal habitat	Stands of tall perennial or biennial herbs such as common nettle or rosebay willowherb.
Temperature inversion	A reversal of the normal behaviour of temperature in the troposphere (the region of the atmosphere nearest the Earth's surface), in which a layer of cool air at the surface is overlain by a layer of warmer air. (Under normal conditions air temperature usually decreases with height.) Inversions play an important role in determining cloud forms, precipitation, and visibility. An inversion acts as a cap on the upward movement of air from the layers below.
Terrestrial habitat	Terrestrial habitats are types of habitat that are found on land, such as forests, grasslands, deserts and rainforests. They are typically defined by factors such as plant structure (trees and grasses), leaf types (e.g. broadleaf and needleleaf), plant spacing (forest, woodland, savanna) and climate.

Glossary term	Description
Topography	Topography is the study and description of the physical features of an area, for example its hills, valleys, or rivers, or the representation of these features on maps.
Traffic management	Traffic Management is the practice of managing the existing traffic environment to allow contractors to perform work duties safely without the possibility of incident or injury through conflict with traffic flows.
Traffic Noise Index (TNI)	A method devised to measure annoyance responses to motor vehicle noise taking into account the traffic flows.
Trans European Transport Network	A network of roads identified by the European Union as key to the efficient operation of businesses across and within country borders.
Transport Analysis Guidance (webTAG)	Department for Transport web based guidance on the appraisal of transport strategies and projects, providing a framework for decision-making on the funding of schemes.
Treatment	Any method used to improve the quality of water before discharge through the removal of sediment or pollutants.
Trial trenching	See 'Archaeological trial trenching'.
Uncertainty log	A document which highlights all the local and external uncertainties and factors likely to affect the traffic / patronage, revenues and delivery of the Scheme benefits. The uncertainty log needs to include those factors that have an individually minor effect, as the cumulative effect of minor factors may be a material consideration.
Unexploded ordnance	Unexploded ordnance (UXO, sometimes abbreviated as UO), unexploded bombs (UXBs), or explosive remnants of war (ERW) are explosive weapons (bombs, shells, grenades, land mines, naval mines, cluster munition, etc.) that did not explode when they were employed and still pose a risk of detonation, sometimes many decades after they were used or discarded.
United Nations Economic Commission for Europe (UNECE)	UNECE's major aim is to promote pan-European economic integration. UNECE includes 56 member states in Europe, North America and Asia. However, all interested United Nations member states may participate in the work of UNECE. Over 70 international professional organizations and other non-governmental organizations take part in UNECE activities.
Unproductive strata	Drift deposits with low permeability that have negligible significance for water supply or river base flow.
Utilities	Useful public services such as electricity, gas, water, cable and telephone.
Vibratory compaction	Compaction is a process of increasing soil density and removing air, usually by mechanical means. Consequential (or accidental) compaction, and thus settlement, can occur due to vibration (piling, traffic, etc.) or self-weight of loose fill.
Vulnerable Users	Pedestrians, cyclists, horse riders and people with disabilities collectively known as 'vulnerable users'.
Waste and Resources Action Programme (WRAP)	An organisation that works in partnership with government and business to improve resource efficiency and reduce the generation of waste.
Waste Management Plan for England (WMPE)	The Waste Management Plan for England (WMPE, December 2013) sets the obligation to implement measures to ensure that at least 70% by weight of construction and demolition waste is subjected to material recovery by 2020.
Waste Prevention Programme for England (WPPE)	The Waste Prevention Programme for England (WPPE, December 2013) is a requirement of the Waste Framework Directive (2008/98/EC) and sets objectives to help people and organisations make the most out of opportunities to save money by reducing waste.
Water Framework Directive (WFD)	The Water Framework Directive (Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy) is a EU directive which commits EU member states to achieve good qualitative and quantitative status of all water bodies (including marine waters up to one nautical mile from shore).
WEBTAG	See 'Transport Analysis Guidance'.

Glossary term	Description
WebTRIS	Highways England's web based Traffic Information System (formerly HATRIS) hosting traffic flow data for external users. The new platform uses Google Maps with count site overlays and bespoke downloadable reporting capabilities.
World Health Organization (WHO)	The World Health Organization is a specialized agency of the United Nations that is concerned with international public health. It was established on 7 April 1948 and headquartered in Geneva, Switzerland.
World Heritage Site	A landmark or area which is selected by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as having cultural, historical, scientific or other form of significance, and is legally protected by international treaties. The sites are judged important to the collective interests of humanity.
Zone of Visual Influence (ZVI) / Zone of Theoretical Visibility (ZTV)	The area within which a scheme may be visible and may influence the quality of views. This covers approximately all land from which the scheme is visible. It is limited by topographic features such as hills and valleys, and by visual barriers such as woodland and buildings.

Abbreviations

AADT	Annual Average Daily Traffic
AAWT	Annual Average Weekly Traffic
ACEC	Aggressive Chemical Environment for Concrete
ACM	Asbestos Containing Materials
AD	Anno Domini
ADMS	Atmospheric Dispersion Modelling System
ADS	Advance Directional Signs
ADS	Archaeological Data Service
AIES	Assessment of Implication on European Sites
ANC	Association of Noise Consultants
AOD	Above Ordnance Datum
APC	Areas of Potential Concern (contamination)
APCh	Areas of Potential Change
APIS	Air Pollution Information System
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AQS	Air Quality Strategy
ARN	Affected Road Network
AURN	Automatic Urban Rural Network
BAME	Black, Asian or Minority Ethnic groups
BAP	Biodiversity Action Plan
BCR	Benefit Cost Ratio
bgl	below ground level
BGS	British Geological Survey

BPM	Best practicable means
CAD	Computer Aided Design
CAZ	Clean Air Zone
CCAAP	City Centre Area Action Plan
CCRA	Climate Change Risk Assessment
CCTV	Closed Circuit Television
CDEW	Construction, Demolition and Excavated Waste
CECT	Carbon Emissions Calculation Tool (Highways England)
CEMP	Construction Environmental Management Plan
CFA	Continuous Flight Auger
CHLG	Cultural Heritage Liaison Group
CIEEM	Chartered Institute of Ecology and Environmental Management
CIRIA	Construction Industry Research and Information Association
CL:AIRE	Contaminated Land: Application in Real Environments
COI	Central Office of Information
CPO	Compulsory Purchase Order
CRF	Congestion Reference Flow
CROW	Countryside Rights of Way
CRRN	Compliance Risk Road Network
CRTN	Calculation of Road Traffic Noise
CSM	Conceptual Site Model
CTC	Carbon Tool Calculator
DAS	Discretionary Advice Service
dB	Decibel
DCO	Development Consent Order
DEFRA	Department of the Environment, Food and Rural Affairs
DEM	Digital Elevation Model

DfT	Department for Transport
DGPS	Differential Global Positioning System
DMRB	Design Manual for Roads and Bridges
DO	Dissolved Oxygen
DrWPA	Drinking Water Protected Area
DWS	Drinking Water Standards
EA	Environment Agency
EAR	Environmental Assessment Report
ECI	Early Contractor Involvement
ECoW	Ecological Clerk of Works
EDI	Equality, Diversity and Inclusion
EDIT	Equality, Diversity and Inclusion Tool
EHO	Environmental Health Officer
EIA	Environmental Impact Assessment
ELC	European Landscape Convention
EMP	Environmental Management Plan
END	Environmental Noise Directive
EOD	Explosive Ordnance Disposal
EPR	Environmental Permitting Regulations
EPS	European Protected Species
EQS	Environmental Quality Standard
ERoYC	East Riding of Yorkshire Council
ES	Environmental Statement
ESSR	Environmental Statement Scoping Report
EU	European Union
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment

GAC	Generic Assessment Criteria
GHG	Greenhouse Gas
GI	Ground Investigation
GIS	Geographic Information System
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GPS	Global Positioning System
GWMU	Groundwater Management Unit
GSV	Gas Screening Value
GVW	Gross Vehicle Weight
HAIG	Hull Access Improvement Group
HAP	Humber Archaeological Partnership
HAPs	Habitat Action Plans
HATRIS	Highways Agency Traffic Information System (now updated by WebTRIS)
HAWRAT	Highways Agency Water Risk Assessment Tool
HBP	Hull Biodiversity Partnership
HCC	Hull City Council
HDV	Heavy Duty Vehicle
HE	Highways England
HEMP	Handover Environmental Management Plan
HER	Historic Environment Records
HGV	Heavy Goods Vehicle
HHJV	Hyder Halcrow Joint Venture
HLCU	Historic Landscape Character Units
HRA	Habitats Regulations Assessment
HRA	Hot Rolled Asphalt
HSMR	Humber Sites and Monuments Record

Humber INCA	Humber Industries Nature Conservation Association
HUMMS	Hull East-West Corridor Multi Modal Study
IAN	Interim Advice Note
IEMA	Institute of Environmental Management and Assessment
IFA	Institute of Field Archaeologist
IP	Inter-Peak
IPC	Infrastructure Planning Commission
JNCC	Joint Nature Conservation Committee
JWLP	Joint Waste Local Plan
KSI	Killed or Seriously Injured
LAPPC	Local Authority Pollution Prevention Control
LAQM	Local Air Quality Management
LBAP	Local Biodiversity Action Plan
LCA	Landscape Character Area
LDF	Local Development Framework
LDV	Light Duty Vehicle
LED	Light-Emitting Diode
LEL	Lower Explosive Limit
LEP	Local Enterprise Partnership
LFRMS	Local Flood Risk Management Strategy
LGBT	Lesbian, Gay, Bisexual and Transgender
LIA	Local Impact Area
LIDAR	Light Detection And Ranging
LLFA	Lead Local Flood Authority
LLTI	Limiting Long Term Illness
LOAEL	Lowest Observed Adverse Effect Level

LSE	Likely Significant Effects
LTT	Long Term Trend
MAC	Managing Agents Contract
MAGIC	Multi-Agency Geographic Information for the Countryside
mbgl	Metres Below Ground Level
MEWP	Mobile Elevating Work Platforms
MLP	Materials Logistics Plan
MMGJV	Mott MacDonald Grontmij Joint Venture
MMO	Marine Management Organization
MMP	Materials Management Plan
MMS	Multi Modal Study
MMSJV	Mott MacDonald Sweco Joint Venture
MPH	Miles Per Hour
NCA	National Character Area
NDD	Network Delivery and Development
NE	Natural England
NERC	Natural Environment and Rural Communities
NHL	National Heritage List (English Heritage)
NIA	Noise Important Area
NMM	Network Management Manual
NMU	Non-Motorised User
NNG	Night Noise Guideline
NN NPS	National Networks National Policy Statement
NPPF	National Planning Policy Framework
NPPG	National Planning Policy Guidance
NPPW	The National Planning Policy for Waste
NPS	National Policy Statement

NPSE	Noise Policy Statement for England
NS	Network Services
NSIP	Nationally Significant Infrastructure Project
NVZ	Nitrate Vulnerable Zone
OCEMP	Outline Construction Environmental Management Plan
ONS	Office for National Statistics
ORP	Oxygen Reduction Potential
OSWMP	Outline Site Waste Management Plan
PAH	Polycyclic Aromatic Hydrocarbon (also Polyaromatic Hydrocarbon)
PCF	Project Control Framework
PCM	Pollution Climate Mapping
PEIR	Preliminary Environmental Information Report
PFA	Pulverised Fuel Ash
PHE	Public Health England
PIA	Personal Injury Accident
PID	Photo-Ionization Detector
PLCA	Project Landscape Character Area
PMA	Private Means of Access
PPG / PPS	Planning Policy Guidance / Statements
PPV	Peak Particle Velocity
PRA	Preferred Route Announcement
PRoW	Public Right of Way
PSED	Public Sector Equality Duty
PSF	Project Support Framework
PSSR	Preliminary Sources Study Report
PTZ	Pan/Tilt/Zoom (CCTV)

RBMP	River Basin Management Plan
REAC	Register of Environmental Actions and Commitments
RIGS	Regional Important Geological and Geomorphological Sites
RIS	Road Investment Strategy
RPA	Root Protection Area (for trees)
RSS	Regional Spatial Strategy
RWSC	Routine & Winter Service Code
SAC	Special Area of Conservation
SAP	Species Action Plan
SAR	Scheme Assessment Report
SBPT	Self Boring Pressuremeter Test
SCI	Site of Community Importance
SCPT	Standard Cone Penetration Test
SDA	Strategic Development Area
SEP	(Humber) Strategic Economic Plan
SFRA	Strategic Flood Risk Assessment
SM	Scheduled Monument
SMR	Sites and Monuments Record
SNCI	Site of Nature Conservation Interest (also known as SINC)
SNRHW	Stable Non-Reactive Hazardous Waste
SOAEL	Significant Observed Adverse Effect Level
SOC	Standard Occupational Classification
SoCC	Statement of Community Consultation
SOM	Soil Organic Matter
SoS	Secretary of State
SPA	Special Protection Area
SPZ	Source Protection Zone

SSSI	Site of Special Scientific Interest
SWMP	Site Waste Management Plan
TAME	Traffic Modelling and Economics (Netserv)
TAR	Technical Appraisal Report
TM	Traffic Management
TNI	Traffic Noise Index
TPH	Total Petroleum Hydrocarbons
TPI	Targeted Programme of Improvements
TRADS	Traffic Flow Data System
UKBAP	UK Biodiversity Action Plan (see also BAP)
UKWIR	UK Water Industry Research
UNECE	United Nations Economic Commission for Europe
UPS	Uninterrupted Power Supply
UXO	Unexploded Ordnance
VCB	Vertical Concrete Barrier
VfM	Value for Money
VM	Value Management
VMS	Variable Message Sign
VOC	Volatile Organic Compounds
VRS	Vehicle Recovery System
WEBTAG	Web based Transport Appraisal Guidance
WEBTRIS	Web based Traffic Information System (formerly HATRIS)
WFD	Water Framework Directive
WHO	World Health Organization
WIA	Wider Impact Area
WMPE	Waste Management Plan for England
WPPE	Waste Prevention Programme for England

WRAP	Waste and Resources Action Programme
WwTW	Waste water Treatment Works
YARFF	Yorkshire Archaeological Research Framework Forum
YHPRSS	Yorkshire and Humber Plan Regional Spatial Strategy (to 2026)
YHRTB	Yorkshire and Humberside Regional Transport Board
ZOI	Zone of Influence
ZVI	Zone of Visual Influence
ZTV	Zone of Theoretical Visibility