14 Human Health

This chapter assesses the impact of the A985 Kincardine Bridge Refurbishment: Piled Viaduct Replacement scheme on the human health of communities with potential to be impacted by the proposed scheme. The communities identified for the purposes of the human health assessment comprise two 2011 Scottish Census data zones: S01009122 (for the purposes of this assessment, referred to as 'West of Kincardine Bridge') and S01009267 (for the purposes of this assessment, referred to as 'Kincardine').

The assessment followed Design Manual for Roads and Bridges (DMRB) LA 112 'Population and human health' guidance, and utilised output from other EIA topic chapters, assessed against various health determinants. The assessments considered from other EIA topics include: geology, soils and groundwater; road drainage and the water environment; air quality; and noise and vibration.

Beneficial and adverse changes to health determinants arising as a result of the proposed scheme have been considered and using evidence a conclusion has been drawn as to whether there is an overall Positive, Negative, Neutral or Uncertain health outcome for the West of Kincardine Bridge and Kincardine communities. The assessment has taken into account the mitigation already proposed in this EIA Report, using the mitigated (residual) position to determine potential impacts on human health.

During construction of the proposed scheme, it is expected that the potential impact on human health from pollution, coastal flooding, dust, and noise and vibration impacts, would not be significant. Therefore, a Neutral (non-significant) residual effect on human health is reported for the construction phase.

Air quality and noise and vibration were scoped out of the assessment for operation. During operation of the proposed scheme, it is expected that the potential impact on human health from pollution and coastal flooding would not be significant. Therefore, a Neutral (non-significant) residual effect on human health is reported for the operational phase.

There are no significant effects on human health on West of Kincardine Bridge or Kincardine communities predicted as a result of the proposed scheme.

14.1 Introduction

14.1.1 This chapter of the Environmental Impact Assessment (EIA) Report presents the assessment of human health impacts during the construction and operation phases of the A985 Kincardine Bridge Refurbishment: Piled Viaduct Replacement scheme (hereafter referred to as the proposed scheme).

14.1.2 The World Health Organisation (WHO) (2020) defines human health as *'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'*. For the purposes of this assessment, health encompasses both physical and mental health. Overall well-being is not assessed within the chapter as there is no established methodology for assessing wellbeing under DMRB or in the context of EIA, including no clear way of establishing a baseline from which the change of conditions can be established.

14.1.3 The assessment is based on guidance presented in DMRB guidance LA 112 'Population and Human Health' (Highways England, Transport Scotland, Welsh Government and Department for Infrastructure Northern Ireland 2020) and LA 104 Environmental Assessment and Monitoring (Highways England, Transport Scotland, Welsh Government and Department for Infrastructure Northern Ireland 2019). Under the DMRB guidance LA 112 (hereafter referred to as DMRB LA 112), 'Population and Human Health' encompasses the three sub-topics of land use, accessibility and human health. Land use and accessibility have been scoped out of the EIA for the proposed scheme as reported in the Scoping Report (Jacobs 2018).

14.1.4 This chapter focuses on the potential for impacts on human health in relation to the determinants of health, as illustrated in Diagram 14.1. Health determinants are the range of personal, social, economic and environmental factors which determine the health status of individuals or populations. The health determinants relevant to road schemes are further defined in DMRB LA 112 and those relevant to the proposed scheme are outlined in paragraph 14.3.3.

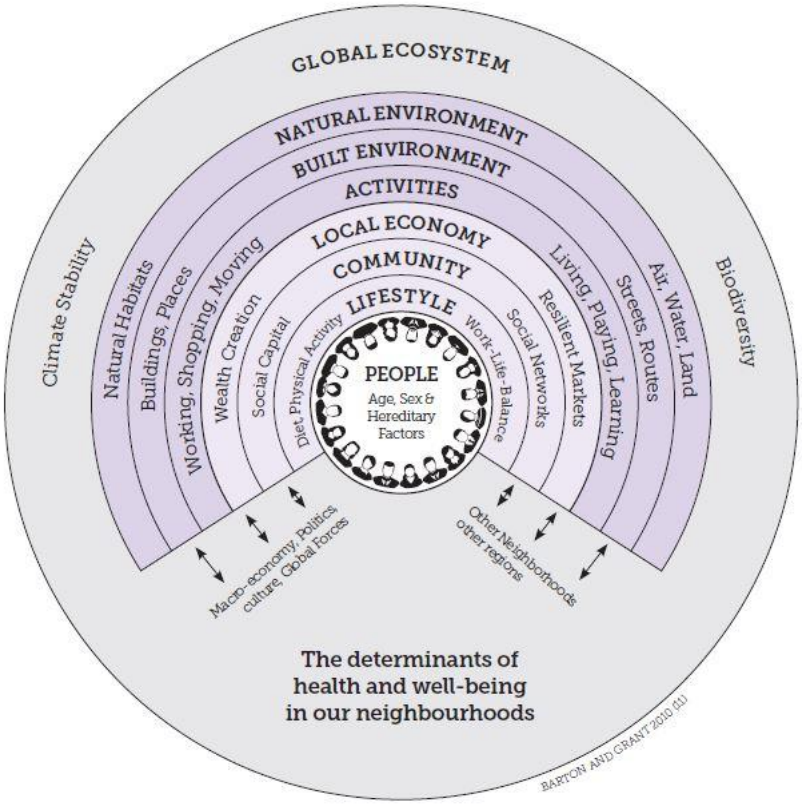

Diagram 14.1: Determinants of Health and Well-being (Barton & Grant 2006)

14.1.5 This chapter reports on the potential human health impacts resulting from the construction of the proposed scheme, making reference to the findings reported in the following chapters:

- Chapter 6 (Geology, Soils and Groundwater);
- Chapter 7 (Road Drainage and the Water Environment);
- Chapter 11 (Air Quality); and
- Chapter 12 (Noise and Vibration).

14.1.6 Chapter 8 (Marine Ecology), Chapter 9 (Terrestrial Ecology), Chapter 10 (Cultural Heritage), and Chapter 13 (Material Assets and Waste) are not referenced within this assessment as it is considered that impacts arising from these topics would not have implications for human health. Chapter 15 (Climate) was scoped out of the assessment due to proposed scheme's minor impact on climate, and the lack of potential for indirect impacts on human health from factors such as extreme heat and natural disasters. Localised impacts that could potentially occur as a result of climate change (i.e. flooding) are captured within Chapter 7 (Road Drainage and the Water Environment) which have been carried forward to the human health assessment.

14.2 Legislation, Policies and Guidance

14.2.1 This section provides an overview of the relevant national, regional and local planning policies and guidance for human health.

14.2.2 The requirement for the inclusion of human health as a specific topic within EIA was introduced by the update to the EIA Directive (Directive 2011/92/EU as updated by Directive 2014/52/EU) (hereafter referred to as the EIA Directive) and The Roads (Scotland) Act 1984 (Environmental Impact Assessment) Regulations 2017 (hereafter referred to as the Roads EIA Regulations).

14.2.3 In preparing this assessment, cognisance has been given to the following guidance: 'Health in Environmental Impact Assessment: A Primer for a Proportionate Approach' (IEMA 2017) and a draft paper 'Addressing Human Health in Environmental Impact Assessment' (IAIA 2019). In terms of guidance specific to human health in the context of road schemes, this assessment predominantly follows the approach and methods outlined in DMRB LA 112.

14.2.4 Table 14.1 sets out the key policies in relation to human health and the level at which they are adopted.

Table 14.1: Overview of Key Policy Relevant to Human Health

Policy	Description	Key Points
National		
Scottish Planning Policy (SPP) (Scottish Government 2014a)	Policy statement on how nationally important land use planning matters should be addressed across the country.	The SPP introduces a presumption in favour of development that contributes to sustainable development. Improving health and well-being by offering opportunities for social interaction and physical activity, including sport and recreation is a guiding policy principle in the SPP.
Scotland's Third National Planning Framework (NPF3) (Scottish Government 2014b)	NPF3 outlines plans for infrastructure investment which support sustainable economic growth.	The policy outlines that '*We will respect, enhance and make responsible use of our natural and cultural assets*'. The document highlights the importance of the quality of Scotland's environment and landscape in supporting health and wellbeing. Linking open spaces and active travel networks in towns and cities, to improve the environment for pedestrians and cyclists, can improve health and well-being. Integral to the delivery of these infrastructure and regeneration projects will be the Central Scotland Green Network – improving quality of place, addressing environmental inequalities and enhancing health and well-being.
Scotland's National Performance Framework (NPF) (Scottish Government 2019a)	NPF sets out 'national outcomes' and aims to increase the wellbeing of people living in Scotland, amongst other aims.	The 'national outcomes' describe the kind of Scotland it aims to create. In relation to health, the outcomes are as follows: • People live in communities that are inclusive, empowered, resilient and safe; • People value, enjoy, protect and enhance their environment; • People are healthy and active; and • People tackle poverty by sharing opportunities, wealth and power more equally. • The NPF indicators relating specifically to health are: • Healthy life expectancy: The estimated average number of years that a new born baby could be expected to live in 'good' or 'very good' health based on how individuals perceive their general health. • Mental wellbeing: Average score on Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS)[1]. • Healthy weight: Percentage of adults (aged 16+) who area healthy weight. • Health risk behaviours: Percentage of adults with two or more health risk behaviours (current smoker, harmful drinking, low physical activity, obesity).

[1] The Warwick-Edinburgh Mental Wellbeing Scales were developed to enable the measuring of mental wellbeing in the general population and the evaluation of projects, programmes and policies which aim to improve mental wellbeing. The 14-item scale WEMWBS has 5 response categories, summed to provide a single score. The items are all worded positively and cover both feeling and functioning aspects of mental wellbeing, thereby making the concept more accessible. (Prof Sarah Stewart-Brown, WEMWS 2018)

Policy	Description	Key Points
		• Physical activity: Percentage of adults meeting physical activity recommendations. • Journeys by active travel: The proportion of short journeys less than 2 miles that are made by walking. • Quality of care experience: Percentage of people who describe the overall care provided by their GP practice as Excellent or Good • Work related ill health (indicator in development) • Premature mortality: European Age Standardised mortality rates per 100,000 for people under 75.
Local		
Strategic Outcomes and Local Delivery Plan 2016 – 2020 (Falkirk Council 2015)	The Plan sets out the community planning partnership's commitment to focus on making the area 'the place to be', through setting a number of priorities.	Address the Impact of Poverty on Children and Young People Key actions relating to this priority are focused on addressing the impact on poverty and children and young people, including: • '*Food Poverty;* • *Cost of the School Day; and* • *Stigma of Poverty*.'
Falkirk Local Development Plan 2 (Falkirk Council 2020)	LDP prepared to guide the future use and development of land within the Falkirk Council area over the next 20 years.	Strategic Objective – Thriving Communities '*Provide infrastructure to meet the needs of an increasing population and further improve the area's connectivity.*'

14.2.5 An assessment of the proposed scheme's compliance with plans and policies relating to human health is provided in Section 14.8 (Assessment of Policy Compliance) and Appendix A4.1: Assessment of Policy Compliance.

14.3 Approach and Methods

14.3.1 The approach used to establish the baseline conditions and assess the potential changes to health outcomes is explained in this section.

Scoping and Consultation

14.3.2 A scoping exercise was undertaken in 2018, as reported in the Scoping Report (Jacobs 2018). The Scoping Report (Jacobs 2018) stated that, *'The potential effects of the proposed scheme on population and human health is covered in Chapter 6 (Geology, Soils and Groundwater) and Chapter 12 (Air Quality). It is proposed that there will be no separate assessment of the proposed scheme on population and human health for the EIA.'* The proposed scope was agreed with the consultees as outlined in Chapter 5 (Consultation and Scoping).

14.3.3 Since the original scoping exercise was undertaken, topic-specific guidance for assessing human health in EIA for road scheme was published in October 2019, under DMRB LA 112 Population and human health. A further, internal scoping exercise was undertaken by Jacobs to align the scope of the human health assessment with the health determinants outlined in DMRB LA 112 and a stand-alone human health chapter was deemed necessary. A health profile of communities with the potential to be impacted by the proposed scheme was developed and the data gathered is provided in Section 14.4 (Baseline Conditions). The scoping exercise identified the determinants relevant to the human health assessment for the proposed scheme which included two determinants in addition to those proposed in the original scope. The determinants scoped into the human health assessment are as follows:

- sources and pathways of potential pollution;
- coastal flood risk;
- air quality management areas and ambient air quality; and
- areas recognised as being sensitive to noise and the ambient noise environment.

14.3.4 EIA topics 'Landscape and Visual', 'All Travellers' and 'Community and Private Assets'[2] were scoped out of assessment as part of the original scoping exercise. Following a review of these topics in the context of the new DMRB guidance, it was proposed that they remain scoped out of the EIA as outlined in Chapter 5 (Consultation and Scoping). Under DMRB LA 112, the topics 'Landscape and Visual', 'Population - Land-use' and 'Population – Accessibility' feed into the human health assessment. As these topics were scoped out of the EIA due to a lack of significant effects, the following health determinants were scoped out of the human health assessment:

- the location and type of community, recreational and education facilities and severance/separation of communities from such facilities;
- the location of green/open space and severance/separation of communities from such facilities;
- the location of healthcare facilities and severance/separation of communities from such facilities;
- outline spatial characteristics of the transport network and usage in the area, including the surrounding road network, Public Rights of Way (including bridleways), cycle ways, non-designated public routes and public transport routes; and
- landscape amenity.

[2] Under new DMRB guidance, previous topics 'People and Communities: Community and Private Assets' and 'People and Communities: All Travellers' are now assessed under the title 'DMRB LA 112 Population and Human Health' as 'Land Use' and 'Accessibility'. The Population aspect, encompassing 'Land Use' and 'Accessibility' has been scoped out for the proposed scheme.

14.3.5 Consultation with NHS Fife and Falkirk Council Environmental Planning Team was undertaken to inform the baseline and establish the communities to be included in the human health assessment. Responses to the request for specific consultation in relation to community-level data to inform this chapter were limited, however, some baseline data sources suggested by Falkirk Council were utilised in building the human profiles (details of sources used are outlined in paragraph 14.3.10). Furthermore, consultation on human health has also been undertaken for the topics that feed into the assessment: e.g. noise, water environment, air quality, and contaminated land. Details of the relevant consultation received on these topics and how this has informed the EIA is provided in Appendix A5.1 (Summary of Consultation Responses).

Study Area

14.3.6 The proposed scheme is located within Falkirk Council area at the Firth of Forth. The southern approach to the Kincardine Bridge is within the Falkirk Council area, and the northern approach is within the Fife Council area. The village of Airth is located to the west of the proposed scheme and the town of Kincardine is located to the north-east. Two residential dwellings are located to the north-west of the proposed scheme at Higgins Neuk Roundabout.

14.3.7 As set out in DMRB LA 112 (Highways England *et al.* 2020, p.20), the study area for the human health assessment has been defined taking cognisance of the following:

'the extent and characteristics of a project, and

the communities/wards directly and indirectly affected by the project.'

14.3.8 The EIA topics pertinent to the human health assessment are outlined in Table 14.2. The study areas of each topic which have been considered and used to inform the study area for the human health assessment. The communities directly and indirectly affected by the project have been identified based on whether they fall within the study areas outlined in Table 14.2.

Table 14.2: Study Areas Defined in Other Technical Chapters of the EIA Report

Chapter	Relevant Health Determinant	Study Area
Chapter 6 (Geology, Soils and Groundwater)	Sources and pathways of potential pollution.	The assessment covers a study area extending to 250m from the footprint of the proposed scheme. The study area for groundwater abstractions was up to a distance of 850m from the footprint of the proposed scheme.
Chapter 7 (Road Drainage and the Water Environment)	Coastal flood risk.	The baseline study area for this assessment extends 500m from the footprint of the proposed scheme and associated temporary works area and includes any identified water features and flood inundation extents.
Chapter 11 (Air Quality)	Air quality management areas and ambient air quality.	As per Institute of Air Quality Management (IAQM) guidance, an assessment is required where there is a 'human receptor' within 350m of the site boundary or 50m of the route used by construction vehicles on the public highway up to 200m from the site exit(s).
Chapter 12 (Noise and Vibration)	Areas recognised as being sensitive to noise and the ambient noise environment.	The nearest residential noise sensitive receptors (NSRs) to the proposed scheme are the two dwellings at Higgins Neuk, the nearest of which is approximately 110m to the north-west of the nearest location where the main construction works would be undertaken. The next nearest NSRs are over 400m away; at this distance, significant construction noise impacts are considered unlikely and are not considered further. There is potential for vibration impacts during construction, depending upon the type of construction works undertaken, for NSRs within 300m of the scheme. For construction traffic, there may be temporary road restriction or closures during construction of the proposed scheme, which has the potential to result in temporary changes in roads traffic noise levels on the local road network.

14.3.9 The communities identified for consideration within the human health assessment and the 2011 Scottish Census data zones[3] used for mapping them are presented in Table 14.3. Due to the nature and extent of the works and their relatively short duration, no potential impacts are expected on human health for communities outwith the study area extents proposed in Table 14.2 (i.e. the village of Airth is not included in the assessment).

Table 14.3: Communities Identified within Study Area for Human Health

Community	Data Zone	Council Area	Description
Kincardine	S01009267*	Fife Council	Town to the east of the proposed scheme that may be subject to impacts on human health.
West of Kincardine Bridge	S01009122	Falkirk Council	Area west of the proposed scheme with a number of residences that may be subject to impacts on human health.

*The data zone in Kincardine closest to the proposed scheme (S01009267) was used as representative of the community as a whole.

Baseline Conditions

14.3.10 The baseline for the human health assessment has been developed through the following approaches:

- Data collection – using sources such as the Office of National Statistics (ONS), Scottish Index of Multiple Deprivation (SIMD), Scottish Census data, National Records of Scotland, The Scottish Public Health Observatory, Fife and Falkirk Council websites, World Health Organisation publications, relevant medical journals, local development plans and policy documents, and others which are referenced where relevant;
- Spatial data mapping – using aerial photography and Ordnance Survey (OS) maps, Jacobs' Geographical Information System (GIS) database, in addition to the above data sources; and
- Consultation – with statutory and non-statutory consultees, as appropriate.

14.3.11 Health baseline data is not always used in the assessment as such; rather it is used to provide context and to provide evidence for assigning sensitivity.

Health Profile and Sensitivity

14.3.12 In accordance with DMRB LA 112, the sensitivity of a community is reported as either low, medium, or high, with evidence provided as to why the category has been assigned.

Health Determinants

14.3.13 As outlined in paragraph 14.1.4, health determinants are the range of personal, social, economic and environmental factors which determine the health status of individuals or populations. A change to a single health determinant can affect the health status of different individuals or communities depending on their characteristics and sensitivity to change, thereby generating multiple health outcomes.

14.3.14 In accordance with DMRB LA 112 guidance, health determinants for the proposed scheme have been identified to inform the baseline scenario. Further details as to how each determinant can affect health in relation to the constituent EIA topics is provided in Table 14.4.

[3] Data Zones are composed of Census Output Areas large enough to present statistics accurately without fear of disclosure and small enough that they can used to represent communities.

Impact Assessment

14.3.15 As outlined in IAIA's draft paper 'Addressing Human Health in Environmental Impact Assessment' (IAIA 2019), tracing change as a result of a proposed scheme through to an 'effect' on human health (as required by EIA Directive Article 3(1)) is a process of identifying:

- first the relevant determinant of health e.g. air quality; and
- secondly, the resulting changes in population health outcomes e.g. cardiovascular and respiratory diseases.

14.3.16 The assessment is qualitative in nature, drawing on output from the other technical chapters of the EIA outlined in paragraph 14.1.5. Evidence is used to determine how predicted changes to health determinants could lead to changes in health outcomes, considering the sensitivity of human receptors as outlined in paragraph 14.3.12.

14.3.17 Not all determinants are applicable to both construction and operational stages of the proposed scheme, and the assessment methodology indicates whether these apply to either one or both.

14.3.18 DMRB LA 112 states that *'Health effects shall be assessed during construction and up to year 15 of operation (future year scenario).'* Any potential health effects associated with the operation of the proposed scheme are expected to reduce by the future year scenario, therefore operational impacts are assessed for opening year only, i.e. worst-case scenario.

Health Pathway

14.3.19 In order for there to be a likely potential health impact, a health pathway must be established. A health pathway is referred to as '*the plausibility of a causal relationship*' (IEMA 2017) i.e. the plausibility of a project generating a potential health impact.

14.3.20 As recommended by IAIA's draft paper 'Addressing Human Health in Environmental Impact Assessment' (IAIA 2019), a literature review has been undertaken to determine an association between changes that are likely to occur due to the proposed scheme in relation to the health determinants described in paragraph 14.2.3, and the resulting potential changes to health outcomes. The results of the literature review and relevant health pathways are provided in Table 14.4.

Table 14.4: Description of Human Health Pathway and Methodology for EIA Report Topic Chapters

EIA Report Chapter Related to Human Health	Relevant Health Determinant	Health Pathway and Methodology
Chapter 6 (Geology, Soils and Groundwater)	Sources and pathways of potential pollution.	Ground gases, unexploded ordnance (UXO) and pollution of ground and surface water can result in personal injury (WHO 2012). Direct impacts from potential disturbance of contaminated land have been reported in Chapter 6 (Geology, Soils and Groundwater). For the assessment of contaminated land, contamination levels must be substantially below the relevant Generic Assessment Criteria (GAC) in order to present no risk to human health. People have the potential to be impacted by pollutants through pathways such as ingestion, inhalation and dermal contact with soils, soil dust, deep and shallow groundwater and surface water, or by migration of ground gases into confined spaces. The literature supports a plausible linkage between exposure to land contamination and birth defects including congenital anomalies and low birth weight, however the evidence towards a causal relationship is limited (Defra 2009). Long-term exposure to asbestos for construction works can cause serious lung conditions such as asbestosis (NHS 2020). Additionally, chemical pollutants such as arsenic and mercury can cause serious health issues, including cancer, if ingested through contaminated water supplies (High Speed Training 2019). The human health assessment considered the direct impacts on human health as a result of potential pollution pathways caused by disturbance of contaminated land due to the construction and operation of proposed scheme.
Chapter 7 (Road Drainage and the Water Environment)	Coastal flood risk.	Flooding can result in injury and illness, and in extreme cases, death by drowning. Flooding can cause people to be displaced from their homes, resulting in stress and anxiety. Long-term impacts on psychological health are also notable due to the stress involved repairing and cleaning up, and dealing with insurance claims (Ohl & Tapsell 2000). Direct impacts on flood storage and flow mechanisms have been reported in Chapter 7 (Road Drainage and the Water Environment). As part of the SPP, any new development must remain flood free during any design flood event as well not increasing flood risk in the surrounding areas. The human health assessment considered the direct and indirect impacts on human health as a result of flood risk due to the construction and operation of the proposed scheme.
Chapter 11 (Air Quality)	Air quality management areas and ambient air quality.	Poor air quality can result in human health conditions such as asthma, respiratory problems and cardiovascular disease (Royal College of Physicians 2016). Direct impacts on air quality have been reported in Chapter 11 (Air Quality) and the main air quality impacts associated with construction activities relate to dust. The term 'dust' refers to all particulate matter including all particles suspended in air or settled and deposited onto a surface after having been suspended during land preparation (e.g. demolition, site clearance), earthworks (including the handling and storage of materials) and during construction activity. This includes the smaller-sized particulates associated with potential health impacts (i.e. PM_{10} and $PM_{2.5}$), and larger particulates associated with causing annoyance through deposition onto a surface. Human exposure to particulate matter can have adverse health impacts. There is no proven safe threshold at which human health is not at risk from particulate matter. The human health assessment considers the direct impacts on air quality in relation to particulate matter (including dust) as a result of the construction of the proposed scheme to assess the potential impacts on health. As reported in Chapter 11 (Air Quality), there are no potentially significant air quality effects expected during operation of the proposed scheme and this stage was scoped out of further assessment.

EIA Report Chapter Related to Human Health	Relevant Health Determinant	Health Pathway and Methodology
Chapter 12 (Noise and Vibration)	Areas recognised as being sensitive to noise and the ambient noise environment.	High levels of noise nuisance and vibration cause by traffic and activities associated with construction works can result in sleep disturbance, increased aggression, and impaired communication (WHO 1995). Direct impacts on noise receptors have been reported in Chapter 12 (Noise and Vibration). To determine the potential construction noise impact, an assessment based on the guidance within British Standard (BS) 5228-1: 2009 + A1 – Code of practice for noise and vibration on construction and open sites, Part 1 – Noise has been undertaken. The "ABC Method" detailed within BS 5228-1 has been adopted to determine whether significant impacts as a result of construction noise are likely. For the assessment of construction vibration, BS 5228-2: 2009 + A1: 2014 - Code of practice for noise and vibration control on construction and open sites, Part 2 – Vibration contains guidance on vibration levels in structures from construction works. For road traffic noise during construction, high level analysis has been undertaken to determine whether road traffic noise levels at noise sensitive receptors are likely to change by 1dB $L_{A10,18h}$ or greater as result of the temporary bridge or the temporary road restriction or closures. The human health assessment considers the direct and indirect impact as a result of the construction of the proposed scheme in relation to potential impacts on noise and vibration, and the resulting health implications. As reported in Chapter 12 (Noise and Vibration), there are no potentially significant noise and vibration effects expected during operation of the proposed scheme and this stage was scoped out of further assessment.

14.3.21 Identification of a health pathway does not mean that there would be a significant effect on human health. Further information on assigning significance of effect is provided in paragraph 14.3.28.

Health Outcomes

14.3.22 A health outcome is a change in the health status of an individual, group, or population which is attributable to a planned intervention or series of interventions, regardless of whether such an intervention was intended to change health status.

14.3.23 Health outcomes describe the predicted impacts on health as a result of the proposed scheme and are assigned a category as defined in DMRB LA 112 and outlined in Table 14.5.

Table 14.5: Human Health Outcome Categories (Highways England *et al.* 2020)

Health Outcome Category	Health Outcome Description
Positive	A beneficial health impact is identified
Neutral	No discernible health impact is identified
Negative	An adverse health impact is identified
Uncertain	Where uncertainty exists as to the overall impact

Mitigation

14.3.24 Mitigation that is relevant to human health impacts are largely captured in the relevant constituent EIA Report topic chapters. Where required, mitigation not related to the constituent EIA Report topic chapters is included within the human health assessment in Section 14.6 (Mitigation).

Significance

14.3.25 For the assessment of human health, sensitivity has been determined based on the health profile of the communities.

14.3.26 Depending on the impact being assessed, some population groups may be more vulnerable to impacts than others. For example, young people and elderly people are considered more sensitive to poor air quality (Royal College of Physicians 2016). Similarly, residential premises, schools, and places of worship are considered to be more sensitive to some impacts e.g. noise. For this assessment vulnerable groups have been considered on a case by case basis; generally, vulnerable groups are assigned a high or very high sensitivity.

14.3.27 For the assessment of human health, no specific magnitude criteria are set out in DMRB LA 112 therefore none has been applied beyond what is identified for individual topic assessments (e.g. noise and vibration). Rather, the assessment has drawn on the mitigated position (residual impacts) of the assessments reported in the constituent chapters and identified whether these impacts had additional implications when considered from the perspective of human health.

14.3.28 Following this process, a qualitative conclusion has been drawn as to the potential for a change in a health determinant and subsequently, a health outcome (i.e. the change to health status of a community as per Table 14.5). At the time of writing, a consensus has not yet been reached on what defines a 'significant effect' for human health in the context of the 2017 EIA Regulations, and no guidance is provided in DMRB LA 112. Therefore, general guidance on significance categories set out in DMRB LA 104 and professional judgement was used to determine whether health outcomes would be considered significant or not significant in the context of the EIA Directive. A Positive or Negative human health outcome was generally considered significant, and a Neutral or Uncertain outcome was considered not significant.

Assumptions and Limitations

14.3.29 At the time of writing this report, the information available - such as temporary construction works, construction methods, and traffic management information - is indicative and dependant on the approved construction proposals of the appointed Contractor. Therefore, impacts on human health in relation to construction may be subject to change. However, the residual impacts on human health resulting from any changes made by the Contractor must be no worse than those reported in this EIA Report or additional assessment and mitigation would be required.

14.3.30 The health profile created for the communities has largely been based on data collection from secondary sources as outlined in paragraph 14.3.10. Whilst this search has provided general information on vulnerable groups along the proposed scheme, the data gathered is at a high-level and not all specific cases have been captured. In particular, the assessment does not assess the health outcomes for individuals.

14.3.31 Community baseline data was not available for every parameter of human health set out in DMRB LA 112. For example, no community-level data is available for chronic obstructive pulmonary disease (COPD) or deaths from respiratory illness, however regional-level data was obtained. It is considered that the absence of this baseline data would not have changed the sensitivity of the communities, which has been assigned as high, or the outcome of the assessment.

14.3.32 The Covid-19 pandemic in early 2020 led to several thousand premature deaths in Scotland, with thousands more seriously ill. At the time of undertaking the human health assessment, the full implications on the physical and mental health of communities as a result of the pandemic are not yet known.

14.3.33 It should be noted that this assessment does not take into account Covid-19 statistics in the health baseline as these are not yet fully known. The chapter does not assess the potential for increased risk to public health as a result of any future Covid-19 outbreaks, as it is presumed that government guidance will be adhered to and the proposed scheme will not go ahead until it is safe to do so.

14.4 Baseline Conditions

Health Profile

Population Overview

14.4.1 The closest residential receptors to the proposed scheme are two dwellings co-located at Higgins Neuk, approximately 110m north-west of the main construction works of the proposed scheme. The town of Kincardine is approximately 750m north-east of the proposed scheme and has a population of 2,834 (Scottish Census 2011). Image 14.1 illustrates the location of these communities in relation to the Kincardine Bridge.

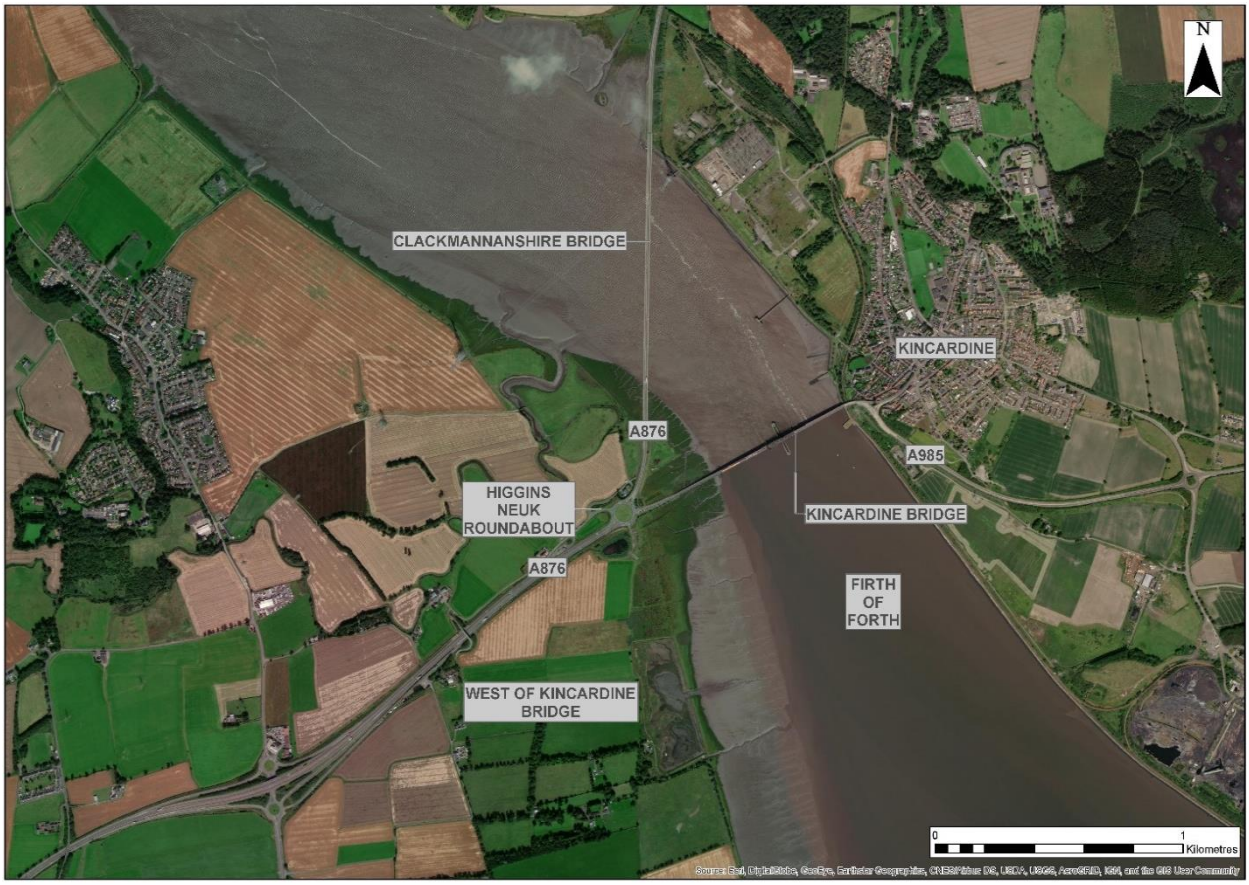

Image 14.1: Location of Communities in Human Health Assessment
©GoogleMaps Satellite 2020

General Health

14.4.2 Life expectancy data was obtained on the Falkirk and Fife Council areas in the absence of localised data for the communities. The life expectancy for both sexes for the two council areas is illustrated in Table 14.6, and the figures align closely with those for Scotland as a whole.

Table 14.6: Life Expectancy in Falkirk Council, Fife Council, and Scotland Overall (National Records of Scotland 2018)

Gender	Life Expectancy in Years		
	Falkirk (West of Kincardine Bridge)	Fife (Kincardine)	Scotland
Male	77.3	77.2	77.0
Female	80.6	80.8	81.1

14.4.3 Table 14.7 shows the percentage of the population that fall under age groups that may be more vulnerable to potential impacts on human health (i.e. the young and the elderly) in comparison to Falkirk Council (West of Kincardine Bridge) and Fife Council (Kincardine). The data indicates that Kincardine has a more elderly population than Fife Council overall with a higher percentage over the age of 65. Both communities have a smaller proportion of the population aged 16 or younger than the council areas.

Table 14.7: Percentage of Young and Elderly in Population by 2011 Data Zones (National Records of Scotland 2018)

Age	Percentage of People			
	West of Kincardine Bridge S01009122	Falkirk Council	Kincardine S01009267	Fife Council
<16	16.0%	18.2%	14.9%	17.6%
>65	16.8%	16.2%	21.1%	17.5%

14.4.4 Table 14.8 illustrates the general health of the West of Kincardine Bridge and Kincardine communities and of the council areas. The table shows that the majority of people in both communities experience very good health, good health or fair health. The percentage of those who experience bad health or very bad health is similar to the percentages reported for the council areas, with the communities faring slightly better.

Table 14.8: General Health by 2011 Data Zones (National Records of Scotland 2018)

	Percentage of People			
	West of Kincardine Bridge S01009122	Falkirk Council	Kincardine S01009267	Fife Council
Very good health	49.2%	50.6%	47.6%	50.8%
Good health	30.5%	31.2%	31.2%	31.0%
Fair health	15.2%	12.7%	16.8%	12.9%
Bad health	3.9%	4.3%	3.2%	4.2%
Very bad health	1.2%	1.2%	1.2%	1.2%

14.4.5 Table 14.9 illustrates the percentage of people in the communities with long-term health conditions in comparison to Falkirk Council and Fife Council. The table shows that the proportion of the West of Kincardine Bridge and Kincardine communities reporting specific health conditions is broadly comparable with those reported in the Falkirk and Fife Council areas. The percentage of the population in Kincardine reporting 'other' health conditions is higher than the percentage for the West of Kincardine Bridge community, and for Fife Council.

Table 14.9: Long-term Health Conditions in Communities from 2011 Census Data (National Records of Scotland 2018)

Long-term Health Condition	Percentage of People			
	West of Kincardine Bridge (S01009122)	Falkirk Council	Kincardine (S01009267)	Fife Council
No condition	69.1%	69.9%	67.1%	68.0%
One or more conditions	30.9%	30.2%	32.9%	32.1%
Deafness or partial hearing loss	5.7%	6.4%	6.3%	7.3%
Blindness or partial sight loss	2.2%	2.2%	2.4%	2.5%
Learning disability	0.3%	0.5%	1.2%	0.5%
Learning difficulty	2.3%	1.9%	1.4%	2.4%
Developmental disorder	0.5%	0.6%	0.5%	0.7%
Physical disability	8.0%	7.0%	7.9%	7.2%
Mental health condition	3.5%	4.1%	4.6%	4.1%
Other condition	19.7%	19.2%	23.5%	20.3%

14.4.6 As outlined in paragraph 14.3.31, no community level data was available for specific illnesses such as COPD and chronic lower respiratory diseases; however this was available at a regional level. In 2017 NHS Fife and NHS Forth Valley reported 249 and 254 patient hospitalisations from COPD respectively, lower than the Scottish national average of 287 (ScotPho 2018).

14.4.7 Table 14.10 sets out data from the National Records of Scotland (2018) relating to deaths from chronic lower respiratory diseases for the local authority areas. These data illustrate that Falkirk Council performs better and Fife Council worse than the national average for this human health indicator.

Table 14.10: Deaths from Chronic Lower Respiratory Diseases in Falkirk Council, Fife Council, and Scotland Overall (National Records of Scotland 2018)

Gender	Deaths from Chronic Lower Respiratory Diseases		
	Falkirk (West of Kincardine Bridge)	Fife (Kincardine)	Scotland
Male	4.5	5.6	5.2
Female	5.8	6.9	6.6

Scottish Index of Multiple Deprivation (SIMD)

14.4.8 The SIMD identifies areas of multiple deprivation across Scotland and ranks them from most deprived to least deprived, using the 2011 data zones set up by the Scottish Government. Image 14.2 shows the relevant SIMD data zones for the communities considered in this assessment. West of Kincardine Bridge is within the Carse and Grangemouth Old Town intermediate data zone and Kincardine is within the intermediate data zone of Kincardine, made up of three SIMD zones. The SIMD combines 38 indicators across seven domains: income, employment, health, education, skills and training, housing, geographic access and crime.

14.4.9 In 2020 Kincardine ranked as 7/10 and West of Kincardine Bridge ranked as 6/10 in terms of overall deprivation, meaning the communities are less deprived than the Scottish average. Within the list of 38 SIMD indicators, there are seven indicators related to health. Generally, across the majority of health indicators the two communities fare comparatively better than Scotland as a whole. The health domain rank combines the scores from the seven indicators to provide an overall health score. In 2020 the health domain rank for both communities was 6/10 (Scottish Government 2020a), demonstrating that they have better health than the average in Scotland.

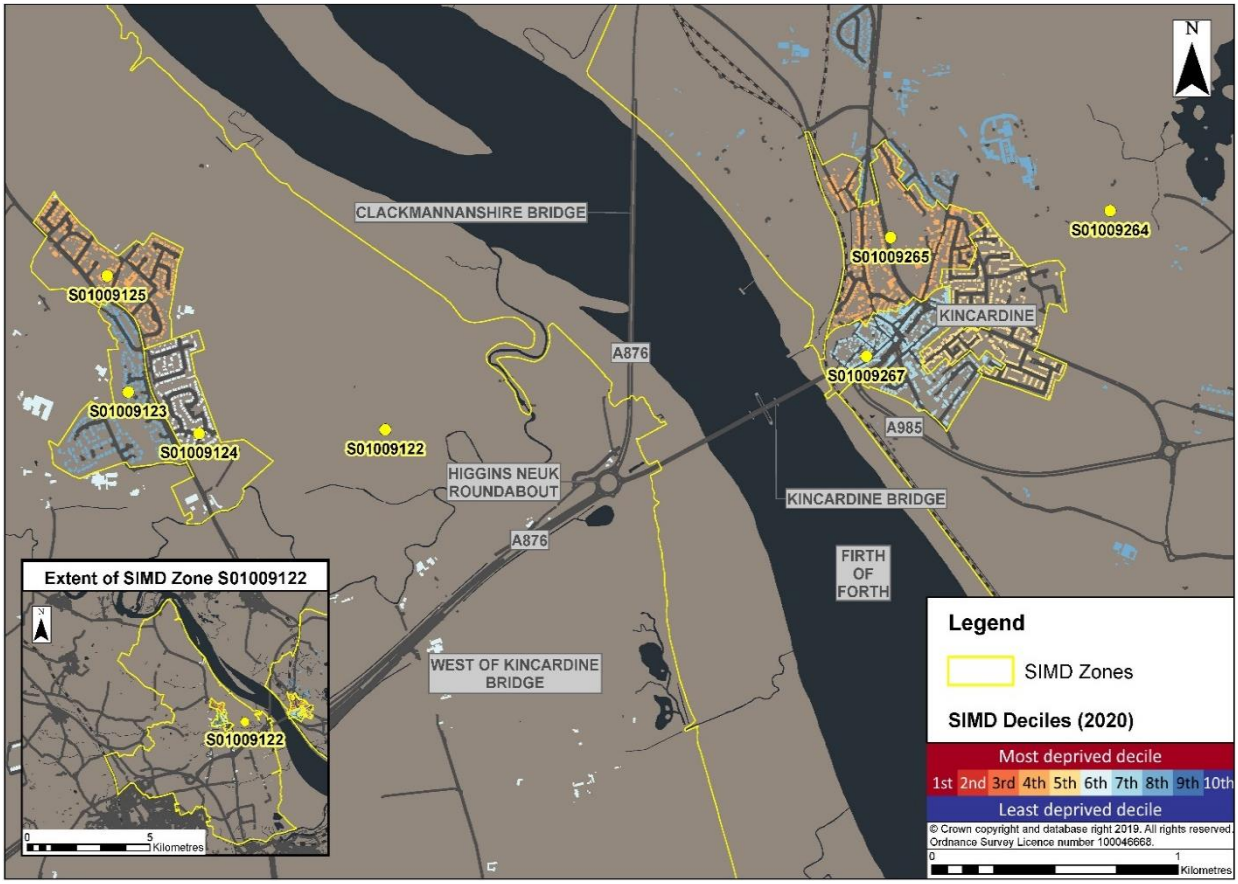

Image 14.2: SIMD Data Zones relative to Communities (Scottish Government 2020a)

Health Profile of Local Communities

14.4.10 As illustrated in paragraph 14.4.2, life expectancy in the Fife and Falkirk Council areas in which the communities are located align closely with the Scottish average. General health in the communities of West of Kincardine Bridge and Kincardine aligns closely with Fife and Falkirk Council. Data on specific health conditions in paragraph 14.4.5 illustrates that conditions such as long-term illnesses or disabilities are no more prevalent in the communities than in the Fife and Falkirk Council areas; with the exception of a higher percentage in Kincardine reporting 'other' health conditions[4]. Additionally, Fife Council had a higher percentage of deaths from chronic lower respiratory diseases than the national average in 2018.

14.4.11 SIMD data presented in paragraph 14.4.9 indicates that the communities in the study area are in general less deprived than the national average, both in terms of health and across the seven SIMD indicators. However, as there are some factors where the communities fare worse than the national average, sensitivity for the communities West of Kincardine Bridge and Kincardine for the purposes of the human health assessment has been assigned as high.

14.4.12 Kincardine has a more elderly population than Fife Council overall, with a higher percentage over the age of 65 as reported in paragraph 14.4.3. Therefore, the elderly have been considered as a specific vulnerable group in the community of Kincardine, and the sensitivity of the group assigned as high.

14.4.13 Additionally, construction workers on the proposed scheme have been identified in Chapter 6 (Geology, Soils, and Groundwater) and Chapter 7 (Road Drainage and the Water Environment) as a receptor within the study area with the potential to experience impacts on human health. Construction workers have

[4] 'Other' condition refers to a box in the 2011 Scottish Census questionnaire where respondents could write in a specific health condition if it did not come under one of the categories listed.

therefore been considered as a specific receptor for these topics and the sensitivity of the group assigned as high.

Health Determinants

14.4.14 The following section provides further information on the health determinants relevant to the proposed scheme, as outlined in Table 14.4.

Pollution

14.4.15 'Made Ground' is land where natural and undisturbed soils have largely been replaced by man-made or artificial materials. As outlined in Chapter 6 (Geology, Soils and Groundwater), the Geotechnical Interpretative Report (GIR) (Jacobs 2019) found that there was no obvious evidence of made ground or contamination identified from historical maps. However, there was potential for made ground of unknown composition to be present within the study area associated with road construction activities. Only three potential contaminated land sources are located within the Land Made Available for temporary works and construction boundary, and proven at one location (within A985 embankment soils on the southern approach to the Kincardine Bridge).

14.4.16 The groundwater body underlying the site is classified by SEPA as the Airth groundwater body, which was given an overall status of Poor in 2016 (SEPA 2018). There are no known groundwater abstractions or groundwater dependent terrestrial ecosystems (GWDTEs) present within the vicinity of the proposed scheme.

Flood Risk

14.4.17 As noted in Chapter 7 (Road Drainage and the Water Environment) there are two dwellings within the study area co-located north-west of Higgins Neuk Roundabout, approximately 110m north-west from the main works of the proposed scheme, which are partially at risk from a 0.5% Annual Exceedance Probability (AEP)[5] (200-year) coastal flood event, based on SEPA flood mapping (SEPA 2016). Flood levels extracted from SEPA data indicates that the Kincardine Bridge and associated trunk roads within the study area are located above the 0.5% AEP (200-year) coastal flood level, although a detailed assessment has not been undertaken.

14.4.18 Due to two dwellings within the study area being at risk of flooding during the 0.5% AEP (200-year) coastal flood event, the Forth Estuary has been assigned an importance of high in relation to flood risk.

14.4.19 Long-term projected conditions for water features within the study area will be influenced by increases to flow conditions as a result of climate change. Specifically, for the Forth river basin region, coastal waterbodies are predicted to experience a cumulative sea-level rise of 0.86m between 2017 to 2100 (SEPA 2019).

Air Quality

14.4.20 As outlined in Chapter 11 (Air Quality), a set of Air Quality Standards and Objectives have been developed for several pollutants of concern for human health. These are described on the Scottish Air Quality website as follows:

- *'Standards are concentrations of pollutants that are considered safe for humans and the environment.*
- *Objectives are derived from the standards are a compromise between what is desirable purely on health grounds and what is practical in terms of feasibility and costs.'* (Scottish Air Quality 2020a)

[5] Annual Exceedance Probability (AEP) refers to the probability of a flood event occurring in any year.

14.4.21 Air Quality Management Areas (AQMAs) are designated by local authorities in areas where Air Quality Strategy Objectives are not (or are unlikely to be) met. Henceforth, local authorities are required to develop and implement a plan to improve air quality in the AQMA (Scottish Air Quality 2020b).

14.4.22 As noted in Chapter 11 (Air Quality) the closest AQMA to the proposed scheme is Falkirk Grangemouth monitoring site, however, this monitoring location is an urban background location approximately 4.9km south-east of the proposed scheme and therefore not within the study area.

14.4.23 The PM_{10} background map concentration for the 1km by 1km grid square representing the maximum PM_{10} concentration in the vicinity of the proposed scheme is 11.1µg/m^3. The background map concentrations are well within the annual mean Air Quality Objectives (AQO) for PM_{10} of 40µg/m^3 (Scottish Government 2019b), and therefore within the standards considered safe for humans and the environment.

Noise and Vibration

14.4.24 As reported in Chapter 12 (Noise and Vibration), noise monitoring surveys undertaken in January 2019 observed that the noise climate at the noise monitoring location north of Higgins Neuk Roundabout is dominated by traffic on the A876 between Higgins Neuk Roundabout and Clackmannanshire Bridge. During lulls in traffic during the night, industrial noise to the south-east and north-west is audible. Other noise sources audible during lulls in the traffic include birds, aeroplane or helicopter fly overs and bird scaring guns.

14.4.25 No Quiet Areas or Candidate Quiet Areas have been identified within the construction noise and vibration assessment study areas. In addition, no Noise Management Areas or Candidate Noise Management Areas have been identified within the construction noise and vibration assessment study areas.

14.5 Potential Impacts

14.5.1 This section reports the assessment of potential impacts on human health through consideration of the relevant impacts and mitigation measures reported in the constituent EIA Report topic chapters. Potential impacts on human health are reported for construction and operation of the proposed scheme in Table 14.11. Air quality and noise and vibration impacts are reported for construction only, as operational impacts have been scoped out.

Table 14.11: Potential Impacts on Human Health During Construction and Operation

Health Determinant	Relevant EIA Report Chapter(s)	Potential Impact Relating to Human Health from Constituent EIA Report Topic Chapters
Pollution	Chapter 6 (Geology, Soils and Groundwater)	Construction of the proposed scheme may impact contaminated land through release or disturbance (including demolition and removal) of potentially contaminated land (i.e. sources that are within the Land Made Available for the proposed scheme), which could pose a potential risk to human health. Geotechnical Interpretative Report (Jacobs 2019a) identified that construction and maintenance workers on the proposed scheme would experience a moderate (construction workers)/low (maintenance workers) risk from potential soil/groundwater contamination, including potentially localised asbestos. There would be a moderate risk to construction workers and low risk to maintenance workers from potential ground gas associated with made ground, natural organic rich/peaty saltings and/or underlying coal seams. The contaminated land risk assessment within the Geotechnical Interpretative Report (Jacobs 2019a) identified a low risk from potential soil/groundwater contamination and a moderate/low risk from potential ground gas associated with made ground, natural organic rich/peaty saltings and/or underlying coal seams to human future end users; in this case the proposed end use is the A985 road (highways/rail). During construction new pollutant pathways may also be generated and present a risk to the water environment and groundwater at depth, which could lead to direct and indirect impacts to human health. With the mitigation measures in place as discussed in Chapter 6 (Geology, Soils and Groundwater) including adherence to SEPA's Pollution Prevention Guidelines (PPGs), implementation of appropriate health and safety and waste management procedures and systems, and consultation with the relevant local authorities and SEPA, effects on sources of pollution related to contaminated land and groundwater are reduced to Slight for all receptors and are not considered to be significant. Therefore, a Neutral human health outcome is predicted for both communities, the elderly population, and construction workers for pollution during construction and operation.
Flood Risk	Chapter 7 (Road Drainage and the Water Environment)	There is potential for an increase in the risk of coastal flooding during construction which could impact on the people living in the West of Kincardine Bridge community. During construction of the proposed scheme, tidal movements may be restricted due to the use of a raised temporary working platform. The temporary working platform will also involve land raising within the coastal floodplain, resulting in a loss of floodplain storage and potential subsequent increases in flood depth due to the displacement of floodwater. The temporary working platform would only be in place for an indicative period of approximately 18 to 24 months, therefore the likelihood of a flood event is considered to be low. Additionally, it is considered that due to the size of the Forth Estuary and nature of surrounding topography, the displacement of coastal water is unlikely to result in any discernible increase in flood depth or extent. Therefore, no flood risk impacts are predicted for the West of Kincardine Bridge community. There is a risk of flooding to the proposed construction activities located below Mean High Water Springs, which could have an adverse impact on the health and safety of construction workers. It is assumed a temporary raised platform is required during construction to provide sufficient bearing capacity for the piling rig and to protect the works from daily tidal inundation, the extent of which will be subject to the Contractor's temporary works construction methodology. Embedded mitigation incorporated into the design of the proposed scheme is outlined in of Chapter 7 (Road Drainage and the Water Environment). The piled viaduct design would minimise flood storage losses and the operational drainage design takes into account increased flooding due to climate change.

Health Determinant	Relevant EIA Report Chapter(s)	Potential Impact Relating to Human Health from Constituent EIA Report Topic Chapters
		Additionally, a Flood and Tidal Response Plan will be developed by the Contractor, and the duration that the temporary raised platform is in place will be minimised as far as practicable. With the adoption of these mitigation measures and taking into account the temporary nature of the construction works, a Slight Adverse flood risk effect is predicted which is not significant. Regarding operational impacts, the new piled viaduct structure would not result in a change from current conditions to tidal movement and flood risk. Therefore there would be no change to flood risk to sensitive receptors within the West of Kincardine Bridge community, and a Neutral significance of effect is predicted. It is considered that impacts from flood risk will not be significant during construction or operation, and therefore, a Neutral human health outcome is predicted for both communities, the elderly population, and construction workers for flood risk.
Air Quality	Chapter 11 (Air Quality)	The population in the West of Kincardine Bridge and Kincardine communities (including the elderly population) have the potential to be impacted by changes in air quality as a result of construction works. Construction plant and machinery were scoped out of the air quality assessment as no significant effects were anticipated as a result of the proposed scheme. The potential impact of emissions from additional road movements associated with the construction traffic for the proposed scheme are considered neutral in terms of air quality as outlined in Chapter 11 (Air Quality) and therefore no further assessment was undertaken. Construction activities can lead to increased short-term and long-term concentrations of fine particulate matter (e.g. PM_{10} and $PM_{2.5}$) at off-site locations which may impact on human health. A Dust Risk Assessment (Appendix A11.1) has been undertaken for the proposed scheme to determine the potential for impacts. With the adoption of good practice mitigation measures including adoption of a Dust Management Plan, there is predicted to be a Low to Negligible risk from demolition, earthworks, construction and trackout activities for dust soiling impacts at sensitive human receptors within both communities. There is limited potential for emissions of PM_{10} to increase baseline concentrations to a value that is above the air quality objectives set for the protection for human health. Therefore, the likely effect of dust emissions on human health during construction is concluded to be not significant. Therefore, a Neutral human health outcome in predicted for both communities (including the elderly population) for air quality during construction and operation.
Noise and Vibration	Chapter 12 (Noise and Vibration)	Construction works for the proposed scheme have the potential to cause noise and vibration disturbance to the communities in the study area. Activities likely to result in noise adverse impacts include the use of construction vehicles, construction of piles and footings, breaking concrete pilasters and removing parapet panels from the existing viaduct, and erection of the temporary bridge and replacement piled viaduct. Given the distance of 110m between the main construction works for the proposed scheme and the nearest dwellings in the West of Kincardine Bridge community, vibration effects for activities such as bored piling and vibratory compaction are not predicted to be significant for the communities within the study area. As outlined in Chapter 12 (Noise and Vibration) it is considered that in the absence of mitigation, certain construction activities, such as piling and concrete breaking, have the potential to temporarily exceed the threshold levels, potentially resulting in significant adverse effects for the West of Kincardine Bridge community. The proposed temporary bridge structure would bring the road moving 10m closer to the West of Kincardine Bridge community, resulting in the temporary realignment of traffic. A maximum increase in road traffic noise of 0.4dB and a negligible adverse impact is predicted, which does not result in a significant effect.

Health Determinant	Relevant EIA Report Chapter(s)	Potential Impact Relating to Human Health from Constituent EIA Report Topic Chapters
		Changes in road traffic noise associated with the traffic management measures in place during the construction phase are predicted to occur at the North Approach Road (minor beneficial impact) and Toll Road (minor adverse impact) in the town of Kincardine. However, the predicted changes in noise levels in these locations are just above the 1dB change which is the smallest that is considered perceptible, and given that the traffic management measures will be temporary, these perceptible impacts are not considered to result in any significant effects. Chapter 12 (Noise and Vibration) identifies the mitigation measures to be employed to reduce potential impacts. Notably, this includes requirement for noise and vibration limits for residential noise receptors to be agreed by the Contractor with the Falkirk Council Environmental Health Department. The Contractor will be required to develop and implement a Noise and Vibration Management Plan to meet these requirements. With the adoption of mitigation measures and taking into account the temporary nature of the construction works, it is considered that any adverse noise or vibration impacts associated with construction of the proposed scheme are unlikely to result in significant effects. Therefore, a Neutral human health outcome in predicted for both communities (including the elderly population) for noise and vibration.

Summary of Potential Impacts on Human Health

14.5.2 Table 14.12 and Table 14.13 summarise the potential construction and operational impacts of the proposed scheme on both communities in relation to human health.

Table 14.12: Summary of Potential Construction Phase Impacts

Description of Impact	Potential Human Health Impact	Potential Effect	Heath Outcome
Pollution of land/water from construction activities (Chapter 6: Geology, Soils, and Groundwater)	Birth defects, lung conditions, cancer	Slight Not significant	Neutral
Coastal flood risk to construction activities and increased flood risk to adjacent land due to the temporary raised platform. (Chapter 7: Road Drainage and the Water Environment)	Injury, illness, death Stress, anxiety	Slight Not significant	Neutral
Dust emissions from construction activities (Chapter 11: Air Quality)	Asthma, respiratory problems and cardiovascular disease	Low to Negligible Not significant	Neutral
Noise and vibration disturbance from construction activities and changes in traffic due to the temporary bridge structure and traffic management (Chapter 12: Noise and Vibration)	Sleep disturbance, increased aggression, and impaired communication	Not significant	Neutral

Table 14.13: Summary of Potential Operational Phase Impacts

Description of Impact	Potential Human Health Impact	Potential Effect	Heath Outcome
Risk to future end users from potential soil/groundwater contamination and ground gas (Chapter 6: Geology, Soils and Groundwater)	Birth defects, lung conditions, cancer	Slight Not significant	Neutral
Net loss of floodplain storage comparative to the existing conditions due to proposed scheme (Chapter 7: Road Drainage and the Water Environment)	Injury, illness, death Stress, anxiety	Neutral Not significant	Neutral

14.5.3 There are no impacts reported which would disproportionately affect the elderly as a vulnerable community of high sensitivity.

14.5.4 There are no impacts reported which would have a significant effect on construction workers on the proposed scheme.

14.6 Mitigation

14.6.1 Mitigation measures for human health impacts are included within the relevant EIA Report topic chapters, and an overview of these measures is provided in Table 14.11. The relevant best practice, embedded, and essential mitigation measures will be implemented during construction and operation to minimise the potential for exceedances of thresholds and guidelines for human health impacts.

14.6.2 Additionally, standard construction mitigation measures set out in Chapter 4 (Overview of Assessment Process) are relevant to potential impacts on communities and are embedded in the human health

assessment, notably **Mitigation Items SM1, SM2** and **SM3**. These mitigation measures, and how they are considered relevant to human health, have been summarised below:

- **Mitigation Item SM1**: implementation of a Construction Environment Management Plan (CEMP) to provide a framework for the implementation of construction activities including plans related to geology and land contamination, surface water and groundwater (including a Flood and Tidal Response Plan); air quality (e.g. dust), and noise and vibration.
- **Mitigation Item SM2**: the EnvCow present on site will monitor the implementation of mitigation measures including those relating to noise, air quality, contaminated land, and flooding during the construction.
- **Mitigation Item SM3**: the communications strategy established for the proposed scheme will ensure that local communities are kept informed of the nature and duration of the works and there will be a telephone helpline and email/postal address implemented for enquiries and complaints during the construction phase.

14.6.3 Since there are no significant residual effects for human health once these mitigation measures are applied, there are no additional mitigation or monitoring measures identified in this human health assessment.

14.7 Residual Effects

14.7.1 As no additional mitigation measures have been proposed specifically for human health, the residual effects for this assessment are as per the potential effects set out in Table 14.12 and Table 14.13, i.e. no significant effects identified.

14.8 Assessment of Policy Compliance

14.8.1 DMRB LA 104 (Highways England *et al*. 2019) states that environmental assessment, reporting and monitoring shall meet the requirements of the national planning policy for each relevant Overseeing Organisation.

14.8.2 Appendix A4.1 (Assessment of Policy Compliance) provides a review of national and local policy documents which are of relevance to the assessment undertaken and reported in this chapter in accordance with DMRB guidance.

14.8.3 National planning policies of relevance to this assessment include the National Planning Framework 3 (Scottish Government 2014b) and Scottish Planning Policy (SPP) themes *Sustainability*, *Valuing the Natural Environment* and *Managing Flood Risk and Drainage*. Other policies of relevance include the National Transport Strategy 2 (Transport Scotland 2020), Climate Change Plan (Scottish Government 2018) and the Environment Strategy for Scotland (Scottish Government 2020b). A full policy compliance assessment can be found in Table 9 of Appendix A4.1 (Assessment of Policy Compliance), however it is assessed that the proposed scheme adheres to the requirements of policies relevant to Human Health, subject to appropriate mitigation proposed in Chapter 6 (Geology, Soils and Groundwater), Chapter 7 (Road Drainage and the Water Environment, Chapter 11 (Air Quality) and Chapter 12 (Noise and Vibration).

Summary of Policy Compliance

14.8.4 Overall, the design and assessment of the proposed scheme has had regard to and is compliant with policy objectives to minimise human health effects. A full policy compliance assessment can be found in Table 9 of Appendix A4.1 (Assessment of Policy Compliance).

14.9 Statement of Significance

14.9.1 Human health outcomes for the West of Kincardine Bridge and Kincardine communities (including the elderly population and construction workers) in relation to the proposed scheme have been assessed as Neutral for construction and operation. In the context of significance, in DMRB LA104 a Neutral significance is described as *'no effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.'* It is considered that this category appropriately describes the significance of the human health effects as well as the human health outcomes. Therefore, the significance of effect on human health is assessed to be Neutral (not significant).

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