



Lower Thames Crossing

7.10 Health and Equalities Impact Assessment (Tracked changes version)

APFP Regulation 5(2)(q)

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

Volume 7

DATE: ~~August~~ **November 2023**

DEADLINE: ~~7~~

Deleted: August

Deleted: 3

Planning Inspectorate Scheme Ref: TR010032
Application Document Ref: TR010032/APP/7.10

VERSION: ~~3~~ **3.0**

Deleted: 2

Lower Thames Crossing 7.10 Health and Equalities Impact Assessment (Tracked changes version)

Revision history

Deleted: 7.10 Health and Equalities Impact Assessment

Version	Date	Submitted at
1.0	31 October 2022	DCO Application
2.0	24 August 2023	Deadline 3
<u>3.0</u>	<u>17 November 2023</u>	<u>Deadline 7</u>

List of contents

	Page number
1 Executive summary.....	1
1.1 Introduction.....	1
1.2 Assessment methodology.....	1
1.3 Project design and mitigation.....	2
1.4 Consultation.....	3
1.5 Assessment.....	3
2 Introduction.....	16
2.1 Purpose of this document.....	16
2.2 The need for the Project.....	16
2.3 Project overview.....	17
2.4 Scheme Objectives.....	20
2.5 Legislative and policy framework.....	20
2.6 Links with other documentation.....	21
2.7 Report structure.....	23
3 Methodology.....	24
3.1 Introduction.....	24
3.2 Definitions of health, wellbeing and equality.....	24
3.3 Relevant guidance.....	27
3.4 Screening and scoping.....	28
3.5 Developing the baseline.....	32
3.6 Assessment framework.....	34
4 Project design and mitigation.....	45
4.1 Introduction.....	45
4.2 Project location and surrounding area.....	45
4.3 Project construction phases and timeline.....	48
4.4 Mitigation.....	66
5 Consultation and engagement.....	69
5.1 Introduction.....	69
5.2 Non-statutory consultation.....	69
5.3 Statutory Consultation.....	70
5.4 Engagement with 'hard-to-reach' groups.....	74
5.5 Stakeholder engagement.....	75
5.6 Approach to wider community engagement.....	79
5.7 Ongoing engagement.....	81

6	Baseline	82
6.1	Introduction	82
6.2	Summary of baseline conditions	82
7	Assessment	86
7.1	Introduction	86
7.2	Accessibility	86
7.3	Traffic-related severance	106
7.4	Access to green space and outdoor recreation	123
7.5	Active travel	143
7.6	Affordability	159
7.7	Road safety	164
7.8	Air quality	172
7.9	Noise and vibration	187
7.10	Work and training	207
7.11	Housing and community services impacts	217
7.12	Mental health and wellbeing	231
7.13	Pollution and flood-risk	244
7.14	Light pollution	253
7.15	Climate change	259
7.16	Electric and Magnetic Fields (EMFs)	267
7.17	Cumulative effects	269
8	Summary	275

Deleted: 1 Executive summary 1¶
1.1 Introduction 1¶
1.2 Assessment methodology 1¶
1.3 Project design and mitigation 2¶
1.4 Consultation 3¶
1.5 Assessment 3¶
2 Introduction 16¶
2.1 Purpose of this document 16¶
2.2 The need for the Project 16¶
2.3 Project overview 17¶
2.4 Scheme Objectives 20¶
2.5 Legislative and policy framework 20¶
2.6 Links with other documentation 21¶
2.7 Report structure 23¶
3 Methodology 24¶
3.1 Introduction 24¶
3.2 Definitions of health, wellbeing and equality 24¶
3.3 Relevant guidance 27¶
3.4 Screening and scoping 28¶
3.5 Developing the baseline 32¶
3.6 Assessment framework 34¶
4 Project design and mitigation 45¶
4.1 Introduction 45¶
4.2 Project location and surrounding area 45¶
4.3 Project construction phases and timeline 48¶
4.4 Mitigation 66¶
5 Consultation and engagement 69¶
5.1 Introduction 69¶
5.2 Non-statutory consultation 69¶
5.3 Statutory Consultation 70¶
5.4 Engagement with 'hard-to-reach' groups 74¶
5.5 Stakeholder engagement 75¶
5.6 Approach to wider community engagement 79¶
5.7 Ongoing engagement 81¶
6 Baseline 82¶
6.1 Introduction 82¶
6.2 Summary of baseline conditions 82¶
7 Assessment 86¶
7.1 Introduction 86¶
7.2 Accessibility 86¶
7.3 Traffic-related severance 106¶
7.4 Access to green space and outdoor recreation 123¶
7.5 Active travel 142¶
7.6 Affordability 158¶
7.7 Road safety 163¶
7.8 Air quality 171¶
7.9 Noise and vibration 186¶
7.10 Work and training 206¶
7.11 Housing and community services impacts 216¶
7.12 Mental health and wellbeing 230¶
7.13 Pollution and flood-risk 243¶
7.14 Light pollution 252¶
7.15 Climate change 258¶
7.16 Electric and Magnetic Fields (EMFs) 266¶
7.17 Cumulative effects 268¶
8 Summary 274¶
References 294¶
Glossary 304¶

List of tables

Page number

Table 1.1 Topics scoped in to the HEqIA.....	3
Table 1.2 Summary of the findings of the HEqIA.....	4
Table 1.3 Summary of health outcomes by ward for sensitive populations (construction) ...	6
Table 1.4 Summary of health outcomes by ward for sensitive populations (operation)	11
Table 3.1 Screening and scoping of the HEqIA	29
Table 3.2 Topics scoped in for assessment.....	29
Table 3.3 Assessment of sensitivity by ward	35
Table 3.4 Identification of sensitive populations.....	37
Table 3.5 Sensitive populations by assessment topic.....	39
Table 4.1 Project description – sections	46
Table 4.2 Utility Logistics Hubs – Section A	54
Table 4.3 Utility Logistics Hubs – Section C	60
Table 4.4 Summary of construction compounds in Section C	61
Table 4.5 Utility Logistics Hubs – Section D	64
Table 4.6 Summary of construction compounds in Section D	65
Table 5.1 Focus groups	75
Table 5.2 Stakeholder consultation – CIPHAG	76
Table 5.3 Stakeholder consultation – other health stakeholders.....	78
Table 7.1 Journey time increases >20% by construction phase	91
Table 7.2 Affected bus routes and journey time changes by construction phase	94
Table 7.3 Health outcome – accessibility (construction)	98
Table 7.4 Health outcomes – accessibility (operation).....	105
Table 7.5 Proposed restrictions for HGVs	111
Table 7.6 Potential severance locations (construction).....	112
Table 7.7 Areas of potential increased severance (construction phase).....	113
Table 7.8 Health outcomes – traffic-related severance (construction).....	115
Table 7.9 Potential severance locations	117
Table 7.10 Areas of increased severance	120
Table 7.11 Health outcomes – traffic-related severance (operation)	122
Table 7.12 Green space and outdoor recreation facilities affected by the temporary or permanent acquisition of land or construction activities.....	129
Table 7.13 Summary of visual effects relating to recreational receptors during construction	134
Table 7.14 Accessibility standards by local authority	135
Table 7.15 Health outcomes – changes in access to green space and outdoor recreation (construction)	136
Table 7.16 Health outcomes – changes in access to green space and outdoor recreation (operation)	142
Table 7.17 Wards principally affected by diversions and closures of PRowS	149
Table 7.18 Health outcome – active travel (construction)	152

Table 7.19 Active travel proposals by ward	156
Table 7.20 Health outcome – active travel (operation)	158
Table 7.21 Health outcome – affordability (operation)	163
Table 7.22 Health outcome – road safety (construction)	169
Table 7.23 Change in accidents by link (With Project compared to Without Project)	171
Table 7.24 Health outcomes – road safety (operation)	172
Table 7.25 Health outcome – air quality (construction)	179
Table 7.26 Summary of findings – receptors that inform the judgement of significance for air quality impacts (NO ₂)	182
Table 7.27 Summary of findings by area – air quality (NO ₂)	183
Table 7.28 Health outcome – air quality (operation)	186
Table 7.29 Construction noise summary of potential impacts	191
Table 7.30 Construction traffic noise – locations where significant effects experienced by construction year	193
Table 7.31 Construction vibration (piling activities) – summary of significant effects	195
Table 7.32 Health outcomes – noise (construction)	197
Table 7.33 Locations where a significant adverse or beneficial effect is predicted	200
Table 7.34 Changes in noise levels at schools and care homes (beneficial and adverse)	203
Table 7.35 Health outcome – noise (operation)	204
Table 7.36 Operational day-time impacts	206
Table 7.37 Operational night-time impacts	206
Table 7.38 Minimum Targets set out in the SEE Strategy	213
Table 7.39 Health outcomes – work and training (construction)	214
Table 7.40 Health outcome – work and training (operation)	216
Table 7.41 Health outcomes – impacts on housing and community services (construction)	226
Table 7.42 Health outcomes – impacts on housing and community services and facilities (operation)	230
Table 7.43 Impacts on mental health and wellbeing during construction	234
Table 7.44 Health outcomes – mental health and wellbeing (construction)	239
Table 7.45 Impacts on mental health and wellbeing during operation	241
Table 7.46 Health outcomes – mental health and wellbeing (operation)	243
Table 7.47 Health outcome – pollution and flood-risk (construction)	248
Table 7.48 Health outcome – pollution and flood-risk (operation)	252
Table 7.49 Summary of environmental lighting zones by LLCA	254
Table 7.50 Health outcome – light pollution (construction)	256
Table 7.51 Health outcome – light pollution (operation)	259
Table 7.52 Health outcome – climate change (GHG emissions)	263
Table 7.53 Health outcome – climate change (vulnerability of the Project during construction)	265
Table 7.54 Health outcome – climate change (vulnerability of the Project during operation)	266
Table 7.55 Summary of intra-project effects – construction	270

1 Executive summary

1.1 Introduction

- 1.1.1 This Health and Equalities Impact Assessment (HEqIA) reports the findings of the assessment of likely effects of the construction and operation of the A122 Lower Thames Crossing (the Project) on human health and equality. The process of preparing the HEqIA has iteratively informed the design development of the Project. This report sets out proposed mitigation measures and other interventions designed to avoid, reduce or remediate potential impacts as well as information relating to environmental enhancements that have been incorporated into the design. This document has been informed by a range of other assessments prepared as part of the Development Consent Order (DCO) application. These include various chapters within the Environmental Statement (ES) (Application Document 6.1), the Transport Assessment (Application Document 7.9) and the Distributional Impact Appraisal (DIA) within Appendix D of the Combined Modelling and Appraisal Report (ComMA) (Application Document 7.7).
- 1.1.2 The World Health Organization (WHO) defines health as a '*state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity*' (WHO, 1948). The range of personal, social, economic and environmental factors that influence health status are known as health determinants and include the physical environment, income levels, employment, education, social support and housing.
- 1.1.3 The Equality Act 2010 includes a public sector equality duty which requires public organisations and those delivering public functions to have due regard to the need to eliminate unlawful discrimination, harassment or victimisation; to advance equality of opportunity; and to foster good relations between communities. The characteristics set out in section 4 of the Equality Act 2010 are legally protected from discriminatory practices and comprise age, race, disability, religion or belief, gender reassignment, sex, sexual orientation, marriage and civil partnerships, and pregnancy/maternity.
- 1.1.4 National Highways (the Applicant), as a public authority, is subject to the public sector equality duty, meaning that it must consider how its projects, policies or decisions affect people who are protected under the Equality Act 2010. This is, therefore, considered within this document.

1.2 Assessment methodology

- 1.2.1 The methodology for the assessment has been taken from the Design Manual for Roads and Bridges (DMRB) LA 112 Population and Human Health (Highways England, 2020d), which provides information relating to scoping stages, definition of study areas, development of the health baseline, assessing the sensitivity of communities and describing health outcomes. A further source of guidance is that produced by the Wales Health Impact Assessment Support Unit (WHIASU, 2021). This describes the process, methods and resources that can be used to support health impact assessment, with appendices to the guidance including checklists of health and wellbeing determinants and vulnerable/disadvantaged groups. Use of the WHIASU guidance was

specifically raised during engagement with public health stakeholders as part of the Project design stage, as set out in further detail in Section 5.4 of this document.

- 1.2.2 The HEqIA is supported by a review of relevant national and regional policy frameworks (Appendix A) and a comprehensive baseline which establishes demographic, socio-economic and human health profiles for wards potentially affected by the Project (Appendix C). This has included wards close to the Order Limits as well as wards to the south and north of the existing Dartford Crossing. A wider study area was established comprising the local authorities through which the Project either directly passes, or which are sufficiently close to the Project for there to be a potential impact on the local population. These local authorities comprise Dartford, Gravesham and Medway to the south of the River Thames, and Thurrock, Havering and Brentwood to the north of the River Thames. The wider study area includes the local authorities of Tonbridge and Malling, Southend-on-Sea and Basildon so that specific health effects (such as accessibility) can be considered.
- 1.2.3 DMRB LA 112 (Highways England, 2020d) requires that, once the health profiles of communities have been established, the sensitivity of a community/population to change is identified. The sensitivity of a community/population is reported as being low, medium or high (with supporting evidence as necessary). This is followed by the identification of changes to health determinants likely to occur as a result of the Project, including whether the change is likely to be beneficial or adverse, an assessment of the duration of change (temporary or permanent) and consideration of the magnitude or severity of the change. Likely health outcomes have then been determined as positive, negative, neutral or uncertain.
- 1.2.4 The assessment of equality effects of the Project has used the Applicant's standard EqIA Screening Analysis and Monitoring template to consider how the Project could directly impact and contribute to equality effects for people with protected characteristics. The completed template is provided in Appendix B. The assessment has identified whether the impact is likely to have a disproportionate or differential effect on people with protected characteristics.

1.3 Project design and mitigation

- 1.3.1 Environmental considerations have influenced the Project throughout the design development process, from early route options assessment through to refinement of the Project design. An iterative process has facilitated design updates and improvements, informed by environmental assessment and input from the Project engineering teams, stakeholders and public consultation.
- 1.3.2 The Project includes a range of environmental mitigation commitments. These commitments fall within the following categories: embedded, good practice and essential mitigation. Other interventions which have a bearing on health impacts have also been identified and these are referenced in relation to relevant assessment topics throughout this HEqIA, including where they have been secured as part of the DCO.

1.4 Consultation

- 1.4.1 The Consultation Report (Application Document 5.1) provides a full description of the consultation activities undertaken, including the Project response to the feedback received. Stakeholder consultation in relation to the preparation of the HEqIA has been facilitated through the creation of the Community Impacts and Public Health Advisory Group (CIPHAG). This was established in 2018 as a body for public health officials and other local authority representatives to attend that could provide support during the preparation of the HEqIA in terms of information sharing and provision of technical advice and guidance around best practice. The advisory group has comprised core representation from the Applicant, including environmental and other technical specialists as required.
- 1.4.2 The group has acted in an advisory capacity only, to enhance local knowledge and understanding. All decisions relating to opportunities to avoid or reduce adverse impacts, or the identification of benefits as a result of the Project, are made by the Applicant. Over twenty CIPHAG meetings have been held between 2018 and submission of the DCO application.

1.5 Assessment

- 1.5.1 Topics scoped in to the HEqIA are listed in Table 1.1. Screening and scoping of relevant health determinants to be included within the HEqIA was carried out through engagement with local authority public health stakeholders as part of the CIPHAG meetings.

Table 1.1 Topics scoped in to the HEqIA

Accessibility	Road safety
Traffic-related severance	Housing and community services impacts
Changes in access to green space and outdoor recreation	Pollution and flood-risk
Active travel	Light pollution
Affordability	Climate change
Air quality	Mental health and wellbeing
Noise and vibration	Electric and Magnetic Fields (EMFs)
Work and training	

- 1.5.2 For each topic, the following information is presented:
- a. A source-pathway-receptor model to identify potential impacts and sensitive communities/populations.
 - b. Review of current evidence to support the identification of potential health impacts.
 - c. Summary of key findings from consultation activities, including statutory and non-statutory consultation.

- d. Summary of relevant priorities and objectives taken from local health and wellbeing strategies, equality strategies and joint strategic needs assessments (further detail for which is provided in Appendix A).
- e. A summary of relevant findings from baseline data (further detail for which is provided in Appendix C).
- f. An assessment of likely effects on health and equality during both construction and operational phases.

1.5.3 A summary of the findings of the HEqIA for both the construction and operational phases is set out in Table 1.2.

Table 1.2 Summary of the findings of the HEqIA

Health determinant	Health outcome
Construction	
Accessibility	• Neutral health outcome
Traffic-related severance	Neutral health outcome for general population Negative health outcome for sensitive populations within affected wards
Access to green space and outdoor recreation	Negative health outcome for general and sensitive populations
Active travel	Neutral health outcome for general and sensitive populations Positive health outcome for construction workforce
Affordability	N/A during construction
Road safety	Neutral health outcome for road safety Negative outcome for driver stress
Air quality	Neutral health outcome
Noise and vibration	Negative (significant) health outcome for general and sensitive populations within affected wards
Work and training	Positive (significant) health outcome (low-income populations, unemployed, children (science, technology, engineering and mathematics (STEM) activity))
Housing and community services impacts	Impacts associated with the loss of private property and associated change in sense of community – negative : people within impacted communities (Baker Street, North Ockendon), older people, people in low-income households Impacts on gypsy and traveller communities: neutral Impacts of construction workforce on local accommodation: neutral Impacts of construction workforce on healthcare services and facilities: neutral
Mental health and wellbeing	Positive and negative health outcomes identified by communities located in close proximity to construction routes and activities in addition to populations within and outside of

Health determinant	Health outcome
	these communities with a high sensitivity to mental health and wellbeing impacts. Impacts experienced by the construction workforce: positive
Pollution and flood-risk	Neutral health outcome
Light pollution	Neutral health outcome
Climate change	Greenhouse gas (GHG) emissions: neutral health outcome Vulnerability of the Project to climate change: neutral health outcome
EMFs	Neutral health outcome
Operation	
Accessibility	Positive (significant) health outcome for general and sensitive populations
Traffic-related severance	Neutral health outcome for general and sensitive populations
Access to green space and outdoor recreation	Positive (significant) health outcome for general and sensitive populations
Active travel	Positive (significant) : people in low-income households, children and young people, women, those without access to private transport and pedestrians/cyclists
Affordability	Positive health outcome for people in low-income households
Road safety	Neutral health outcome
Air quality	Neutral health outcome
Noise and vibration	Negative health outcome for sensitive populations within wards affected by worsening noise levels. Positive health outcome for sensitive populations within wards affected by improvements to noise levels.
Work and training	Positive (significant) health outcome (low-income populations, unemployed, children (STEM activity))
Housing and community services impacts	Neutral health outcome
Mental health and wellbeing	Positive (significant) and negative (significant) health outcomes identified
Pollution and flood-risk	Neutral health outcome
Light pollution	Neutral health outcome
Climate change	GHG emissions: neutral health outcome Vulnerability of the Project to climate change: neutral health outcome
EMFs	Neutral health outcome

1.5.4 Summaries of health outcomes by ward for sensitive populations are shown in Table 1.3 for construction and Table 1.4 for operation.

Deleted: Table 1.4

Table 1.3 Summary of health outcomes by ward for sensitive populations (construction)

Construction phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)														
Ward	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
Gravesham															
Riverside	-	X	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Riverview	-	X	X	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Higham	-	-	X	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Chalk	-	X	X	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Westcourt	-	X	X	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Shorne, Cobham and Luddesdown	-	-	-	-	N/A	-	-	X	✓	-	✓/X	-	-	-	-
Woodlands	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Singlewell	-	X	X	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Northfleet South	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Istead Rise	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Painters Ash	-	-	X	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Central	-	X	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-

Construction phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)														
Ward	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
Coldharbour	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Medway															
Cuxton and Halling	-	-	-	-	N/A	-	-	X	✓	-	✓/X	-	-	-	-
Strood South	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Strood North	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Strood Rural	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Dartford															
Newtown	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Stone Castle	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Stone House	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Bridge	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Temple Hill	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Longfield, New Barn and Southfleet	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Tonbridge and Malling															

Construction phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)														
Ward	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
Snodland East	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Thurrock															
Ockendon	-	-	X	-	N/A	-	-	X	✓	X	✓/X	-	-	-	-
Belhus	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Orsett	-	-	-	-	N/A	-	-	X	✓	X	✓/X	-	-	-	-
Stifford Clays	-	-	X	-	N/A	-	-	X	✓	-	✓/X	-	-	-	-
Little Thurrock Rectory	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Little Thurrock Blackshots	-	-	X	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Chadwell St Mary	-	X	X	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Tilbury St Chads	-	X	X	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Tilbury Riverside and Thurrock Park	-	-	-	-	N/A	-	-	X	✓	-	✓/X	-	-	-	-
East Tilbury	-	-	X	-	N/A	-	-	X	✓	-	✓/X	-	-	-	-
Aveley and Uplands	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-

Construction phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)														
Ward	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
West Thurrock and South Stifford	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Chafford and North Stifford	-	-	-	-	N/A	-	-	X	✓	-	✓/X	-	-	-	-
Stanford-le-Hope West	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Stanford East and Corringham Town	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
The Homesteads	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Corringham and Fobbing	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Having															
Upminster	-	-	X	-	N/A	-	-	X	✓	-	✓/X	-	-	-	-
Cranham	-	-	X	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Harold Wood	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Rainham and Wennington	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Gooshays	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-

Construction phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)														
Ward	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
Brentwood															
Warley	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
South Weald	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Herongate, Ingrave and West Horndon	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-

Table 1.4 Summary of health outcomes by ward for sensitive populations (operation)

Operation phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)														
Ward	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services impacts	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
Gravesham	Deleted Cells														
Riverside	✓	-	✓	-	✓	-	-	-	✓	-	✓/X	-	-	-	-
Riverview	✓	-	✓	✓	✓	-	-	X	✓	-	✓/X	-	-	-	-
Higham	✓	-	✓	✓	✓	-	-	✓	✓	-	✓/X	-	-	-	-
Chalk	✓	-	✓	✓	✓	-	-	-	✓	-	✓/X	-	-	-	-
Westcourt	✓	-	✓	✓	✓	-	-	✓/X	✓	-	✓/X	-	-	-	-
Shorne, Cobham and Luddesdown	✓	-	✓	✓	✓	-	-	✓/X	✓	-	✓/X	-	-	-	-
Woodlands	✓	-	✓	✓	✓	-	-	✓	✓	-	✓/X	-	-	-	-
Singlewell	✓	-	✓	✓	✓	-	-	✓	✓	-	✓/X	-	-	-	-
Northfleet South	✓	-	✓	-	✓	-	-	-	✓	-	✓/X	-	-	-	-
Istead Rise	✓	-	✓	✓	✓	-	-	-	✓	-	✓/X	-	-	-	-
Painters Ash	✓	-	✓	✓	✓	-	-	✓	✓	-	✓/X	-	-	-	-
Central	✓	-	✓	-	✓	-	-	-	✓	-	✓/X	-	-	-	-

Deleted Cells

Operation phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)														
Ward	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services impacts	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
Coldharbour	✓	-	✓	-	✓	-	-	-	✓	-	✓/ X	-	-	-	-
Medway															
Cuxton and Halling	✓	-	✓	-	-	-	-	X	✓	-	✓/ X	-	-	-	-
Strood South	✓	-	✓	-	-	-	-	-	✓	-	✓/ X	-	-	-	-
Strood North	✓	-	✓	-	-	-	-	-	✓	-	✓/ X	-	-	-	-
Strood Rural	✓	-	✓	-	-	-	-	-	✓	-	✓/ X	-	-	-	-
Dartford															
Newtown	✓	-	✓	-	✓	-	-	-	✓	-	✓/ X	-	-	-	-
Stone Castle	✓	-	✓	-	✓	-	-	-	✓	-	✓/ X	-	-	-	-
Stone House	✓	-	✓	-	✓	-	-	-	✓	-	✓/ X	-	-	-	-
Bridge	✓	-	✓	-	✓	-	-	-	✓	-	✓/ X	-	-	-	-
Temple Hill	✓	-	✓	-	✓	-	-	-	✓	-	✓/ X	-	-	-	-
Longfield, New Barn and Southfleet	✓	-	✓	-	✓	-	-	✓	✓	-	✓/ X	-	-	-	-

Operation phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)														
Ward	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services impacts	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
Tonbridge and Malling															
Snodland East	✓	-	✓	✓	-	-	-	X	✓	-	✓/ X	-	-	-	-
Thurrock															
Ockendon	✓	-	✓	✓	✓	-	-	✓/ X	✓	-	✓/ X	-	-	-	-
Belhus	✓	-	✓	✓	✓	-	-	✓	✓	-	✓/ X	-	-	-	-
Orsett	✓	-	✓	✓	✓	-	-	✓/ X	✓	-	✓/ X	-	-	-	-
Stifford Clays	✓	-	✓	✓	✓	-	-	✓	✓	-	✓/ X	-	-	-	-
Little Thurrock Rectory	✓	-	✓	✓	✓	-	-	✓	✓	-	✓/ X	-	-	-	-
Little Thurrock Blackshots	✓	-	✓	✓	✓	-	-	✓	✓	-	✓/ X	-	-	-	-
Chadwell St Mary	✓	-	✓	✓	✓	-	-	✓/ X	✓	-	✓/ X	-	-	-	-
Tilbury St Chads	✓	-	✓	✓	✓	-	-	-	✓	-	✓/ X	-	-	-	-
Tilbury Riverside and Thurrock Park	✓	-	✓	✓	✓	-	-	-	✓	-	✓/ X	-	-	-	-

Operation phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)															
	Ward	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services impacts	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
East Tilbury	✓	-	✓	✓	✓	-	-	X	✓	-	✓/X	-	-	-	-	
Aveley and Uplands	✓	-	✓	-	✓	-	-	✓	✓	-	✓/X	-	-	-	-	
West Thurrock and South Stifford	✓	-	✓	-	✓	-	-	-	✓	-	✓/X	-	-	-	-	
Chafford and North Stifford	✓	-	✓	✓	✓	-	-	-	✓	-	✓/X	-	-	-	-	
Stanford-le-Hope West	✓	-	✓	-	✓	-	-	-	✓	-	✓/X	-	-	-	-	
Stanford East and Corringham Town	✓	-	✓	-	✓	-	-	-	✓	-	✓/X	-	-	-	-	
The Homesteads	✓	-	✓	-	✓	-	-	-	✓	-	✓/X	-	-	-	-	
Corringham and Fobbing	✓	-	✓	-	✓	-	-	-	✓	-	✓/X	-	-	-	-	
 Havering																
Upminster	✓	-	✓	✓	-	-	-	✓	✓	-	✓/X	-	-	-	-	
Cranham	✓	-	✓	✓	-	-	-	✓	✓	-	✓/X	-	-	-	-	

Operation phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)														
Ward	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services impacts	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
Harold Wood	✓	-	✓	-	-	-	-	-	✓	-	✓/ X	-	-	-	-
Rainham and Wennington	✓	-	✓	-	-	-	-	-	✓	-	✓/ X	-	-	-	-
Gooshays	✓	-	✓	-	-	-	-	-	✓	-	✓/ X	-	-	-	-
Brentwood															
Warley	✓	-	✓	-	-	-	-	✓	✓	-	✓/ X	-	-	-	-
South Weald	✓	-	✓	-	-	-	-	-	✓	-	✓/ X	-	-	-	-
Herongate, Ingrave and West Horndon	✓	-	✓	-	-	-	-	-	✓	-	✓/ X	-	-	-	-

2 Introduction

2.1 Purpose of this document

- 2.1.1 National Highways (the Applicant) has submitted an application under section 37 of the Planning Act 2008 for a Development Consent Order (DCO) for the A122 Lower Thames Crossing (the Project).
- 2.1.2 The Project is a Nationally Significant Infrastructure Project under the Planning Act 2008. Therefore, an application for development consent has been submitted to the Planning Inspectorate. The application is accompanied by this combined Health and Equalities Impact Assessment (HEqIA), prepared in accordance with relevant guidance as described in Section 3.3.
- 2.1.3 This HEqIA is part of the suite of documents that comprise the DCO application. A full description of the DCO Application Documents is provided in the Introduction to the Application (Application Document 1.3).
- 2.1.4 The HEqIA reports the findings of the assessment of likely effects of the construction and operation of the Project on human health and equality. The process of preparing this HEqIA has informed the development of mitigation measures and other interventions (further information relating to this can be found in ES Chapter 4: Project Design and Mitigation) (Application Document 6.1). This report sets out proposed mitigation measures to avoid, reduce or remediate potential impacts on human health and equality.

2.2 The need for the Project

- 2.2.1 For over 56 years, the Dartford Crossing has provided the only significant road crossing of the River Thames east of London. Designed for 135,000 vehicles per day, it regularly carries over 180,000 vehicles on the busiest days of the year. Traffic flows this far above the design capacity of the road result in frequent congestion and poor journey time reliability, making the Dartford Crossing one of the least reliable sections of the strategic road network. Congestion is exacerbated when accidents and incidents occur and the time it takes to restore normal operation can be as long as five hours. This poor resilience of the Dartford Crossing is further undermined by a lack of alternative access across the Thames.
- 2.2.2 The Dartford Crossing is a critical part of the country's road network. It connects communities and businesses and provides a vital link for the nearby major ports, which play an important role in the distribution of goods across the rest of the UK. Reliable river crossings are essential for the provision of services and goods, enabling local businesses to operate effectively and for residents to access housing, jobs, leisure and retail facilities on both sides of the river.
- 2.2.3 The Project would deliver the following:
- a. Improved journey times and traffic flows on key approach roads in the surrounding area, such as parts of the A2, A127, A13 and M20
 - b. Reduced congestion on approach roads to the Dartford Crossing (including parts of the M25, A13 and A2)

- c. Increased capacity across the River Thames from four lanes in each direction currently (at the Dartford Crossing) to seven lanes each way (the Dartford Crossing plus the Project), representing an 80% increase in capacity.

2.2.4 The Need for the Project (Application Document 7.1) provides further information.

2.3 Project overview

2.3.1 The Project would provide a connection between the A2 and M2 in Kent and the M25 south of junction 29, crossing under the River Thames through a tunnel.

2.3.2 The A122 road would be approximately 23km long, 4.25km of which would be in tunnel. On the south side of the River Thames, the Project route would link the tunnel to the A2 and M2. On the north side, it would link to the A13, M25 junction 29 and the M25 south of junction 29. The tunnel portals would be located to the east of the village of Chalk on the south of the River Thames and to the west of East Tilbury on the north side.

2.3.3 Junctions are proposed at the following locations:

- a. New junction with the A2 to the south-east of Gravesend
- b. Modified junction with the A13/A1089 in Thurrock
- c. New junction with the M25 between junctions 29 and 30

2.3.4 To align with National Policy Statement for National Networks (Department for Transport, 2014a) policy and to help the Project meet the Scheme Objectives, it is proposed that road user charges would be levied in line with the Dartford Crossing. Vehicles would be charged for using the new tunnel.

2.3.5 The Project route would be three lanes in both directions, except for:

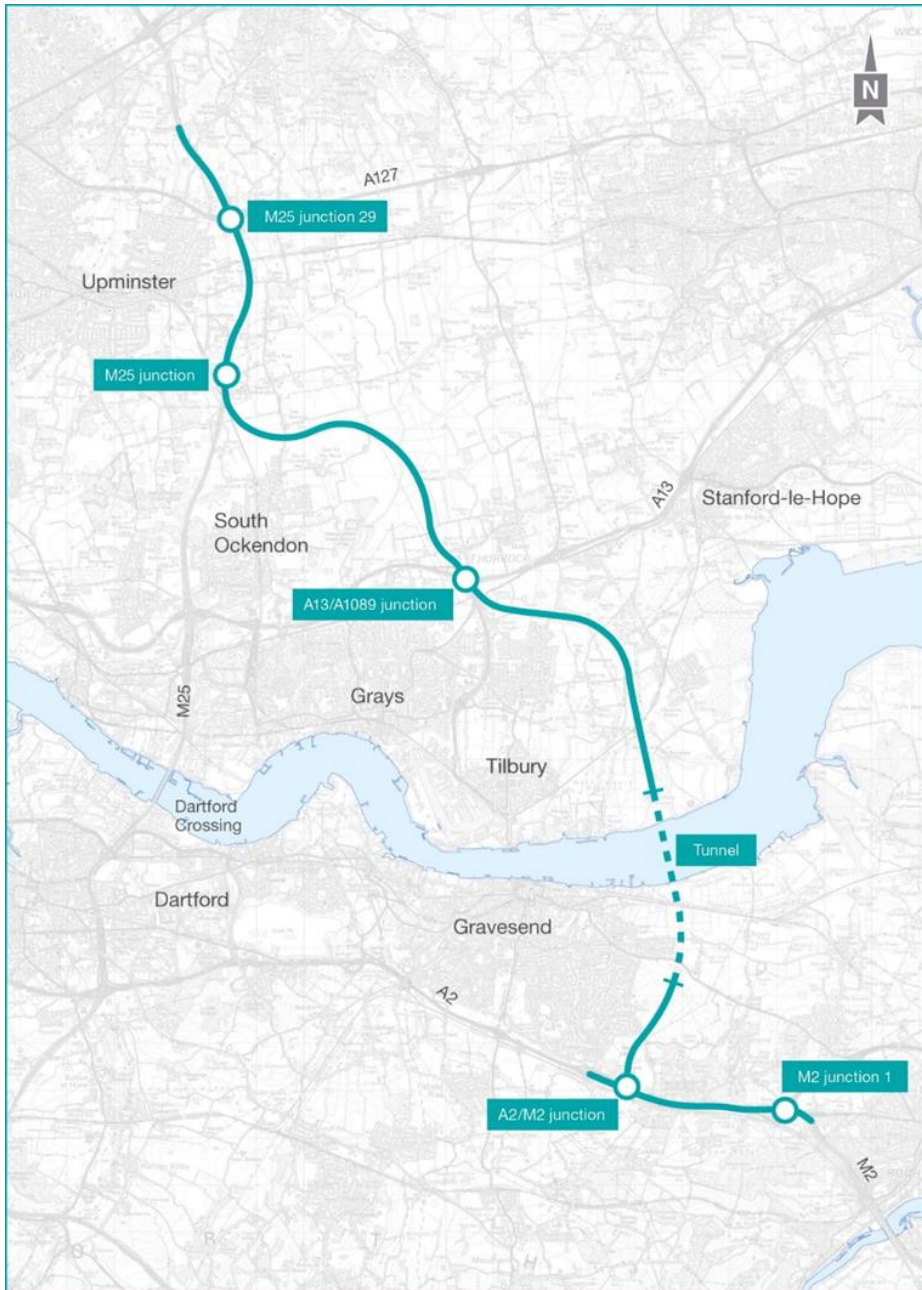
- a. link roads
- b. stretches of the carriageway through junctions
- c. the southbound carriageway from the M25 to the junction with the A13/A1089, which would be two lanes

2.3.6 In common with most A-roads, the A122 would operate with no hard shoulder but would feature a 1m hard strip on either side of the carriageway. It would also feature technology including stopped vehicle and incident detection, lane control, variable speed limits and electronic signage and signalling. The A122 design outside of the tunnel would include emergency areas. The tunnel would include a range of enhanced systems and response measures instead of emergency areas.

2.3.7 The A122 would be classified as an 'all-purpose trunk road' with green signs. For safety reasons, walkers, cyclists, horse riders and slow-moving vehicles would be prohibited from using it.

- 2.3.8 The Project would include adjustment to a number of local roads. There would also be changes to a number of Public Rights of Way, used by walkers, cyclists and horse riders. Construction of the Project would also require the installation and diversion of a number of utilities, including gas mains, overhead electricity powerlines and underground electricity cables, as well as water supplies and telecommunications assets and associated infrastructure.
- 2.3.9 The location of the Project is shown in Plate 2.1. A more detailed project description, including construction phasing, is included in ES Chapter 2: The Project (Application Document 6.1). For the purposes of this assessment, construction is planned to last for a period of approximately six years, with the opening date for the Project assumed to be in late 2030.

Plate 2.1 Lower Thames Crossing route



2.4 Scheme Objectives

2.4.1 The Scheme Objectives are:

- a. To support sustainable local development and regional economic growth in the medium to long term
- b. To be affordable to the government and users
- c. To achieve value for money
- d. To minimise adverse impacts on health and the environment
- e. To relieve the congested Dartford Crossing and approach roads and improve their performance by providing free-flowing north–south capacity
- f. To improve the resilience of the Thames crossings and the major road network
- g. To improve safety.

2.5 Legislative and policy framework

Legislation

- 2.5.1 Changes to the Environmental Impact Assessment (EIA) Directive 2014/52/EU came into force in May 2017. The Directive introduced new topics to the environmental assessment process including a requirement to assess population and human health. This requirement was then transposed into English law via the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations).
- 2.5.2 The Equality Act 2010 includes a public sector equality duty which requires public organisations and those delivering public functions to have due regard to the need to eliminate unlawful discrimination, harassment or victimisation; to advance equality of opportunity; and to foster good relations between persons with a relevant protected characteristic.
- 2.5.3 The characteristics set out in section 4 of the Equality Act 2010, which are listed below, are legally protected from discriminatory practices:
- a. Age
 - b. Disability
 - c. Race
 - d. Religion or belief
 - e. Sex
 - f. Gender reassignment
 - g. Sexual orientation

- h. Marriage and civil partnerships
- i. Pregnancy/maternity

Policy framework

- 2.5.4 Health impacts are addressed in the National Policy Statement for National Networks (Department for Transport (DfT), 2014a) which states that '*where the proposed project has likely significant environmental impacts that would have an effect on human beings, any environmental statement should identify and set out the assessment of any likely significant adverse health impacts*' (paragraph 4.81). The National Policy Statement for National Networks also includes the requirement for the development of the national road network to be '*designed to minimise social and environmental impacts and improve quality of life*' (paragraph 3.2).
- 2.5.5 The UK Government White Paper 'Healthy Lives, Healthy People' (Department of Health, 2010) provides a framework for tackling the wider social determinants of health, presenting the UK Government's commitment to protecting the population from serious health threats; helping people live longer, healthier and more fulfilling lives; and improving the health of the poorest, fastest. The White Paper notes that local government (including county, district and parish councils) play a significant role in protecting and improving the health of their communities through, for example, environmental health, air quality, planning, transport and housing.
- 2.5.6 The relevant national and regional policy framework for this HEqIA is set out in Appendix A. This includes a review of the Health and Wellbeing Strategies and Joint Strategic Needs Assessments for each local authority, which identify the health needs and priorities of their populations and provide the evidence base for decisions about local services. Impacts of the Project on local health and wellbeing priorities are highlighted further within the relevant topic chapters of this HEqIA.

2.6 Links with other documentation

- 2.6.1 A range of technical assessments and supporting documents have informed the development of the HEqIA. These have included:
- a. The Environmental Statement (ES) (Application Documents 6.1, 6.2 and 6.3) – relevant assessment chapters which have been used to inform various assessments within the HEqIA include ES Chapter 5: Air Quality, ES Chapter 7: Landscape and Visual, ES Chapter 10: Geology and Soils, ES Chapter 12: Noise and Vibration, ES Chapter 13: Population and Human Health, ES Chapter 14: Road Drainage and the Water Environment, ES Chapter 15: Climate and ES Chapter 16: Cumulative Effects Assessment (Application Document 6.1).
 - b. The Code of Construction Practice (CoCP) (Application Document 6.3, ES Appendix 2.2) provides a framework to manage construction activities that may affect the environment. The key aims are to ensure environmental mitigation, DCO Requirements, consents and licences are met to minimise

- and manage the risk of adverse environmental impacts. This is a certified document. The CoCP includes the Register of Environmental Actions and Commitments (REAC) (Application Document 6.3, ES Appendix 2.2) which sets out mitigation proposed in the ES and other DCO Application Documents such as this HEqIA, and shows how they are secured in the draft DCO, e.g. through DCO Requirements.
- c. The Environmental Masterplan (Application Document 6.2, ES Figure 2.4) visually represents the environmental mitigation on plans.
 - d. The Design Principles document (Application Document 7.5) sets out principles that underpin the design measures to integrate the Project into its context. It secures embedded mitigation measures and establishes parameters which must be met in the final design of the Project.
 - e. The Stakeholder Actions and Commitments Register (SAC-R) (Application Document 7.21) sets out additional key commitments for the Project.
 - f. Draft planning obligations and Heads of Terms are described in Application Document 7.3 (Section 106 Agreements: Heads of Terms).
 - g. The Consultation Report (Application Document 5.1) provides an account of the pre-application consultation undertaken for the Project. The report includes details of consultation which the Applicant was required to undertake in accordance with the Planning Act 2008, informal engagement that has taken place, and how comments received from members of the community and stakeholders have been accounted for when developing the Project. Relevant findings from consultation have been summarised in topic sections of the HEqIA as appropriate.
 - h. The Statement of Engagement (Application Document 5.2) describes the extensive engagement undertaken with stakeholders throughout the pre-application stage of the Project, which has helped shape the Project and facilitated continuous improvement to its design. This engagement has also been of significant benefit to the Applicant, as it has provided a deeper understanding of local issues and enabled information to be gathered to support decision making.
 - i. The Applicant has sought to jointly prepare a number of Statements of Common Ground with stakeholders. These are the primary source for understanding issues and how the Applicant has responded to concerns; Statements of Common Ground can be found in Application Document 5.4.
 - j. The Distributional Impact Appraisal (DIA) within Appendix D of the Combined Modelling and Appraisal Report (ComMA) (Application Document 7.7) provides an assessment of distributional impacts relating to

- topics including user benefits, noise, air quality, accidents, severance and personal affordability.
- k. The Transport Assessment (Application Document 7.9) assesses the forecast impacts of the Project during both construction and operation on the strategic and local highway networks, and local sustainable modes of transport (including walkers, cyclists and horse riders (WCH)).
 - l. An outline Traffic Management Plan for Construction (oTMPfC) (Application Document 7.14) has been prepared which describes the approach to traffic management during construction, including potential measures that could be taken to reduce impacts on local communities.
 - m. The Framework Construction Travel Plan (FCTP) (Application Document 7.13) sets out a framework for travel planning for the movement of personnel to and from the construction areas and compounds during the construction phase of the Project. Key aims of the FCTP are to minimise adverse local disruption or traffic impacts on the highway network from worker and visitor travel to and from construction areas and compounds, by reducing the number of single-occupancy vehicle trips and encouraging the uptake of sustainable and active modes of travel.
 - n. The Sustainability Statement (Application Document 7.11) provides a summary of where the preliminary design for the Project has met the aims of DMRB GG 103 Introduction and General Requirements for Sustainable Development and Design (Highways England, 2019a). This covers a range of sustainability matters under the headings of various economic, social and environmental subjects.

2.7 Report structure

2.7.1 This document comprises the following chapters:

- a. Chapter 1 – Executive summary
- b. Chapter 2 – Introduction
- c. Chapter 3 – Methodology
- d. Chapter 4 – Project design and mitigation
- e. Chapter 5 – Consultation and engagement
- f. Chapter 6 – Baseline
- g. Chapter 7 – Assessment
- h. Chapter 8 – Summary

3 Methodology

3.1 Introduction

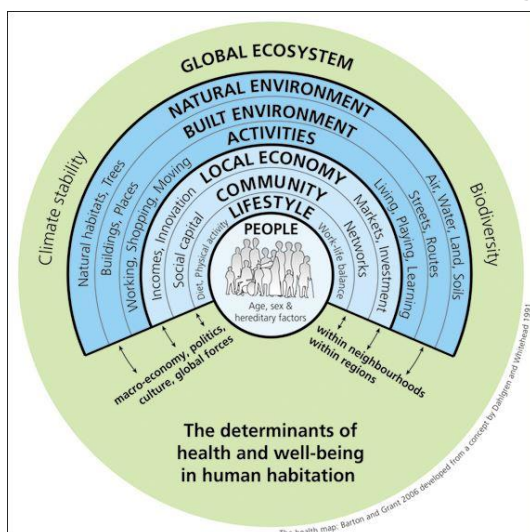
3.1.1 This section describes the methodology used to undertake the HEqIA, including setting out key definitions, use of guidance, scoping of health determinants for inclusion in the assessment, how baseline information has been developed, definition of study areas used, and the assessment framework followed.

3.2 Definitions of health, wellbeing and equality

Health and wellbeing

3.2.1 The World Health Organization (WHO) defines health as a ‘*state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity*’ (WHO, 1948). The range of personal, social, economic and environmental factors that influence health status are known as health determinants and include the physical environment, income levels, employment, education, social support and housing. Determinants of health and wellbeing are summarised in Plate 3.1.

Plate 3.1 Determinants of health and wellbeing



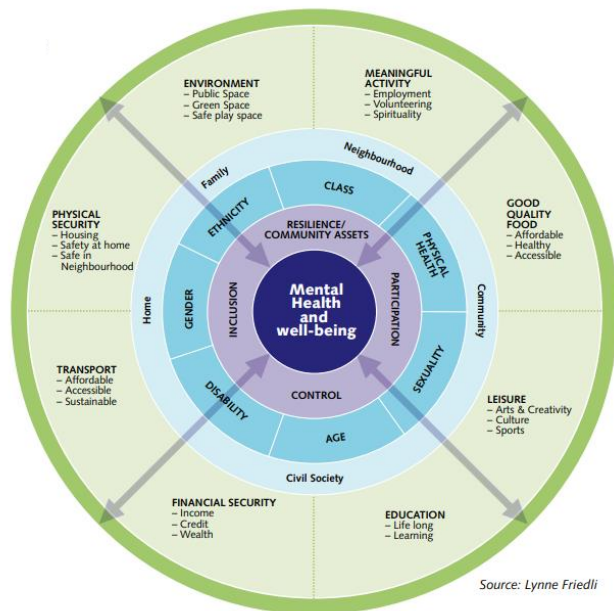
Source: Barton and Grant (2006) as amended from Dahlgren and Whitehead (1991)

3.2.2 Key determinants of health can be categorised as follows:

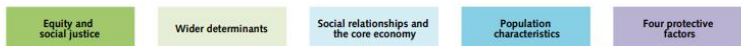
- a. Factors such as age and genetic make-up, which strongly influence a person’s health status.
- b. Social and economic circumstances, such as poverty, unemployment and other forms of social exclusion. Such circumstances strongly influence health, and improving these can significantly improve health.

- c. The environments in which people live, work and play. The way these are provided and managed (for example air quality, aspects of the built environment) can either damage health or provide opportunities for health improvement.
 - d. Lifestyle factors, which can have significant impacts on health.
 - e. The accessibility of services such as the National Health Service (NHS), education, social services, transport and leisure facilities, which influence the health of the population.
- 3.2.3 The purpose of a health assessment is to identify potential for changes to health determinants as a result of a project or programme, setting out where improvements and potential harm to health might occur.
- 3.2.4 Vulnerable populations are groups of people within society who may be sensitive to changes in health determinants and may include, for example, children, older people and people in low-income households.
- 3.2.5 The WHO states that '*there is no health without mental health*' (WHO, 2005). Mental health problems are unevenly distributed across society, with disproportionate impacts on vulnerable populations, for example people living in poverty. In the same way that projects and plans can impact on the physical health of people and communities, they can also impact on mental health and wellbeing.
- 3.2.6 There is increasing evidence and understanding of the importance of good mental health and wellbeing and how it can be influenced by a variety of factors, including the environment, the availability of meaningful activity (for example employment or volunteering) as well as more obvious links such as with financial or physical security. As well as these wider determinants, mental wellbeing is also affected by 'protective' factors, such as the level of control that individuals and communities feel they possess, how resilient they are, levels of participation and feelings of inclusion. The Mental Health and Wellbeing Impact Assessment Toolkit (Cooke *et al.* 2011) uses the diagram shown in Plate 3.2 to illustrate these factors and connections.

Plate 3.2 Model of mental health and wellbeing



Source: Lynne Friedli



Source: Cooke et al. 2011, reproduced from the Mental Wellbeing Impact Assessment Toolkit

Equality

- 3.2.7 The Equality and Human Rights Commission defines equality as being about 'ensuring that every individual has an equal opportunity to make the most of their lives and talents and believing that no-one should have poorer life chances because of where, what or whom they were born, what they believe or whether they have a disability'.
- 3.2.8 The equality assessment process is designed to ensure that projects, policies and practices do not discriminate or disadvantage people, and consider how equality can be improved or promoted. Equality impact assessments identify where inequality of outcomes may occur; that is, inequality of the central and valuable freedoms in life that individuals and groups can achieve. Such freedoms can be classified under several areas, for example health, security, education and learning, standard of living, participation and social life.
- 3.2.9 Although health and equality assessments each have a distinct purpose, there is much overlap in terms of the vulnerable populations or protected characteristics being considered and in terms of the topics being assessed (for example access to employment or to open space would be relevant areas of assessment for both health and equalities). Inequality is a pressing issue both

in health and in society overall; integrating the health and equality assessments for the Project was agreed with stakeholders as a way of promoting a more holistic approach to assessment.

3.3 Relevant guidance

- 3.3.1 Population and human health was introduced as a new topic to the environmental assessment process as part of the EIA Regulations in 2017. DMRB LA 112 Population and Human Health (Highways England, 2020d), provides information relating to scoping stages, definition of study areas, development of the health baseline, assessing the sensitivity of communities and describing health outcomes. In terms of assessment, DMRB LA 112 requires a qualitative assessment of health to be undertaken, identifying changes to health determinants.
- 3.3.2 Health in Environmental Impact Assessment – A Primer for a Proportionate Approach (Institute of Environmental Management and Assessment (IEMA), 2017) is primarily a discussion document outlining issues arising from changes brought about by EIA Directive 2014/52/EU. The IEMA guidance notes that scoping of population and human health issues should be proportionate and pay specific attention to vulnerable groups.
- 3.3.3 Human Health: Ensuring a high level of protection (International Association of Impact Assessment and European Public Health Association, 2020) is a reference paper prepared to address human health in environmental impact assessment and provides guidance in terms of assessing sensitivity, magnitude and significance of health effects. The document has been used to inform decision-making in relation to the assessment of significant effects.
- 3.3.4 A further source of guidance is that produced by the Wales Health Impact Assessment Support Unit (WHIASU, 2021). This describes the process, methods and resources that can be used to support health impact assessment, with appendices to the guidance including checklists of health and wellbeing determinants and vulnerable/disadvantaged groups. Use of the WHIASU guidance was specifically raised during engagement with public health stakeholders as part of the Project design stage, as described further in Section 5.5 of this document.
- 3.3.5 The assessment of effects on mental health and wellbeing is an area which can be difficult to assess in a meaningful way due to data limitations and the relatively subjective nature of assessment. Importantly, there is a need to distinguish between mental health/wellbeing and mental disorders or illness. Mental wellbeing is defined as '*a dynamic state, in which the individual is able to develop their potential, work productively and creatively, build strong and positive relationships with others, and contribute to their community. It is enhanced when an individual is able to fulfil their personal and social goals and achieve a sense of purpose in society*' (Foresight, 2009). Mental disorders are characterised by a clinically significant disturbance in an individual's cognition, emotional regulation, or behaviour (World Health Organization, 2022).
- 3.3.6 The assessment has taken into consideration guidance provided by the Mental Health and Wellbeing Impact Assessment Toolkit (Cooke *et al*, 2011) which uses a four-factor framework, namely:

- a. Enhancing control
- b. Increasing resilience
- c. Facilitating participation
- d. Promoting social inclusion

3.3.7 Finally, the National Highways guidance document Equality Impact Screening and Assessment (Highways England, 2017a) has been used to inform the equality assessment. Equality impacts have been identified in relation to individual topics throughout this document; these are also recorded separately within Appendix B - National Highways EqIA Screening Template.

3.4 Screening and scoping

3.4.1 A standalone Health Impact Assessment was requested by stakeholders as part of responses made to the Planning Inspectorate on the Scoping Report prepared by the Applicant (Highways England, 2017a). Comments made by stakeholders related to the importance of preparing a detailed, overarching assessment of the effects of the Project on human health, and highlighted that a standalone Health Impact Assessment would enable a more robust and holistic assessment to be carried out. Similar feedback was provided by stakeholders following Statutory Consultation which took place between 10 October 2018 and 20 December 2018 (further detail relating to consultation is provided in Chapter 5 of this HEqIA).

3.4.2 Following consideration of feedback from stakeholders, the Applicant confirmed that a standalone Health Impact Assessment would be prepared for the Project. An advisory group to support this workstream was established by the Applicant, with representatives from local authorities potentially affected by the Project invited to join. Terms of reference were established for the group (which was named the Community Impacts and Public Health Advisory Group (CIPHAG)). Regular meetings with the group have been held – over twenty meetings have been held prior to DCO submission. The purpose of individual meetings has been varied, including information-sharing, discussing topics of interest and importantly informing the scope of the standalone Health Impact Assessment. The decision to integrate the health and equalities impact assessments and produce an HEqIA was made at the initial advisory group meeting, with agreement from representatives. Further detail about the membership and role of CIPHAG, together with a schedule of information presented and discussed at individual meetings, can be found in Chapter 5 of this HEqIA.

3.4.3 Screening and scoping of relevant health determinants to be included within the HEqIA was carried out through subsequent engagement with local authority public health stakeholders as part of the CIPHAG meetings. Table 3.1 summarises when key discussions with the CIPHAG took place in relation to screening and scoping of the HEqIA.

Table 3.1 Screening and scoping of the HEqIA

Meeting details	Commentary
26/11/18 CIPHAG 29/01/19 CIPHAG	Proposed scope of health assessment discussed and summary baseline data/metrics provided.
02/04/19 CIPHAG	Detailed scoping note for accessibility and severance topics presented and discussed.
04/06/19 CIPHAG	Detailed scoping note for air quality and noise topics presented and discussed.
26/11/19 CIPHAG	Detailed draft HEqIA structure setting out all topics and proposed content was circulated prior to meeting and discussed.
25/02/20 CIPHAG	Revised detailed HEqIA structure discussed and agreed, following stakeholder comments on draft.
16/06/21 CIPHAG	Independent review of HEqIA following withdrawal of DCO submission 1.0 undertaken by CIPHAG members. This was presented and discussed at the meeting on 16 June 2021, with subsequent further discussions relating to scoping and assessment of topics (additional topics scoped into the assessment – refer to paragraph 3.4.5).
30/06/21 CIPHAG	Details relating to sensitive populations for inclusion in the HEqIA by assessment topic circulated following the meeting. Comments received on sensitive populations from Thurrock Council.
29/09/21 CIPHAG	Details relating to how ward sensitivity will be defined in the HEqIA discussed at CIPHAG meetings and circulated to members following the meeting. Comments received from Thurrock Council and Kent County Council.

Scoping of topics for assessment

- 3.4.4 The initial list of topics proposed for inclusion within the HEqIA (together with justification for inclusion), and presented to CIPHAG members in November 2019, is provided in Table 3.2. All topics are scoped in for both construction and operational phases.

Table 3.2 Topics scoped in for assessment

Topic for assessment	Justification
Accessibility	There is a direct link between accessibility and how people socialise, access services and employment, thereby affecting health and wellbeing. The Project may result in changes in access to employment as well as to community services and facilities during both construction and operational phases. Changes in accessibility both by car and for public transport users are considered in the HEqIA. For accessibility by private vehicle, access is measured to different types of destinations including education, employment, health, shopping and social welfare.

Topic for assessment	Justification
Severance	<p>Severance relates to the extent to which the Project separates residents from the facilities and services they use within their community because of either changes in routes used or changes in traffic flows.</p> <p>Severance during the construction phase may arise because of road closures, Public Rights of Way (PRoW) closures or diversions or use of roads as haul routes. During operation, severance may arise from changes in vehicle flows and speeds.</p>
Access to open space and nature (including physical activity)	<p>The importance of open space for people’s physical and mental wellbeing is well documented. There may be changes in access to open space/landscape amenity during the construction phase due to the temporary or permanent acquisition of land or closures of WCH routes. Access to open space may be improved during the operational phase because of replacement land, or land which could mitigate the impacts identified, and the provision of new and/or enhanced WCH routes.</p>
Road safety	<p>Road safety can directly impact on the health and wellbeing of the population. During construction, changes in road safety may arise from changes in traffic flows and patterns, including a change in the number of construction vehicles using the road network. Accident records and forecast traffic flows have been used to predict accident rates during operation of the Project.</p>
Air quality	<p>Changes in air quality can have a direct effect on exposure to pollutants and thereby the health and wellbeing of populations, including vulnerable populations. Construction activities can have a short-term negative impact on air quality as a result of emissions from construction vehicles as well as dust emissions from site works.</p> <p>Concerns about changes in air quality during both construction and operation have been highlighted during Statutory Consultation, Supplementary Consultation, Design Refinement Consultation, Community Impacts Consultation and Local Refinement Consultation.</p>
Noise	<p>There are proven linkages between noise and health. Noise has also been identified as a common issue in responses at Statutory Consultation, Supplementary Consultation, Design Refinement Consultation, Community Impacts Consultation and Local Refinement Consultation.</p> <p>Noise impacts during construction would include those from construction activities (noise generated by plant or equipment used on site), construction vehicle noise impacts (accounting for the number of average daily Heavy Goods Vehicle (HGV) movements along assumed construction routes) and night-time construction noise impacts.</p> <p>During operation, the Project could affect existing noise levels (increases or decreases) at sensitive receptors, due to changes in traffic flows both on the Project road and surrounding road network.</p>
Work and training	<p>The Project would create construction employment and associated local procurement and training opportunities. Access to work and training can have beneficial impacts on people’s health and life prospects, particularly for people living in more deprived areas.</p>

Topic for assessment	Justification
Housing and community-related impacts	<p>Potential impacts from the Project during the construction phase include the permanent acquisition and temporary possession of land and associated impacts (particularly in terms of mental wellbeing) on vulnerable communities as a result of changes in social capital (defined as including social links, networks, participation and satisfaction with living in an area). Impacts also include those associated with the construction workforce on the local housing market and local healthcare facilities.</p> <p>During operation, there is evidence from other large-scale infrastructure and regeneration schemes that some populations may be disproportionately sensitive to gentrification/transformation as a result of proposals (for example low-income groups). Potential impacts may include the displacement of existing communities, with potential inequality of impact across population groups.</p>
Climate change	<p>Potential impacts on the health and wellbeing of existing and future populations arising from climate-related impacts such as flooding or temperature change.</p>
Sources and pathways of potential pollution	<p>Environmental change as a result of pollution may be relevant to human health. Potential sources of pollution may include contamination, with impacts during both construction and operational phases.</p>
Light pollution	<p>Environmental change as a result of light pollution may be relevant to human health, with impacts during both construction and operational phases.</p>
Electric and Magnetic Fields (EMF)	<p>Modification of existing electricity infrastructure is necessary as part of the Project, due to the interaction of the Project with existing electricity towers (pylons) and the need for new and replacement towers. An assessment of the likely significant effects of EMFs has been carried out to support this work, which is provided in Appendix D.</p>

- 3.4.5 Following further discussion with stakeholders, further amendments to the scope of the HEqIA were made as follows:
- a. It was agreed that mental health and wellbeing would be covered in a separate section of the report. The mental health and wellbeing section includes issues associated with the perception of environmental effects (for example noise and air quality) as well such as perceptions of community safety arising from an influx of construction workers.
 - b. Access to open space and nature (including physical activity) was agreed to be subdivided into separate topics for assessment – these have been retitled as access to green space and outdoor recreation; and active travel.
 - c. Inclusion of a cumulative assessment to ensure that impacts on human health associated with other schemes were appropriately considered.

3.5 Developing the baseline

Data sources

- 3.5.1 A detailed understanding of baseline conditions has been obtained through a variety of means, including a review of existing data sources, findings from Statutory Consultation, Supplementary Consultation, Design Refinement Consultation, Community Impacts Consultation and the Local Refinement Consultation, as well as information from wider stakeholder engagement.
- 3.5.2 The following data sources have been used to determine baseline conditions:
- a. Office for National Statistics (ONS) – used to identify a range of data at different spatial levels relating to demography and the social and economic characteristics of the population. Data sources have included Nomis (official labour market statistics), Mid-Year Population Estimates and Census data from 2001 and 2011.
 - b. Ministry of Housing, Communities and Local Government data relating to deprivation levels in 2015 and 2019, including the Index of Multiple Deprivation and individual deprivation domains. The indices provide a set of relative measures of deprivation across England, based on seven different domains:
 - i. Income
 - ii. Employment
 - iii. Education, skills and training
 - iv. Health deprivation and disability
 - v. Crime
 - vi. Barriers to housing and services
 - vii. Living environment
 - c. Area profiles compiled by the Office for Health Improvement and Disparities (OHID) have been accessed to provide data relating to a range of health conditions, life expectancy and mortality rates. OHID's (2021) Local Health website has been used to identify similar information at ward level.
 - d. Information from the Kent Public Health Observatory and Essex Insight have been used to provide an overview of health issues and priorities for the two areas.
 - e. Statistics relating to the impacts of COVID-19 on the local population have been drawn from relevant sources (e.g. ONS data).

- f. The Joint Strategic Needs Assessments and local authority Health and Wellbeing Strategies have been reviewed to determine health needs and priorities at local authority level.
 - g. Baseline evidence has been supported by a review of relevant literature relating to specific health determinants and impacts on health outcomes.
- 3.5.3 Environmental baseline information relating to topics such as air quality, noise, landscape, geology and soils, climate change and land use as presented within the ES (Application Document 6.1) have also informed the HEqIA.
- 3.5.4 A future baseline has been set out using population and employment growth projections.

Study areas

- 3.5.5 Study areas for the HEqIA have been defined based on the extent and characteristics of the Project. A review of initial baseline information (which can be found at Appendix C to this HEqIA) has helped identify and characterise communities that may be directly or indirectly affected.
- 3.5.6 The following study areas have been used:
- a. A local study area comprising wards located within 1km of the Order Limits. These are wards potentially affected due to their proximity to the Project (i.e. part of the Project may be located within them or they are close enough to the Project that they may experience some effects, either from construction or during operation). Community profiling has been undertaken for the following wards:
 - i. Gravesham – the wards of Riverside, Riverview, Higham, Chalk, Westcourt, Singlewell, Woodlands, Shorne, Cobham and Luddesdown, Northfleet South, Painters Ash, Central, Coldharbour and Istead Rise
 - ii. Dartford – the ward of Longfield, New Barn and Southfleet
 - iii. Medway – the wards of Strood North, Strood South, Strood Rural and Cuxton and Halling
 - iv. Tonbridge and Malling – the ward of Snodland East
 - v. Thurrock – the wards of Ockendon, Belhus, Orsett, Stifford Clays, Little Thurrock Rectory, Little Thurrock Blackshots, Chadwell St Mary, Tilbury St Chads, Tilbury Riverside and Thurrock Park, East Tilbury, Stanford-le-Hope West and Chafford and North Stifford
 - vi. Havering – the wards of Upminster, Cranham, Harold Wood and Gooshays
 - vii. Brentwood – the wards of Warley, South Weald and Herongate, Ingrave and West Horndon

- b. A further area of consideration are wards further away for which there may be a particular reason for inclusion. These include the wards to the south and north of the existing Dartford Crossing – to the south of the river, these include the wards of Bridge and Stone Castle within Dartford¹; to the north of the river, they include Aveley and Uplands, and West Thurrock and South Stifford (both within Thurrock) and Rainham and Wennington (in Havering). Other wards are included as a result of stakeholder requests due to concerns about impacts of the Project on wider accessibility. For this reason, the wards of Stanford East and Corringham Town, The Homesteads and Corringham and Fobbing (all in Thurrock) have been included as part of the study area.
- c. A wider study area include the local authorities through which the Project either directly passes, which are close enough to the Project for there to be a potential impact on the local population, or which are the statutory providers for services at that level. These local authorities comprise Dartford, Gravesham, Medway and Kent to the south of the River Thames, and Thurrock, Havering, Brentwood and Essex to the north of the River Thames. This wider study area also includes the local authorities of Tonbridge and Malling, Southend-on-Sea and Basildon so that specific health effects (such as accessibility) can be considered. Administrative areas within the NHS hierarchy of service provision (for example former Clinical Commissioning Group areas) are also included within the wider study area to enable analysis of effects relating to healthcare.
- d. For specific environmental topics (notably air quality and noise), study areas are aligned with those provided in the ES (Application Document 6.1).

3.6 Assessment framework

Defining the sensitivity of communities

- 3.6.1 The sensitivity of communities has been assessed in line with DMRB LA 112 (Highways England, 2020d) as high, medium or low, according to supporting evidence. A series of indicators has been reviewed for wards included within the study area for the Project, namely:
- a. Percentage of community with increased susceptibility to health issues (people aged 60+)
 - b. Percentage of children (aged <16 years)
 - c. Emergency hospital admissions for Chronic Obstructive Pulmonary Disease (COPD) standardised admission ratio – 2016 to 2020 indirectly standardised ratio per 100 (standardised admission ratio is a summary of admission rates relative to the national pattern of admissions and taking

¹ Note that for the purposes of baseline data collation, Dartford's ward boundaries were amended in 2019; throughout this document the previous ward names of Stone, Littlebrook and Joyce Green are referred to instead, which cover a similar geographical area.

into account differences in population characteristics (for example age, sex, socio-economic deprivation)

- d. Deaths from respiratory diseases
- e. Percentage of people who reported having a limited long-term illness or disability (2011)
- f. General health – percentage of residents who report ‘bad health’ or ‘very bad health’
- g. Life expectancy – male
- h. Life expectancy – female
- i. Income deprivation

3.6.2 For each indicator, data has been compared against that for England as a whole and categorised according to whether the ward is performing ‘better than England’ (coloured green), ‘similar to England’ (coloured orange) or ‘worse than England’ (coloured red). This information is presented in ES Appendix 13.2: Ward Sensitivities (Application Document 6.3).

3.6.3 The sensitivity of individual wards has been identified as high, medium or low based on professional judgement and agreed during CIPHAG meetings. Sensitivity is assessed as follows:

- a. High sensitivity – wards where more than two datasets are categorised as being ‘worse than England’
- b. Medium sensitivity – wards where up to two datasets are categorised as being ‘worse than England’
- c. Low sensitivity – wards where all datasets are either ‘similar to England’ or ‘better than England’.

3.6.4 Table 3.3 summarises the sensitivity of individual wards based on the above approach.

Table 3.3 Assessment of sensitivity by ward

Ward	Sensitivity	Ward	Sensitivity
South of the River Thames			
Gravesham			
Riverside	High	Singlewell	High
Riverview	Medium	Woodlands	Medium
Higham	Medium	Northfleet South	Medium
Chalk	Medium	Istead Rise	Medium
Westcourt	High	Painters Ash	High
Shorne, Cobham & Luddesdown	Medium	Coldharbour	High
Central	Medium		
Dartford			
Newtown	High	Bridge	High

Ward	Sensitivity	Ward	Sensitivity
Stone Castle	High	Temple Hill	High
Stone House	High	Longfield, New Barn and Southfleet	Medium
Medway			
Cuxton and Halling	Low	Strood North	Low
Strood South	High	Strood Rural	Medium
Tonbridge and Malling			
Snodland East	High		
North of the River Thames			
Thurrock			
Ockendon	High	Tilbury St Chads	High
Belhus	High	Chadwell St Mary	High
Orsett	Medium	East Tilbury	Medium
Stifford Clays	High	Aveley and Uplands	High
Little Thurrock Rectory	Low	West Thurrock and South Stifford	High
Little Thurrock Blackshots	High	Chafford and North Stifford	Medium
Tilbury Riverside and Thurrock Park	High	Stanford-le-Hope West	Medium
Stanford East and Corringham Town	High	Corringham and Fobbing	Low
The Homesteads	Low		
Brentwood			
Warley	Low	South Weald	High
Herongate, Ingrave and West Horndon	Medium		
Havering			
Upminster	Medium	Harold Wood	Medium
Cranham	Medium	Rainham and Wennington	Low
Gooshays	High		

Defining the sensitivity of population groups

- 3.6.5 Protected characteristics for the purposes of equality impact assessment were set out in paragraph 2.5.3.
- 3.6.6 A wider range of sensitive population groups have been identified as part of the health assessment, through baseline data gathering, stakeholder engagement and consideration of information contained in WHIASU guidance (WHIASU,

2021). The guidance provides a population group checklist, identifying groups considered to be more susceptible to poorer health and wellbeing outcomes. The guidance notes that groups identified as more sensitive to potential impacts will depend on the characteristics of the local population, the context and the nature of the proposal (WHIASU, 2021). It is noted that the list of population groups is not exhaustive and for guidance purposes only.

3.6.7 Table 3.4 sets out sensitive populations identified in the WHIASU checklist and identifies for each group whether they are of high, medium or low relevance to the Project and associated assessment of impacts.

Table 3.4 Identification of sensitive populations

Sensitive population	Likely relevance to the assessment	Examples of relevance
Sex/gender related groups		
Female/male/ transgender	High	Community safety, access to services and facilities
Age-related groups		
Children and young people	High	Potentially sensitive to changes in access to open space, walking and cycling opportunities
Early years (including pregnancy and first year of life)	High	Potentially sensitive to noise disturbance, access to services
Older people	High	Potentially sensitive to changes in access to services
Groups at higher risk of discrimination or other social disadvantage		
Minority ethnic populations	Medium	High proportions of minority ethnic populations within particular affected wards, including a number of deprived wards
Carers	Medium	May work shift patterns and be more sensitive to noise disturbance
Ex-offenders	Low	N/A
Gypsies and travellers	High	Sites potentially affected by the Project
Homeless	Low	N/A
Language/culture	Low	N/A
Lesbian/gay/bisexual people	Low	N/A
Looked after children	Low	N/A
People seeking asylum	Low	N/A
People with long-term health conditions	High	Potentially sensitive to changes in air quality or noise levels

Sensitive population	Likely relevance to the assessment	Examples of relevance
People with mental health conditions	High	Potentially sensitive to perceptions of change in air quality or noise levels or other disturbance as a result of construction activity
People with physical, sensory or learning disabilities/difficulties	High	As above. May also be potentially affected by changes in access or severance
Refugee groups	Low	N/A
Religious groups	Medium	Sites potentially affected indirectly by the Project
Lone parent families	High	Potentially affected by changes to local community (e.g. cohesion), work and training opportunities
Veterans	Low	N/A
Income-related groups		
People in low-income households	High	Potentially more sensitive to a range of changes to the local environment, including access to jobs and services, access to nature, new work and training opportunities
Economically active	High	Potentially sensitive to changes in journey time/disruption during construction phase. Access to new work and training opportunities
Unemployed/workless	High	Access to new work and training opportunities
People who are unable to work due to ill health	Medium	Access to services and facilities
Geographical groups and/or settings		
People in key settings (e.g. workplaces, schools, hospitals)	High	Potentially sensitive to changes in journey time/disruption during construction phase
People living in areas known to exhibit poor economic/health indicators	High	Potentially more sensitive to a range of changes to the local environment, including access to jobs and services, access to nature, new work and training opportunities
People living in rural/isolated areas	High	Potentially more sensitive to noise disturbance, to changes to local community (e.g. cohesion)
People unable to access services and facilities	Low	N/A
People living close to the Project	High	Potentially more sensitive to a range of changes to the local environment

3.6.8 Sensitive populations have been identified for each of the assessment topics scoped in, as shown in Table 3.5.

Table 3.5 Sensitive populations by assessment topic

Assessment topic	Sensitive populations
Accessibility	<ul style="list-style-type: none"> • Children and young people • Older people • Women • People in low-income households • People with disabilities/long-term health conditions • People living in rural areas • Carers • People in key settings: workplaces/schools/hospitals/care homes/prisons
Severance	<ul style="list-style-type: none"> • Children and young people • Older people • People with disabilities/long-term health conditions • Parents with young children/pushchairs • People in low-income households • People living in rural areas • Lone-parent families • Carers • People in key settings: workplaces/schools/hospitals/ care homes/prisons
Access to green space and outdoor recreation	<ul style="list-style-type: none"> • Children and young people • People living in areas which exhibit poor economic/health indicators • Users of existing areas of open space and recreational assets • People with disabilities/long term health conditions • People with mental health conditions • Older people • Carers • Lone-parent families
Active travel	<ul style="list-style-type: none"> • Children and young people • Women • People in low-income households • Lone-parent families • People living in rural areas
Road safety	<ul style="list-style-type: none"> • Children and young people • Older people • People in low-income households • People with disabilities/long term health conditions
Air quality	<ul style="list-style-type: none"> • Children and young people • Older people

Assessment topic	Sensitive populations
	<ul style="list-style-type: none"> • People with disabilities/long term health conditions (for example people with pre-existing respiratory health conditions such as asthma) • People living in areas which exhibit poor economic/health indicators • People in key settings: workplaces/schools/hospitals/ care homes/prisons
Noise and vibration	<ul style="list-style-type: none"> • Children and young people • Older people • Early years (for example pregnant women/parents with newborn babies who may already be suffering from sleep disturbance) • People with disabilities/long term health conditions (for example people with pre-existing aural health conditions or cardiovascular conditions) • People with mental health conditions (for example people with autism or dementia who may have different levels of susceptibility to changes in noise levels) • Shift workers (for example carers) • People living in areas which exhibit poor economic/health indicators • People living in close proximity to the route or construction activities (e.g. residents of the Gammon Field Travellers Site) • People in key settings: workplaces/schools/hospitals/care homes/prisons
Work and training	<ul style="list-style-type: none"> • People living in areas which exhibit poor economic/health indicators • People who are economically inactive or unemployed • Children and young people (who may be affected by changes in household income) • People who are unable to work due to ill health • Lone-parent families • Carers • Migrant and itinerate workers (potential members of the construction workforce)
Housing and community-related impacts	<ul style="list-style-type: none"> • People living in properties affected by land acquisition • People living in communities affected by loss of properties (e.g. Baker Street, North Ockendon) • Older people • People in low-income households • Younger families with school-age children • Gypsy and traveller communities • People with disabilities/long term conditions • Carers

Assessment topic	Sensitive populations
	<ul style="list-style-type: none"> • People living in rural areas • People living in properties within close proximity of the route • People with mental health conditions
Mental health and wellbeing	<ul style="list-style-type: none"> • People in low-income households • People who are long-term unemployed • People in poor living conditions • People with a long-term or chronic illness or disability • People from ethnic minority groups • People with a history of drug and/or alcohol misuse • Lone-parent families • People with existing mental health conditions/needs • Carers • Gypsy and traveller communities
Pollution and flood-risk	<ul style="list-style-type: none"> • Local residents and land-users in the vicinity of significant earthwork movements • Construction workers • Road users • Maintenance workers
Light pollution	<ul style="list-style-type: none"> • Residential populations located in close proximity to construction compounds/activities • Older people • Children and young people • People with sensory disabilities • People living in rural areas • People with mental health conditions
Climate change	<ul style="list-style-type: none"> • People in low-income groups • People with disabilities • Older people • People living in areas which exhibit poor economic/health indicators • People with disabilities/long-term health conditions • People living in high flood risk zones
Electric and magnetic fields (EMF)	<ul style="list-style-type: none"> • N/A

Temporal scope

3.6.9 The HEqIA has defined temporal scales to characterise the duration of potential effects as follows:

- a. Short term is defined as under six months.
- b. Medium term is defined as between six months and two years.

- c. Long term is defined as more than two years in duration.
- d. Permanent.

Assessment of health outcomes

- 3.6.10 DMRB LA 112 does not currently include significance criteria for health but instead states that health outcomes should be reported as:
- a. Positive – a beneficial health impact is identified
 - b. Neutral – no discernible health impact is identified
 - c. Negative – an adverse health impact is identified
 - d. Uncertain – where uncertainty exists as to the overall health impact
- 3.6.11 Consultation with health stakeholders via CIPHAG has highlighted that the assessment of effects on human health should include an assessment framework which identifies the sensitivity of the community/population, whether the change is beneficial or adverse, the duration (temporary or permanent), the magnitude and severity of the change and a judgement as to whether or not the effect is likely to be significant.
- 3.6.12 The guidance document Human health: ensuring a high level of protection. A reference paper on addressing human health in Environmental Impact Assessment (International Association of Impact Assessment and European Public Health Association, 2020) has been used to inform an approach to identifying significance, taking into account multiple criteria.
- 3.6.13 Accordingly, the following has been taken into account when assessing population health effects that may arise as a result of the Project:
- a. The strength of evidence to support an association between changes arising from the Project, the determinant of health and a health outcome
 - b. The relationship with the health policy context and/or local health priorities
 - c. The extent to which stakeholders are concerned about particular determinants of health or health outcomes
 - d. The proportion of the population likely to be affected by or exposed to the potential change (high, medium or low) including the distribution of effects where this is relevant and the nature of the population affected (for example where a population may be particularly sensitive due to pre-existing health conditions or other factors)
 - e. Duration of effect (short-, medium-, long-term or permanent in line with the temporal scope set out in paragraph 3.6.9)
 - f. An assessment of the severity of health outcome, for example whether this relates to changes in mortality/morbidity or whether the change is related to wellbeing or quality of life

- g. The potential impact of the change on health inequalities at a population level
- h. Whether the change is likely to be beneficial, adverse, neutral or uncertain (in line with categories set out in DMRB LA 112 as described in paragraph 3.6.10)

3.6.14 Taking the above factors into account, an assessment of whether the effect is likely to be significant or not significant in terms of population health.

Equality effects

3.6.15 The assessment of equality effects of the Project has used National Highways' standard EqIA Screening Analysis and Monitoring template to consider how the Project could directly impact and contribute to equality effects for protected characteristics. The completed template is provided in Appendix B.

3.6.16 To capture specific effects on protected characteristics in line with the Equality Act 2010, where relevant the assessment has identified whether the impact is likely to have a disproportionate or differential effect, described as follows:

- a. Disproportionate – where there is a proportionately greater impact on members of a protected group than on other members of the general population in a particular area.
- b. Differential – an impact which affects members of a protected group differently from the rest of the general population because of specific needs or a recognised vulnerability.

Cumulative assessment

3.6.17 A cumulative assessment of effects has been carried out, which considers both intra-project and inter-project effects. Intra-project effects relate to where the separate effects of the Project (for example noise and air quality) are considered together in terms of their combined impact on health, wellbeing and equality. Inter-project impacts relate to the potential effects of the Project in combination with likely significant effects from other developments. The inter-project cumulative assessment is aligned with the cumulative assessment undertaken within the ES Chapter 16: Cumulative Effects Assessment (Application Document 6.1).

Assumptions and limitations

- 3.6.18 Assumptions and limitations of the health and equalities impact assessment include the following:
- a. For all topics, the assessment has been aggregated to ward level unless otherwise specified. Health effects are therefore considered at a population, rather than an individual level.
 - b. Some of the baseline data used to inform ward sensitivities and the topic assessments themselves is based on the 2011 Census and therefore is dated. Trends may have changed between 2011 and 2021, notably as a

result of the COVID-19 pandemic. Furthermore, the baseline data provided in Appendix C covers a variety of spatial scales according to the type of data available, with data not always being available at ward level.

- c. Ascertaining the level of exposure of a population to impacts on certain health determinants is based on professional judgement, taking into account the fact that there are inherent uncertainties in identifying how and where people may spend their time (for example in a location exposed to impacts) as opposed to other locations where other factors may be responsible for health changes. The HEqIA draws from and builds upon the outputs of the supporting technical disciplines, and is therefore subject to the same limitations and assumptions affecting those assessments.
- d. The scale and significance of impacts cannot always be quantified. It is common for health and equality impact assessment to address this through descriptive analysis of impacts and identification of the potential direction of effects. The HEqIA seeks to identify those areas with potential for effects and can only consider those effects that can reasonably be foreseen. In many cases these effects may be minor.
- e. There may be reasonable mitigation measures that can eliminate or reduce potential health or equalities impacts, but such impacts may not always be avoidable. Many of the wider aspects of the Project, including future employment and recruitment decisions, will themselves be subject to the Equality Act, separately from the planning system.
- f. The nature of the protected characteristics means that some equality effects are sensitive and personal in nature, and in some cases public data does not exist at a local level to predict them with certainty.

4 Project design and mitigation

4.1 Introduction

- 4.1.1 This chapter provides a more detailed description of the Project together with a summary of mitigation measures proposed to avoid, reduce or offset impacts on health, wellbeing and equality during the construction and operational phases.

4.2 Project location and surrounding area

South of the River Thames

- 4.2.1 Urban areas to the south of the River Thames close to the Project route include Gravesend, Higham and Chatham. There are a number of footpaths, bridleways, National Cycle Network routes, local cycle routes and trails within the area to provide WCH with access and connectivity to surrounding areas.
- 4.2.2 Areas of the physical environment around the Project are designated for their important ecological, cultural heritage and landscape features. Close to the A2, there are a number of areas of nationally important ancient woodland, Sites of Special Scientific Interest (SSSIs) and sites of local biodiversity importance. To the south of the River Thames, to the east of Gravesend and the north-east of Chalk lie the South Thames Estuary and Marshes SSSI and Thames Estuary and Marshes Ramsar site, with the land further east also being designated as a Special Protection Area.
- 4.2.3 The land between the villages of Thong and Shorne and to the south of the A2 forms part of the Kent Downs Area of Outstanding Natural Beauty. Also to the south of the A2 lies the Cobham Hall Registered Park and Garden. The villages of Shorne and Cobham are also designated as Conservation Areas.
- 4.2.4 A number of listed buildings of all grades, particularly Grade II and II*, are found throughout the area. Other heritage features of note are scheduled monuments including New Tavern Fort and Cliffe Fort on the southern bank of the River Thames. There are extensive areas of floodplain across the area associated with the River Thames.
- 4.2.5 There are a number of Air Quality Management Areas (AQMAs) designated by Gravesham Borough Council, which demonstrate the existing air quality issues in these areas. There is also an AQMA designated at the existing Dartford Crossing. A number of Noise Important Areas are also designated south of Gravesend along parts of the A2 and the M25.

North of the River Thames

- 4.2.6 Urban areas to the north of the River Thames close to the Project include Grays, Tilbury, Chadwell St Mary, Linford, East Tilbury and Ockendon.
- 4.2.7 Important ecological features to the north of the River Thames include Goshems Farm Local Wildlife Site together with several other Local Wildlife Sites between the river and the M25, as well as other areas of ancient woodland. In terms of cultural heritage features, the settlements of East and West Tilbury are designated as Conservation Areas. There are a number of listed buildings of all grades, particularly Grade II and II*. Coalhouse Fort

- Battery and Artillery Defences and Tilbury Fort are located on the northern bank of the River Thames as well as a cropmark complex at Orsett next to the A13.
- 4.2.8 The Mardyke lies to the north of the River Thames in Thurrock and flows into the River Thames at Purfleet. Parts of the area benefit from the River Thames tidal flood defences. Numerous smaller watercourses and drainage ditches traverse the area particularly to the north of the River Thames.
- 4.2.9 There are a number of AQMAs designated by Thurrock Council and the London Borough of Havering, which demonstrate the existing air quality issues in these areas.

Project description

- 4.2.10 The Project has been broken down geographically into the nine sections described in Table 4.1. Further details relating to the Project description can be found in ES Chapter 2: Project Description (Application Document 6.1).

Table 4.1 Project description – sections

Section	Name	Description
1	M2/A2 corridor	Alteration of the A2 from M2 junction 1 running west under Thong Lane green bridge south, towards the M2/A2/A122 Lower Thames Crossing junction.
2	M2/A2/A122 Lower Thames Crossing junction	Alteration of the A2 and construction of the new junction with the Project continuing north to a point directly south of the new Thong Lane green bridge north over the A122.
3	M2/A2/A122 Lower Thames Crossing junction to South Portal	Construction of the Project road between the M2/A2/A122 Lower Thames Crossing junction, directly south of the new Thong Lane green bridge north over the A122, running north beyond the South Portal until Rochester Road. Section 3 includes construction of the portal structure and infrastructure associated with the tunnel.
4	A122 Lower Thames Crossing Tunnel	Construction of the tunnels and the A122 through the tunnels between the South Portal and North Portal.
5	North Portal to northern end of Tilbury Viaduct	Construction of the A122 at the North Portal to the northern end of the Tilbury Viaduct. Section 5 includes construction of the portal structure and infrastructure associated with the tunnel and its maintenance access.
6	Chadwell St Mary link	Construction of the A122 between the Tilbury Viaduct and the A13/A1089/A122 Lower Thames Crossing junction.
7	A13/A1089/A122 Lower Thames Crossing junction	Alteration of the existing A13/A1089 junction, and construction of the new A13/A1089/Lower Thames Crossing junction.
8	Lower Thames Crossing Ockendon Link	Construction of the highway between the junction with the A13 and the M25.
9	A122 Lower Thames Crossing/M25 junction	Construction of the A122 Lower Thames Crossing/M25 junction, and alteration of the M25 including junction 29.

Project design process

- 4.2.11 This Project description is based on the design of the Project at the time the DCO application is made. Further design development would take place within the constraints defined by the DCO, the limits of deviation and by the Rochdale Envelope as set out within ES Chapter 2: Project Description (Application Document 6.1). The final detailed design of the above ground structures and buildings would be governed by a set of Design Principles submitted with the DCO (Application Document 7.5).
- 4.2.12 The Design Principles reflect the design aspirations of the Applicant, creating an overarching, shared resource which gives clarity to stakeholders over the expected design outcomes. They give detail on design intent but still provide some flexibility to develop the detailed design in the light of prevailing circumstances as the Project is implemented.
- 4.2.13 The Design Principles apply to the Project's permanent structures and landscape works. They do not apply to the temporary works and methods of construction, and do not address how the Project would be operated and maintained.
- 4.2.14 The Design Principles have been developed in consultation with local authorities and other stakeholders and by using feedback from Statutory Consultation and the non-statutory Supplementary Consultation, Design Refinement Consultation, Community Impacts Consultation and Local Refinement Consultation. They establish parameters that must be met in the final detailed design of the Project. The Design Principles have been submitted for approval as part of the DCO application and reflect the commitments that the Project is making and that would be secured through DCO.
- 4.2.15 Engagement with stakeholders and communities has influenced the design of the Project. Information relating to how the Project has responded to feedback has been set out in 'You Said, We Did' documents shared as part of Community Impacts and Local Refinement Consultations. Many design changes have been made during the development of the Project, often as a result of consultation and direct engagement with stakeholders. Examples of changes made include:
- a. Refinements to the design of the utility diversions in order to reduce the footprint of land required, and in doing so reduce the potential impacts on the Shorne and Ashenbank Woods SSSI, Jeskyns Community Woodland and Claylane Wood
 - b. Relocation of the proposed car parking facility to be closer to Shorne Woods Country Park, in order to provide access and parking for users.
However, this has now been removed from the design as a result of further stakeholder discussions.
 - c. The design of the proposed Tilbury Fields and Chalk Park features
 - d. Inclusion of an additional WCH bridge over the A127 to the west of M25 junction 29 due to concerns raised by London Borough of Havering and Transport for London regarding connectivity

- e. Inclusion of a heavy good vehicle (HGV) ban along Lower Higham Road within the outline Traffic Management Plan for Construction (Application Document 7.14), with the A226 Gravesend Road compound to be accessed from the A226 Gravesend Road
- f. We refined our proposals for construction compounds. The addition of Long Lane compound B included moving certain aspects of the compound further away from the Gammon Field Travellers Site, therefore slightly reducing its impact
- g. To reduce the impacts on the Whitecroft care home we moved the A13 slip road further west, and increased the amount of woodland planting between the care home and the slip road.
- h. Inclusion of new commitments within the CoCP and REAC (Application Document 6.3, ES Appendix 2.2)
- i. Use of section 106 agreements as a securing mechanism forming part of the DCO application. This facilitates the commitment to the Skills, Education and Employment targets, and secures the community funds and the ring-fencing of the funds by affected wards – both of which have been longstanding requests of the local authorities

4.3 Project construction phases and timeline

4.3.1

The construction activities described in this section provide the basis for the assessment. The approach to construction described is indicative but it is representative of the likely approach to be adopted. The Project construction site has been split into four construction sections which have then been further divided into sub-sections for the purposes of managing the construction process. The four construction sections are described as follows:




- a. Section A: South of the River Thames – M2/A2/A122 Lower Thames Crossing corridor. This section includes the area of the M2/A2 corridor, the proposed M2/A2/A122 Lower Thames Crossing junction and highways up to, and including, the proposed Thong Lane green bridge north over the A122.
- b. Section B: Tunnel Crossing – from the Thong Lane green bridge north over the Project to Tilbury Viaduct. This section covers the area between the proposed Thong Lane green bridge north and the proposed Tilbury Viaduct. This includes the work needed to construct the tunnels and their approach roads, south and north of the River Thames. A ground protection tunnel would run from south of Lower Higham Road to north of the Medway Canal and North Kent railway line.
- c. Section C: North of the River Thames – the Project north of the A13/A1089/A122 Lower Thames Crossing junction from Tilbury Viaduct.

This section includes the area north of the River Thames between the proposed Tilbury Viaduct and Green Lane, north of the A13/A1089/A122 Lower Thames Crossing junction.

- d. Section D: North of the River Thames – M25/Project corridor from Green Lane. This section covers the northern extent of the Project, including the Ockendon link and the M25 junction 29.

4.3.2 Each of the four construction sections (A to D) have been further divided into sub-sections which describe works that would take place in a specified location, together with initial works, utility works and testing and commissioning activities that would take place across the construction section.

4.3.3 Indicative timelines are provided for each of the sub-sections, including periods of low, medium and high intensity activity, as described below.

	Lower levels of activity would include traffic management setup, site setup, utility connections, testing and commissioning.
	Medium levels of activity would include sustained traffic management, localised works on structures and landscape preparation.
	High levels of activity would include additional activities including heavy civil engineering and earthworks.

4.3.4 Up to 18 construction compounds would be needed for the construction of the Project, with a further 15 compounds for specific utility works, known as Utility Logistics Hubs (ULHs). Where practical, construction compounds and ULHs have been located such as to avoid or reduce environmental and community impacts, provide the best access for personnel and deliveries in relation to major structures and worksites, and meet other construction requirements of the Project. Plate 4.1, Plate 4.2 and Plate 4.3 show the locations of the construction compounds and ULHs across the Project route.

Plate 4.1 Construction compounds and Utility Logistics Hubs (1 of 3)

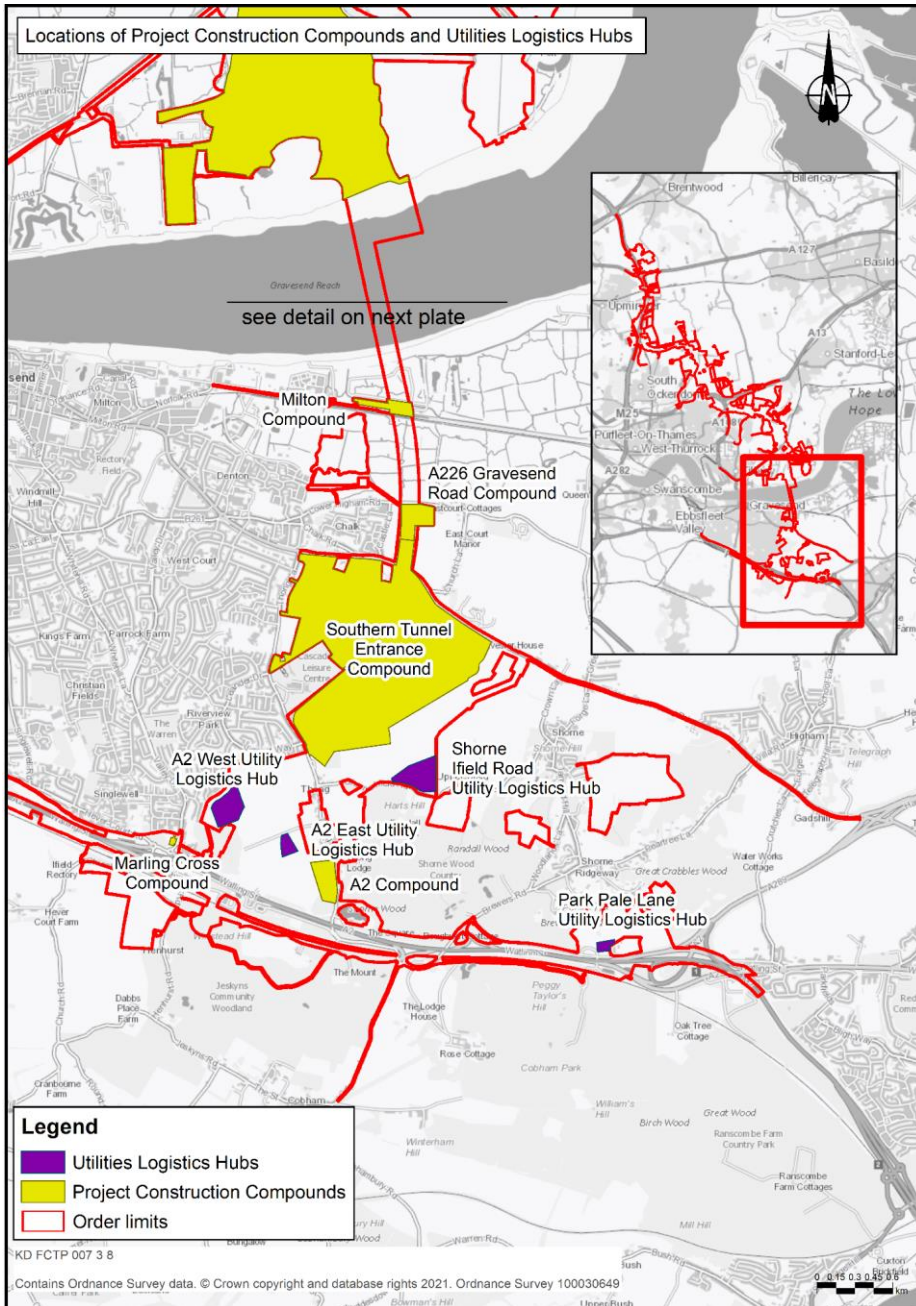


Plate 4.2 Construction compounds and Utility Logistics Hubs (2 of 3)

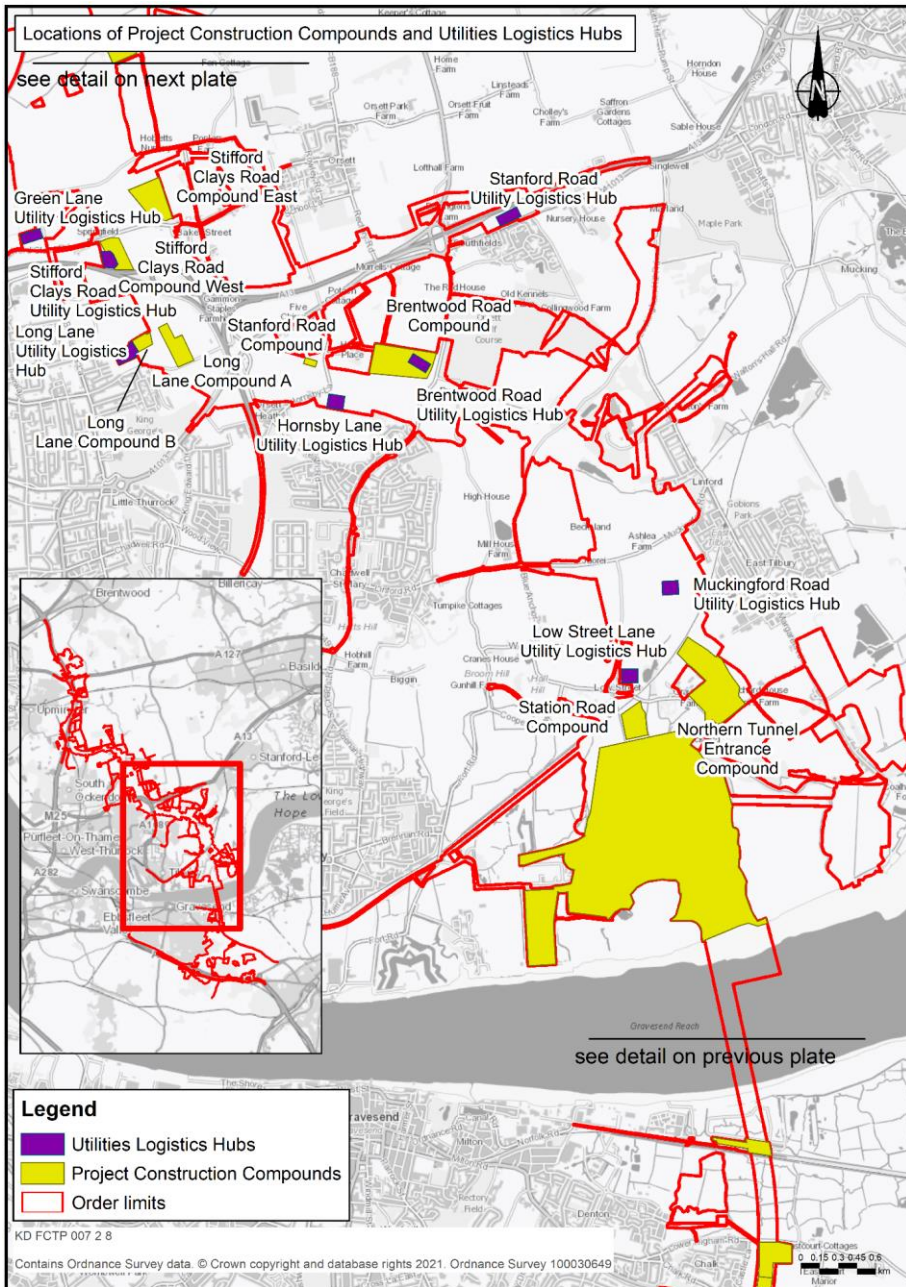
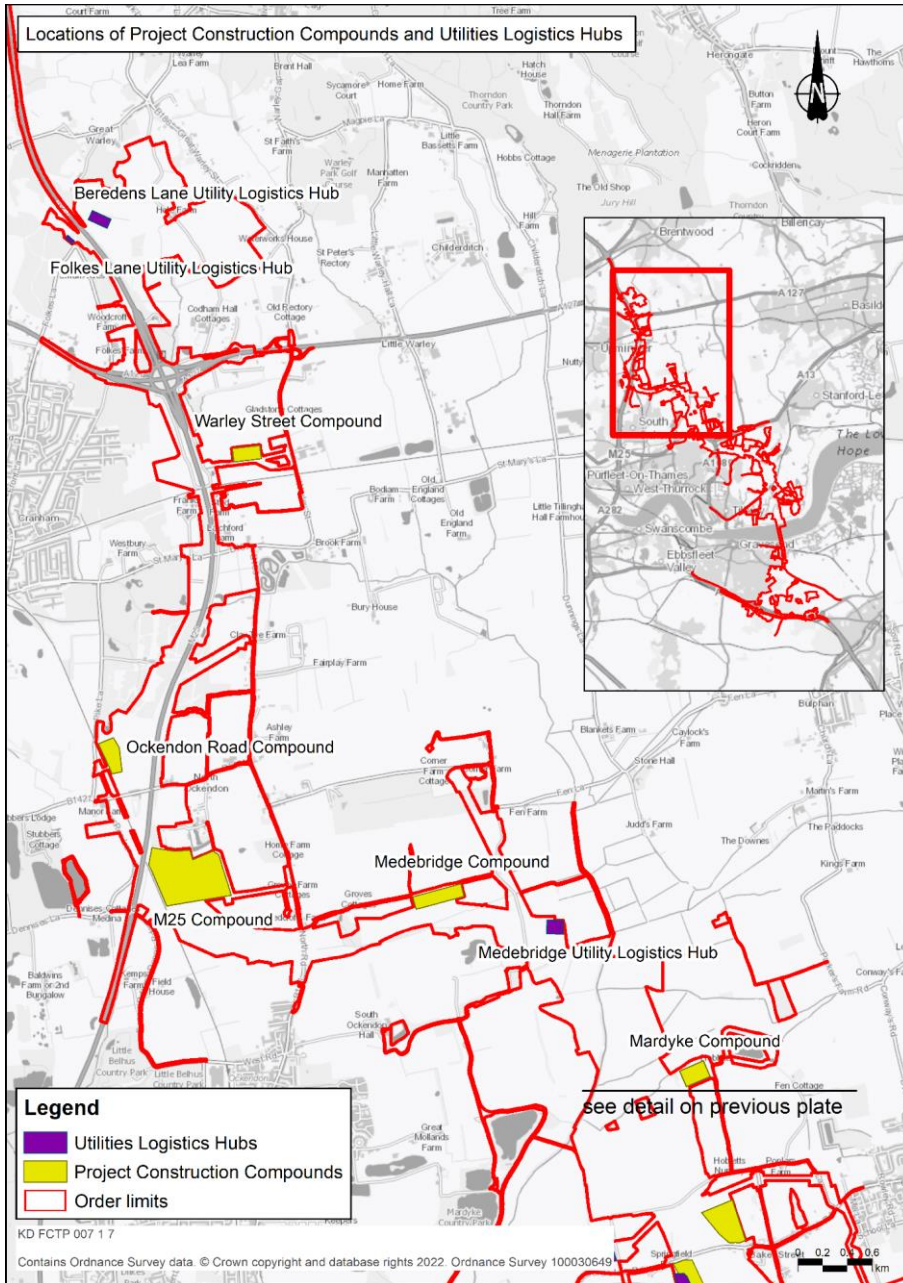


Plate 4.3 Construction compounds and Utility Logistics Hubs (3 of 3)

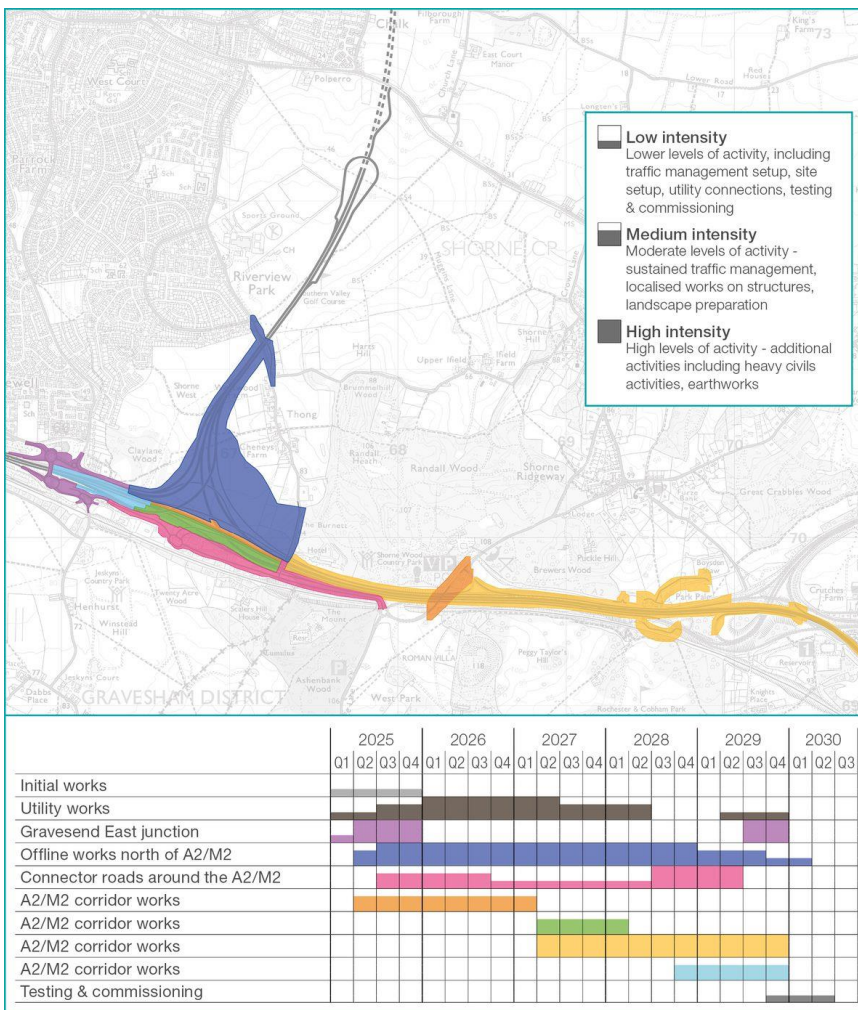


4.3.5 A brief overview of each of the four sections is provided below, with further detail relating to the various sub-sections and construction techniques set out in ES Chapter 2: Project Description (Application Document 6.1).

Section A: South of the River Thames – M2/A2/A122 Lower Thames Crossing corridor

4.3.6 Plate 4.4 illustrates the locations of the key construction infrastructure and locational sub-sections for Section A, along with the proposed construction programme, including periods of low, medium and high intensity activity.

Plate 4.4 Construction activities and timeline (Section A)



- 4.3.7 Initial works comprise those activities that prepare the site and the compounds for the main construction activity. Initial works could include elements such as ecological mitigation, establishing haul roads, securing works areas including PRowS, and construction compound set-up activities.
- 4.3.8 Utilities works would begin at the start of construction for Section A, and would continue for up to five years. Temporary connections would be removed towards the end of the construction period during 2028, and, where appropriate, the land would be reinstated to its previous condition. There are four proposed ULHs in Section A, details of which are summarised in Table 4.2.

Table 4.2 Utility Logistics Hubs – Section A

ULH name	Utility company	Specific works	Approximate duration (months)
Park Pale Lane Utility Hub	Southern Gas Networks	Gas pipeline diversions: Marling Cross to Park Pale	27
A2 East Utility Hub	National Grid Electricity Transmission	Overhead electricity network modifications: south of HS1 to the A226	16
A2 West Utility Hub	National Grid Gas	Gas pipeline diversions: Claylane Wood to Thong Lane	16
Shorne Ifield Road Utility Hub	National Grid Gas	Gas pipeline diversions: Claylane Wood to Thong Lane; and Thong Lane to the A226	14

- 4.3.9 Construction activities in Section A include the following:
- a. Gravesend East junction – construction works would include modifications to the junction, including an upgrade to the existing roundabout, widening an existing bridge, and changes to existing utilities in the area. The works would be scheduled to begin early in the construction of Section A with an initial period of around one year of construction. The works would be completed towards the end of the overall construction period.
 - b. Offline works north of M2/A2 – construction of the Project between the M2/A2/A122 Lower Thames Crossing junction and the Thong Lane green bridge over the Project. The construction of these works would be expected to take five years, between 2025 and 2030. The M2/A2/A122 Lower Thames Crossing junction would require the construction of two viaducts: Gravesend East to the M2 eastbound viaduct, and the Project road southbound to the A2 westbound viaduct. A new green bridge would be constructed to allow Thong Lane to pass over the new road.
 - c. Connector roads around the M2/A2 – these works would include modifications to existing roads and the construction of new connector roads and bridges. These works would take place throughout the construction of Section A. They would begin in 2025 and end in 2029. Activities include the construction of a new green bridge over the M2/A2 at Thong Lane and a new green bridge at Brewers Road. The new Brewers Road green bridge would be built on the same alignment as the existing bridge as this would

need to connect directly to the existing High Speed 1 (HS1) green bridge immediately to the south.

- d. M2/A2 widening works – this would include adding a fourth lane to the M2 through junction 1, and additional lanes in both directions running parallel to the A2.

4.3.10 There are two proposed construction compounds in Section A: one to support the Gravesend East junction works (Marling Cross compound), and a second near Thong Lane (A2 compound) to serve the other construction activities in Section A. Both of these are 'main compounds'. These are sites for which the primary use would be for overall Project and area management. Durations for use of the compounds are 31 months for Marling Cross and 62 months for the A2 compound.

4.3.11 Access to the works within Section A would primarily be from the A2 carriageway but would also use the Gravesend East junction (to avoid weaving traffic between the A2 eastbound on-slip and the construction offline access off-slip). Parts of Thong Lane and Brewers Road would also be used to access works areas (shown as a secondary route to access works south of the A2).

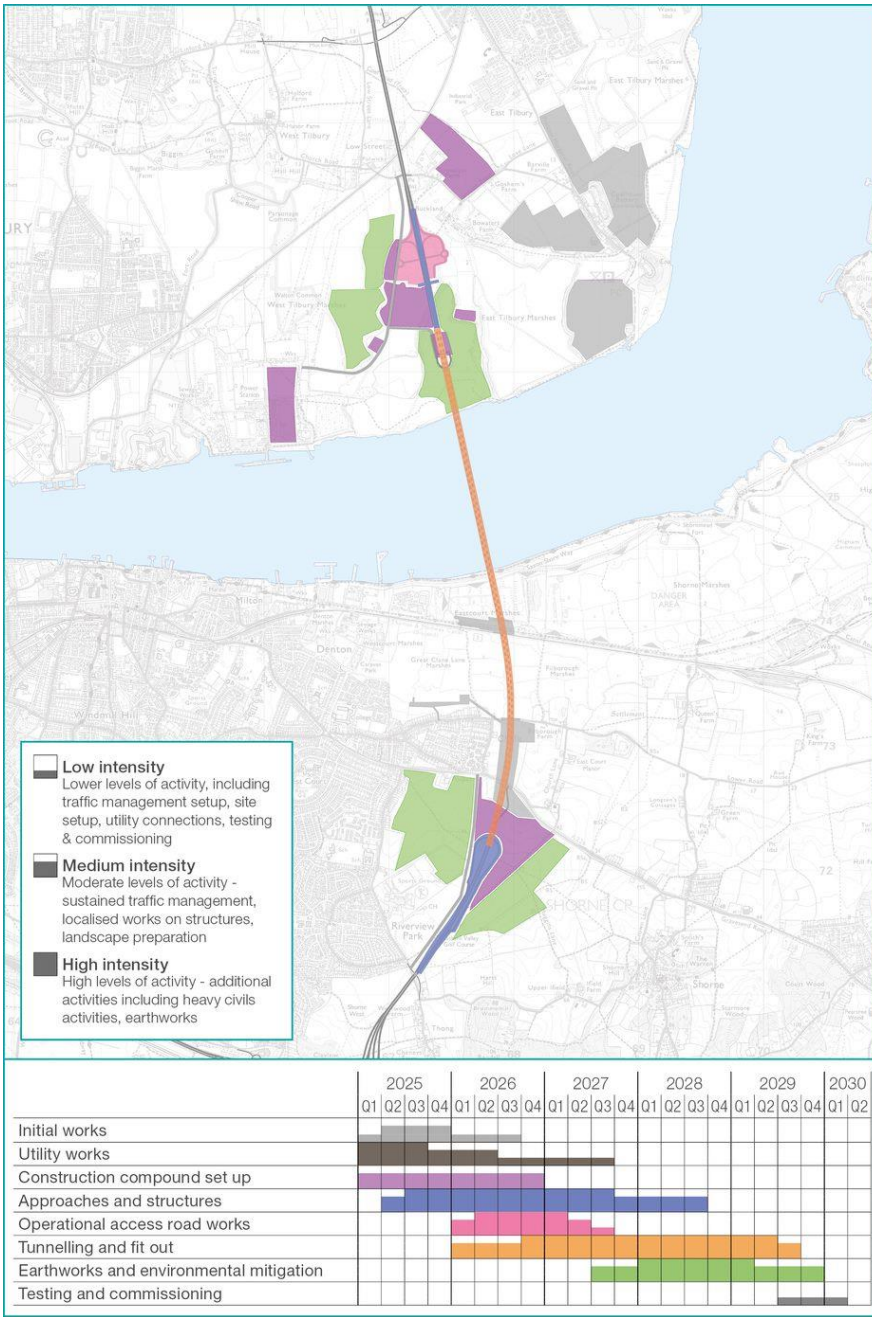
4.3.12 The traffic management measures required for Section A works are described in the Transport Assessment (Application Document 7.9) and the oTMPfC (Application Document 7.14).

Section B: Tunnel Crossing – north of the Thong Lane green bridge over the Project to Tilbury Viaduct

4.3.13 Section B covers the area between the proposed Thong Lane green bridge north and the proposed Tilbury Viaduct. This includes the work needed to construct the tunnels and their approach roads, south and north of the Thames. A ground protection tunnel would run from south of Lower Higham Road to north of the Medway Canal and North Kent railway line.

4.3.14 Plate 4.5 illustrates the locations of the key construction infrastructure and locational sub-sections for Section B, along with the proposed construction programme, including periods of low, medium and high intensity activity.

Plate 4.5 Construction activities and timeline (Section B)



- 4.3.15 Initial works comprise those activities that prepare the site and the compounds for the main construction activity. Initial works could include elements such as ecological mitigation, establishing haul roads, securing works areas including PRoWs, and construction compound set-up activities.
- 4.3.16 There would be four construction compounds located within Section B. The northern and southern tunnel entrance compounds are both main compounds and would therefore be in place for the duration of construction works in this section.
- 4.3.17 The northern tunnel entrance compound would be located next to the North Portal, to the west of East Tilbury and Coalhouse Fort. The main access would be from the west through the Port of Tilbury, with a separate access for cars and vans from Station Road. These access points would be connected through the site by an internal haul road. Tunnelling and supporting operations on the surface would require the installation of temporary infrastructure. Work would be carried out on a 24/7 basis. Concrete batching plants would be built within this compound.
- 4.3.18 Before tunnel construction begins, essential site facilities would be set up next to the North Portal. In addition to the usual compound arrangements of offices, welfare, parking and areas for material to be delivered and stored, this site would include temporary facilities such as:
- A precast facility for tunnel lining production and storage
 - A separation plant for processing excavated material
 - A water treatment plant
 - Hyperbaric facilities, allowing specialist workers to remain in high pressure compressed air environments, which would be necessary for certain tunnelling activities
 - Sleeping accommodation for around 400 construction workers to allow for shift-working and an additional approximately 80 beds for hyperbaric workers as described above
 - Other equipment to support tunnel construction such as cranes and special vehicles to carry segments into the tunnel
- 4.3.19 Prior to tunnelling, the tunnel entrance would need to be dug and constructed. This would also serve as the assembly and launch pit for the tunnelling machines.
- 4.3.20 The southern tunnel entrance compound would provide welfare and construction support for the works at the South Portal. The compound would be around 163ha in size, but the scope of works here would be narrower than at the northern launch site. The compound would be located south of the Ramsar area, with no direct connection to the River Thames.
- 4.3.21 A temporary, one-way internal access road would be built off the A226 to provide access for construction materials, equipment, personnel and for



emergency services. The access road would be built to limit disruption to other road users and in line with standards required for HGVs.

4.3.22 The A226 Gravesend Road compound and Milton compound are both 'satellite' compounds, meaning they are required for specific works within the section (namely ground treatment measures as part of the tunnel works), and therefore would not be used for the full duration of construction activities.

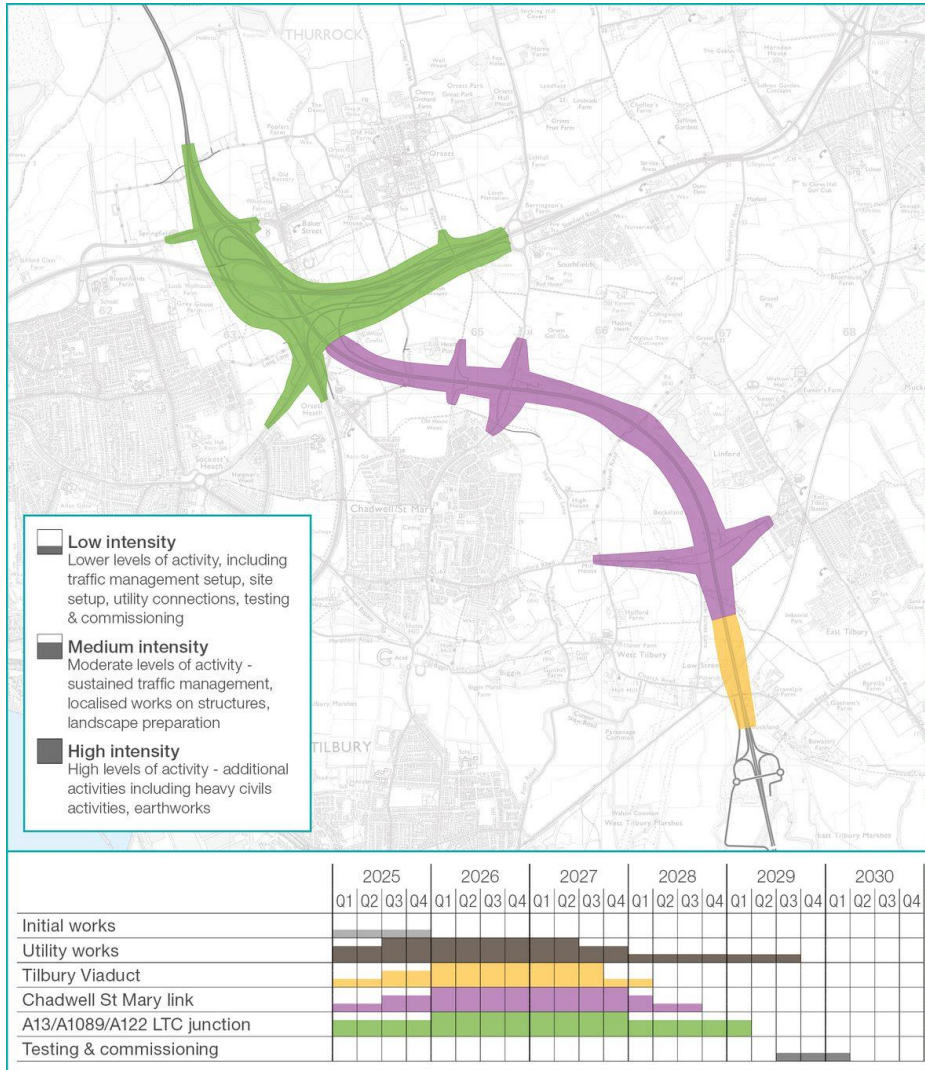
4.3.23 There are no ULHs proposed within Section B.

4.3.24 The traffic management measures required for Section B works are described in the Transport Assessment (Application Document 7.9) and the oTMPfC (Application Document 7.14).

Section C: North of the River Thames – Project north of the A13/A1089/A122 Lower Thames Crossing junction from Tilbury Viaduct

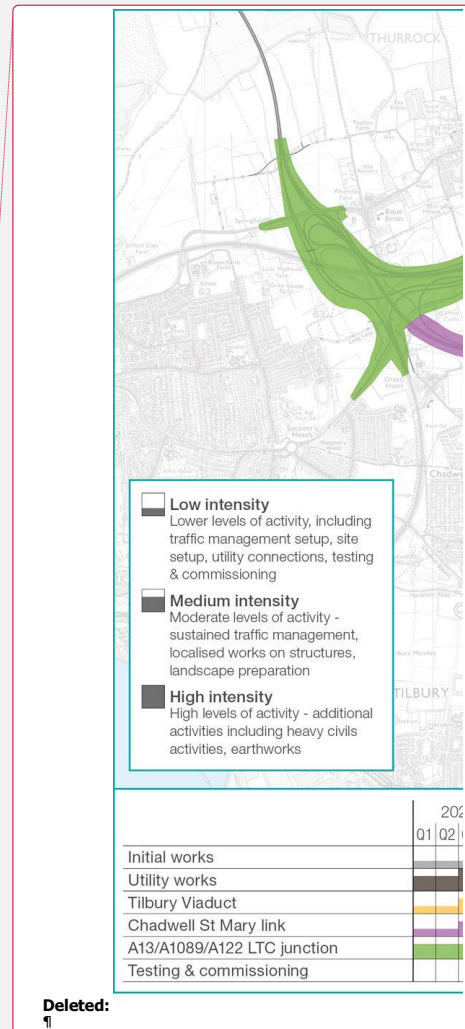
4.3.25 Section C includes the area north of the River Thames between the proposed Tilbury Viaduct and Green Lane, north of the A13/A1089/A122 Lower Thames Crossing junction. Plate 4.6 illustrates the locations of the key construction infrastructure and locational sub-sections for Section C, along with the proposed construction programme, including periods of low, medium and high intensity activity.

Plate 4.6 Construction activities and timeline (Section C)



4.3.26 Initial works comprise those activities that prepare the site and the compounds for the main construction activity. Initial works could include elements such as ecological mitigation, establishing haul roads, securing works areas including PRowS, and construction compound set-up activities.

4.3.27 Utilities works would begin at the start of construction for Section C, and would continue for approximately five years. Temporary connections would be removed towards the end of the construction period during 2028, and where appropriate, the land would be reinstated to its previous condition.



4.3.28 There are eight proposed ULHs located in Section C, details of which are summarised in Table 4.3.

Table 4.3 Utility Logistics Hubs – Section C

ULH name	Utility company	Specific works	Approximate duration (months)
Low Street Lane Utility Hub	National Grid Electricity Transmission	Overhead electricity modifications: East of Tilbury to north of Linfoord	14
Muckingford Road Utility Hub	National Grid Electricity Transmission	Overhead electricity modifications: East of Tilbury to north of Linfoord	14
Brentwood Road Utility Hub	Cadent	Gas pipeline diversion: Brentwood Road	14
Hornsby Lane Utility Hub	National Grid Electricity Transmission	Overhead electricity modifications: Mardyke to Hornsby Lane	33
Long Lane Utility Hub	National Grid Electricity Transmission	Overhead electricity modifications: Mardyke to Hornsby Lane	33
Stifford Clays Road Utility Hub	National Grid Electricity Transmission	Overhead electricity modifications: Mardyke to Hornsby Lane	33
Stanford Road Utility Hub	Cadent	Gas pipeline diversion: A13/A1089/A122 Lower Thames Crossing junction	27
Green Lane Utility Hub	Cadent	Gas pipeline diversions: A13/A1089/A122 Lower Thames Crossing junction and Green Lane	27

4.3.29 Construction activities in Section C include the following:

- a. Tilbury Viaduct – proposed to carry the new road over the Tilbury Loop railway line. Works would begin early in 2024 and be complete in early 2027. Works would be carried out offline.
- b. Chadwell St Mary link – the proposed A13/A1089/A122 Lower Thames Crossing junction requires new slip roads to be constructed to link these roads. This particular section concerns works south of the A13. Works would begin early in 2025 and are expected to continue until mid-2028. Works would involve construction of a series of bridges at Brentwood Road, Muckingford Road and Hoford Road.
- c. A13/A1089/A122 Lower Thames Crossing junction – the proposed junction between the Project, the A13 and A1089 would require changes to the existing junction as well as modifications to approach roads. The Project

road would pass beneath the A13, with one underpass to the west of the A1089 and another to the east. Work to build the A13/A1089/A122 Lower Thames Crossing junction and modify the approach roads would begin at the start of the construction phase, and would take until early 2029. Works comprise construction of the A13 underpass, replacement of the Rectory Road bridge, realignment of the A1013 (which would include building three new bridges), construction of the Orsett Fen Viaduct over Baker Street and the A1089, and the realignment of Baker Street, Heath Road, Stifford Clays Road and Green Lane.

- 4.3.30 The traffic management measures required for Section C works are described in the Transport Assessment (Application Document 7.9) and the oTMPfC (Application Document 7.14).
- 4.3.31 There are seven construction compounds proposed in Section C, of which two would be main compounds while the remaining five would be satellite compounds. A summary of the activities proposed within each compound and an indicative duration of activities is provided in Table 4.4.

Table 4.4 Summary of construction compounds in Section C

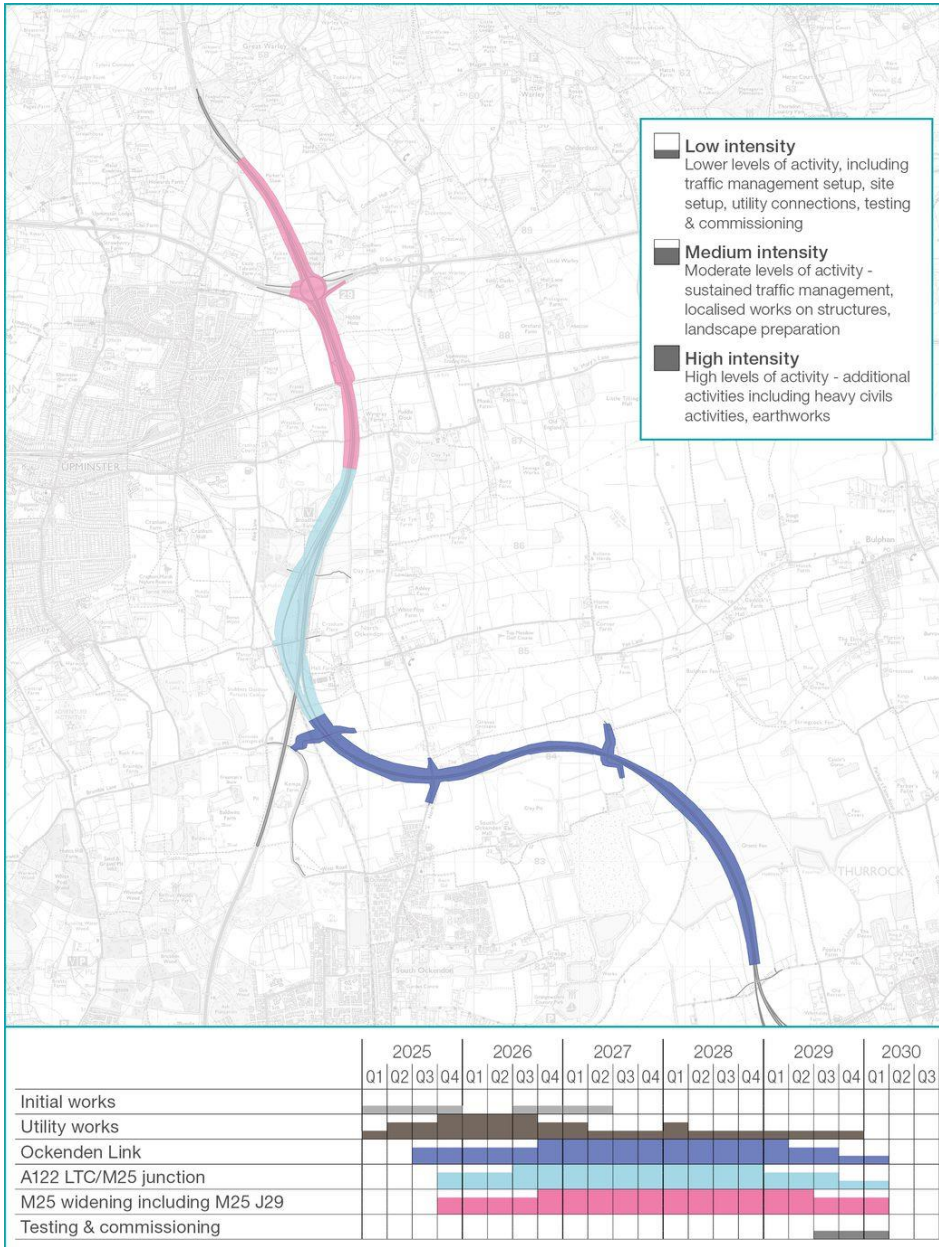
Compound name	Compound type	Proposed activities	Approximate duration (months)
Station Road compound	Satellite	Stockpiling materials, workshops, offices, welfare facilities and parking. The compound would be accessed via an internal access road from the northern tunnel entrance compound.	39
Brentwood Road compound	Main	Car parking, offices, welfare facilities, storage of equipment and spoil. Construction traffic would access the site via Brentwood Road between the Orsett Cock junction and the Project route.	36
Stanford Road compound	Satellite	Storage, equipment and stockpiling. Space for car parking, offices, welfare facilities and workshops. The compound would be accessed via Hornsby Lane and an internal haul road.	24
Long Lane (compounds A and B)	Satellite	Around half of the compounds would be for storage and equipment, and the other half for parking, offices and welfare facilities, workshops and earthworks stockpiling. Access to the site would be via Long Lane.	36

Compound name	Compound type	Proposed activities	Approximate duration (months)
Stifford Clays Road compound West	Satellite	Space would be allocated within the compound for stockpiling materials, workshops, offices, welfare facilities and parking. Stifford Clays Road would be used by construction traffic until a temporary haul road from Medebridge Road is built (approximately six months).	39
Stifford Clays Road compound East	Main	Space for car parking, offices, welfare facilities and storage. Around half the site would be set aside for earthworks stockpiling. Stifford Clays Road would be used by construction traffic until a temporary haul road from Medebridge Road is built (approximately six months).	39

Section D: North of the River Thames – M25/Project corridor from Green Lane

- 4.3.32 Section D includes the area between the A13/A1089/A122 Lower Thames Crossing junction and the M25, including the Ockendon link and the A122 Lower Thames Crossing/M25 junction. Plate 4.7 illustrates the locations of the key construction infrastructure and locational sub-sections for Section D, along with the proposed construction programme, including periods of low, medium and high intensity activity.

Plate 4.7 Construction activities and timeline (Section D)



- 4.3.33 Initial works comprise those activities that prepare the site and the compounds for the main construction activity. Initial works could include elements such as ecological mitigation, establishing haul roads, securing works areas including PRowS, and construction compound set-up activities.
- 4.3.34 Work affecting utilities is expected to take place throughout most of the construction phase for Section D, from early 2025 until the end of 2029. The highest levels of activity are expected from the end of 2024 for a period of one year. There are four proposed ULHs located in Section D, details of which are summarised in Table 4.5.

Table 4.5 Utility Logistics Hubs – Section D

ULH name	Utility company	Specific works	Approximate duration (months)
Medebridge Utility Hub	National Grid Electricity Transmission	Overhead electricity network modifications: Mardyke	33
Folkes Lane Utility Hub	Cadent	Gas pipeline diversion: M25 Folkes Lane	13
Beredens Lane Utility Hub	Cadent	Gas pipeline diversion: M25 Folkes Lane	13

- 4.3.35 Construction activities in Section D include the following:
- a. Ockendon link – describes the 5km section of the Project route that extends between the A13 and M25. It includes construction of two viaducts, three embankments, earthworks cuttings, two footbridges and an overbridge to carry North Road (B186) over the Project road. Works are expected to begin in the second half of 2025 and continue throughout the construction period for Section D, ending in early 2030. This includes construction of the North Road green bridge.
 - b. A122 Lower Thames Crossing/M25 junction – this section of the Project route includes the construction of new roads to form a junction between the A122 and the M25. Works would include a cutting to take the A122 northbound below the existing ground level before passing under the existing M25 via a new underpass and joining the M25 northbound approximately 1km north of Ockendon Road. The A122 southbound off-slip would pass under the existing Ockendon Road bridge and would then run between North Ockendon and the Upminster railway line before joining with the A122 northbound carriageway. A new overbridge is needed to carry Ockendon Road over the A122 northbound carriageway. This work would begin in late 2025 and would be expected to end in early 2030.
 - c. M25 widening, including M25 and junction 29 – these works would take place south of junction 29 to where the A122 connects to the M25, and

would involve widening the M25 southbound over the B187 St Mary's Lane and Shoeburyness railway line bridge. Works would be expected to begin in early 2025 and continue until early 2030.

- 4.3.36 The traffic management measures required for Section D works are described in the Transport Assessment (Application Document 7.9) and the oTMPfC (Application Document 7.14).
- 4.3.37 There are five construction compounds proposed in Section D, of which one (M25 compound) would be a main compound, while the remainder would be satellite compounds. A summary of the activities proposed within each compound and an indicative duration of activities is provided in Table 4.6.

Table 4.6 Summary of construction compounds in Section D

Compound name	Compound type	Proposed activities	Approximate duration (months)
Mardyke compound	Satellite	Space in the compound would be used for parking, welfare and office space, workshops, equipment and material storage. Excavated soil would be kept onsite temporarily in bunds to provide screening for residential properties to the south as set out in the Register of Environmental Actions and Commitments (REAC) (Application Document 6.3, ES Appendix 2.2). Initially, access would be via Green Lane until temporary haul roads are set up for construction traffic only.	36
Medebridge compound	Satellite	The compound would include a concrete mixing plant to supply the surrounding works. Most of the remaining space in the compound would be used for equipment and storage, parking, offices and welfare facilities. Earthworks would need to be stockpiled, and these would be limited to a height of five metres as set out in the REAC (Application Document 6.3, ES Appendix 2.2). Construction vehicles would need to use Fen Lane at the start of the programme, for a period of around nine months, to allow utilities works to be carried out. The access route for HGVs and most staff vehicles would be via the A127, Warley Street, St Mary's Lane, Clay Tye Road and North Road for the first 9–12 months of the construction programme. For the remainder of the programme, access to the compound would be provided by the	36

Compound name	Compound type	Proposed activities	Approximate duration (months)
		haul roads constructed from the A13 rather than these public roads.	
M25 compound	Main	This would be the main workforce compound for Section D. Most of the space in the compound would be used for equipment and storage, with the remainder for parking or offices and welfare facilities. Earth up to five metres high would need to be stockpiled and earthwork bunds of two to three metres would need to be created as set out in the REAC (Application Document 6.3, ES Appendix 2.2). This compound would also be likely to contain a concrete mixing plant and a temporary pre-cast facility. Construction vehicles and workforce would need to use Clay Tye Road at the start of the works to access this site and the Ockendon Road compound. Temporary works access off the M25 would be created to allow construction vehicles to enter the Project road and worksites, at which point Clay Tye Road would only be used for workforce access.	36
Ockendon Road compound	Satellite	The compound would provide space for parking, offices and welfare, as well as storage and equipment.	63
Warley Street compound	Satellite	The compound would provide space for parking, offices and welfare, as well as storage and equipment. Access would be via a temporary haul road from Warley Street. Construction vehicles would need to use Warley Street between the A127 junction and the entrance of the compound (about 200–300m north of the bridge over the Shoeburyness railway line) throughout construction.	32

4.4 Mitigation

- 4.4.1 Environmental considerations have influenced the Project throughout the design development process, from early route options assessment through to refinement of the Project design. An iterative process has facilitated design updates and improvements, informed by environmental assessment and input from the Project engineering teams, stakeholders and public consultation.
- 4.4.2 The Project includes a range of environmental mitigation commitments. These commitments fall within the following categories:

- a. Embedded mitigation: measures that form part of the engineering design, developed through the iterative design process.
- b. Good practice: standard approaches and actions commonly used on infrastructure development projects to avoid or reduce environmental impacts, and typically applicable across the whole Project.
- c. Essential mitigation: any additional Project-specific measures needed to avoid, reduce or offset potential impacts that could otherwise result in effects considered significant in the context of the EIA Regulations. Essential mitigation has been identified by environmental topic specialists, taking into account the effect of embedded mitigation and good practice mitigation.

4.4.3 Mitigation measures relevant to each of the assessment topics covered in Chapter 7 of this HEqIA are summarised within each section accordingly.

4.4.4 The key commitments that have been secured through the DCO are outlined within the following control documents:

- a. Embedded mitigation is included within the Design Principles (Application Document 7.5) or as features presented on ES Figure 2.4: Environmental Masterplan (Application Document 6.2).
- b. Good practice and essential mitigation are included in the Register of Environmental Actions and Commitments (REAC). The REAC forms part of the CoCP (Application Document 6.3, ES Appendix 2.2).
- c. Other commitments are secured in documents including the SAC-R (Application Document 7.21) and the FCTP (Application Document 7.13).
- d. It is likely that a series of planning obligations would be required under section 106 of the Town and Country Planning Act 1990. Draft Heads of Terms for planning obligations have formed part of discussions with stakeholders prior to the submission of the DCO application. It is expected that these obligations would be secured through bilateral agreement however in the event that is not possible, they will be secured via a unilateral undertaking. Draft Heads of Terms are set out in Application Document 7.3 (Section 106 Agreements).

4.4.5 Specific commitments relevant to each of the assessment topics within the HEqIA are discussed further in the relevant sections of Chapter 7.

Benefits and legacy

4.4.6 The Project's approach to the wider benefits and outcomes in the DCO application was raised as a potential area for development during consultation with stakeholders. While the Need for the Project (Application Document 7.1) covers the benefits captured within the DCO and control documents, there are additional areas of work being undertaken by the Applicant that sit outside the

Order Limits and control documents. This work aims to leave a positive legacy in the community, both during construction and once the Project is operational; and includes benefits to both the community and the environment. This work is summarised in the Benefits and Outcomes Document (Application Document 7.20).

5 Consultation and engagement

5.1 Introduction

5.1.1 The Consultation Report (Application Document 5.1) provides a full description of the consultation activities undertaken, including the Project response to the feedback received. This section provides a summary of these activities, including stakeholder and public engagement relevant to the preparation of the HEqIA. The Statement of Engagement (Application Document 5.2) describes the extensive engagement with stakeholders throughout the pre-application stage of the Project. Ongoing engagement has helped stakeholders shape the Project and has facilitated continuous improvement to its design, providing a deeper understanding of local issues and enabling information to be gathered to support decision making.

5.2 Non-statutory consultation

5.2.1 The DfT held a non-statutory public consultation in 2013, which considered the need for a new Lower Thames Crossing and invited views on three locations and one variant:

- a. Option A: at the site of the existing A282 Dartford–Thurrock crossing
- b. Option B: connecting the A2 and Swanscombe Peninsula with the A1089
- c. Option C: connecting the M2 with the A13 and the M25 between junctions 29 and 30
- d. Option C Variant: connecting the M2 with the A13 and M25 between junctions 29 and 30, and additionally widening the A229 between the M2 and the M20

5.2.2 The consultation period ran for a period of eight weeks from 21 May to 16 July 2013. The DfT published its response to their consultation in July 2014, confirming that there is a need for an additional crossing between Essex and Kent, but that there was no consensus about where it should be. The Government then commissioned the Applicant to carry out a more detailed assessment of Options A and C, with or without C Variant.

5.2.3 As part of this assessment, the Applicant undertook a programme of engagement starting in September 2014 to determine constraints and priorities which would affect the identification and development of feasible options for a new Lower Thames Crossing. A planned and focused approach was adopted to ensure high quality and meaningful engagement. This provided opportunities for sharing complex and technical information and facilitated relationship building with opportunities for further engagement.

5.2.4 Key stakeholders for this purpose were local authorities, statutory and environmental bodies, statutory undertakers (utilities) and businesses which might be affected. The Applicant also sought to engage council leaders and Members of Parliament in directly affected and neighbouring areas.

- 5.2.5 The Applicant held a non-statutory consultation from 26 January to 24 March 2016. The consultation presented the shortlisted routes that performed satisfactorily against the Scheme Objectives and were considered viable. The consultation also included information on those routes that were not considered viable and the reasons for those conclusions, together with the opportunity to comment on these issues and to propose other solutions. The consultation aimed to inform as many people as possible about the proposals and get feedback on the proposals, and to identify any new and relevant information that should be considered in the decision-making process. The Applicant then conducted further assessment of the route options, taking account of consultation responses, to inform the preferred route recommendation that was made to the DfT.
- 5.2.6 The 2016 consultation was widely publicised, and a variety of material was made available, digitally and in hard-copy form, to ensure the public had access to the information needed to consider the options presented and respond to the consultation accordingly. The Applicant also held a total of 24 Public Information Events in 20 locations in the Lower Thames area during the consultation period. The consultation generated more than 47,034 responses, the largest ever for a UK road project. Responses were received from across the UK, with the largest proportion from south Essex, north Kent and the London boroughs. The majority of responses were received from individual members of the public; 523 responses were received on behalf of organisations and groups; 13,284 responses were received from 14 separate campaigns; and three petitions were submitted.
- 5.2.7 The Government announced the preferred route for the Project on 12 April 2017. Following this, the Project was subject to further design development and refinement, resulting in further changes to the proposals presented in the Preferred Route Announcement.

5.3 Statutory Consultation

- 5.3.1 Under the Planning Act 2008, there are two separate formal stages of pre-application consultation:
- Section 42 consultation with prescribed consultees (e.g. Natural England, Environment Agency, Historic England), local authorities, landowners and others with interests in land
 - Section 47 consultation with the local community in accordance with the Statement of Community Consultation
- 5.3.2 Both pre-application consultation stages were run in parallel for the Project. Statutory Consultation took place between 10 October 2018 and 20 December 2018. This consultation gave members of the public, prescribed consultees, local authorities, businesses, organisations, and people with an interest in land the opportunity to comment on an updated set of proposals for the preferred route. The Applicant held 60 public consultation events, which were attended by nearly 15,000 people.
- 5.3.3 A Preliminary Environmental Information Report (PEIR) (Highways England, 2018a) and a non-technical summary were published to support the Statutory

Consultation. The PEIR was made available to the prescribed consultees, local authorities and landowners, as well as members of the public and the community.

- 5.3.4 The purpose of the PEIR was to enable consultees to understand the potential likely significant effects that could arise as a result of the Project. Feedback from the consultation was used to inform environmental and other assessments.
- 5.3.5 The pre-application consultation received 28,493 responses, including 2,117 campaign responses and 55 from prescribed consultees. Responses were submitted in several formats, including 25,210 online responses, 945 feedback forms (both by email and via the post) and 221 letters and emails.
- 5.3.6 The Applicant commissioned Traverse, an independent company specialising in public consultations, to receive, analyse and report on the consultation responses.
- 5.3.7 The Applicant recognised that, even with an extended series of Public Information Events at a wide range of community venues, some people with an interest in the proposals might not be able to attend. To help address this concern, the Applicant planned and implemented a series of additional events that made use of the Mobile Information Centre (MIC). The MIC was a National Highways branded vehicle that provided space for display material and for discussions between event staff and visitors. Dates and locations of MIC events can be found in Tables 4.8 and 4.9 of the Consultation Report (Application Document 5.1).
- 5.3.8 Using the MIC allowed the Applicant to hold events in smaller communities that did not have venues large enough for a full Public Information Event. It also allowed the Applicant to have a presence in areas of high footfall, for example pedestrianised areas close to shopping centres or high streets.
- 5.3.9 The consultation response form prepared for Statutory Consultation included a number of identification questions, the purpose of which was to gain an understanding of the background and personal circumstances of consultees. A summary of this information is provided within the EqIA Screening Template in Appendix B.

Supplementary Consultation

- 5.3.10 Supplementary Consultation took place from 29 January 2020 until 2 April 2020. This provided information on the proposed changes to the design since the Statutory Consultation in 2018 and provided stakeholders and the general public with the opportunity to view and comment on these changes.
- 5.3.11 The information produced for Supplementary Consultation included an Environmental Impacts Update (Highways England, 2020e), which presented the expected effects on the environment for the proposed changes, during both construction and operation. It also outlined the mitigation measures proposed to reduce adverse effects, and why. The Supplementary Consultation received over 6,000 responses.
- 5.3.12 A Disabled Road Users Forum was set up to engage with disability and mobility groups to understand what concerns these road user groups have when driving

through tunnels and how the Applicant can communicate safety advice and specific safety features within tunnels. A meeting of the forum was convened on 9 March 2020, providing an opportunity for representatives of disability and mobility groups to provide feedback on the Project proposals during Supplementary Consultation, including the tunnel designs and systems. One of the objectives of the meeting was to develop the tunnel evacuation strategy with input from representatives of disability and mobility groups.

- 5.3.13 Thirteen MIC events were held during Supplementary Consultation. Locations for these events were chosen based on where changes were proposed and data from the Statutory Consultation. The accessibility of venues and locations was considered by completing a Buildings Accessibility Checklist and carrying out risk assessments on each to evaluate their suitability to ensure they were accessible for all.

Design Refinement Consultation

- 5.3.14 Following the non-statutory Supplementary Consultation, the Applicant further developed its proposals for the Project. This resulted in refinements to the proposals, informed by consideration of the issues raised during stakeholder engagement, consultation, ongoing design development and assessments and investigations. These refinements were presented during the Design Refinement Consultation which took place between 14 July and 12 August 2020.
- 5.3.15 As a result of the restrictions in place due to the COVID-19 pandemic, a 'digital-first' approach to consultation was taken. During the consultation, there were approximately 50,000 click throughs to the website and around 41,000 visits to the exhibition section of the website. Special provisions were put in place for those who did not have internet access and those who would normally attend a consultation event to speak to a member of the Project Team. Provisions included public webinars and a telephone surgery; four webinars were held, with two covering the Project's proposals south of the River Thames and two covering the Project's proposals north of the River Thames. Each webinar included British Sign Language translation and closed captioning. In total, 79 people registered to attend the webinars and a combined 57 questions were answered during the question-and-answer sections of the webinars. The telephone surgery resulted in a total of 68 calls being received and answered across the consultation period.

Community Impacts Consultation

- 5.3.16 In October 2020, following the completion of the Design Refinement Consultation, the Applicant submitted a DCO application for the Project to the Planning Inspectorate. However, based on early feedback from the Planning Inspectorate, the Applicant withdrew the application in November 2020.
- 5.3.17 After the withdrawal of the Application, the Applicant reviewed all of the Adequacy of Consultation Representations (AoCRs) from local authorities and feedback from the Planning Inspectorate. The Applicant also conducted a round of independent reviews of the DCO application, consultation and engagement activity.

- 5.3.18 The key concerns raised centred on a lack of information on the impacts of the Project and how the Applicant would manage the effects. There were also concerns raised around the environmental information in the application and the time that had passed since Statutory Consultation in 2018 and submission in 2020.
- 5.3.19 As a result, the Applicant developed a plan for a community impacts consultation to address the core concerns, focusing on the impacts and mitigation measures of the Project during construction and in operation. The Community Impacts Consultation took place between 14 July and 8 September 2021. This was also during a time of COVID-19 pandemic restrictions and uncertainty on whether those restrictions would ease or be lifted during the summer of 2021. This being the case, the Applicant undertook a primarily digital approach to consultation, similar to the approach taken to the Design Refinement Consultation, and put measures in place to ensure the consultation was as accessible, interactive and engaging as possible. The Applicant looked to support this approach with a series of public information events and outdoor information centres along the route.
- 5.3.20 The Community Impacts Consultation sought feedback on how the Applicant would build and operate the Project, its impacts on local communities and the environment, and how the Applicant proposed to mitigate these. Respondents were also asked for their views on changes to the Project since the Design Refinement Consultation. The Community Impacts Consultation included a comprehensive 'You Said, We Did' document, setting out how the Applicant has addressed issues and suggestions received at each of the previous consultations.

Local Refinement Consultation

- 5.3.21 Following the non-statutory Community Impacts Consultation, the Applicant further developed its proposals for the Project. This resulted in refinements to the proposals, informed by consideration of issues raised through the preceding consultation, as well as stakeholder engagement, on-going design development, assessments and investigations. These refinements were presented during the Local Refinement Consultation, which took place between 12 May and 20 June 2022.
- 5.3.22 Preparations for the Local Refinement Consultation took place when restrictions to the COVID-19 pandemic were being eased. The Applicant was aware that while some people would be prepared to participate in a consultation through traditional face-to-face engagement, others would not, and so the consultation was prepared using many of the 'digital-first' methods that had been successfully used for the Design Refinement Consultation and refined again for the Community Impacts Consultation. These included a telephone service, where people could speak to a Project representative if they had any questions regarding the proposals; an interactive map where people could search by address or postcode to see the Project proposals in their area; and video guides to the proposals north and south of the River Thames.
- 5.3.23 Following the precedent set at the Community Impacts Consultation, the Applicant produced a 'You Said, We Did' summary of how feedback from the

Community Impacts Consultation had been considered and used as part of ongoing development of the Project proposals.

5.4 Engagement with ‘hard-to-reach’ groups

- 5.4.1 The Applicant considers it to be of vital importance that everyone who wishes to participate in the various consultations has had the opportunity to consider and respond to the proposals. When preparing for non-statutory consultation, the Applicant developed a strategy for engaging effectively with the stakeholders and communities it had identified as its target audience. In developing this strategy, the Applicant researched and considered the presence of hard to reach communities, which typically include older people, those with disabilities, those who may not be able to read, and those for whom English is not their first language.
- 5.4.2 In line with accessibility guidelines and the wishes of local authorities, the Applicant produced Easy Read versions for various consultations. Easy Read is a format that is designed to be used by people with learning difficulties and the versions published for the Applicant’s consultations have been produced by specialist companies with extensive experience in their field.
- 5.4.3 The Project has continued to work closely with local authorities, community groups and representatives on identifying relevant stakeholders who cannot access digital resources, to ensure they are notified of the consultations and that the opportunity to take part is genuinely provided for these groups. Activities undertaken to ensure those with limited or no access to the internet are notified of consultation activities have included:
- a. Issuing of information leaflets to properties within 5km of the route.
 - b. Publishing of notices in local and national newspapers, before the launch of the Community Impacts and Local Refinement Consultations.
 - c. Ordering of consultation materials free of charge and a telephone service available on days when there are no physical events or webinars, to ensure the consultation is accessible to everyone was put in place for the Design Refinement, Community Impacts and Local Refinement consultations.
 - d. Easy Read and Braille versions of the consultation material were available, as well as providing British Sign Language translation at the public webinars.
- 5.4.4 A series of community focus groups and mapping exercises was undertaken in 2019. The aim of the focus groups was to engage specifically with seldom-heard groups to:
- a. Better understand the activities of vulnerable populations living close to the Project, with an emphasis on travel behaviour and preferences
 - b. Explore how the lives and travel behaviours of vulnerable people may be affected by the introduction of the Project

- c. Highlight any differences between views of vulnerable and non-vulnerable audiences.

- 5.4.5 The information gathered from these focus groups was used to contribute to the wider understanding of how and where local people currently travel and how they might potentially be affected by the Project. The focus groups focused particularly on issues such as local connectivity, public health and community wellbeing as well as the wider opportunities for local people that may be presented by the Project.
- 5.4.6 Focus groups were held with representatives of the populations outlined in Table 5.1. It should be noted that the findings from these focus groups are **not** representative of specific populations, and have **not** been relied upon to develop topic assessments, however they have provided a useful understanding of specific issues and travel behaviour that are of relevance to the wider assessment.

Table 5.1 Focus groups

Population	Location
General public	Thurrock (one group), and Gravesham (one group)
Young jobseekers	Thurrock
Older people	Thurrock
Individuals from minority ethnic groups	Gravesham
Mothers with young children	Thurrock
People with disabilities	Gravesham

5.5 Stakeholder engagement

- 5.5.1 Stakeholder consultation in relation to the preparation of the HEqIA has been facilitated through the creation of a Community Impacts and Public Health Advisory Group (CIPHAG). This was established in 2018 as a body for public health officials and other local authority representatives to attend that could provide support during the preparation of the HEqIA in terms of information sharing, and provision of technical advice and guidance around best practice. Environmental specialists have been invited to attend meetings of the advisory group as necessary, dependent on the subject matter under discussion.
- 5.5.2 Representatives from the following local authorities were invited to attend advisory group meetings. Local authorities were identified based on proximity to the Project, and their having registered interest:
- a. Kent County Council
 - b. Essex County Council
 - c. Thurrock Council
 - d. Southend-on-Sea City Council
 - e. London Borough of Havering

- f. Brentwood Borough Council
 - g. Gravesham Borough Council
 - h. Dartford Borough Council
 - i. Medway Council
- 5.5.3 Other attendees of CIPHAG have included representatives of the UK Health Security Agency (UKHSA) in an observational capacity, and representatives of the NHS Mid Essex Clinical Commissioning Group.
- 5.5.4 Terms of reference were agreed for the group, with stated objectives being to:
- a. Develop a collaborative working practice between the Applicant and local authorities potentially affected by the Project
 - b. Enable a holistic understanding of how the Project potentially impacts on local people and communities
 - c. Consider potential benefits and opportunities for the Project
- 5.5.5 The group has acted in an advisory capacity only, to enhance local knowledge and understanding. All decisions relating to opportunities to avoid or reduce adverse impacts, or the identification of benefits as a result of the Project, are made by the Applicant.
- 5.5.6 Over twenty CIPHAG meetings have been held between 2018 and submission of the DCO application. Table 5.2 summarises outcomes of meetings held.

Table 5.2 Stakeholder consultation – CIPHAG

Date of meeting held with CIPHAG	Summary of outcome of discussions
November 2018	Discussion of the process being used to assess health and equality impacts, including guidance. Baseline data identified to date, identification of gaps and issues. Initial list of HEqIA topics agreed. Scope for data sharing and collaborative working practices.
January 2019	Confirmation and agreement of terms of reference. Sharing emerging findings from Statutory Consultation. Proposed approach to health impact assessment and next steps discussed.
April 2019	Scoping discussed for topics including accessibility, severance, road safety, skills and legacy. Identification of likely benchmark projects/best practice.
June 2019	Scoping discussed for air quality and noise assessment topics. Discussion of mental health and wellbeing issues and incorporation of these into the HEqIA. Discussed attendance at the Thurrock Task Force meeting to present health issues and assessment process.

Date of meeting held with CIPHAG	Summary of outcome of discussions
September 2019	Scoping for assessment of potential impacts on WCH. Discussion of environmental mitigation incorporated to date and need for involvement of stakeholders in further mitigation workshops (subsequently held in April 2020). Employment and skills update.
November 2019	Presentation of the Green Infrastructure Study and scoping of assessment of access to open space. Legacy and benefits update. Structure of the HEqIA assessment discussed.
February 2020	Discussion of DMRB LA 112 (Highways England, 2020d) and implications for HEqIA. Presentation of early findings of the assessment for severance.
May 2020	Topic-by-topic discussion about progress of the HEqIA and likely sensitive populations/communities under consideration. Requests for full disclosure of all data sources and analysis.
July 2020	Update on progress of HEqIA and key findings by topic. Requests for full disclosure of all data sources and analysis.
March 2021	Introductory session at which general comments were considered in relation to the Health and Equalities Impact Assessment document circulated following DCO submission 1.0. Identification of particular areas for more detailed discussion at subsequent meetings.
May 2021	Advised of co-ordinated response to HEqIA being prepared on behalf of local authorities. Discussion of new Community Impact Report to be prepared as part of the DCO submission, setting out local area impacts in a transparent and accessible way. Presentation and discussion of the exceedance framework for and monitoring; further discussion of possible approaches to health monitoring for large projects.
June 2021 (meeting 1)	Presentation and discussion of the Independent Review of the HEqIA prepared by Stantec on behalf of nine local authorities (Kent, Essex, Gravesham, Dartford, Medway, Southend-on-Sea, Thurrock, Havering and Brentwood).
June 2021 (meeting 2)	Presentation and discussion of approach to engagement with hard to reach groups. Sharing of information relating to: <ul style="list-style-type: none"> • Construction phasing, durations and activities • Initial findings of journey time impacts analysis during construction • Initial findings of noise impacts during construction
September 2021	Discussions around a number of topics, including: <ul style="list-style-type: none"> • Feedback on Community Impacts Consultation • Update on Community Impacts Report

Date of meeting held with CIPHAG	Summary of outcome of discussions
	<ul style="list-style-type: none"> • Sharing of environmental information • Process for attributing sensitivity on a ward by ward basis
December 2021	Discussion about sharing of environmental information prior to submission. Presentation and discussion of noise and air quality impacts and mitigation during the construction and operation phases. Discussion of use of ultra-low noise surfacing proposed for the Project.
January 2022	Presentation and discussion of refreshed approach to severance during the operation phase. Timings and topics of interest/concern identified for further exploration at future CIPHAG meetings.
March 2022	Presentation and discussion of information relating to how the HEqIA will report on health inequalities and topics where this is of particular relevance. Discussion of sensitive receptors such as Whitecroft Care Home and Project approach. Discussion of Project approach to climate change and resilience.
May 2022	Overview provided of the Community Fund and links with health and wellbeing. Update provided on the approach being taken to mental health and wellbeing, including the need for welfare facilities for construction workers.
July 2022	Presentation and discussion of construction workforce impacts on accommodation. Feedback sought on design of accommodation helpdesk to ensure effectiveness of approach. Impacts of presence of construction workforce on wider healthcare services emphasised. Further engagement required with local authority housing officers.
August 2022	Interim meeting to provide updates on construction worker accommodation assessment progress, drafting of medical and occupational healthcare commitment to be secured in the DCO, and update on timescale for DCO submission.
September 2022 – various workshops	A series of information sharing workshops to present outputs from the noise, air quality and health assessments being prepared.

5.5.7 Engagement with other public health stakeholders that has taken place outside of CIPHAG meetings is summarised in Table 5.3.

Table 5.3 Stakeholder consultation – other health stakeholders

Consultee	Date of meeting/ communication	Summary of outcome of discussions
Public Health England (PHE)	26 March 2020	Discussions around a number of topics, including: <ul style="list-style-type: none"> • incorporation of mental health within the HEqIA baseline;

Consultee	Date of meeting/ communication	Summary of outcome of discussions
		<ul style="list-style-type: none"> • importance of mitigation for open and green space impacts, including around tranquillity effects; • vulnerabilities of residents in the private rented sector; • consideration of potential impacts of the construction workforce on accommodation, primary health care and community safety. <p>Agreed that PHE would attend future meetings of CIPHAG in the capacity of observers only.</p>
NHS Mid Essex Clinical Commissioning Group	2 December 2021	Discussion around GP capacity within the Mid Essex area and sharing of data sources to support this.
Dartford, Gravesham & Swanley Integrated Care Partnership	25 August 2022	Presentation of information relating to construction workforce numbers and associated potential impacts on primary healthcare services. This included discussion of potential areas of concern/impact and a description of Project interventions to overcome these, including commitments relating to Project healthcare provision.

5.6 Approach to wider community engagement

- 5.6.1 The Applicant has aimed to ensure that the Project has identified and mapped out the relevant stakeholders at the outset to ensure that local insight is provided as early as possible in the development of the Project. A number of distinctive ‘stakeholder cohorts’ were therefore established to guide engagement, with individual cohorts including local authorities, environmental bodies, statutory undertakers and communities and local parishes.
- 5.6.2 There are five parish councils within the Order Limits, of which only Shorne Parish Council, Cobham Parish Council and Higham Parish Council have expressed interest in technical engagement outside of the formal consultation process. Information from ongoing engagement with each of these bodies has been incorporated where relevant into the various assessment topics contained within this HEqIA. Statements of Common Ground have been progressed with

these three Parish Councils, and these can be found in Application Document 5.4.

- 5.6.3 Extensive consultation across the Project route has taken place with a wide range of community groups and individuals, both through the statutory and non-statutory formal consultations and as part of more general and targeted engagement activities. Input from this engagement has helped inform understanding of issues assessed within this HEqIA.

Engagement with traveller and gypsy communities

- 5.6.4 The Project potentially impacts a number of traveller and gypsy communities along its route. These include the Gammon Field Travellers Site located to the west of Baker Street in Thurrock as well as a number of private travellers' sites in Gravesham, Thurrock and Havering, including View Point Place, Linford Crescent and Railway Sidings respectively. Engagement has taken place with members of the community living at these sites to raise awareness of the Project proposals and to help inform the Project as relevant (for example extensive engagement with residents of the Gammon Field Travellers Site has helped to inform design of a replacement site on adjoining land). Further detail about how traveller communities have been engaged with is described in Appendix B.

Engagement with schools

- 5.6.5 Schools have formed an important part of wider community engagement, in terms of those who might be impacted by the Project throughout its planning and construction phases, as well as during long-term operation. Extensive engagement has taken place to identify and support existing needs and priorities.
- 5.6.6 Local education provisions have been arranged in a tier classification to understand how directly impacted they could be by the Project. The tiers are based on anticipated construction impacts for noise, air quality, vibration and severance, and have been informed by this HEqIA as well as environmental impact assessment work and other workstreams such as skills and employment. Engagement with schools has been prioritised towards education providers most affected by the Project works as well as schools located in areas of socio-economic disadvantage or where education providers deliver a large proportion of work-related project-based learning.

Working Groups

- 5.6.7 A number of working groups have been established over the course of the Project to date. Working groups of relevance to topics assessed within this HEqIA include:
- a. The Emergency Services and Safety Partnerships Group which includes representatives from local authorities, and has been meeting regularly since early 2021 to discuss interaction with the emergency services and the Project.
 - b. The Project has established an overarching Benefits Steering Group and four working groups to oversee and drive forward initiatives that maximise

benefits. These working groups have been set up across a number of delivery themes and typically include stakeholders who have the powers to deliver the projects. The four working groups are as follows:

- i. Environment Working Group – developing and delivering a programme of activity that increases biodiversity and habitat connectivity, enhances the landscape and improves public access to green space
- ii. Heritage Working Group – developing and delivering a programme of activity that protects and enhances heritage, through restoration and conservation, and is also connecting communities with their heritage by supporting community-led archaeology and increasing interpretation
- iii. The Skills, Education and Employment (SEE) Working Group – developing a programme of activity designed to provide local communities with the skills that would be needed to deliver the project and the significant planned investment in the region
- iv. Sustainable Transport Working Group – focusing on developing and delivering improvements to sustainable transport infrastructure, including improving cross-river transport connectivity.

5.7 Ongoing engagement

- 5.7.1 Engagement in the months following the submission of the DCO application will centre on the matters that remain under discussion within the Statements of Common Ground. In most cases, the Applicant and the local authorities have agreed to these being ‘under discussion’ as they rely on the local authorities having full access to the application materials, which can only happen after submission. As such, the Applicant is anticipating that these matters will continue to mature in advance of the examination period. The Applicant will continue to work collaboratively with the local authorities to ensure that discussions on those matters continue.
- 5.7.2 A number of working groups would continue or have been set up to further cross-organisation engagement and influence decision-making as the Project progresses into delivery.

6 Baseline

6.1 Introduction

- 6.1.1 The basis for the HEqIA is the development of a comprehensive baseline, detailing the demographic, socio-economic and health characteristics of local authorities and local communities within the local and wider study areas to the north and south of the River Thames.
- 6.1.2 The baseline provides a profile of residents living in communities potentially affected by virtue of their proximity to the Project or affected by environmental change (for example changes in traffic levels, air quality or noise levels) in addition to groups who may be particularly vulnerable to environmental and social change.
- 6.1.3 The full baseline is provided in Appendix C. This section provides an overview of key findings from the baseline analysis as they relate to particular communities, areas and vulnerable populations.

6.2 Summary of baseline conditions

- 6.2.1 The areas to the north and south of the River Thames have distinct characteristics, communities and networks. The baseline data shows that socio-economic and health inequalities exist across local and wider study areas, demonstrated by concentrations of deprivation, differences in life expectancy between communities as well as differences in mortality rates and prevalence of health conditions.

South of the River Thames

- 6.2.2 To the south of the River Thames, the study area encompasses the three local authorities of Dartford, Gravesham and Medway. The M2/A2 corridor divides a predominantly urban landscape to the north with a rural area to the south. The urban area located between the River Thames and the A2 corridor comprises settlements including Dartford, Greenhithe, Swanscombe, Northfleet and Gravesend; within Medway District, the urban area is clustered to the east of the M2 around the Medway towns of Strood, Rochester and Chatham. Outside of these urban areas, the landscape is characterised by smaller towns and villages within open countryside. The transport network to the south of the River Thames is dominated by east–west routes, including the M2/A2, the A226 (Gravesend Road) and the HS1 railway line.
- 6.2.3 Wards to the south of the River Thames clearly illustrate the following variations between local areas in relation to a range of health and wellbeing indicators and in relation to the presence of concentrations of more vulnerable populations:
- Wards such as Riverside and Westcourt in Gravesham are characterised by poor economic conditions, deprivation, and poor health outcomes. Extremes in socio-economic characteristics within Gravesham are exemplified by household tenure data, which show that 92.1% of residents of Riverview ward own their own home, compared to 44.7% of residents of Riverside (Census, 2011).

- b. Higham and Chalk wards in Gravesham contain higher proportions of older populations (for example 35.1% of the Chalk ward population is aged over 60, compared to 22.7% of the population for Gravesham as a whole) (Census, 2011).
- c. Riverside ward has a high ethnic minority population (29.6% compared to 17.1% for Gravesham) (Census, 2011).
- d. Within Medway, the Strood area and further to the south, the towns of Chatham and Rochester are areas where deprivation is more concentrated. The ward of Strood South has a poorer score in relation to several health indicators (OHID, 2022).

6.2.4 Further areas of consideration are the communities to the south and north of the existing Dartford Crossing. To the south of the River Thames, these include the wards of Stone, Littlebrook and Joyce Green, all within the local authority area of Dartford Borough Council. Characteristics of these wards include high levels of deprivation and poor health outcomes (for example lower life expectancy, significantly worse mortality rates from various conditions, and high levels of obesity).

North of the River Thames

- 6.2.5 The area to the north of the River Thames encompasses the three local authority areas of Thurrock Council, Brentwood Borough Council and the London Borough of Havering. The A13 runs in a predominantly west–east direction between the M25 and Southend-on-Sea, passing to the north of the towns of Grays and Tilbury. The area is bound by the M25 in the west, the A13 in the north and the A1089 in the east, and is heavily urbanised, incorporating the Lakeside Shopping Centre and surrounding industrial/commercial developments near the Dartford Crossing, in addition to developments associated with Tilbury Docks.
- 6.2.6 Beyond the A1089, the area includes residential communities of Tilbury, Chadwell St Mary and East Tilbury, set within a low-lying landscape. To the north of the A13, the area is predominantly rural in character; settlements include South and North Ockendon as well as the villages of Orsett and Bulphan. The landscape to the west of the M25 becomes more urbanised near its junction with the A127, with settlements including Upminster and Cranham.
- 6.2.7 There are distinct variations in socio-economic and health characteristics across the area:
- a. In Thurrock, the wards of Tilbury St Chads, Tilbury Riverside and Thurrock Park, and Chadwell St Mary experience a range of issues as reflected in poor performance against health and socio-economic indicators. For example, 21.9% of residents in the ward of Chadwell St Mary consider their day-to-day activities to be limited a little or a lot as a result of a health condition or disability, compared to 15.5% for Thurrock as a whole (Census, 2011). These wards also show a significantly worse situation across several mortality indicators than is the case for England (OHID, 2022).

- b. OHID data shows that inequality in life expectancy at birth over the period 2018–2020 was 9.5 years for men and 6.3 years for women (i.e. the difference in life expectancy between the most and least deprived areas of Thurrock) (OHID, 2022).
 - c. Local communities in Havering and Brentwood are close to the Project and the data indicates a generally higher standard of living and better health outcomes overall (OHID, 2022). Upminster and Cranham wards (Havering) have older populations than is the case for Havering as a whole (Census, 2011).
 - d. Levels of childhood and adult obesity are an issue across the area. Some wards, for example East Tilbury, Ockendon and Belhus wards in Thurrock, have a much higher proportion of obese or overweight children than is the case nationally. Wards in Havering similarly exhibit these characteristics (OHID, 2022).
 - e. The Gammon Field Travellers Site is located within the Order Limits for the Project, with further traveller sites located to the north and north-west of Grays.
- 6.2.8 Communities near to the existing Dartford Crossing to the north of the River Thames include the wards of Aveley and Uplands; and West Thurrock and South Stifford (both of which are within Thurrock Council's authority area). Characteristics of these wards include high levels of deprivation and poor health outcomes (for example lower life expectancy, significantly worse mortality rates from various conditions, and high levels of obesity).
- 6.2.9 Data has been obtained relating to persons considered to be clinically extremely vulnerable (and therefore advised to shield during the COVID-19 pandemic). For example, a total of 9,950 people within Thurrock fall into this category (known as Category A persons) which translates into a rate of 58 per 1,000 persons, slightly higher than the average for England (40 per 1,000 persons). Over half of Category A persons are aged over 65; 62% of Category A persons live within deprived areas. The wards of Aveley and Uplands and Chadwell St Mary have high concentrations of Category A persons (rates of 102 and 100 per 1,000 persons respectively), with the wards of Orsett and South Chafford among the lowest (rates of 35 and 25 per 1,000 persons respectively).

Health inequalities

- 6.2.10 The baseline data clearly show common strands and trends relating to socio-economic and health data. Sensitive populations have been identified across the local and wider study areas. It is recognised that some populations would be more vulnerable than others to change as a result of the multiplicity of factors affecting them. This relates particularly to poorer communities who already experience inequalities of outcomes in their daily lives.
- 6.2.11 Addressing health inequalities is a cross-cutting theme for all local authorities within the study area, with analysis showing that health inequalities are widening. An update on the Marmot Review released in 2020 showed that

health in England is *'getting worse for people living in more deprived districts and regions, health inequalities are increasing and, for the population as a whole, health is declining'* (Marmot *et al.*, 2020).

Health priorities

- 6.2.12 Analysis of the Joint Strategic Needs Assessments and Health and Wellbeing Strategies for each local authority area (findings of which are detailed in Appendix A) identified the following common themes and issues:
- a. Growing proportions of older people as a result of ageing populations. Future issues/priority areas would include increasing numbers of people developing chronic conditions as well as higher demand for health and social care services.
 - b. Widening health inequalities is a factor for many local authorities.
 - c. Excess weight and obesity among adults and children, creating problems in terms of multi-morbidity.
 - d. Promoting protective factors to improve mental health and wellbeing.

7 Assessment

7.1 Introduction

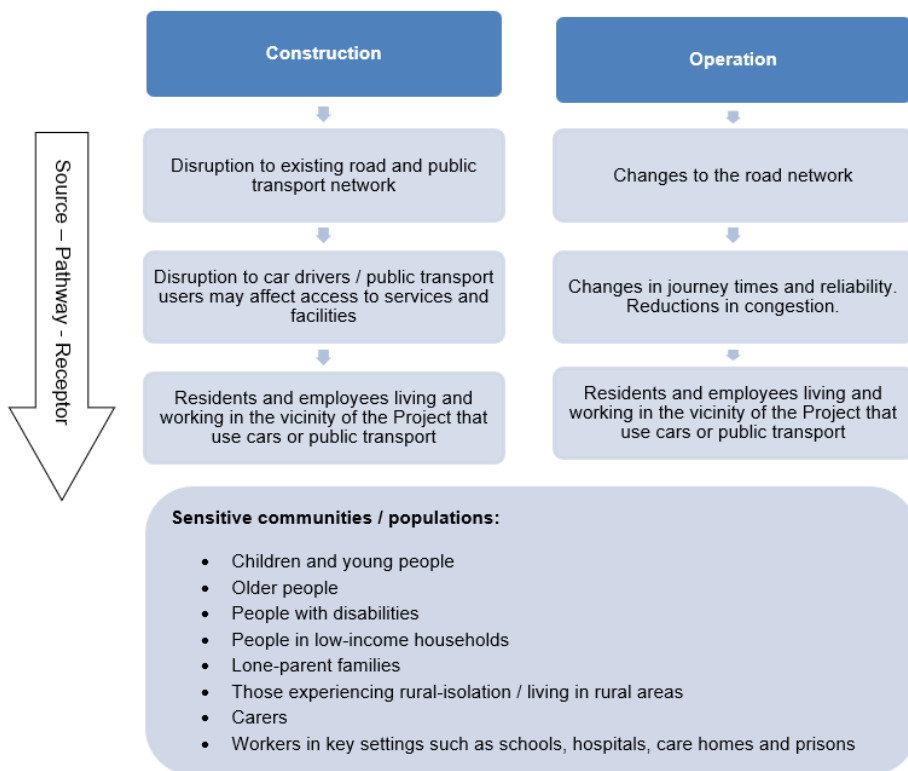
- 7.1.1 This section sets out the findings of the assessment in relation to specific topics. For each topic, the section includes an overview, a summary of the links between the topic and health outcomes from relevant literature, a summary of issues raised about the topic during consultation, a description of the potential impacts that could arise during the construction and operational phases, relevant mitigation measures and a summary assessment for both health and equality impact.

7.2 Accessibility

Overview

- 7.2.1 Accessibility relates to the ease of reaching different destinations, with various factors combining to affect how accessible individual locations are (factors could relate, for example, to the physical characteristics of a place, or to existing transport connectivity). Accessibility therefore has a direct impact on where people live, work, how they access services and leisure activities, and consequently on their health and wellbeing.
- 7.2.2 This section describes how accessibility for both car and public transport users may change as a result of the Project during both construction and operational phases. It covers access to a variety of destinations including community services (such as education and healthcare) as well as employment. Changes in access to green space and outdoor recreation are considered separately in Section 7.4. The relationship between accessibility and outcomes on health and equality is summarised in Plate 7.1.

Plate 7.1 Source-pathway-receptor model – accessibility



Evidence base

7.2.3 Accessibility by a variety of transport means is fundamental to access employment, services and social opportunities (Mackett and Thoreau, 2015). Transport barriers are not experienced equally across populations and are more likely to affect some groups than others. Transport-related social exclusion includes those with no access to a car or the skills and confidence to use available transport. Populations of low income and socio-economic groups are the most likely to be excluded from full access to transport (Government Office for Science, 2019).

7.2.4 Access to services and social infrastructure such as healthcare and education can impact on people’s physical and mental health (Global Research Network on Urban Health Equity, 2010). Access to health facilities has a direct positive effect on health (Healthy Urban Development Unit, 2013) and is important for providing access to information, screening, prevention and treatments. Access to healthcare services is affected by transport mode, availability of financial support for those on low incomes and the location of healthcare services. Older people and groups impacted by disability and long-term illnesses are more dependent on health and social care services (Harner, 2004), and are therefore

more vulnerable if access to these services becomes restricted. Barriers created by transport can lead to rescheduled or missed appointments, delayed care, and missed or delayed medication use. These consequences may lead to poorer management of chronic illnesses and thus poorer health outcomes.

- 7.2.5 Access to leisure and cultural facilities can have a ‘positive effect on people’s physical, social, emotional and cognitive health through prevention, coping (adjustment, remediation, diversion), and transcendence’ (Caldwell, 2005). People participate in cultural activities for various reasons, including personal growth and development, to learn new skills, for enjoyment and entertainment, as a means of creative expression, to meet new people and to pass on cultural traditions.
- 7.2.6 Employment is a key determinant of health due to its associations with feelings of security, income, increased friendship networks and social status. Income from employment has an indirect financial effect on the quality of life of families, their health and the health of dependants.
- 7.2.7 Car ownership levels are highest among those in full time employment, as opposed to people who are unemployed or economically inactive. Lack of access to a car or increased travel costs associated with car ownership may contribute to social exclusion. Car ownership among vulnerable groups (such as young people, older people, disabled people and those on low incomes) is typically low.
- 7.2.8 Public transport may be more commonly used by vulnerable populations such as children and young people, older people, those without access to a car, people on low incomes and women. Changes in public transport provision may present a barrier to jobs, health services, education, shops and other services.
- 7.2.9 The vulnerability of older people increases with reduced mobility. The provision of safe travel options (public and private) that allow easy access to services and amenities is a vital factor in maintaining mobility among older people. Difficulties in using public transport can limit older people’s participation in society, thereby impacting negatively on their health.

Relevant themes from local health and equality strategies

- 7.2.10 The policy and strategic context for health and equalities is set out in Appendix A. Local priorities of relevance to accessibility are summarised below:
- a. Reducing health inequalities – specified as a priority in a number of Health and Wellbeing Strategies. The London Health Inequalities Strategy (Greater London Authority (GLA), 2018) references the importance of developing and promoting London as a healthy place for all reducing income inequality and the negative consequences of relative poverty. The Kent Joint Health and Wellbeing Strategy (Kent County Council, undated) identifies tackling health inequalities as one of four priorities. Key areas of focus of the Essex Joint Health and Wellbeing Strategy include influencing conditions and behaviours linked to health inequalities (Essex County Council, 2022). Reducing health inequalities is an overarching theme of the Brentwood Health and Wellbeing Strategy 2020–2023 (Brentwood Borough Council, 2020).

- b. Promoting opportunity – for example the London Health Inequalities Strategy (GLA, 2018), has regard to the importance of increasing opportunities for people to access potential benefits of good work and other meaningful activity. Domain Four of Thurrock Council's Health and Wellbeing Strategy includes an 'Opportunity for All' goal, supporting people in Thurrock to be aspirational, resilient and able to access high quality education and training (Thurrock Council, 2022). The Southend-on-Sea Health and Wellbeing Strategy includes provision of accessible services as a priority for the borough (Southend-on-Sea Borough Council, 2021).
- c. Creating healthier environments – accessibility priorities of Thurrock Council's Health and Wellbeing Strategy include the importance of providing access to services to residents across the borough through affordable and well-connected public transport, active travel and the provision of local based services and support (Thurrock Council, 2022). Key performance indicators set out within the London Health Inequalities Strategy (GLA, 2018) also relate to healthy places, with all Londoners benefiting from an environment and economy that promote good mental and physical health. Theme Four of Medway's Joint Health and Wellbeing Strategy 2018–2023 (Medway Council, 2018) is 'Improving Mental and Physical Health and Wellbeing', recognising that mental and physical health and wellbeing are affected by many wider issues in our day-to-day environment.
- d. Achieving equality objectives – for example, Essex County Council's seven equality outcomes for the residents of Essex include that people have aspirations and achieve their ambitions through education, training and lifelong learning; and that people can live independently and exercise control over their lives (Essex County Council, 2015). The London Borough of Havering includes reducing inequalities in health and wellbeing across communities in Havering as an overarching cohesion priority (London Borough of Havering, 2018). Strategic equality priorities and objectives for Thurrock and Gravesham include access to services and access to all respectively.

Findings from consultation

- 7.2.11 A summary of issues raised by stakeholders and members of the public with regard to accessibility is provided below for both the construction and operational phases.

Construction

- a. Congestion on local roads caused by construction traffic, diversions and road closures.

- b. Concerns that accessibility by both car and public transport would be directly affected as a result of road closures, delays and disruption to the bus network. There may be potential impacts on local journeys as a result (for example accessing local services and facilities).
- c. Concerns about congestion during construction impacting on response times for emergency service vehicles.

Operation

- a. Improved connectivity and resilience across the wider region and mitigated effect of disruptions at the Dartford Crossing. This would support economic growth and bring economic benefits, stimulating employment and attracting developers and investors.
- b. Concerns that the positive effects of the proposed crossing would not be realised and that additional road network improvements would be required through the immediate and wider area.
- c. Concerns that the Project may create additional traffic pressure as people would be more easily able to access areas.
- d. Concerns over local accessibility near the M2/A2.
- e. Reliance on private transport in rural areas currently.
- f. Concern that existing infrastructure in Thurrock would not be able to accommodate increased traffic levels.

Findings from baseline review

- 7.2.12 Relevant data from the baseline analysis includes information relating to car ownership and travel choices:
- a. Non-car ownership is relatively low for each local authority area, except for Southend-on-Sea. Car ownership is higher across local authorities as a whole when compared to the communities found close to the Project, masking pockets of low car-ownership (for example in Gravesham and Rochester) which suggests a propensity to use public transport, walk and cycle in these areas.
 - b. Poor access to private transport occurs in more deprived wards such as Riverside in Gravesham and wards in proximity to the Dartford Crossing in Dartford. Information for the Tilbury Riverside and Thurrock Park ward shows there are 34.2% of households without access to a car (compared to 25.8% for England as a whole) (Census, 2011).
 - c. National Public Transport Access Nodes (NaPTAN) data (DfT, 2014b) shows the public transport network is concentrated in and around urban centres, which contain the main concentrations of public transport routes

and high frequency routes. Rural areas to the south of Gravesend and along the Hoo Peninsula, for example, appear less served by public transport.

- d. Residents in more deprived areas appear to take a higher proportion of more local trips. In more rural locations such as Orsett, residents travel further, for example to get to work (Census, 2011).

Accessibility impacts and mitigation during construction

7.2.13 Accessibility impacts have been considered in relation to both car and public transport users. The Transport Assessment (Application Document 7.9) sets out likely impacts on the road network as a result of the construction of the Project.

7.2.14 The Transport Assessment identifies impacts on journey times across 28 distinct journey routes through the wider area to the north and south of the River Thames. These include roads on the strategic road network such as the M25 and M20, as well as a selection of more local routes including Valley Drive/Henhurst Road, Thong Lane, St Mary’s Lane, and Baker Street/Heath Road. The Transport Assessment identifies where, for each phase of construction, journey time changes by more than one minute or by more than 5%. Routes experiencing the greatest journey time delays (i.e. more than a 20% increase in journey time) for each construction phase are summarised in Table 7.1.

Table 7.1 Journey time increases >20% by construction phase

Construction phase	Journey time increases by affected route
Phase 1	<p>The B1421 Ockendon Road eastbound (EB) and westbound (WB) would see an increase in journey time across all three periods (AM peak, inter-peak and PM peak) of just under one minute.</p> <p>Stifford Clays Road (EB and WB) would also see an increase in journey time across all three periods. The greatest increase would be for Stifford Clays Road (EB) in the PM peak, which would see a journey time increase of 1.8 minutes.</p> <p>Baker Street/Heath Road northbound (NB) would see an increase in journey time across all periods, with the greatest increases seen in the AM and PM peaks of around 1.1 minutes. Baker Street/Heath Road southbound (SB) would only see a journey time increase of more than 20% during the PM peak (of one minute in duration).</p>
Phase 2	<p>St Marys Lane WB would see an increase in journey time during all three periods, with the greatest increases in the AM and PM peaks of around 1.1 minutes. St Marys Lane EB would also experience an increase in journey time during the AM peak, again of 1.1 minutes.</p>
Phase 3	<p>Station Road/Fort Road/A1089 would see an increase in journey time of around 2.3 minutes in the AM peak.</p> <p>East Tilbury Road/Muckingford Road EB would see an increase in journey time of 1.4 minutes in the AM peak.</p> <p>St Marys Lane WB would see an increase of 1.1 minutes in the AM and PM peaks and of just under one minute in the inter-peak period.</p>

Construction phase	Journey time increases by affected route
Phase 4	Baker Street/Heath Road NB and SB would see increases in journey time across all three periods. For NB traffic, the greatest increase in journey time would be three minutes in the PM peak; for SB traffic, the greatest increase would be 3.5 minutes in the AM peak.
Phase 5	Baker Street/Heath Road SB would see an increase in journey time of just under one minute in the AM and interpeak periods.
Phase 6	The A289 WB would see an increase in journey time across all three periods ranging from 1.3 minutes in the inter-peak to 2.1 minutes in the AM peak. The A2 (Strood) (WB) would see an increase in journey time of two minutes in the AM and PM peaks. Baker Street/Heath Road (SB) would see increases in journey time of over 20% across all three periods, with the greatest increase of 1.1 minute experienced in the AM peak. Baker Street/Heath Road (NB) would experience increases in journey time of just under one minute across all three periods.
Phase 7	Baker Street/Heath Road (SB) would see an increase in journey time across all three periods ranging from 0.9 minutes in the inter-peak to 1.1 minutes in the AM peak. Baker Street/Heath Road (NB) would experience increases of more than 20% in the AM and inter-peak periods (0.8 minutes and 0.7 minutes respectively). The A289 (WB) would see an increase in journey time of more than 20% across all three time periods (with the greatest increase of 2.1 minutes in the AM peak). The A2 (Strood) (WB) would see increases of more than 20% in both the Am and PM peak periods (1.9 and 2.0 minutes respectively).
Phase 8	The A289 (WB) would see an increase in journey time across all three time periods of more than 20% (2.1 minutes, 1.2 minutes and 1.9 minutes respectively). The A2 (Strood) (WB) would see increases of 1.9 minutes in both the AM and PM peaks. Baker Street/Heath Road SB would see an increase in journey time of one minute in the AM peak and just under one minute in the inter-peak period.
Phase 9	Baker Street/Heath Road (NB and SB) would see increases in journey time of more than 20% across all three time periods. These range from 0.8 minutes (NB) in the AM and inter-peak periods to an increase of 1.1 minutes (SM) in the inter-peak and PM peak periods. The A289 (WB) would experience an increase in journey time of 1.5 minutes in the PM peak.
Phase 10	The only route to experience a journey time increase greater than 20% would be Baker Street/Heath Road (NB) during the AM peak of 0.8 minutes.
Phase 11	No increases in journey time greater than 20% predicted on any of the journey routes identified.

7.2.15 Impacts on the local road network have been considered in relation to road closures and lengths of temporary diversions. Road closures are required in relation to the construction of new structures; the majority have been designed to be constructed offline in order to reduce potential impacts, with traffic

subsequently diverted from the existing onto the new alignment. Instances where this would not be the case are as follows:

- a. Brewers Road – the proposed closure of Brewers Road would be required as the alignment of the new bridge is the same as for the existing bridge meaning there is no alternative but to close the road. The closure is envisaged to be 19 months in duration. During the closure, Thong Lane would be kept open and maintained (with the exception of short term night/weekend closures). The planned diversion route for cars would be via the Three Crutches roundabout and the Gravesend East junction.
- b. Baker Street – the Baker Street closure is proposed to allow the safe construction of scheme elements around the A13. The section between the A13 and A1013 would be closed for approximately 16 months. During this time, Rectory Road would remain open. Access from Stifford Clays Road to Baker Street would be available.
- c. Rectory Road – the proposed closure of Rectory Road would be required as the alignment of the new bridge is the same as for the existing bridge, meaning there is no alternative but to close the road. The bridge section of Rectory Road over the A13 would be closed for approximately seven months. During this time Baker Street would be open and access from High Road and School Lane would be available.
- d. Ockendon Road – the section of Ockendon Road approximately between the rail bridge and existing properties would be required for around 19 months. This would be to allow construction of scheme elements as well as to ensure safe management of significant earthworks in the area to reduce interface between construction and the public. The diversion route would be via the B186, West Road, Dennis Road, Dennises Lane and Stubbers Lane.
- e. Hornsby Lane – would be affected by the construction of a new bridge, and permanently closed to all road users including WCH. People accessing residential properties on Hornsby Lane during the construction phase would experience increased journey distances and therefore times.

7.2.16 In order to assess accessibility by public transport during the construction phase, bus routes have been mapped and timetable information collated. This has been used to compare bus routes against construction routes and identify potential impact areas.

7.2.17 The Transport Assessment (Application Document 7.9) identifies that construction activities would have an impact on a number of bus and coach routes in terms of journey times. These are summarised in Table 7.2.

Table 7.2 Affected bus routes and journey time changes by construction phase

Construction phase	Affected bus routes
Phase 1	<p>More bus routes would be affected in Phase 1 than in any other modelled construction phase. All increases in bus journey times are less than six minutes in duration. Affected routes include:</p> <ul style="list-style-type: none"> • Brentwood – 475 (NB and SB) • Dartford – 481 (EB) • Gravesham – 416 (AC and CW), 306 (NB and SB), 308 (NB), 735 (EB), 736 (EB) • Thurrock – 7A (EB and WB), 7B (EB and WB), 7C (EB and WB), 11 (NB and SB), 51 (EB and WB), 66 (EB and WB), 73 (EB), 73A (EB and WB), 77 (EB and WB), 77A (EB and WB), 99 (loop), 200 (NB and SB), 265 (NB), 269 (NB), 370 (SB), Z1 (EB and WB) and Z4 (NB and SB) <p>The Z4 route (NB and SB) in Thurrock would see an increase in journey time across all three time periods (AM peak, inter-peak and PM peak) ranging from 2.1 minutes (SB in the PM peak) to 4.3 minutes (SB in the AM peak).</p> <p>A number of routes would see increases in journey time in both the AM and PM peak periods. These include the 735 (EB) in Gravesham, and the 11 (SB), 77 (EB and WB), 77A (EB and WB), 200 (NB and SB) and 21 (EB and WB), all of which are in Thurrock. The greatest increases in journey time would be experienced by users of the 77 (WB) in the PM peak (an increase of 5.8 minutes), the 77A (WB) (increase of 5.6 minutes in the PM peak), 73A (WB) (increase of 5.2 minutes in the PM peak) and the 66 service (EB and WB) which would each see an increase of just under five minutes in the PM peak.</p>
Phase 2	<p>All affected bus routes would be in Thurrock, with the biggest impacts on the evening peak hour. Affected bus routes are:</p> <ul style="list-style-type: none"> • Thurrock – 11 (NB and SB), 73A (WB only), 77A (EB and WB), 269 (NB and SB), 347 (NB and SB), 370 (NB and SB) <p>The 77A (EB and WB routes) and 347 (NB and SB routes) would see an increase in journey time in all three periods, ranging from 2.1 minutes to 3.9 minutes for the 77A route and from 2.0 minutes to 3.6 minutes for the, 347 route.</p> <p>Routes 11 (SB) and 269 (SB) would experience increases in journey time in both the AM and PM peak. For route 11 (SB) these would be of 2.7 minutes and 2.6 minutes for the AM and PM peak respectively; for the 269 (SB) these would be 3.6 minutes and 2.9 minutes for the AM and PM peak respectively.</p> <p>For all other routes identified, changes relate to the PM peak only; the greatest increase in journey time is predicted to be 4.3 minutes for the 269 (NB) route.</p>
Phase 3	<p>Affected bus routes include:</p> <ul style="list-style-type: none"> • Brentwood – 9 (EB) • Gravesham – 416 (CW), 417 (EB and WB), 736 (WB) • Thurrock – 11 (NB and SB), 100 (SB), 200 (SB), 269 (NB and SB), 374 (NB and SB), Z1 (WB), Z4 (SB) <p>Bus routes affected across all three time periods would be the 416(CW) and 417 (EB and WB) in Gravesham. The greatest increase in journey time would be 3.2 minutes (for the 417 (WB) in the PM peak).</p>

Construction phase	Affected bus routes
	Of all other bus routes affected during this phase, the greatest increase in journey time would be 3.6 minutes (bus route 11 (SB) in Thurrock in the AM peak).
Phase 4	<p>The impact on local bus services would be north of the river in Phase 4, with bus routes affected by the closure of Rectory Road and the B187.</p> <p>Affected bus routes include:</p> <ul style="list-style-type: none"> • Thurrock – 11 (NB and SB), 100 (NB and SB), 200 (NB and SB), 370 (NB and SB), 374 (SB), Z3 (WB) and Z4 (SB) <p>The 370 (NB and SB) would be impacted across all three time periods, with journey time increases ranging from 4.5 minutes (370 (NB) in the inter-peak period) to 6.1 minutes (370 (SB) in the AM peak).</p> <p>Routes 100 (SB), 200 (SB) and Z3 (WB) would be impacted in the Am and PM peak periods, with the greatest journey time increase of 4.3 minutes (200 (SB) service in the AM peak).</p> <p>All other identified routes would be affected for periods of around three minutes and less.</p>
Phase 5	<p>In Phase 5 the impact on bus routes would remain to the north of the river. Affected bus routes include:</p> <ul style="list-style-type: none"> • Brentwood – 9 (EB) • Thurrock – 11 (NB and SB), 100 (NB and SB), 200 (NB and SB), 370 (NB and SB), 374 (SB), Z3 (EB and WB) • Bus routes 11, 200, 475 and 370 would be affected by road closures; these routes would operate with local diversions which are reflected in the journey times. • Bus route 200 (SB) and 370 (NB and SB) would see increases in journey times across all three periods, with the greatest increases being seen in the 370 (SB) service during the AM and PM peaks (increases of 6.1 and 5.6 minutes respectively). • The 11 (NB and SB), 100 (NB and SB) and Z3 (WB) services would see increases in the AM and PM peaks of between two to four minutes, with the exception of the 11 (SB) which would see an increase of 5.5 minutes in the AM peak.
Phase 6	<p>Affected bus routes include:</p> <ul style="list-style-type: none"> • Brentwood – 9 (EB) • Gravesham – 311 (NB and SB), 416 (AC), 417 (EB and WB), 700 (EB and WB), 695 (EB) • Medway – 149 (NB and SB) • Thurrock – 11 (NB and SB), 100 (SB), 200 (SB), 370 (NB and SB), 374 (SB) and Z4 (SB) <p>Bus routes 417 (EB and WB) and 700 (WB) in Gravesham would experience and increase in journey time across all three periods. The 417 routes would experience increases ranging from 4.5 minutes in the EB service (inter-peak period) to six minutes in the WB service (PM peak) and 6.3 minutes in the EB service (PM peak).</p>

Construction phase	Affected bus routes
	<p>In Thurrock, the 370 (NB and SB) services would experience an increase in journey time across all three periods of between 4.5 minutes (NB inter-peak period) to 6.1 minutes (SB service during the AM peak).</p> <p>The 700 (EB) service in Gravesham and the 149 (NB and SB) services in Medway would experience an increase in journey time in both the AM and PM peak, all of which would be below four minutes in duration.</p> <p>Other changes in journey time are predominantly below four minutes, with the exception of the 311 (NB) service (4.6 minute increase in the inter-peak) and the 311 (SB) service (5.9 minute increase in the AM peak).</p>
Phase 7	<p>In Phase 7 there would be an increase in the impact on services to the south of the River Thames. Affected bus routes include:</p> <ul style="list-style-type: none"> • Brentwood – 9 (EB) • Gravesham – 311 (NB and SB), 416 (AC), 417 (EB and WB), 695 (EB), 700 (EB and WB), 736 (WB) • Medway – 149 (NB and SB) <p>Thurrock – 100 (SB), 200 (SB), 370 (NB and SB), 374 (SB) and Z4 (SB)</p> <p>Bus routes 417 (EB and WB) and 700 (WB) in Gravesham would see increases in journey time across all three periods of under six minutes in duration.</p> <p>Route 370 (NB and SB) in Thurrock would also see an increase in journey time across all three periods; there would be an increase of 6.1 minutes in journey time during the AM peak for the 370 (SB) service.</p> <p>The 149 (NB and SB) service in Medway would experience an increase in journey time in the AM and PM peak of around three minutes. Other services would see an increase in one of the three time periods only, with the majority being below four minutes in duration with the exception of the 311 (SB) service in the AM peak (5.7 minute increase in journey time) and the 311 (NB) service in the inter-peak period (which would see an increase of around 4.4 minutes in journey time).</p>
Phase 8	<p>By Phase 8 the impact on bus services north of the River Thames would be greatly reduced.</p> <p>Affected bus routes include:</p> <ul style="list-style-type: none"> • Brentwood – 9 (EB) • Gravesham – 311 (NB and SB), 416 (AC and CW), 417 (EB and WB), 700 (EB and WB), 695 (EB) • Medway – 149 (NB and SB) • Thurrock – 11 (SB), 100 (SB), 200 (SB) <p>The 417 (EB and WB) and 700 (WB) services would experience an increase in journey times across all three periods, ranging from a two minute increase in the inter-peak period for the 700 (WB) service to changes of 5.6 and 5.8 minutes in the PM peak for the 417 EB and WB services respectively.</p> <p>The 700 (EB) service in Gravesham and 149 (NB and SB) services in Medway would experience an increase in journey time in both AM and PM peaks of less than four minutes.</p> <p>The 311 (SB) service and 311 (NB) service in Gravesham would experience an increase of 5.6 minutes in the AM peak and 4.4 minutes in the inter-peak</p>

Construction phase	Affected bus routes
	period respectively. All other increases in journey times are below 3.5 minutes.
Phase 9	<p>Road closures would continue to affect bus services in Thurrock. Affected bus routes include:</p> <ul style="list-style-type: none"> • Brentwood – 475 (NB and SB) • Gravesham – 417 (WB) and 700 (EB and WB) • Thurrock – 11 (NB and SB), 68 (WB), 200 (NB and SB) <p>The 11 service (NB and SB) and 200 (SB) services in Thurrock would experience increases in journey time across all three periods. The greatest increases would be experienced by the 11 (NB) service, of 6.5 minutes in the AM peak.</p> <p>All other changes in journey time would be below four minutes.</p>
Phase 10	The only services affected in Phase 10 would be the 11 (NB) service, the 200 (SB) and the Z4 (SB) in Thurrock, which would be affected in the AM peak only and the 9 eastbound in the PM peak, with the greatest change being an increase of 2.4 minutes.
Phase 11	No bus services would be affected such that there is a change in journey time of more than two minutes during this phase.

7.2.18 The Transport Assessment (Application Document 7.9) also notes that some bus routes use roads which would be closed during construction and that these bus services would follow diverted routes. This would affect services using Rectory Road, the B187 where it passes under the M25 and Brewers Road.

7.2.19 The oTMPfC (Application Document 7.14) has been prepared to provide an overview of the approach that would be followed when undertaking temporary traffic management for the safe construction of the Project and which would be used to inform the Traffic Management Plan for Construction (TMP). The oTMPfC outlines various stakeholder groups that may be affected by construction activities. For public transport users and operators, the oTMPfC states that the following would be addressed in the TMP as a minimum:

- Maintain existing routes (as far as reasonably practicable).
- Provide temporary diversions, temporary bus stops when and where required.
- Seek view of authorities when designing diversion routes and temporary bus stops following approval of TMP.
- Reduce impact to the rail network and schedule.
- Engage with rail companies on proposed works and programme to reduce impacts following approval of TMP.

7.2.20 The CoCP (Application Document 6.3, ES Appendix 2.2) would establish how communication would be maintained with local authorities and residents throughout the construction phase.

- 7.2.21 The oTMPfC (Application Document 7.14) outlines what the TMP would address as a minimum for emergency services access. This includes:
- a. Identification of a process and procedure for allowing emergency services through the works/haul roads.
 - b. Diversion routes which avoid narrow roads and low bridges.
 - c. Sufficient notification of closures.
 - d. Early engagement with Emergency Services to ensure clarity.
- 7.2.22 Two Traffic Management Forums (TMFs) (covering roads in Kent and roads north of the Thames) would be established following the grant of the DCO. The TMF would consist of the Contractors, utility companies, local authorities, local highway authorities, public transport operators, emergency services, National Highways maintenance providers and any other affected stakeholders depending on the planned construction phases (as set out in the oTMPfC (Application Document 7.14)). Emergency diversion routes for the local road network would be discussed and developed by the TMF.
- Health outcomes assessment – accessibility (construction)**
- 7.2.23 Changes in accessibility have the potential to affect people from across a wide geography, not only including those wards located in closest proximity to the Project, but also those which are further away and where residents may be undertaking longer journeys which cross the Project route.
- 7.2.24 Populations identified as having a **high** sensitivity to changes in accessibility during construction include people who are more reliant on public transport (for example children and young people, older people, people in low-income households and people without access to private transport) as well as people with disabilities who may also be car users, those who may be experiencing rural isolation, carers and workers in key settings (such as healthcare, education, care homes).
- 7.2.25 The assessment of likely health outcomes as a result of the Project during construction in relation to accessibility is summarised in Table 7.3.

Table 7.3 Health outcome – accessibility (construction)

Community/population	Assessment summary
General population Sensitive populations/ communities	<p>Access to jobs, services and community infrastructure may be impacted as a result of increased journey times during construction. However, this would be managed through measures set out in the TMP and appropriate communication with local residents and affected communities.</p> <p>Negative effects may be experienced by more vulnerable populations who are more dependent on public transport use and therefore may have less choice around mode of transport and route. Increased journey times for buses using the local road network may have an impact in relation to accessing services and employment for these groups, although it is noted that these impacts would be temporary in nature (although long-term). The majority of increases in journey time</p>

Community/population	Assessment summary
	<p>would be below six minutes in duration, although there are a handful of routes that may experience delays of just over six minutes during various time periods and construction phases.</p> <p>Delays in undertaking local journeys may be experienced by residents directly affected by temporary and permanent road closures; these may particularly relate to residents and users of facilities in Orsett and Baker Street. Although users of Baker Street/Heath Road may experience increases in journey time across a number of the construction phases, these are typically of around one minute in duration (with the exception of Phase 4 where journey time may increase by 3.5 minutes).</p> <p>The link between being able to access jobs, services and social opportunities and people's health and wellbeing is well documented.</p> <p>The number of people potentially impacted by changes in accessibility during the construction period is likely to be high, relating to communities along the route and within a wider geographical area.</p> <p>Local health, wellbeing and equalities strategies and priorities reference the importance of reducing health inequalities and promoting opportunity, both of which areas can be influenced by changes in accessibility and how it may affect populations disparately.</p> <p>The main construction works are anticipated to last approximately six years, but the phasing of construction activities may reduce the length of time that particular areas are impacted for. Impacts on accessibility are likely to be long-term for communities along the length of the route – even where they may be affected by a single construction phase, this may last for up to two years.</p> <p>A range of traffic management measures have been identified which are secured in the oTMPfC (Application Document 7.14) and which would be taken forward into the TMP. Communication with local communities around changes in traffic management at local area level would take place through the Community Liaison Groups and Traffic Management Forums set out in the CoCP (Application Document 6.3, ES Appendix 2.2) and oTMPfC respectively.</p> <p>The health outcome for the general population within the wider study area in relation to changes in accessibility is considered to be neutral and therefore not significant in terms of overall population health.</p>

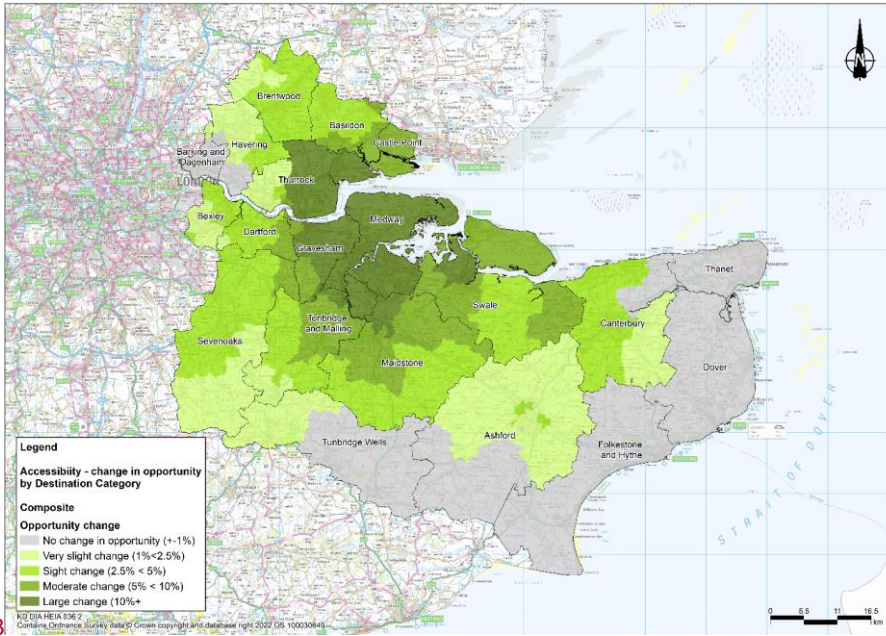
Equality impact assessment – accessibility (construction)

- 7.2.26 As noted above, impacts may be experienced by groups who are more reliant on public transport (particularly bus services) for example children, women, older people and people with disabilities.
- 7.2.27 People with disabilities who are car users may experience impacts relating to increased journey times, although this would be in line with the general population and no differential or disproportionate impact is anticipated.

Accessibility impacts and mitigation during operation

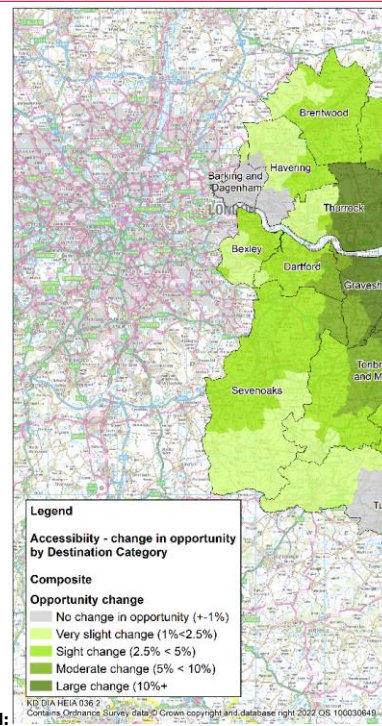
- 7.2.28 Accessibility by private vehicle has been measured to a range of destination types including education (primary and secondary schools, Special Educational Needs establishments, further education colleges and universities), healthcare facilities (hospitals, medical practices), railway stations and shopping facilities (supermarkets and town centres). Changes in accessibility for WCH are covered separately in Section 7.2, with changes in access to green space and outdoor recreation assessed in Section 7.4. Access to employment during the operational phase is covered in Section 7.10.
- 7.2.29 Analysis has used data from the Lower Thames Area Model (LTAM) to look at opportunity to travel as a function of travel time and destination attractiveness. This has incorporated a distance decay function (i.e. the longer the distance to travel to a particular type of destination, the less likely people are to travel), the value of which differs by destination type. The *origin* area is defined as model zones in Brentwood, Dartford, Gravesham, Havering, Medway and Thurrock with *destinations* across the wider region. The analysis has calculated a level of opportunity for each of the destination categories, the results from which have then been apportioned at ward level taking into account whether the origin zone is within a single ward or split across multiple wards.
- 7.2.30 The output has been identification of a composite percentage change in opportunity at ward level in addition to a percentage change for each destination type. The composite change in accessibility across the modelled area is shown in Plate 7.2. This shows that the vast majority of changes in accessibility to all types of destinations within the model zones and wider area are positive, albeit to varying degrees. The greatest change in overall accessibility is seen in wards within Gravesham, Medway, eastern and central parts of Thurrock and wards to the north of Tonbridge and Malling.

Plate 7.2 Change in access to opportunity (all destination types)



6.3

7.2.31 Plate 7.3, Plate 7.4 and Plate 7.5 show accessibility to different destination categories, notably to healthcare services, to education facilities and to retail destinations (this includes both supermarkets and town centres) respectively.



Deleted:

Plate 7.3 Change in access to opportunity (health)

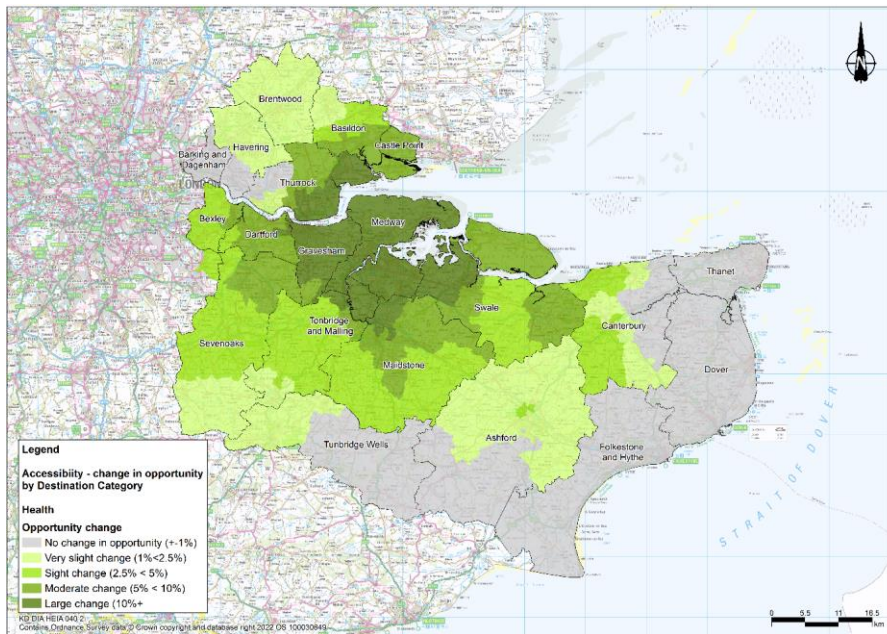
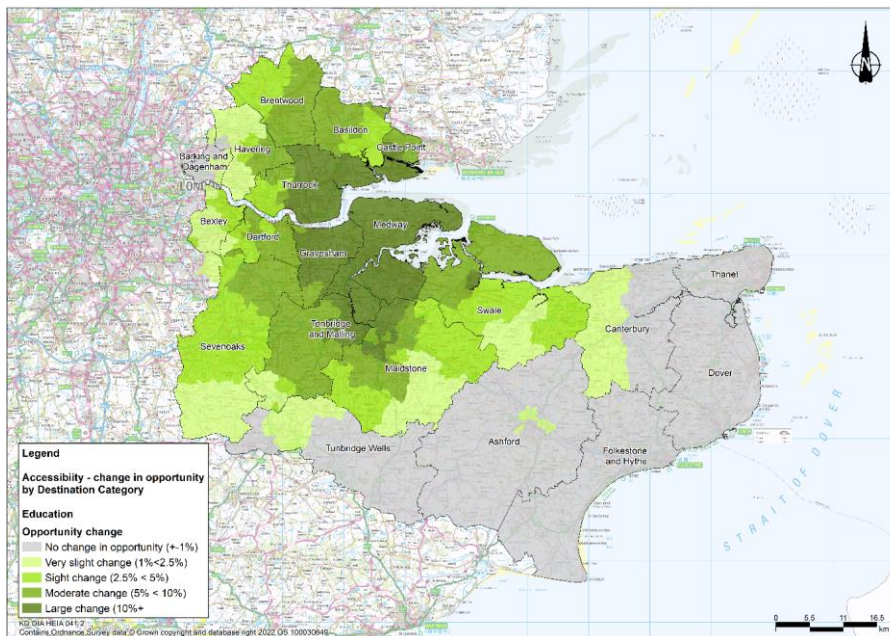


Plate 7.4 Change in access to opportunity (education)



- d. Brentwood – an area already characterised by good accessibility due to existing road links and proximity to London. Generally improvements to accessibility would be slight, with the exception of access to education, where moderate improvements in accessibility would be seen particularly in wards to the eastern half of the district.
- e. Havering – wards in Havering generally would see lower changes to accessibility as a result of the Project, with again the greatest improvement being in changes to accessing education facilities, where a moderate increase is predicted for wards to the south-east of the borough (for example Upminster).
- f. Thurrock – although all wards are predicted to show some level of improvement in accessibility across all destination types, there is a significant variation in terms of degree of change. In relation to healthcare services, Thurrock wards show a spectrum of change in access, from large improvements in wards to the south and west such as East Tilbury and Tilbury Riverside and Thurrock Park; through to more moderate increases in wards such as Orsett, Chadwell St Mary and Stifford Clays; with little or no change in terms of accessibility in wards to the west such as Aveley and Uplands. A similar picture is exhibited in terms of access to retail opportunities, with access to education showing a more even distribution in terms of increased accessibility across wards.

7.2.33 There may be impacts on the journey times of some bus and coach services as a result of changes in traffic speeds of the roads they use once the Project opens. The impact for an individual passenger would depend upon where they board or alight a particular service. The Transport Assessment (Application Document 7.9) has forecast impacts on total journey time for bus routes in the area for the AM peak, inter-peak and PM peak, with a threshold for change being set at two minutes over the entire route. The findings show that most bus routes would not be affected or that there would be a reduction in journey time:

- a. During the AM peak, eleven bus routes show a decrease in journey time ranging between 2.1 and 3.5 minutes. Four bus routes show an increase in journey time of between 2.1 and 2.8 minutes (these comprise the Z3 WB and Z4 SB services in Thurrock and the 149 SB and 151 SB services in Strood).
- b. During the inter-peak, one bus route (the X80 NB in Thurrock) is forecast to experience a decrease in journey time of around 3.5 minutes. One bus route (the 695 WB in Gravesham) would experience an increase in journey time of 2.4 minutes.
- c. During the PM peak, ten bus routes would experience a decrease in journey times ranging from 2.0 minutes to 4.1 minutes. Three bus routes would experience an increase in journey times of 2.0 minutes, 2.1 minutes

and 2.9 minutes (relating to the Z4 NB in Thurrock, 149 SB in Strood and the Z3 WB in Thurrock respectively).

- 7.2.34 The Transport Assessment (Application Document 7.9) notes the relocation of a pair of bus stops from their current position adjacent to Heath Road to a position approximately 400m to the east along the A1013. These bus stops are currently used by bus routes 100, 200 and 475 along Stanford Road (A1013). By relocating the bus stops further to the east, they would be closer to the Whitecroft Care Home, which is accessed from Stanford Road and may therefore be beneficial for workers and visitors accessing the facility.
- 7.2.35 While there are currently no proposals to run local buses or long distance coaches on the Project, it could be used by both if desired by operators. Any long distance coaches that choose to re-route from the Dartford Crossing to the A122 Lower Thames Crossing may benefit from reduced journey times.
- 7.2.36 The Applicant is proposing to undertake traffic impact monitoring during the operational phase of the Project to identify changes in performance on the surrounding road network. Information setting out how such a scheme would be implemented is contained in the Wider Network Impacts Management and Monitoring Plan (Application Document 7.12).

Health outcomes assessment – accessibility (operation)

- 7.2.37 As noted in terms of accessibility impacts during construction, changes in accessibility have the potential to affect people from across a wide geography.
- 7.2.38 Populations identified as having a **high** sensitivity to changes in accessibility during the operational phase include people who are more reliant on public transport (for example children and young people, older people, people in low-income households and people without access to private transport) as well as people with disabilities who may also be car users, those who may be experiencing rural isolation, carers and workers in key settings (such as healthcare, education, care homes).
- 7.2.39 The assessment of likely health outcomes as a result of the Project during operation in relation to accessibility is summarised in Table 7.4

Table 7.4 Health outcomes – accessibility (operation)

Community/ population	Assessment summary
General population Sensitive communities/ populations	<p>The analysis has shown improvements in accessibility to varying degrees for different types of services and facilities for wards across the study area. Improvements to accessibility would have a beneficial effect for both car and public transport users due to improvements in journey time and reliability on the road network. Traffic impact monitoring is proposed during the operational phase of the Project to identify where there may be changes in performance on the surrounding road network.</p> <p>A number of wards currently experiencing high levels of deprivation according to the Index of Multiple Deprivation and particular deprivation domains (for example income deprivation) are shown to experience improvements in accessibility (notably wards within Thurrock, Medway and Gravesham).</p>

Community/ population	Assessment summary
	<p>Populations who are more dependent on public transport use may have less choice around mode of transport and route. The Transport Assessment (Application Document 7.9) has shown that the majority of bus routes using the local road network experience beneficial impacts in terms of reductions in journey times.</p> <p>The link between being able to access services and social opportunities and people’s health and wellbeing is well documented.</p> <p>The number of people potentially impacted by changes in accessibility is likely to be high, relating to communities across a wide geography.</p> <p>Local health, wellbeing and equalities strategies and priorities reference the importance of reducing health inequalities and promoting opportunity, both of which areas can be influenced by changes in accessibility and how it may affect populations disparately.</p> <p>The health outcome for both the general population and sensitive populations identified within the wider study area in relation to changes in accessibility is considered to be positive and significant in terms of overall population health.</p>

Equality impact assessment – accessibility (operation)

7.2.40 It is noted that disabled drivers may have particular needs within the tunnelled section of the Project. In designing the Project, the needs of different road user groups have been considered. Relevant design standards have included DMRB CD 352 Design of Road Tunnels (Highways England, 2020a) and the DfT’s Inclusive Mobility document (DfT, 2005); further, there has been consultation with the Disabled Road Users Forum. This has highlighted the range of travel needs across specific user groups, with relevant aspects incorporated into the tunnel design including the following:

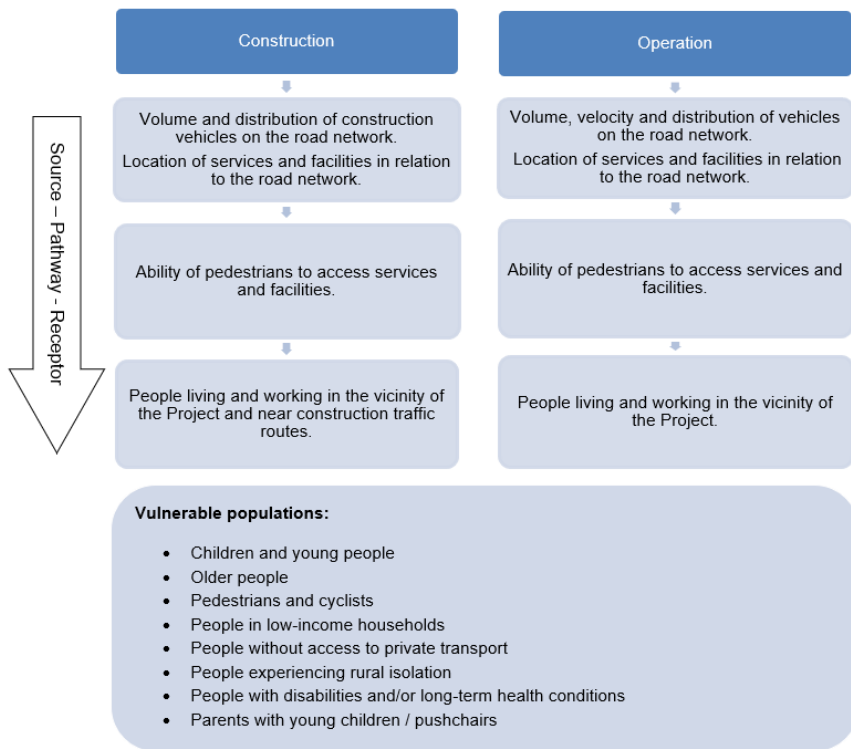
- a. A public address system, as well as visual aids, to guide road users in the event of an incident or emergency.
- b. The section of the Project within the tunnel specifies a walkway width of 1.2m, limited to 1.0m only at the locations of rising services and emergency panels, to improve mobility for vulnerable users in the event of an emergency in the tunnel. The tunnel design allows for a 75mm ramped kerb to the walkway for wheelchair access, and provision for pedestrians to pass a wheelchair on the walkway.

7.3 Traffic-related severance

Overview

7.3.1 Severance relates to the extent to which the Project may separate residents from facilities and services they use within their community as a result of changes in traffic flows (volume and speed). This section describes the likely severance impacts for pedestrians as a result of the Project during both the construction and operational phases. The relationship between severance and outcomes on health and equality is summarised in Plate 7.6.

Plate 7.6 Source-pathway-receptor model – severance



Evidence base

- 7.3.2 Evidence dating back to a study in 1972 by Appleyard and Lintell in San Francisco discovered the negative effects of traffic in urban streets on perceived liveability. It concluded an inverse correlation of traffic intensity to levels of social interaction, among other factors, resulting in disruption to interpersonal networks and reduced access to goods and services, creating the term ‘community severance’ (Mindell and Karlsen, 2012).
- 7.3.3 Road construction, in particular new major urban roads, are associated with community severance, reduced access to local amenities and disruption of social networks caused by a physical barrier through the community (Egan *et al.*, 2003).
- 7.3.4 There is empirical evidence that traffic speed and volume can affect physical activity, social contacts, children’s play, and access to goods and services. For example, increases in traffic speed and volume may deter people from using or crossing the local road network. However, no available studies have investigated mental or physical health outcomes in relation to community severance. While not designed specifically to do so, recent developments in road design (for example wider pavements) may also ameliorate community severance (Mindell and Karlsen, 2012). Overall, there is a lack of current

evidence directly examining and illustrating direct links between community severance and health. A study by Anciaes *et al.* (2019) linked perceptions of road traffic conditions and their impact on walking to measures of subjective wellbeing.

7.3.5 Evidence suggests that when adults reported having access to appropriately located shops, public transport, pavements, bicycle facilities and recreational facilities, they were 20–50% more likely to meet physical activity guidelines than if they lacked these amenities (Salvo *et al.*, 2018). Evidence further suggests that roads that divide otherwise coherent areas either physically or psychologically can lead to significant decreases in pedestrian journeys from necessity and choice as well as disrupting and reducing demand for local amenities (Mindell and Karlsen, 2012).

7.3.6 Higginbotham *et al.* (2022) refer to a small but growing body of research into the concept of the 'barrier effect' – or community severance – and how it may affect health, including through increasing sedentary behaviours, reducing local social contacts and impeding access to amenities important to health. Barrier effects are described as static (for example a road without pedestrian crossings), dynamic (created by volume or speed of traffic), or psychological (an unpleasant road environment/perceptions of risk). The study by Higginbotham *et al.* (2022) identified that those with high or very high community severance index scores had higher odds of reporting poor self-rated health.

Relevant themes from local health and equality strategies

7.3.7 The policy and strategic context for health and equalities is set out in Appendix A. Local priorities of relevance to severance are summarised below:

- a. Reducing health inequalities – specified as a priority in a number of Health and Wellbeing Strategies. The London Health Inequalities Strategy (GLA, 2018) references the importance of developing and promoting London as a healthy place for all, reducing income inequality and the negative consequences of relative poverty. The Kent Joint Health and Wellbeing Strategy (Kent County Council, undated) identifies tackling health inequalities as one of four priorities. Key areas of focus of the Essex Joint Health and Wellbeing Strategy include influencing conditions and behaviours linked to health inequalities (Essex County Council, 2022). Reducing health inequalities is an overarching theme of the Brentwood Health and Wellbeing Strategy 2020–2023 (Brentwood Borough Council, 2020).
- b. Promoting opportunity – for example the London Health Inequalities Strategy (GLA, 2018), has regard to the importance of increasing opportunities for people to access potential benefits of good work and other meaningful activity. Domain Four of Thurrock Council's Health and Wellbeing Strategy includes an 'Opportunity for All' goal, supporting people in Thurrock to be aspirational, resilient and able to access high quality education and training (Thurrock Council, 2022). The Southend-on-Sea

Health and Wellbeing Strategy includes provision of accessible services as a priority for the borough (Southend-on-Sea Borough Council, 2021).

- c. Creating healthier environments – accessibility priorities of Thurrock Council's Health and Wellbeing Strategy include the importance of providing access to services to residents across the borough through affordable and well-connected public transport, active travel and the provision of local based services and support (Thurrock Council, 2022). Key performance indicators set out within the London Health Inequalities Strategy (GLA, 2018) also relate to healthy places, with all Londoners benefiting from an environment and economy that promote good mental and physical health. Theme Four of Medway's Joint Health and Wellbeing Strategy 2018–2023 (Medway Council, 2018) is 'Improving Mental and Physical Health and Wellbeing', recognising that mental and physical health and wellbeing are affected by many wider issues in our day-to-day environment.
- d. Addressing issues relating to physical activity – this is stated as a priority area for a number of local authorities. The Essex Joint Health and Wellbeing Strategy includes addressing obesity, improving diet and increasing physical activity as a key area of focus, with priority measures including reducing the percentage of residents (aged 16+) who undertake less than 30 minutes physical activity per week. Southend-on-Sea Health and Wellbeing Strategy includes a priority for the provision of active environments (Southend-on-Sea Borough Council, 2021). The Southend-on-Sea, Essex and Thurrock Mental Health and Wellbeing Strategy 2017–2021 describes how spatial planning will enable healthy lifestyles within active environments, thereby creating attractive places to live (Southend-on-Sea Borough Council, Essex County Council and Thurrock Council, 2017). Key themes of the Brentwood Health and Wellbeing Strategy 2020–2023 include encouraging physical activity (Brentwood Borough Council, 2020).
- e. Achieving equality objectives – Essex County Council's equality outcomes for the residents of Essex include that people have aspirations and achieve their ambitions through education, training and lifelong learning; and that people can live independently and exercise control over their lives (Essex County Council, 2022). The London Borough of Havering includes reducing inequalities in health and wellbeing across communities in Havering as an overarching cohesion priority (London Borough of Havering, 2018). Strategic equality priorities and objectives for Thurrock and Gravesham include access to services and access to all respectively.

Findings from consultation

- 7.3.8 Issues raised by stakeholders and members of the public regarding severance primarily relate to the construction phase. Particular concerns relate to impacts of road closures on people's ability to access services and facilities, together with temporary disruption to walking and cycling routes, which may affect how people travel. During the operational phase of the Project, concerns have been raised about communities being potentially isolated due to the introduction of a physical barrier limiting east-west movements across the area.

Findings from baseline review

- 7.3.9 ES Chapter 13: Population and Human Health (Application Document 6.1) identifies community land and assets located to the north and south of the River Thames which are either within the Order Limits or within a 500m buffer area from the Order Limits (this study area was extended so that specific facilities could be included if their catchment area was considered to cover a wider area). Community assets include services and facilities such as education, healthcare, sport and recreation facilities.
- 7.3.10 The baseline provided in Appendix C provides detail of the demographic make-up of those communities within the immediate vicinity of the Project, identifying particularly where there are higher or lower proportions of vulnerable groups such as the elderly or children.

Traffic-related severance impacts and mitigation during construction

- 7.3.11 Options for strategic construction traffic movements for the Project are restricted to using the A2 and A226 in the south, and the A13, A1089 and the M25 in the north. The local road network is also limited across the Project alignment, and as such construction traffic would be constrained to a relatively small number of routes.
- 7.3.12 The Transport Assessment (Application Document 7.9) identifies distinct sources of construction traffic as follows:
- HGV movements between construction compounds and external locations, associated with earthworks
 - HGV movements between different construction compounds
 - HGV movements due to deliveries from external suppliers
 - Light Goods Vehicle (LGV) trips associated with each construction compound
 - Vehicle trips of construction workers commuting to construction compounds from their places of residence
- 7.3.13 Measures have been proposed to reduce construction vehicle movements, including the use of offsite build/modular construction processes and consolidation of deliveries.

- 7.3.14 The oTMPfC (Application Document 7.14) has identified restrictions for HGVs along local roads in response to stakeholder requests. These are shown in Table 7.5.

Table 7.5 Proposed restrictions for HGVs

Road	Road section	Type of restriction
Thong Lane	Between the A2 compound access off Thong Lane and the A226	HGV ban for deliveries and earthworks associated with main works only (excluding utilities works)
Brewers Road	Between Park Pale and the A226 (including The Ridgeway and Peartree Lane)	HGV ban for all works
Castle Lane	Entire road	HGV ban for all works
The Street (Cobham)	Entire road	HGV ban for all works
Lower Higham Road	Entire road	HGV ban for deliveries and earthworks associated with main works
Rectory Road	From School Lane to Prince Charles Avenue	HGV ban for all works
School Lane	From Mill Lane to Rectory Road	HGV ban for all works
B188 High Road	From Mill Lane to Rectory Road	HGV ban for all works
Prince Charles Avenue	From Rectory Road to the A128 Brentwood Road	HGV ban for all works
Church Lane	Entire road (Ockendon)	HGV ban for all works

- 7.3.15 The TMP would detail how construction traffic movements are managed, including for example one-way systems, managing reversing movements, haul route crossings and WCH segregation.
- 7.3.16 The FCTP (Application Document 7.13) sets out a framework with regard to the implementation of travel planning for the movement of personnel to and from the construction worksites, compounds and ULHs during the construction phase of the Project. The aims of the FCTP include to minimise adverse local disruption or traffic impacts on the highway network from worker and visitor travel to and from construction worksites, compounds and ULHs by reducing the number of single-occupancy vehicle trips and encouraging the uptake of sustainable and active modes of travel. Site Specific Travel Plans would be developed by contractors for individual construction sites, following the latest guidance and best practice.
- 7.3.17 There are a number of road closures, for differing lengths of time, during the Project's construction programme. Local roads used by pedestrians would mainly be temporarily closed for short durations during the construction phase, typically overnight and at weekends. The only minor road to be permanently severed as a result of the Project would be Hornsby Lane. Residents/visitors accessing properties along Hornsby Lane during the construction phase would

experience increased journey distances and likely further delays if they are required to travel through the construction works to reach their destinations on Hornsby Lane.

- 7.3.18 The severance assessment during construction has considered the potential separation of residents from services they may use within their community as a result of substantial changes in transport infrastructure or changes in construction traffic flows arising from the Project. The assessment has focused on single carriageway roads, likely to be crossed at grade (primarily because these are typically roads that pedestrians would be crossing to reach community facilities). An assessment of the change in the level of severance was then carried out which considered the flow changes, together with an estimation of the number of people affected and the location of amenities.
- 7.3.19 The assessment has considered the 11 construction traffic modelling phases set out in the Transport Assessment (Application Document 7.9), taking the greatest change in traffic flow (positive or negative) across all phases and time periods. Filters have then been applied to remove dual carriageways, roundabouts and slip roads from the assessment (as these are not likely to be used by pedestrians). Road links with existing pedestrian crossing infrastructure were also removed from the assessment. The final stage has involved a desk-based review of all road links to identify existing environment, infrastructure, location and other factors that may influence crossing requirements (for example the presence of community facilities).
- 7.3.20 Table 7.6 identifies locations of potential community severance during the construction period and the relevant construction phase within which it sits. These are locations where a moderate increase in vehicle movements has been identified. Table 7.6 also shows locations where a moderate decrease has been identified.

Table 7.6 Potential severance locations (construction)

Severance locations – moderate increase in vehicle movements	Construction traffic modelling phase
Old Road East	Phase 2 AM/PM, Phase 3 AM, Phase 6 AM/PM, Phase 7 AM/PM, Phase 8 AM/PM, Phase 9 PM
Feenan Highway	Phase 1 PM
Chalk Road	Phase 2 PM
St Chads Road	Phase 6 PM, Phase 7 PM, Phase 8 PM, Phase 9 PM
Lower Higham Road (A226 to Chalk Road)	Phase 6 PM, Phase 7 PM, Phase 8 PM
Lower Higham Road (Chalk Road to Orlick Road)	Phase 1 AM/inter-peak (IP)/PM
Linford Road	Phase 1 AM/PM, Phase 2 AM/IP/PM, Phase 3 AM/IP/PM, Phase 4 AM/IP, Phase 5 AM/IP/PM, Phase 6 AM, Phase 7 AM/IP, Phase 8 AM/IP, Phase 9 AM/IP, Phase 10 AM/IP
Gravesend Road (A226)	Phase 1 PM

Thong Lane (A226 to Leander Drive)	Phase 2 AM/PM, Phase 3 AM, Phase 6 AM/PM, Phase 7 AM/PM, Phase 8 AM/PM, Phase 9 AM/PM
Thong Lane (Leander Road to Vigilant Road)	Phase 6 AM/IP/PM, Phase 7 AM/IP/PM, Phase 8 AM/IP/PM, Phase 9 AM/IP/PM
Feenan Highway	Phase 6 PM, Phase 7 PM, Phase 8 PM, Phase 9 PM
Brennan Road	Phase 1 IP/PM
Lower Higham Road (A226 to Chalk Road)	Phase 1 PM
Leander Drive	Phase 1 IP/PM
Valley Drive	Phase 1 AM/IP/PM
Thong Lane	Phase 2 IP

Deleted: Severance locations – moderate decrease in vehicle movements

7.3.21 The above locations have been reviewed in relation to whether there may be a corresponding high proportion of vulnerable populations within an 800m study area (vulnerable populations of relevance to severance include non-car owning populations, children, older people (aged 70+) or people with life-limiting illnesses). Table 7.7 provides a closer review of areas where this correlation may occur, in terms of existing pedestrian environment, presence of community facilities and road crossing infrastructure.

Table 7.7 Areas of potential increased severance (construction phase)

Impacted road/link	Commentary
Chalk Road, Gravesham	Chalk Road is a residential street connecting the A226 Rochester Road with Lower Higham Road. The majority of the road has pavements on either side of adequate width; the exception is the section of Chalk Road nearest the A226 Rochester Road where pavement only exists on the eastern side of the road adjacent to the property frontages. There are no community facilities along Chalk Road itself until the junction with Lower Higham Road, where Chalk Parish Hall is located on the southern side of the road. Chalk allotments are located to the rear of Chalk Road; although pedestrian access is possible via a narrow footpath from Chalk Road, the principal means of access is via Lower Higham Road. Mullender Court, a retirement complex, is located near the junction of Chalk Road with Vicarage Lane. Chalk Road is a bus route, with bus stops midway along its length. There are no pedestrian crossing points along the length of Chalk Road. The surrounding area has a high proportion of children within the general population. The assessment has identified a potential increase in traffic flows only during the PM peak of phase 2 of the construction works; the duration of phase 2 is six months.
Lower Higham Road, Gravesham	The section of Lower Higham Road from Orlick Road to Chalk Road is a residential street with pavements to either side. There are no community facilities along this stretch of the road, with the exception of access to Chalk allotments. At the junction of Lower Higham Road with Chalk Road there is a small parade of commercial units and Chalk Parish Hall. The section of Lower Higham Road between Chalk Road and the A226 is again predominantly residential in nature, with pavements again to both sides of the road. North Kent College and the City Praise Centre are located near to the junction with the A226.

Impacted road/link	Commentary
	<p>There are no pedestrian crossings or refuges along the length of Lower Higham Road. The surrounding area has a high proportion of children within the general population. The section of road between Chalk Road and Orlick Road also has a higher proportion of people with life-limiting illness within the general population. Lower Higham Road has been identified in the oTMPfC (Application Document 7.14) as being subject to an HGV ban for deliveries and earthworks associated with main works. The increase in vehicle numbers is forecast during phases 6, 7 and 8, which combined would last a total of 20 months.</p>
Gravesend Road (A226)	<p>The section of Gravesend Road potentially affected extends approximately from the junction with Church Lane to the roundabout with the A289. There is a pavement along one side of the road for the majority of its length, although the pedestrian environment is not welcoming due to the nature of the A road. There are several central refuges along the length of the road. The A226 is a bus route and there are a few stops along its length, typically associated with clusters of residential properties. The Thames View Crematorium is located on Gravesend Road; access to the facility is likely to primarily be by car or public transport rather than on foot. The increase in vehicle numbers is forecast only during the PM peak of phase 1, envisaged to last a period of eight months.</p>
Thong Lane (A226 to Vigilant Way)	<p>Thong Lane is a residential road with pavements either side of adequate width. There are traffic calming features at various points along the road; between the A226 and Leander Drive these comprise road narrowing and raised platforms which may facilitate pedestrian crossing. Thamesview School is located near the junction of Thong Lane with Leander Drive – while the main school complex is located to the west of Thong Lane, school sports facilities are located to the east of the road. One of the road narrowings is located at this point to facilitate pedestrian access. Viewpoint Community Centre is also located to the north of the school.</p> <p>From Leander Road south towards the junction with Vigilant Way, residential properties front the road to the west, with the Cascades Leisure Centre, Gravesend Golf Centre and Southern Valley Golf Club access to the east. Pavements are located on the western side of the road only. Road narrowings include speed bumps from this point rather than raised platforms.</p> <p>Thong Lane has been identified in the oTMPfC (Application Document 7.14) as being subject to an HGV ban for deliveries and earthworks associated with main works (excluding utilities works).</p> <p>The area around Thong Lane has higher proportions of both older people (70+) and children.</p> <p>The increase in vehicles along Thong Lane is predicted for phases 2 3, 6, 7, 8 and 9. Phases 2 and 3 last for a period of nine months; phases 6–9 last a total of 24 months.</p>
St Chad's Road	<p>St Chad's Road extends from Tilbury centre north to the roundabout at which the Gateway Academy is located. Local shops are located at the southern end of the road, alongside residential properties, pavements to either side and bus stops at various locations. King George's Field is located to the east of the road. The character of the road to the north changes, becoming more rural in nature. There are pedestrian refuges and a signalised pedestrian crossing at the northern end of the road near the junction for the Gateway Academy.</p> <p>The increase in vehicles is forecast to take place in phases 6, 7, 8 and 9, which combined last for a total of 24 months</p>

Impacted road/link	Commentary
Linford Road	<p>Linford Road extends in an east–west direction between Chadwell Hill and High House Lane. For the section of road between Chadwell Hill and Cole Avenue/Sandy Lane the road passes through a residential area of Chadwell St Mary. This stretch of road is relatively wide with pavements set back from the road itself and no community facilities or crossing points. Bennett Lodge and Carlyne House Senior Living complex is located at the junction of Linford Road with Waterson Road; there is a pedestrian refuge facilitating crossing of Linford Road at this point.</p> <p>The change in traffic flows along Linford Road is predicted to last for 10 of the 11 phases.</p>
Old Road East	<p>Old Road East is located to the south of Gravesend town centre. Community facilities located along the road include St Joseph’s Preparatory School, Christ Church and St John’s Catholic Voluntary Aided School (there is a signalised pedestrian crossing near the junction of Old Road East with Valley Drive).</p> <p>The increase in vehicles along Thong Lane is predicted for phases 2, 3, 6, 7, 8 and 9. Phases 2 and 3 last for a period of nine months; Phases 6–9 last a total of 24 months.</p>

Health outcomes assessment – traffic-related severance (construction)

- 7.3.22 Communities where a potential severance impact has been identified include the wards of Chalk, Westcourt, Riverview, Shorne, Cobham and Luddesdown, Higham and Central to the south of the River Thames; and Chadwell St Mary and East Tilbury to the north of the River Thames. Of these wards:
- a. Chalk, Riverview, Higham and Shorne, Cobham and Luddesdown wards each have higher proportions of older populations than the national average, who may be more susceptible to health issues.
 - b. East Tilbury ward has a higher concentration of children than the national average.
 - c. Westcourt and Chadwell St Mary wards have been ascribed a high sensitivity due to a combination of socio-economic and health factors.
- 7.3.23 Populations identified as having a **high** sensitivity to changes in severance during construction as a result of changes in the local road and footpath network include children, older people, people with disabilities and/or long-term health conditions, pedestrians, parents with young children/pushchairs, people in low-income households, people without access to private transport and those experiencing rural isolation.
- 7.3.24 The assessment of likely health outcomes as a result of construction of the Project in relation to severance is summarised in Table 7.8.

Table 7.8 Health outcomes – traffic-related severance (construction)

Community/population	Assessment summary
General population	Measures have been proposed to reduce construction vehicle movements. HGVs would be restricted along a number of local

Community/population	Assessment summary
	<p>roads in response to stakeholder requests. Potential severance impacts have been identified at a number of locations during the construction period as a result of increases in traffic flows. The characteristics of these routes in terms of adjacent land uses and populations has been assessed.</p> <p>Severance impacts during construction would be temporary in nature, although at a number of the locations identified the duration would be long-term (i.e. more than two years in duration). The phasing of construction activities may reduce the length of time that particular areas are impacted. Duration of effect has therefore been identified as medium to long-term.</p> <p>Evidence has shown that the potential 'barrier effect' associated with road traffic can be linked to people's health and wellbeing, with the potential to affect quality of life and discourage trip-making, which can impact on mental wellbeing particularly for older populations.</p> <p>The number of people potentially impacted by changes in traffic-related severance is likely to be low, and restricted to communities at particular locations identified.</p> <p>Local health, wellbeing and equalities strategies and priorities reference the importance of reducing health inequalities and the importance of promoting mental health and wellbeing.</p> <p>The health outcome for the general population in relation to changes in severance during construction is considered to be neutral.</p>
Sensitive communities/ populations	<p>Effects may be experienced by sensitive populations who may have less choice around mode of transport and route. A number of the wards identified as potentially experiencing a severance effect contain higher proportions of more sensitive groups, for example older people or people in low income households.</p> <p>As noted for the general population, duration of effect has been identified as medium to long-term.</p> <p>The potential 'barrier effect' associated with road traffic can be linked to people's health and wellbeing, with the potential to affect quality of life and discourage trip-making, which can impact on mental wellbeing particularly for older populations. A number of the road links identified where a potential severance may occur are in wards where there is a higher than average proportion of older people; a more localised analysis of demographic data reveals that this is the case only at Thong Lane. Other locations, including Chalk Road, Lower Higham Road, Gravesend Road, Long Lane and St Chad's Road, all show higher proportions of children at a local level.</p> <p>The number of people potentially impacted by changes in severance is likely to be low, and restricted to communities at particular locations identified.</p> <p>Local health, wellbeing and equalities strategies and priorities reference the importance of reducing health inequalities and the importance of promoting mental health and wellbeing.</p> <p>The health outcome for sensitive populations in relation to changes in severance during construction is considered to be negative but not significant.</p>

Equality impact assessment – traffic-related severance (construction)

7.3.25 Certain groups (namely children, older people and people with disabilities and/or long-term health conditions) may experience temporary severance impacts as a result of changes in the local road network, for example as a result of increased traffic flows as described in the oTMPfC (Application Document 7.14) and TMP. Appropriate communication with local residents and affected communities would help to reduce these impacts.

Traffic-related severance impacts and mitigation during operation

7.3.26 The severance assessment during operation has considered the potential separation of residents from community facilities and the services they use within their community as a result of substantial changes in transport infrastructure or by changes in traffic flows arising from the Project. Changes arising in terms of access to open space are considered separately in Section 7.4.

7.3.27 The assessment has been informed by findings from the DIA within Appendix D of the ComMA (Application Document 7.7). The assessment has used a two stage process to analyse flow changes for the 2030 opening year (the analysis has only considered roads included in the LTAM). The first stage has used the LTAM outputs for the three peak hour periods (AM, inter-peak and PM) to select road links where there is a +/- 10% change in vehicle flow between the Do Minimum and Do Something scenarios and to filter out instances where the actual change in number of vehicles may be small. Further filters have been applied to remove dual carriageways, roundabouts and slip roads from the assessment (as these are not likely to be used by pedestrians). Road links with existing pedestrian crossing infrastructure were also removed from the assessment. The second stage involved a desk-based review of all road links to identify existing environment, infrastructure, location and other factors that may influence crossing requirements (for example the presence of community facilities).

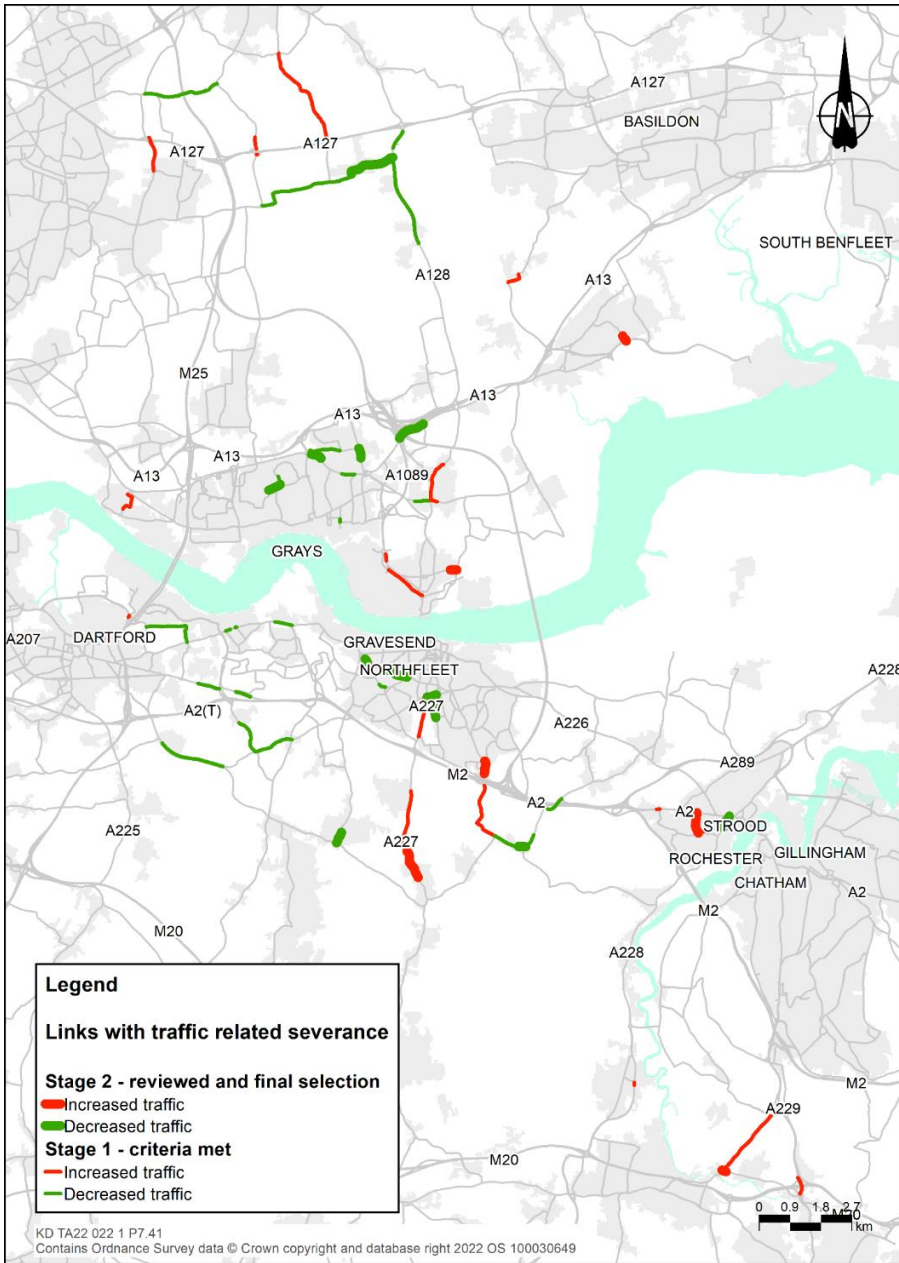
7.3.28 A number of road locations have been identified where there would either be a moderate increase or decrease in traffic; seven locations are shown to have a moderate increase and twelve to have a moderate decrease. These locations are summarised in Table 7.9. Plate 7.7 shows impacted road links where there would be a likely increase or decrease in vehicle flows as a result of the Project.

Table 7.9 Potential severance locations

Severance locations – moderate increase	Severance locations – moderate decrease
<ul style="list-style-type: none"> • Valley Drive (two locations), Gravesend • Wrotham Road, Gravesend • Elaine Avenue, Strood • Forstal Road, Aylesford • Springhouse Lane, Stanford-le-Hope • Brennan Road, Tilbury 	<ul style="list-style-type: none"> • Lodge Lane, Chafford Hundred • The Street, Cobham • Stanford Road, Grays • Warren Lane, Chafford Hundred • Station Road, West Horndon • Singlewell Road, Gravesend • Cross Lane West, Gravesend

Severance locations – moderate increase	Severance locations – moderate decrease
	<ul style="list-style-type: none">• Dover Road East, Gravesend• Dover Road, Gravesend• Northcote Road, Rochester• Blackshots Lane, Little Thurrock• New Barn Road, Longfield

Plate 7.7 Severance during Project operation – impacted road links

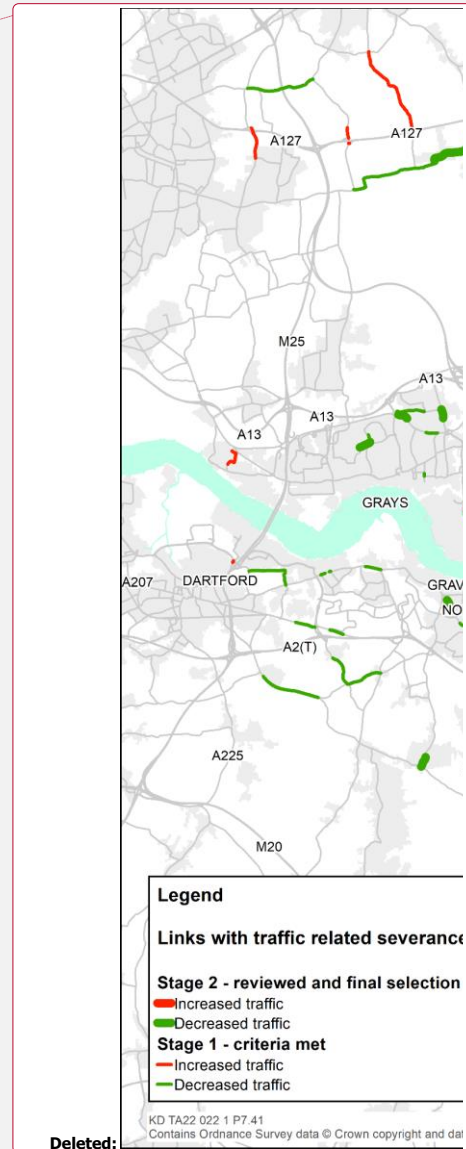


- 7.3.29 The DIA (included within Appendix D of the ComMA (Application Document 7.7)) reports that the Project is expected to have a neutral impact on traffic-related severance, due to the fact there would be both increases and decreases across the study area. However, there would be the following specific impacts of relevance to sensitive communities:
- Non-car-owning households – the percentage of non-car owning households in the proximity of each affected link is lower than for both the regional study area (the whole of the Fully Modelled Area covered by the LTAM) and England and Wales for all locations experiencing an increase in severance, apart from Brennan Road in Tilbury.
 - Children under 16 – the increase in severance on Wrotham Road, Gravesham has a larger than expected impact on the proportion of the population under 16 years; the decrease in severance on Station Road, West Horndon and Lodge Lane, Chafford Hundred affects a larger than expected proportion of young people.
 - Older people – Forstal Road (Tonbridge and Malling), Elaine Avenue (Medway) and Brennan Road (Thurrock) are identified as areas where residents aged 70 years and older may experience a greater disbenefit as a result of increased severance. Areas where a greater proportion of people aged 70 years and older may experience a benefit as a result of decreased severance are identified at Stanford Road, Grays (Thurrock) and Singlewell Road (Gravesham).

7.3.30 Table 7.10 provides a closer review of areas where an increase in severance has been identified in relation to vulnerable groups as above.

Table 7.10 Areas of increased severance

Impacted road/link	Commentary
Wrotham Road	Wrotham Road is identified as a link potentially affected by increased severance as a result of forecast changes in traffic flow. To the south of the A2, Wrotham Road bypasses the community of Istead Rise. Residential development, services and facilities here are located to the west of Wrotham Road (with the exception of several isolated rural properties to the east). Further south, Wrotham Road passes through Meopham village. Facilities within Meopham include a train station, and two small parades of shops (one each at the northern and southern ends of the village). There are several pedestrian refuges at various points through Meopham.
Valley Drive, Gravesend	Valley Drive is a residential road with properties fronting both sides along the majority of its length, together with wide pavements. There is a small precinct of shops near to the junction with St Benedict's Avenue. There is a signalised pedestrian crossing on Valley Drive at this point. Further to the south of Valley Drive there are regular refuge points in the centre of the road, although these would not be suitable for all users due to the lack of dropped kerbs/tactile paving.



Impacted road/link	Commentary
	Community facilities located to the south of Valley Drive include places of worship (the Jesus Victory Centre), areas of informal green space (such as in the vicinity of Whitehill Road and opposite The Warren) and retirement housing complexes (for example Mike Spring Court near the junction with Whitehill Lane). A further parade of shops is located at the junction of Livingstone Road and Valley Drive and again, a signalised pedestrian crossing is located here. A further signalised pedestrian crossing is located at the south of Valley Drive, near to the junction with Hever Court Road.
Elaine Avenue, Strood	Elaine Avenue is a through route connecting the A2 in the north with Darnley Road in the south. It is a residential road which already has an HGV ban imposed upon it (except for loading). Although the road has pavements along either side, these are frequently obstructed by parked vehicles. Elaine Primary School is located towards the south of the road. There are two pedestrian refuges in the vicinity of the school entrance, the closest one to the entrance having dropped kerbs to enable access. St Francis Church is also accessed from Elaine Avenue, close to its junction with Galahad Avenue. A small retail outlet is located on the eastern side of Elaine Avenue near to the junction with Darnley Road.
Springhouse Lane, Stanford-le-Hope	Springhouse Lane is a section of rural singletrack road to the south of the A1014 in Corringham. The road does not provide access to community facilities and services only a handful of rural properties.
Brennan Road, Tilbury	Brennan Road is a residential road linking Civic Square in Tilbury to Fort Road on the eastern edge of the town. This is a bus route. Residential properties front both sides of the road and there are adequate pavements to either side. There are no pedestrian crossing points or refuges currently. The section of road nearest the centre of Tilbury includes green spaces to either side including Anchor Fields Park and the Tilbury Children's Centre. There is a convenience store located on the corner of Brennan Road and Portsea Road.
Forstal Road, Aylesford	Forstal Road extends from the junction with the A229 to the centre of Aylesford. The road provides access to the Cottage Industrial Estate, which is the dominant land-use here. Vehicular access to Cobtree Manor Park car park is enabled from Forstal Road. There are limited residential properties along the road and it is a very vehicle dominated environment. Towards Aylesford, where Forstal Road joins Station Road, there is vehicular access to allotments.

7.3.31 The traffic modelling provides a forecast of where changes in traffic flows would occur during the operational phase. Following the traffic-related severance assessment, further actions may be required in certain locations to enhance the road crossing provision for local residents and thereby ensure that effects do not impact on people's ability to cross roads and access community services and infrastructure. A commitment has been made as part of the Section 106 Agreements Heads of Terms (Application Document 7.3) for further investigation at identified locations to discuss the need for, and provision of, pedestrian crossing infrastructure.

7.3.32 All minor roads (with the exception of Hornsby Lane) that would be severed during construction would be re-linked as part of the Project design, either along their original alignment or with very little deviation from the original alignment. To the north of the River Thames, there would be a slight increase in road length (less than 50m) and thereby journey time for pedestrians as a result of minor changes to the alignments of Muckingford Road, Brentwood Road, Rectory Road, Stanford Road, Stifford Clays Road and Ockendon Road.

7.3.33 Hornsby Lane would be permanently closed to vehicular traffic as a result of the Project. Access would be maintained to all affected properties and turning heads provided at the end of a cul-de-sac to the south of the Project and a cul-de-sac to the north, to permit all vehicles to turn around safely. WCH would be able to access each section of Hornsby Lane independently, but would be required to follow a diversion for through-route activities.

Health outcomes assessment – traffic-related severance (operation)

7.3.34 Communities where a potential severance impact has been identified include the wards of Westcourt, Whitehill, Shorne, Cobham and Luddesdown, Strood South and Aylesford North and Walderslade to the south of the River Thames; and East Tilbury and Stanford East and Corringham Town wards to the north of the River Thames.

7.3.35 Communities identified as having a **high** sensitivity to changes in severance during operation include children, the elderly, people with disabilities and/or long-term health conditions, walkers and cyclists, and people in low-income households.

7.3.36 The assessment of likely health outcomes as a result of the Project during operation in relation to traffic-related severance is summarised in Table 7.11.

Table 7.11 Health outcomes – traffic-related severance (operation)

Community/ population	Assessment summary
General population Sensitive populations	<p>Areas of increased and decreased severance have been identified at various locations. Each of the links potentially affected by increased severance has been analysed to consider the likely impact on local residents in relation to the presence of amenities and facilities, with a particular focus on areas where a potential impact has been identified in relation to sensitive populations.</p> <p>The analysis has shown that, in the majority of locations where there would be increased severance as a result of changes in traffic flow, this is unlikely to have an adverse impact on health and wellbeing. This is due to factors such as the presence of existing pedestrian links and crossings, or alternatively where the existing pedestrian environment is such that severance is not likely to be an issue (for example rural roads with no pavements or nearby amenities/facilities). For several locations – notably Elaine Avenue (Strood), Brennan Drive (Tilbury) and Valley Drive (Gravesham) – it is considered that further investigation may be required into the potential for improving pedestrian crossing provision; this has been included as part of the Section 106 Agreements Heads of Terms document (Application Document 7.3).</p> <p>The duration of effect would be permanent.</p> <p>Evidence has shown that the potential 'barrier effect' associated with road traffic can be linked to people's health and wellbeing, with the potential to affect</p>

Community/ population	Assessment summary
	<p>quality of life and discourage trip-making, which can impact on mental wellbeing particularly for older populations.</p> <p>The number of people potentially impacted by changes in traffic-related severance is likely to be low, and restricted to communities at particular locations identified.</p> <p>Local health, wellbeing and equalities strategies and priorities reference the importance of reducing health inequalities and the importance of promoting mental health and wellbeing.</p> <p>The health outcome for the general population in relation to changes in severance during operation is considered to be neutral.</p>

Equality impact assessment – traffic-related severance (operation)

- 7.3.37 Both adverse and beneficial disproportionate impacts have been identified on the following protected characteristics in relation to severance during operation:
- a. Older people – Forstal Road, Aylesford (Tonbridge and Malling), Elaine Avenue, Strood (Medway) and Brennan Road, Tilbury (Thurrock) are identified as areas where residents may experience a greater disbenefit as a result of increased severance. Areas where a greater proportion of older people may experience a benefit as a result of decreased severance are identified at Stanford Road, Grays (Thurrock) and Singlewell Road, Gravesend (Gravesham).
 - b. Children aged under 16 – the increase in severance on Wrotham Road, Gravesham has a larger than expected impact on the proportion of the population under 16 years, for the regional study area and England and Wales. The decrease in severance on Station Road, West Horndon and Lodge Lane, Chafford Hundred affects a larger than expected proportion of the population of children under 16 years, for the regional study area and England and Wales.
- 7.3.38 The severance identified is not considered to be significant, due to other factors, for example the presence of existing pedestrian refuges and traffic-controlled crossings at appropriate locations (notably to enable access to shops and services).

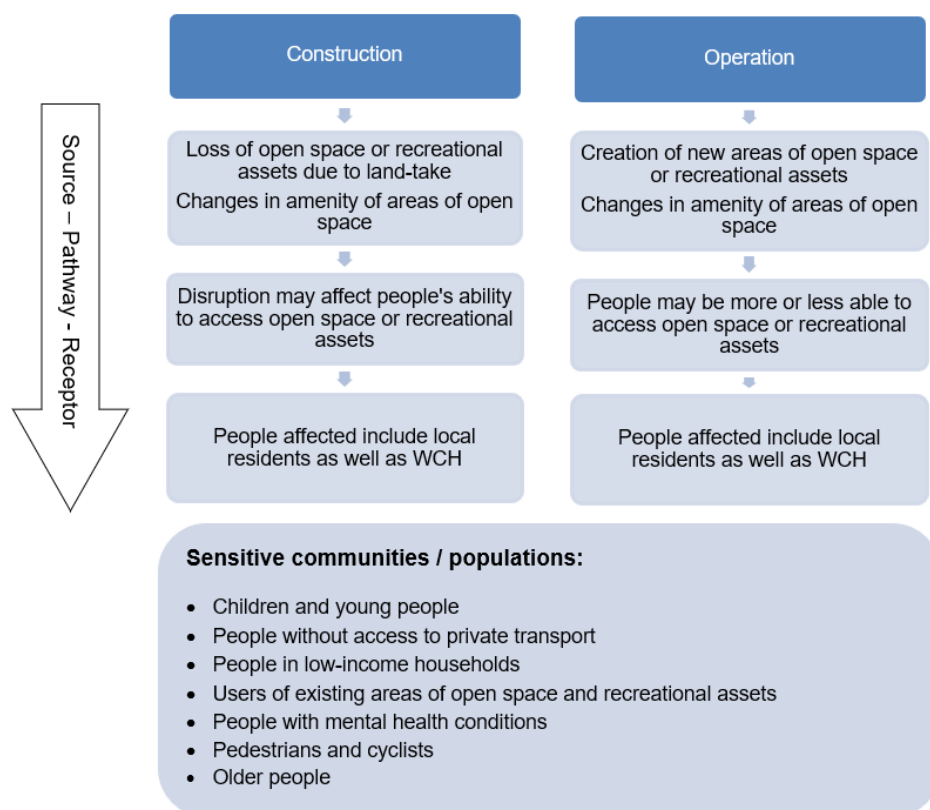
7.4 Access to green space and outdoor recreation

Overview

- 7.4.1 The importance of open spaces for people’s physical and mental wellbeing is well documented (Croucher *et al.*, 2007). Changes to green space and areas used for outdoor recreation may arise during the construction phase as a result of the acquisition of land or changes in access or amenity. Changes during the operational phase may relate to enhancements associated with the provision of replacement land or again, changes to access or amenity.

7.4.2 This section describes the likely impacts in terms of changes to green space and outdoor recreation as a result of the Project during both the construction and operational phases. The relationship between changes to green space and outdoor recreation and outcomes on health and equality is summarised in Plate 7.8.

Plate 7.8 Source-pathway-receptor model – changes to green space and outdoor recreation



Evidence base

7.4.3 Public amenities such as parks, green spaces and recreational facilities benefit the wellbeing of local residents, providing opportunities for health-promoting activity, physical exercise, and meeting-places (Koohsari *et al.*, 2015). Studies have shown that there is a strong relationship between the amount of green space around a person's home and their feelings of life satisfaction, happiness and self-worth; green space within 300m of the home is particularly important (Houlden *et al.*, 2019). Proximity to green space has been shown to be more important than lifestyle factors such as employment, income and general health.

- 7.4.4 Access to green space can affect health by encouraging beneficial physical activity and reducing stress levels and can improve social cohesion by increasing interaction. These factors have been shown to be effective for reducing depression, anxiety and other psychological distress. Living in areas with high natural environment availability has been shown to reduce the odds of cognitive impairment by 30% (Mental Health Foundation, 2015).
- 7.4.5 The National Institute for Health and Care Excellence (NICE) physical activity and environment guidance concludes that safety provision, aesthetics, maintenance and amenities are important attributes in supporting physical activity. Reducing or disrupting access to green space may have negative health consequences (NICE, 2018).
- 7.4.6 There is strong evidence that access to nature can boost physical and mental wellbeing and reduce mortality, helping determine quality of life (Wildlife and Countryside Link, 2022). The health benefits of spending time in nature are well documented. Evidence suggests that proximity and accessibility to nature is associated with better health outcomes, including lower levels of obesity, improved mental health and wellbeing, as well as increased longevity (PHE, 2014). High quality green space also provides a series of social benefits such as greater community cohesion and interaction and reduced social isolation.
- 7.4.7 The attractiveness or quality of green space is also an important determinant of use of green space (Croucher *et al.*, 2007). Contact with nature has positive health benefits through its positive effects on blood pressure, cholesterol and stress reduction, with particular relevance to mental health and cardiovascular disease (Maller, 2005). Green space can provide spaces to promote social interaction and cohesion (Lee, 2010), and reduce social annoyances and crime, all of which can contribute to the mental health of individuals (Maas, 2006).
- 7.4.8 The Landscape Institute produced a position statement relating to 'Public Health and Landscape' in 2013. The statement noted many examples of the important role the natural environment plays in terms of reconnecting communities with green spaces, the use of green space to treat mental illness and break drug dependency, and as a means of providing therapeutic benefit for illnesses such as dementia (Landscape Institute, 2013).
- 7.4.9 Access to green space and nature can affect health by ameliorating stress levels and has been shown to be effective for reducing depression, anxiety and other psychological distress. The mental health and wellbeing benefits of natural environments have been illustrated by a range of studies including Alcock *et al.* (2014), which studied the longitudinal effects on mental health of people moving to greener and less green urban areas; its conclusions noted that moving to greener urban areas was associated with sustained mental health improvements.
- 7.4.10 There is strong evidence that spending at least 120 minutes a week in nature leads to a significant increase in wellbeing (White *et al.*, 2019), with some 70% of UK adults finding that being close to nature improves their mood (Mental Health Foundation, 2021).
- 7.4.11 Exercising within a natural environment ('green exercise') is shown to benefit self-esteem and mood, confirming that the environment has the ability to provide 'an important health service' (Barton and Pretty, 2010). Greater

exposure to natural environments is associated with better health and wellbeing outcomes, including lower probabilities of cardiovascular disease, obesity and mental distress (White *et al.*, 2019). Studies have shown that spending more time outdoors in natural environments can improve sleep quality, reduce stress levels and enhance mood and wellbeing. Regular exposure to nature in childhood may reduce the risk of mental health and psychiatric disorders in adolescence and young adulthood (Engemann *et al.*, 2019).

- 7.4.12 Research into the impacts of COVID-19 on levels of exercise, usage of green space and the link between nature and wellbeing has shown changes in the way people interact with the outdoors as well as changes in people's perceptions of nature (ONS, 2021). There is evidence that the natural environment helped some people to cope with negative feelings such as increased anxiety during lockdowns.
- 7.4.13 The People and Nature Survey for England (Natural England, 2021) gathered information on people's experiences and views about the natural environment, and its contributions to health and wellbeing. During April to June 2020, some adults in England were getting outside more often than usual, with 40% of adults reporting that they had spent more time outside since the COVID-19 restrictions began and 31% exercising more in outdoor spaces. Over these three months, 58% of the adult population had visited a natural space in the last 14 days. In total, 85% of adults reported that being in nature makes them happy, and this was consistent across different population groups, with those who had visited a natural space in the last seven days reporting being happier than those who had not. The main reasons people visited natural spaces were for fresh air, physical and mental health, and to connect with wildlife/nature.
- 7.4.14 Access to green space and nature is not equal, with poorer communities likely to suffer from 'green deprivation' (either less or lower quality green space accessible within their neighbourhood) (New Economics Foundation, 2021). Only one in three people in England have access to a greenspace within 15 minutes' walk of home, with significant variations across the country (Natural England, 2021). The most economically vulnerable often experience poorer quality outdoor environments and suffer disproportionately from a lack of equitable access to ecology and green spaces. Disparities in access to nature can also have a disproportionate impact on minority ethnic groups, with an estimated 40% of people from ethnic minority backgrounds living in the most green-space deprived areas (Groundwork, 2021). Research has suggested that there is a positive association between the percentage of green space in a person's residential area and their perceived general health, and that this relationship is strongest for lower socio-economic groups (Maas, 2006).

Relevant themes from local health and equality strategies

- 7.4.15 The policy and strategic context for health and equalities is set out in Appendix A. Local priorities of relevance to access to green space and outdoor recreation are summarised below:
- a. Reducing health inequalities – specified as a priority in a number of Health and Wellbeing Strategies. The Kent Joint Health and Wellbeing Strategy (Kent County Council, undated) identifies tackling health inequalities as one of four priorities. Key areas of focus of the Essex Joint Health and

Wellbeing Strategy include influencing conditions and behaviours linked to health inequalities (Essex County Council, 2022). Reducing health inequalities is an overarching theme of the Brentwood Health and Wellbeing Strategy 2020–2023 (Brentwood Borough Council, 2020).

- b. Creating healthier environments – forming one of Thurrock’s health and wellbeing goals, including building strong, well-connected communities. Key performance indicators set out within the London Health Inequalities Strategy (GLA, 2018) also relate to healthy places, with all Londoners benefiting from an environment and economy that promote good mental and physical health. Theme Four of Medway’s Joint Health and Wellbeing Strategy 2018–2023 (Medway Council, 2018) is ‘Improving Mental and Physical Health and Wellbeing’, recognising that mental and physical health and wellbeing are affected by many wider issues in our day-to-day environment. The London Borough of Havering includes ‘the communities and areas we live in’ as one of its four pillars within the Havering Joint Health and Wellbeing Strategy 2019/20–2023/24 (London Borough of Havering, 2019).
- c. Addressing issues relating to physical activity – this is stated as a priority area for a number of local authorities. The Essex Joint Health and Wellbeing Strategy includes addressing obesity, improving diet and increasing physical activity as a key area of focus, with priority measures including reducing the percentage of residents (aged 16+) who undertake less than 30 minutes physical activity per week. Southend-on-Sea Health and Wellbeing Strategy includes a priority for the provision of active environments (Southend-on-Sea Borough Council, 2021). The Southend-on-Sea, Essex and Thurrock Mental Health and Wellbeing Strategy 2017–2021 describes how spatial planning will enable healthy lifestyles within active environments, thereby creating attractive places to live (Southend-on-Sea Borough Council, Essex County Council and Thurrock Council, 2017). Key themes of the Brentwood Health and Wellbeing Strategy 2020–2023 include encouraging physical activity (Brentwood Borough Council, 2020).
- d. Achieving equality objectives – Essex County Council’s equality outcomes for the residents of Essex includes that children get the best start in life (Essex County Council, 2022). The London Borough of Havering includes reducing inequalities in health and wellbeing across communities in Havering as an overarching cohesion priority (London Borough of Havering, 2018). Strategic equality priorities and objectives for Thurrock and Gravesham include access to services and access to all respectively.

Findings from consultation

7.4.16 Issues raised by stakeholders and members of the public regarding access to green space and outdoor recreation during the construction and operational phases are summarised below.

Construction

- a. Concerns around disruption to, and loss of, areas of open space, common land and recreational areas during construction. Particular areas highlighted during consultation have included impacts on the countryside, Green Belt and woodland, with specific concerns around impacts on sites such as Thames Chase Community Forest, areas around Coalhouse Fort, East Tilbury, West Tilbury, Shorne Woods Country Park and Jeskyns Community Woodland. Comments also relating to the importance of the areas of open space to the east of Gravesend for general wellbeing.
- b. The importance of connectivity with nature for people's mental health and wellbeing has been raised.
- c. Duration of impacts on areas of open space for children, given the length of the construction programme.
- d. Potential impacts of the Project on sports clubs and recreational areas, including Orsett Showground, Southern Valley Golf Course, Cascades Leisure Centre, Gravesend Golf Centre and the Cyclopark.

Operation

- a. There has been support for the enhancement of local areas through the creation of additional woodland areas and community spaces, together with support for the green bridges as being beneficial both to local wildlife and to community access.
- b. Comments relating to a perceived lack of outdoor provision for families and older generations.
- c. Concerns over amenity impacts on both existing and proposed new areas of open space as a result of changes in air quality and noise levels arising from road traffic.

Findings from baseline review

7.4.17 ES Chapter 13: Population and Human Health (Application Document 6.1) describes areas of community land and public open space located to the north and south of the River Thames which are either within the Order Limits or within a 500m buffer area from the Order Limits. As set out in that chapter, the definition of community land is wider than the definition of open space under sections 131 and 132 of the Planning Act 2008. The chapter has drawn on information set out in open space assessments undertaken by individual local authorities regarding the quality and characteristics of areas of open space, including catchment area information where this is known. The chapter also

includes information about community assets – these can include recreational facilities such as sports clubs.

- 7.4.18 All transport modes may be used to access areas of open space and recreational assets, depending on location, and therefore other relevant baseline data includes that relating to accessibility and car ownership as set out in Section 7.2.
- 7.4.19 The baseline provided in Appendix C provides detail of the demographic make-up of those communities within the immediate vicinity of the Project, identifying particularly where there are higher or lower proportions of sensitive communities such as children and young people or people from low-income households.

Changes to green space and outdoor recreational assets – impacts and mitigation during construction

- 7.4.20 Potential impacts on community land (including areas of public open space, other green spaces, sports and recreation facilities) during the construction phase are assessed in ES Chapter 13: Population and Human Health (Application Document 6.1). Locations affected by permanent land acquisition and the temporary possession of land and temporary construction activities are detailed in Table 7.12. Further detail relating to specific parcels of land (in terms of area and purpose for which land is required) can be found in the Book of Reference (Application Document 4.2), the Statement of Reasons (Application Document 4.1) and Appendices D and G of the Planning Statement (Application Document 7.2).
- 7.4.21 Where there are effects on well used areas of green space (such as Jeskyns Community Woodland or Thames Chase Community Forest), the Applicant would work closely with operators to ensure that sites could remain open and that disruption for users would be reduced.

Table 7.12 Green space and outdoor recreation facilities affected by the temporary or permanent acquisition of land or construction activities

Receptor	Description of impact
South of the River Thames	
Jeskyns Community Woodland	Users are predominantly from local communities including Gravesend, Thong and nearby villages such as Cobham. The site is host to a range of user groups, including a Forest Schools Programme. Access to Jeskyns Community Woodland is primarily by car. Temporary possession of land would be required as part of works associated with utilities diversions, notably the restringing of existing overhead lines and pylons; other temporary works comprise upgrading of an existing path to enable the diversion of NCR177, and the translocation of protected species. There may be some temporary (short-term) disruption to the use of the site as a result of these works. The land would be returned to its existing land use as public open space as part of Jeskyns Community Woodland.
Shorne Woods Country Park	The site is used for recreational purposes and includes a variety of walking trails as well as two adventure play areas. Regular users are from local

Receptor	Description of impact
	<p>communities such as Thong, Gravesend and Strood, with access both by car and on foot/by bicycle.</p> <p>Permanent acquisition of part of the Country Park would be required to construct the Project, for example for the extension and realignment of Thong Lane with the new green bridge over the A2. There would also be temporary disruption to the Country Park as a result of proposed utilities diversions along the north side of the A2.</p> <p>Access to the Country Park via Brewers Road would be restricted during construction of the green bridge at this location; Brewers Road to the south of the Country Park would be closed for 18 months.</p> <p>The main access to the Country Park would not be impacted, and direct access to the site from the central car park within the Country Park would be retained.</p> <p>Replacement land is located immediately to the east of Brewers Wood, which forms part of Shorne Woods Country Park. This would be landscaped to match the existing site and allow for the spaces to link together and function as one. The new area of woodland to the east of Brewers Wood would link Shorne Woods with Great Crabbles Wood and create new recreational areas. The open space would be capable of being used for walking, cycling and horse riding purposes. This would provide both environmental and community benefits, plus additional links between isolated parcels of woodland, adding benefits to the wider community and Shorne Woods Country Park users. The works affecting the existing open space at Shorne Woods Country Park are anticipated to last for six years; the replacement land would require a period of up to five years without public use for it to establish.</p> <p>Communities to the south of the A2 would be more likely to experience impacts from changes in accessibility as a result of the road closure. Alternative open spaces available near Shorne Woods for communities to the south of the A2 include the Kent Downs Area of Outstanding Natural Beauty.</p> <p>The oTMPFC (Application Document 7.14) secures the provision and maintenance of a suitable alternative route connecting Riverview Park and Gravesend with Shorne Woods Country Park within one month of closing the existing route except where short term closures are required for safety reasons.</p>
Cascades Leisure Centre	<p>Temporary construction impacts likely to relate to traffic management measures on Thong Lane, although access to and from Cascades Leisure Centre would be maintained at all times during the construction phase.</p>
Michael Gardens Play Area	<p>There would be works to upgrade the existing footpath through the site during the construction phase, offering improved access to the wider footpath network. The works are envisaged to be short-term in nature, after which the land would be returned to its existing use.</p>
Gravesend Golf Centre (private recreational facility)	<p>This is a private outdoor recreation facility, part of which (the pitch and putt element) would be required temporarily as part of the southern tunnel entrance construction compound; this area (approximately 6.3ha in area) would also be required on a permanent basis as part of landscape mitigation measures and the creation of Chalk Park following construction. To enable this, the pitch and putt facility is proposed to be relocated on land adjacent to the Cascades Leisure Centre, within the Order Limits. The relocated site is greater in area than the original pitch and putt facility, would be equally accessible to the current provision and be of an equal or improved quality in terms of setting.</p>

Receptor	Description of impact
Land to the rear of Gravesend Golf Centre	The land is accessible off Thong Lane through the Cascade Leisure Centre site and consists of an informal path around the boundary of the closed 9-hole golf course. The route is in the ownership of Gravesend Borough Council. The Project requires the permanent acquisition of land and rights over this land to provide a new recreational site (Chalk Park), including the creation of associated landscape and public rights of way. The land is not identified as open space in the Gravesend Open Space Assessment (Knight, Kavanagh and Page, 2016) and does not follow the alignment of any public right of way; however, the Project proposes to treat this land as a public open space on a precautionary basis. Accordingly, an area of replacement land has been included to the east of the existing informal path, as part of the proposals for Chalk Park.
Cyclopark	Users are primarily local residents from Gravesend and nearby areas. Temporary construction impacts related to enabling works for utilities diversions (restricted to a narrow section of the northern part of the site). Proposed works estimated to be one-month duration in order to extend the existing balancing pond, upgrade the cycling track and install a permanent asset underground to supply power to the South Portal. Access to the site would be maintained at all times. There may be potential disturbance to amenity of users.
Roman Road open space	Located between Gravesend and the M2/A2, the Roman Road open space is primarily a walking and cycling route (NCR177) but has substantial green open areas (grass/planting) either side of the route laid out for public recreation. There are other recreational facilities along the route such as benches and bins laid out for public usage. The Project would permanently acquire a very small corner of the Roman Road open space; the overall function of the Roman Road open space would remain unaffected.
Ashenbank Wood	Located to the south of the M2/A2 between Jeskyns Community Woodland (to its west) and Cobham Hall (to its east). The site is used for recreational purposes with extensive walking tracks throughout the site. Temporary possession of land required to upgrade the Darnley Trail and a further byway as part of provision for the temporary diversion of NCR177. The upgraded route would be open to WCH during the construction of the Project only. There would be potential disturbance to the amenity of users during the upgrade.
Cobham Hall Park and Garden	Part of this land is required permanently and part temporarily to establish a new bridleway connection between Brewers Road and Park Pale along the southern side of HS1. Temporary construction impacts also in relation to utilities works. Recreational access to the site is low (restricted access for members of the public).
Claylane Wood	Claylane Wood is private property, and although there is evidence of the public trespassing and using the site for recreational purposes, this is without the landowner's consent. There is a bridleway through the wood (NR174) which connects with a wider PRoW network across land to the east of Gravesend. Permanent acquisition would be required of the south-eastern part of Claylane Wood in order to construct and operate the new A2/Lower Thames Crossing slip roads; permanent and temporary impacts would also be related to utilities diversions to the south and east of the wood.

Receptor	Description of impact
Southern Valley Golf Club (SVGC) (private recreational facility)	The golf club closed in 2021. Permanent loss of private 18-hole golf course and associated clubhouse facilities.
Rochester & Cobham Park Golf Club (private recreational facility)	Temporary construction impacts related to the improvement of an existing bridleway at the northern boundary of the site. Impacts on operational aspects of the golf course are likely to be minimal. Access to the golf club would be maintained at all times.
North of the River Thames	
Thames Chase Community Forest	<p>Thames Chase is a popular recreational area, regularly used by local residents and members of the wider community.</p> <p>Permanent acquisition of land would be required at Thames Chase Community Forest for construction of the Project. There would also be temporary possession of land and permanent acquisition of rights for the diversion and modification of utility works on both sides of the M25. Finally, temporary possession of a further area of land would be required at the western side of the M25 during the construction period to allow working room for construction activities</p> <p>There is likely to be disruption to the internal footpath network of Thames Chase and links to the wider PRow network.</p> <p>Replacement land is proposed directly to the north and to the south of the existing Thames Chase Community Forest. The replacement land would be greater in area and designed to match the existing forest, providing new woodland and biodiversity mitigation including a mixture of grassland, scrub and trees. The layout of the replacement land is being developed in collaboration with stakeholders. The replacement land would be accessed through the existing site and internal footpath network of Thames Chase and there would be additional access from the Thames Chase WCH bridge over the M25 providing access from Ockendon Road and Clay Tye Road. There are proposals to further develop access to the north of the site from St Mary's Lane from where an existing footpath already links to Thames Chase Community Forest. Replacement land would provide equal accessibility and would be no less advantageous to the public.</p>
Folkes Lane Woodland	Temporary possession of land would be required during construction over a nine-month period at Folkes Lane (part of Thames Chase Community Forest) as part of enabling works for the widening of the M25 carriageway and provision of a footbridge over the M25. A permanent easement would also be required at Folkes Lane, and replacement land would be provided.
Coalhouse and Tilbury Forts	Construction impacts for Coalhouse Fort relate primarily to amenity impacts for visitors (as a result of changes in noise, traffic and landscape quality). Potential disturbance impacts from construction traffic may arise due to the use of Princess Margaret Road. Tilbury Fort may similarly experience amenity impacts for users arising from changes in noise and landscape quality.
Ron Evans Memorial Field	The area of open space is currently well used by members of the local community for informal recreational purposes such as dog walking and off-road

Receptor	Description of impact
	<p>cycling. There are a number of formal and informal footpaths passing through it, including Footpath 97 running in a north-east direction from Long Lane. Permanent acquisition of land to the north-east of the site would be required for the construction of the new road, associated earthworks and landscaping.</p> <p>Replacement land which is equally accessible to the community has been identified, with footpaths connecting to the existing space and landscaping proposals to match existing uses.</p>
Thurrock Rugby Football Club (private facility)	<p>Potential impacts from runoff impacting on playing field drainage. Temporary construction impacts related to restringing of existing overhead electricity cables would cause minimal disruption to club.</p>
Tilbury Green	<p>The Project would pass directly through common land known as Tilbury Green. FP 200 passes through this area and is well used for recreational purposes by residents of East Tilbury.</p> <p>An area of land is proposed to be acquired permanently for the construction of the Project and associated earthworks extending from the existing footpath at Station Road to the edge of the proposed earthworks. An area of replacement land would be provided, connecting the two severed parts of the existing common. The characteristics of the setting would be improved, with the replacement land set within the new Tilbury Fields landscape east of the North Portal.</p> <p>Works affecting the existing common land would last for approximately five years, with replacement land not available for public use for up to a further year.</p>
Linford Allotments	<p>Temporary construction impacts related to utilities diversions which may include temporary restrictions in use.</p>
Orsett Golf Club (private facility)	<p>South-western corner of site impacted by works to Brentwood Road (land permanently acquired for highways works to construct Brentwood Road Bridge), the diversion of a high-pressure gas pipeline and environmental mitigation. There would be a temporary impact on the championship tee at the ninth hole during works to divert the gas pipeline; the tee may need to be relocated during the works but this would not impact overall use of the course.</p>
Top Meadow Golf Club (private facility)	<p>Temporary construction impacts related to restringing of existing overhead electricity cables. Proposed works will be for a short period to adjust the tension of existing overhead cables (estimated to be up to one year in duration). Minimal disruption to golf club; access and use of the golf club would be maintained at all times. Potential impacts on amenity for users.</p>
Walton Common	<p>Temporary possession of land and permanent acquisition of rights for the installation of multi-utilities for the permanent power supply to the northern portal building and a temporary power cable to power the TBM Substation is needed by the Project. The proposed works would be underground in this location. Once the works are completed, the land would be reinstated to the existing land use.</p> <p>Construction of the Thurrock Flexible Generation Plant (TFGP), which was granted development consent in February 2022, would result in the loss of approximately 10.1ha of the common. A successful application to de-register the area of Walton Common affected by the TFGP DCO was made in 2022, resulting in the release of 10.1ha of Walton Common and the provision of an</p>

Receptor	Description of impact
	area of replacement common land to the north of the railway line in exchange. The proposed exchange land is not affected by the Project.
Cranham Golf Course (private recreational facility)	Nearby enabling works would take approximately two years. Construction activities would not impact on the ability to play golf. Potential impacts on amenity for users.
Orsett Fen	Permanent acquisition of land for construction of Project. Replacement common land would be provided which would be no less advantageous than the existing land. The Project has environmental mitigation which proposes to re-wet the Orsett Fen (i.e. the existing land designated as common land) back to its original state. The mitigation land would be designated with rights to allow public access.
West Tilbury Marshes	The Project may have to acquire permanent rights in connection with a power supply for the North Portal, although there would not be an effect on any activity above ground. The site is currently not publicly accessible.
King George's Field	Temporary possession of land at the eastern corner of the Field as part of the utilities working area for the proposed underground utilities work along the adjacent A1013. Following the works, the land would revert to its former state as open space.

7.4.22 No direct impacts during construction have been identified in relation to other areas of community land to the south of the River Thames, including Shorne Marshes, Cobham Village Sports Ground, Cobham Cricket and Tennis Club, the Thames and Medway Canal Corridor, the North Kent College Sports Ground, Chalk allotments, or the area of open space at Mackenzie Way. Similarly, to the north of the River Thames, no direct impacts have been identified in relation to other areas of open space, including Gobions Park, Anchor Fields Park, Arthur Barnes Court Recreational Ground (also known as Wickham Fields), Orsett Cricket and Bowling Clubs, Rectory Road Allotments and the South Ockendon Recreation Ground.

7.4.23 Indirect impacts are associated with the quality of user experience, for example in relation to noise (tranquillity) and landscape amenity. The changes in these factors may be such that people choose not to access areas of green space or outdoor recreation facilities during the construction phase. A detailed schedule of visual impacts anticipated during construction can be found in ES Appendix 7.10: Schedule of Visual Effects (Application Document 6.3). A summary of significant visual effects during construction as they relate to recreational receptors (areas) is given in Table 7.13.

Table 7.13 Summary of visual effects relating to recreational receptors during construction

Recreational receptor (area)	Significance of effect (ES Appendix 7.10: Schedule of Visual Effects)
Jeskyns Community Woodland, Henhurst Road, Gravesend	Large adverse

Recreational receptor (area)	Significance of effect (ES Appendix 7.10: Schedule of Visual Effects)
Shorne Woods Country Park, Brewers Road, Shorne (two locations)	Moderate adverse
Green space on MacKenzie Way, southern edge of Gravesend	Moderate adverse
Green space, Stening Avenue, East Tilbury	Large adverse
Green space (also known as Wickham Park), St Francis Way, Chadwell St Mary	Moderate adverse
Orsett Golf Club, Brentwood Road, Orsett	Moderate adverse
Cranham Golf Club, St Marys Lane, Upminster	Moderate adverse

7.4.24 ES Chapter 7: Landscape and Visual (Application Document 6.1) summarises significant effects as they relate to visual impacts on recreational routes (footpaths, bridleways and so on). Moderate and large adverse effects (and thereby significant) have been identified at locations to the south and north of the River Thames along the route of the Project. The chapter also notes reductions in tranquillity that would be experienced at locations along the Project route.

7.4.25 Changes in access to the open countryside would be experienced differently according to people’s ability to travel to alternative destinations. Accessibility standards are set by local authorities in relation to open space, to indicate the extent people are likely to travel to access open space (noting that the distance travelled is likely to be different for different types of open space). Accessibility standards for those local authorities where there are predicted impacts on open space due to the temporary possession or permanent acquisition of land for the Project are shown in Table 7.14.

Table 7.14 Accessibility standards by local authority

Local authority	Open space type	Accessibility standard
Havering	Natural and semi-natural	10-minute walk time 30-minute drive time
Thurrock	Natural and semi-natural space/parks	15-minute walk time 30-minute drive time
Gravesham	Natural and semi-natural	10-minute walk time 30-minute drive-time
	Amenity greenspace	5-minute walk time

Source: Local authority open space assessments (various)

7.4.26 A range of alternative open space opportunities are available for people with access to private vehicles within the drive times specified above. People without access to private vehicles (non-car-owning households, children, people with certain disabilities, or some older people) may however experience a greater impact, due to fewer alternatives being available to them within an appropriate journey time. To the south of the River Thames, this relates particularly to

people within these groups on the eastern fringe of Gravesend, who may currently access fields next to Claylane Wood, or the wider countryside via footpaths near Shorne Woods Country Park. To the north of the River Thames, this relates to people within these groups near Thames Chase Forest Centre (southern outskirts of Cranham) or users near the Ron Evans Memorial Field. However, there are instances where diversions to existing WCH routes providing access to a number of these areas would be provided prior to closure of routes, thereby facilitating continued access. These are described further in Section 7.5 and include:

- a. the provision and maintenance of a suitable alternative route connecting Riverview Park and Gravesend with Shorne Woods Country Park within one month of closing the existing route except where short term closures are required for safety reasons. This benefits residents in communities on the eastern fringe of Gravesend, notably Chalk, Westcourt, Riverview Park and Singlewell.
- b. Access to an undesignated recreational route linking Thames Chase Forest Land either side of the M25 to be maintained during construction or a suitable temporary diversion to be provided and maintained prior to closure of the existing route.
- c. Footpath access to be maintained between Long Lane and Ron Evans Memorial Field via the existing route (FP97) or by temporary diversion around the working area, except where short term closures are required for safety reasons.

Health outcomes assessment – changes in access to green space and outdoor recreation (construction)

- 7.4.27 Communities of **high** sensitivity that are potentially affected by changes to areas of green space or people’s ability to access outdoor recreation during the construction period comprise Westcourt, Singlewell and Painter’s Ash to the south of the River Thames, and Ockendon, Little Thurrock Blackshots, and Tilbury St Chads to the north of the River Thames.
- 7.4.28 Populations identified as having a **high** sensitivity to changes are people in low-income households, children and young people, those without access to private transport and pedestrians/cyclists.
- 7.4.29 The assessment of likely health outcomes as a result of the Project during construction in relation to access to open space and nature is summarised in Table 7.15.

Table 7.15 Health outcomes – changes in access to green space and outdoor recreation (construction)

Community/ population	Assessment summary
Users of existing areas of green	Generally, access would be maintained to areas of public open space and outdoor recreation assets during the construction period. There are limited

Community/ population	Assessment summary
<p>space and outdoor recreation assets</p> <p>Sensitive populations include:</p> <p>Children and young people</p> <p>People in low-income households</p> <p>People without access to private transport</p> <p>People with mental health conditions</p> <p>Pedestrians and cyclists</p> <p>Older people</p>	<p>instances where this may not be the case – for example with the loss of Southern Valley Golf Course.</p> <p>There is strong evidence setting out the links between access to green space and the benefits of outdoor recreation with people’s health and wellbeing, particularly in relation to the health benefits of an active lifestyle, or accessing nature on people’s mental health and wellbeing.</p> <p>The number of people that would be impacted by changes to areas of green space and outdoor recreation facilities is likely to be high along the route, with particular communities visiting local areas of green space. However, areas of open space are available within reasonable travel distances of populations along the Project route. The main construction works are planned to last up to six years; during this time it is anticipated that people would adapt their behaviour according to the location and extent of construction activities.</p> <p>Impacts associated with visual intrusion are likely to be confined to locations in the vicinity of construction activities and there are alternative routes and locations available should people wish to avoid these.</p> <p>People in low-income households who may not have access to private vehicles may experience an adverse impact, due to fewer alternatives being available to them within a reasonable journey time. To the south of the River Thames, this may relate to some groups on the eastern fringe of Gravesend, who may currently access fields next to Claylane Wood, or the wider countryside via footpaths through the SVGC. To the north of the River Thames, this may relate to some groups near Thames Chase (southern outskirts of Cranham) or users near the Ron Evans Memorial Field. However, as described, alternative means of access for these areas would be provided within a short period of time of existing routes being closed.</p> <p>The Applicant has been working with local authorities to identify replacement land, or land which could mitigate the impacts identified for areas of temporary and permanent land acquisition affecting public open space.</p> <p>Local health, wellbeing and equalities strategies and priorities reference the importance of physical activity among local residents as a way of improving health outcomes.</p> <p>The duration of potential impact varies according to location along the Project route, from short-term impacts associated with small-scale utilities diversions or footpath upgrades through to medium- and long-term impacts associated with more significant works.</p> <p>Health outcomes associated with changes to green space and outdoor recreation are considered to relate primarily to mental health and wellbeing. Although the assessment of impacts on population health is considered to be negative, it would not be significant in terms of overall population health.</p>

Equality impact assessment – changes in access to green space and outdoor recreation (construction)

- 7.4.30 No disproportionate or differential impact has been identified on people with protected characteristics in relation to changes to green space and outdoor recreation during construction.

Changes to green space and outdoor recreation – impacts and mitigation during operation

- 7.4.31 The Applicant has been working with local authorities to identify replacement land, or land which could mitigate the impacts identified for areas of temporary and permanent acquisition of land affecting public open space.
- 7.4.32 Replacement land has been identified which is equal to or greater in size than the land required for the Project and similar in terms of quality and accessibility. Further detail relating to specific parcels of land (in terms of area and purpose for which land would be required) can be found in the Statement of Reasons (Application Document 4.1) and Appendices D and G of the Planning Statement (Application Document 7.2). Replacement land is identified on ES Figure 2.4: Environmental Masterplan (Application Document 6.2) in relation to the following areas:
- a. Shorne Woods Country Park – the replacement land would improve accessibility by supporting a new connection between Brewers Wood and Great Crabbles Wood, east of Shorne Woods Country Park. By providing a link between Shorne Woods Country Park, Brewers Wood and Great Crabbles Wood, the replacement land would connect parcels of woodland which are currently fragmented. As a result, Shorne Woods Country Park would be more accessible off The Ridgeway, Bowesden Lane and Park Pale.
 - b. Land to the rear of Gravesend Golf Centre – replacement land would be greater in size than the area of land impacted (land impacted is 5,278m² compared to area of replacement land of 5,760m²). The replacement land is also likely to be more accessible than the current route; the replacement land could be accessed from Gravesend off Thong Lane in the same way as currently, or alternatively from other directions from within Chalk Park by using the network of new and diverted WCH routes that the new recreational landscape would accommodate.
 - c. The Ron Evans Memorial Field – replacement land would be greater in size and would be located closer to nearby residential areas. The replacement open space would be designed to be of the same character and planting as the Blackshots Nature Reserve; a new bridleway would also be provided through the site linking Long Lane in the south to an existing access track in the north-west as set out in the Design Principles (Application Document 7.5).

- d. Orsett Fen – the existing site is currently used for agricultural purposes and not accessible to the public. The replacement land would be located adjacent to upgraded/new walking routes and the publicly accessible wet grassland habitat creation. The Project includes environmental mitigation which proposes to re-wet the Orsett Fen (i.e. part of the existing common land that is to be de-registered) in order to create a mosaic of wet grassland with a network of ditches and ponds for water voles. This mitigation land, which is currently in agricultural use, would be accessible to the public with footpaths along the Mardyke and alongside the mitigation land. Therefore, the ability for the public to access the area is improved as part of the Project.
- e. Tilbury Green Common Land – replacement land is proposed to the east of the existing Tilbury Green. The northern half of the replacement land would follow the diverted Footpath 200, maintaining a connection between Station Road in the north and Coalhouse Fort and beyond in the south. The replacement land would also support proposed walking routes to the new riverfront Tilbury Fields open space from Station Road. Although the replacement land will be close to the new Project alignment, it would be screened from the new road by earthworks and planting as set out in the Design Principles (Application Document 7.5).
- f. Thames Chase Community Forest – replacement land would be provided directly to the north and to the south of the existing Thames Chase Forest Centre. It would be located closer to nearby residential areas and there would be a new purpose built bridge over the M25 to enable accessibility for WCH. The design of new areas of woodland planting south of the Thames Chase Community Forest, including the location of memorial tree planting and replacement of trees planted by the community, would be developed in collaboration with Thames Chase Trust and Forestry England (as secured in the Design Principles (Application Document 7.5).
- g. Folkes Lane Woodland – replacement land would be provided directly to the east of the M25 footbridge on the eastern side of the M25. It would serve the multi-purpose of public open space, woodland planting and community woodland (as part of the new Hole Farm community woodland) over a greater land area.

7.4.33 Two areas of new green space are proposed to be created as part of the Project:

- a. Chalk Park, to the south of the River Thames
- b. Tilbury Fields, to the north of the River Thames

7.4.34 Chalk Park would be a new recreational area of over 35 hectares located to the west of the South Portal and approach cutting. Chalk Park would provide a

recreational landscape for north-eastern Gravesend and Chalk, currently an area of limited public open space provision as identified in Gravesend Borough Council's Open Space Assessment (Knight, Kavanagh and Page, 2016). This would benefit residents of Riverview and Westcourt wards as well as providing access to the new PRow routes around the South Portal. These would provide connectivity between the eastern fringes of Gravesend, through the north Thong Lane green bridge, to existing footpaths into Shorne Woods Country Park and the wider Area of Outstanding Natural Beauty. The proposed country park would have open views to the Area of Outstanding Natural Beauty and the River Thames, with woodland planting to ensure that it complies with landscape and design principles for the Project (set out in the Project Design Report (Application Document 7.4) and ES Figure 2.4: Environmental Masterplan (Application Document 6.2)).

- 7.4.35 The Project would create a new country park directly to the south and east of the tunnel approach and North Portal. It would span from the River Thames in the south to footpath FP200 in the north. Called Tilbury Fields, this park would be the site of new earthworks creating viewing points over the river and towards historic assets. The park would be over 35 hectares in size and incorporate sculptural earthworks designed with elevated areas to create vistas across the Thames Estuary and guide views to features such as Tilbury Fort, Cliffe Fort and Coalhouse Fort that reflect the military history of the Thames.
- 7.4.36 The new park would be publicly accessible, via the Two Forts Way in the south and from FP200 in the north, and incorporate accessible permissive routes through the landforms allowing users to reach the elevated areas. Placemaking features would be located at the top of the earthworks, to create a focal point and landmark.
- 7.4.37 Land within the Order Limits that is not required for the Project permanently (including areas of open space used temporarily for construction purposes) would be restored to its original use.

Nitrogen deposition compensation areas

- 7.4.38 Forecast changes to traffic flows arising from the operation of the Project have the potential to result in the deposition of nitrogen on nearby habitats, including sites designated for ecological conservation. Where it has not been feasible to identify appropriate mitigation measures to reduce potential significant effects from nitrogen deposition, compensation measures have instead been identified. These have been designed to offset significant effects of nitrogen deposition once the Project is operational, by planting new compensatory habitats and enhancing existing ones. Eight sites have been identified for the provision of compensatory habitat planting for the effects of nitrogen deposition on designated habitats, equating to 245.7ha in total. These sites comprise:
- a. Hole Farm East
 - b. Buckingham Hill
 - c. Hoford Road
 - d. Henhurst Hill

- e. Fenn Wood
- f. Court Wood site
- g. Blue Bell Hill
- h. Burham

7.4.39 Sites would have a woodland-dominated mosaic of habitats created through planting and natural regeneration, including woodland, grassland and scrub; providing new wildlife-rich habitats, linked to existing habitats and improving biodiversity. Additional benefits would include opportunities for increasing public access to the countryside and local landscape improvements through planting.

User experience

7.4.40 Changes in the quality of user experience (for example as a result of noise or visual impacts) may deter people from accessing areas of green space or undertaking outdoor recreation. A detailed schedule of visual impacts anticipated during operation is provided in ES Appendix 7.10: Schedule of Visual Effects of (Application Document 6.3). **No significant** effects have been identified in relation to visual effects on recreational receptors (areas), with the exception of the green space at Stenning Avenue in East Tilbury where the visual effect has been identified as moderate adverse. **No significant** effects have been identified in relation to recreational receptors (routes) to the south of the River Thames; to the north of the River Thames there are significant adverse visual effects experienced on routes along the length of the Project, including at Footpath 200 at Tilbury Green and Footpath 230 (within Thames Chase Forest Centre).

7.4.41 Visual effects on a range of representative viewpoints during operation are described in ES Chapter 7: Landscape and Visual (Application Document 6.1). There are moderate adverse effects in opening and design years at a number of locations to the south and north of the River Thames.

Accessibility

7.4.42 Accessibility to green spaces by private vehicle during the operational phase of the Project has been assessed. Categories of open space considered included playing fields, green space and sports facilities. The assessment took into account the change in opportunity that may arise for accessing open space by private vehicle at individual ward level. No wards were predicted to experience a worsening of accessibility to open space. The biggest predicted improvements in accessibility occurred within the following wards (improvements of over 10%):

- a. Gravesham – Chalk, Higham, Gravesham Central, Riverside, Riverview, Singlewell, Westcourt, Woodlands and Whitehill.
- b. Medway – improvement in accessibility to open space of more than 10% predicted for all wards. The Hoo Peninsula, Strood North, Strood South and Strood Rural were predicted to experience the largest improvements.

- c. Thurrock – Corringham and Fobbing, Tilbury Riverside and Thurrock Park, Stanford East and Corringham Town, East Tilbury, Little Thurrock Rectory, Stanford-le-Hope West and Tilbury St Chads.

7.4.43 Consideration has been given to reducing existing PRoW severance, in addition to maintaining, and where practicable improving, existing access. For example, construction of the M25 impacted the ability of residents within the M25 to access countryside beyond it. Through the creation of a new bridge and by forming missing connections, the Project aims to create opportunities for people to gain access to the countryside to the east of the M25 by WCH.

Health outcomes assessment – changes in access to green space and outdoor recreation (operation)

- 7.4.44 Communities of **high** sensitivity that are potentially affected by changes to areas of green space or people’s ability to access outdoor recreation during the operation phase comprise Westcourt, Singlewell and Painter’s Ash to the south of the River Thames, and Ockendon, Little Thurrock Blackshots, and Tilbury St Chads to the north of the River Thames.
- 7.4.45 Populations identified as having a **high** sensitivity to changes are people in low-income households, children and young people, those without access to private transport and pedestrians/cyclists. The construction workforce is a further group identified as being a sensitive population and for whom health benefits may be achieved.
- 7.4.46 The assessment of likely health outcomes during operation of the Project in relation to changes in access to open space and nature is summarised in Table 7.16.

Table 7.16 Health outcomes – changes in access to green space and outdoor recreation (operation)

Community/ population	Assessment summary
Users of existing and new areas of green space and outdoor recreation assets	Replacement land, or land which could mitigate the impacts identified for areas of temporary and permanent land acquisition affecting public open space, has been identified. Access to green space and nature has been detailed and would be improved. Examples include the greater size and improved quality of replacement land for the Ron Evans Memorial Field, the provision of a new area of publicly accessible fenland at the Mardyke, and provision of new areas of open space at Thames Chase.
Sensitive populations include:	Enhancement opportunities include the creation of two publicly accessible country parks – Chalk Park to the south of the River Thames and Tilbury Fields to the north. The eight nitrogen deposition compensation sites identified equate to 245.7ha of a woodland-dominated mosaic of habitats including opportunities for increasing public access to the countryside.
Children and young people People in low-income households	Accessibility to open space would be improved in wards across the study area, including wards where there are high levels of deprivation and high proportions of the population with pre-existing health conditions.

Community/ population	Assessment summary
People without access to private transport People with mental health conditions Pedestrians and cyclists Older people	Local health, wellbeing and equalities strategies and priorities reference the importance of physical activity among local residents as a way of improving health outcomes. The duration of potential impact would be permanent. Health outcomes associated with changes to green space and outdoor recreation relate both to physical and mental health and wellbeing. The new green spaces would encourage more people to undertake physical activity and be connected to nature. New areas of green space are located in close proximity, and are well connected to, areas of high deprivation such as communities to the east of Gravesend and communities in the vicinity of Tilbury. Health outcomes are considered to be positive and significant in terms of overall population health.

Equality impact assessment – open space access (operation)

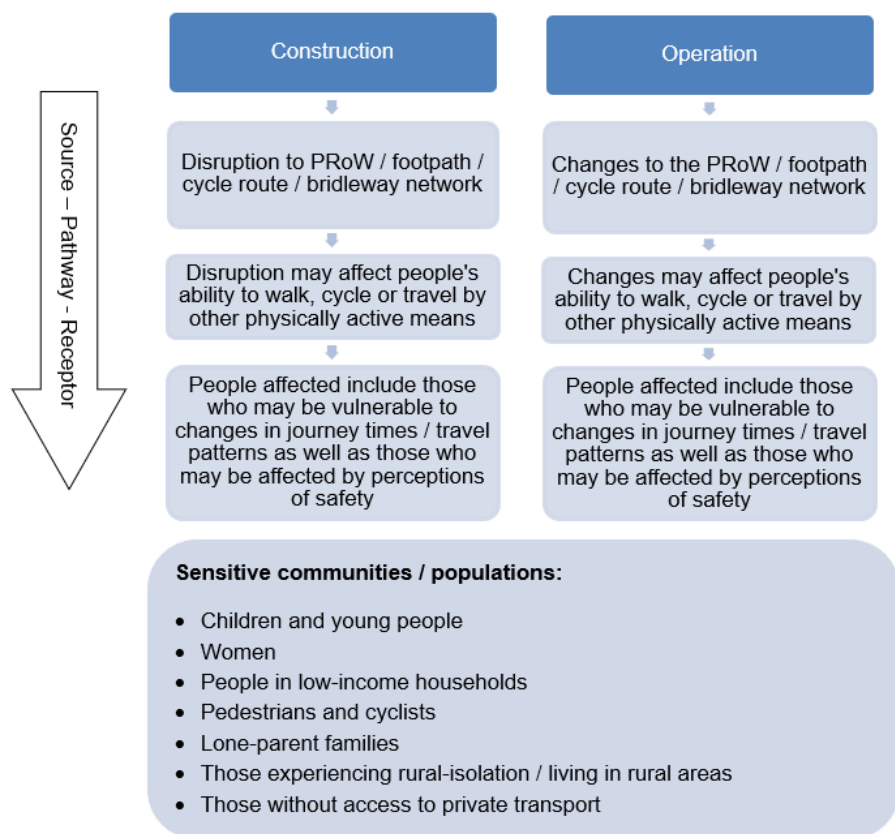
- 7.4.47 A beneficial impact has been identified for people who may not have access to a car as a result of the variety of new connections and routes planned. This may result in beneficial impacts for people with protected characteristics including children, older people and people with disabilities.

7.5 Active travel

Overview

- 7.5.1 Evidence for the beneficial effect of increasing levels of physical activity in all parts of the population is robust and well documented, with active travel giving people an opportunity to be physically active as part of their daily routine (Kent County Council, 2016). Active travel means making journeys by physically active means, like walking or cycling (House of Commons Library, 2020).
- 7.5.2 This section describes impacts on health and equalities arising from changes in active travel as a result of the Project during both the construction and operational phases. The relationship between these aspects is summarised in Plate 7.9.

Plate 7.9 Source-pathway-receptor model – changes in active travel



Evidence base

- 7.5.3 Public Health England's briefing note for local authorities on promoting active travel (PHE, 2016) describes the many benefits of increasing physical activity through active travel. This means walking or cycling as an alternative to motorised transport for the purpose of making everyday journeys, citing that, for most people the easiest and most acceptable forms of physical activity are those that can be built into everyday life (PHE, 2016).
- 7.5.4 Creating an environment where people actively choose to walk and cycle as part of everyday life can have a significant impact on public health and may reduce inequalities. The physical environment, both built and natural, can influence opportunities for participation in physical activity (WHO, 2022). For older people, factors such as safety, connectivity and the availability of good pedestrian access will influence walking as a preferred mode of travel. For children, factors including concerns about road traffic injury can be a major contributor to physical inactivity (PHE, 2016). Evidence indicates that creating

environments that are more conducive to active transport can play a role in reducing health inequalities (WHO, 2018).

- 7.5.5 Hirst (2020) notes that the majority of people in England do not cycle and while walking is common for short journeys, the rates of walking drop off when journeys are greater than a mile (House of Commons Library, 2020). Walking and cycling statistics for England in 2019 showed that two-fifths of people had access to a bicycle, with cycling making up 3% of all trips; walking made up 26% of all trips, with the number of walking trips and the reasons for walking differing between men and women, and people of different ages (Department of Transport, 2019b).
- 7.5.6 There is a link between socio-economic grouping, health and active travel. For example, there are inequalities in obesity rates between different socio-economic groups – research shows that among children in reception and Year 6, the prevalence of obesity in the 10% most deprived groups is approximately double that in the 10% least deprived (PHE, 2013). Encouraging active travel within these socio-economic groups can thereby improve health.
- 7.5.7 Transportation has strong linkages to physical activity. Physical inactivity is the fourth leading risk factor for death worldwide and contributes to one in six deaths in the UK. There is strong evidence around the relationship between physical activity and health, including not only cardiovascular health, but metabolic health (for example benefiting conditions such as type 2 diabetes), cancer and mental health. Older people who participate in regular physical activity have a lower risk of falls (Sherrington *et al*, 2020).
- 7.5.8 The NHS recommends that adults carry out 150 minutes of moderate aerobic activity per week, such as cycling and brisk walking, or 75 minutes of vigorous activities such as running or sport (NHS, 2019). Regular physical activity reduces the risk of depression and has positive benefits for mental health including reduced anxiety, and enhanced mood and self-esteem (Mental Health Foundation, 2013).

Relevant themes from local health and equality strategies

- 7.5.9 The policy and strategic context for health and equalities is set out in Appendix A. Local priorities of relevance to active travel are summarised below:
- a. Reducing health inequalities – specified as a priority in a number of Health and Wellbeing Strategies. The London Health Inequalities Strategy (GLA, 2018) references the importance of developing and promoting London as a healthy place for all reducing income inequality and the negative consequences of relative poverty. The Kent Joint Health and Wellbeing Strategy (Kent County Council, undated) identifies tackling health inequalities as one of four priorities. Key areas of focus of the Essex Joint Health and Wellbeing Strategy include influencing conditions and behaviours linked to health inequalities (Essex County Council, 2022). Reducing health inequalities is an overarching theme of the Brentwood Health and Wellbeing Strategy 2020–2023 (Brentwood Borough Council, 2020).

- b. Focus on children/young people – ‘giving every child a good start’ is an area of focus for Medway, Kent and Brentwood Health and Wellbeing Strategies. Enabling Gravesham to be a healthy and safe place is a core objective of the Gravesham Borough Council Draft Youth and Community Health and Wellbeing Strategy 2022–2027 (Gravesham Borough Council, undated).
- c. Addressing issues relating to physical activity – this is stated as a priority area for a number of local authorities. The Essex Joint Health and Wellbeing Strategy includes addressing obesity, improving diet and increasing physical activity as a key area of focus, with priority measures including reducing the percentage of residents (aged 16+) who undertake less than 30 minutes physical activity per week. Southend-on-Sea Health and Wellbeing Strategy includes a priority for the provision of active environments (Southend-on-Sea Borough Council, 2021). The Southend-on-Sea, Essex and Thurrock Mental Health and Wellbeing Strategy 2017–2021 describes how spatial planning will enable healthy lifestyles within active environments, thereby creating attractive places to live (Southend-on-Sea Borough Council, Essex County Council and Thurrock Council, 2017). Key themes of the Brentwood Health and Wellbeing Strategy 2020–2023 include encouraging physical activity (Brentwood Borough Council, 2020). Domain Five of Thurrock Council’s Health and Wellbeing Strategy identifies the importance of homes and places in Thurrock providing environments where everyone feels safe, healthy, connected and proud (Thurrock Council, 2022).
- d. Achieving equality objectives – Essex County Council’s equality outcomes for the residents of Essex include that people have aspirations and achieve their ambitions through education, training and lifelong learning; and that people can live independently and exercise control over their lives (Essex County Council, 2022). The London Borough of Havering includes reducing inequalities in health and wellbeing across communities in Havering as an overarching cohesion priority (London Borough of Havering, 2018). Strategic equality priorities and objectives for Thurrock and Gravesham include access to services and access to all respectively.

Findings from consultation

- 7.5.10 Consultation feedback highlighted the importance of walking and cycling in terms of supporting national and local health and environmental priorities. During construction, concerns have been raised regarding potential temporary disruption of PRoWs and cycle routes.
- 7.5.11 The following comments have also been identified relating to the operational phase:

- a. The potential benefits that enhancements/upgrades of PRowS and cycle routes would have in terms of encouraging people to lead healthier lifestyles through increased physical activity. Enhancements should enable walking and cycling to be people's first choice for short, everyday journeys.
- b. The Project should consider more ways to support active travel to both mitigate the impacts of the Project and promote local benefit. Concerns raised also related to health inequalities and the need for further consideration as to how the Project could improve outcomes for residents in more deprived areas and not worsen inequalities.
- c. Other comments relate to the design of new walking and cycling routes, including the need for them to be safe, to consider the convenience of users and taking into account the context of the landscape within which they are located. Location of new routes has also been highlighted, relating to the fact that a number are in the vicinity of the proposed Project route with a concern that air quality may be poor in these locations.

Findings from baseline review

- 7.5.12 ES Chapter 13: Population and Human Health (Application Document 6.1) provides details relating to the existing WCH network near the Project, including characteristics and usage levels of PRowS and other walking routes (for example roadside footways along minor roads) potentially affected.
- 7.5.13 Relevant data about accessibility has been summarised in Section 7.2 (notably data relating to non-car-ownership and travel behaviour as it relates to walking and cycling).
- 7.5.14 The baseline information set out in Appendix C includes information relating to walking and cycling accessibility for areas to the north and south of the River Thames. The information shows that areas to the south of the River Thames experiencing low accessibility for walking and cycling are predominantly rural communities such as those located on the Hoo Peninsula in Medway and villages to the south of the urban settlements of Dartford and Gravesend. Central areas of Gravesend and Dartford experience high levels of accessibility for both walking and cycling. To the north of the River Thames, communities experiencing low accessibility for walking and cycling are again predominantly rural communities such as villages found to the north and east of Grays. Central areas of Grays and Tilbury experience high levels of accessibility for both walking and cycling.
- 7.5.15 The baseline provided in Appendix C provides detail of the demographic make-up of those communities within the immediate vicinity of the Project, identifying particularly where there are higher or lower proportions of sensitive communities such as children and young people or people from low-income households.

Active travel impacts and mitigation during construction

- 7.5.16 The construction of the Project would require the temporary closure and/or diversion of some existing footpaths and roadside footways, as well as some

- bridleways and cycleways. PRowS that would be severed or temporarily affected by construction activities (for example utility diversions or main works) are described in ES Chapter 13: Population and Human Health (Application Document 6.1) and in the Transport Assessment (Application Document 7.9).
- 7.5.17 The impact on footpaths (including roadside footways), cycleways and bridleway links along the route of the Project has been reduced, in so far as reasonably practicable, through the design process. The general approach to mitigation includes constructing new PRowS before closing any existing PRowS, where reasonably practicable. Where site haul routes created next to the Project route would cross the existing PRow network, active control measures would be implemented to manage the safety of PRow users and could include staffed crossings and the provision of temporary gates or signals, which would be removed on completion of the works.
- 7.5.18 Construction works would be planned to reduce the durations when footpaths, cycleways and bridleways would need to be closed. Other mitigation measures would include early engagement with members of the public and relevant stakeholders (for example, local walking groups), to ensure that any closures and diversions are notified in advance, with clear and concise signposting for any temporary diversions, and the use of social media to update members of the public regarding any active closures and diversions.
- 7.5.19 PRow surveys were undertaken in August and September 2019 to establish the nature of the PRowS and their usage by WCH. The surveys included PRowS and roads that would be crossed by the Project, and other PRowS likely to be affected by the Project through, for example, impacts on amenity. The majority of the PRow surveys were undertaken during the weekend at times when recreational use was expected to be highest, but surveys of PRowS likely to be used for non-leisure uses such as commuting were undertaken on a weekday. The survey results can be found in the Transport Assessment (Application Document 7.9).
- 7.5.20 The surveys indicated that the majority of PRowS crossed by the Project route have a low level of usage; fewer than 10 people a day were recorded on 12 out of the 35 PRowS surveyed. Routes where a high level of usage were recorded include footpaths to the south of the River Thames (75 walkers were recorded on Footpath NS169/2 over a 15-hour period) and footpaths to the north of the Thames such as FP 230 (171 walkers recorded over a 15-hour period).
- 7.5.21 The likely duration of impact and changes in journey time as a result of permanent or temporary closures has been assessed. The findings of this assessment are set out in ES Chapter 13: Population and Human Health (Application Document 6.1). All PRowS affected by the Project are shown on ES Figure 13.2: Population and Human Health Baseline – PRow and WCH routes (Application Document 6.2).
- 7.5.22 The wards principally affected by temporary or permanent closures of PRowS during the construction phase are listed in Table 7.17.

Table 7.17 Wards principally affected by diversions and closures of PRoWs

Affected wards to the south of the River Thames	Affected wards to the north of the River Thames
Shorne, Cobham and Luddesdown Chalk Westcourt Riverview Singlewell	East Tilbury Chadwell St Mary Little Thurrock Blackshots Orsett Ockendon Upminster Cranham

- 7.5.23 A number of PRoWs have been identified as needing alternative diversion routes prior to closure for construction purposes. The detail of these routes is listed in Article 12, and Schedules 3 and 4 of the draft DCO (Application Document 3.1). A summary of key routes where diversions would be provided prior to closure (thereby facilitating continued access for active travel purposes) is as follows:
- a. There are a number of affected footpaths in the vicinity of the M2/A2/A122 Lower Thames Crossing junction. Although proposals are for the permanent closure and diversion of a number of WCH routes in this location (for example NS169, NS167 and NS174), the oTMPfC (Application Document 7.14) secures the provision and maintenance of a suitable alternative route connecting Riverview Park and Gravesend with Shorne Woods Country Park within one month of closing the existing route except where short term closures are required for safety reasons. This benefits residents in communities on the eastern fringe of Gravesend, notably Chalk, Westcourt, Riverview Park and Singlewell.
 - b. Similarly, the Sustrans route NCR177 is a well-used commuter route parallel to the A2, connecting Rochester in the east to Gravesend and Ebbsfleet and with NCR1 to Bluewater in the west. The proposed works to create the M2/A2/A122 Lower Thames Crossing junction would sever the existing alignment of this route. Consequently, it is proposed that prior to construction of the junction a replacement route be created south of HS1 that is suitable for road bikes. Similarly, this benefits residents in communities along the route of the A177, stretching from Rochester in the east and connecting communities to the south of Gravesend such as Singlewell, Woodlands and Painters Ash.
 - c. A suitable alternative route linking Brentwood and Cranham is to be provided within one year of closing the existing route (this relates to bridleway BR183).
 - d. Access to an undesignated recreational route linking Thames Chase Forest Land either side of the M25 to be maintained during construction or a

suitable temporary diversion to be provided and maintained prior to closure of the existing route.

- e. Footpath access to be maintained between Long Lane and Ron Evans Memorial Field via the existing route (FP97) or by temporary diversion around the working area, except where short term closures are required for safety reasons.
- f. Footpath FP61 connects Low Street Lane with East Tilbury and its existing alignment will be severed by the Project route. The route may be closed temporarily for safety reasons between Low Street Lane and Beechcroft Avenue. This is to facilitate the utilities diversion works in the area, construction of the viaduct to carry the Project over the Tilbury Loop railway and the new Muckingford Road green bridge. A permanent or temporary diversion to be provided at the earliest opportunity, noting that the period of severance caused by the temporary closure shall not exceed 2.5 years. Although this is long-term in terms of duration, the closure of this route does not preclude residents from East Tilbury from walking or cycling along other routes in the vicinity of the settlement.
- g. While a short term closure of the A226 (less than one month) is required to create a construction access from the A226, there are no other plans to close the existing road, footway and cycle provision. Provision has been made within the Order Limits to temporarily widen the A226 should it be necessary to maintain the safety of vulnerable road users while the A226 is being used by construction traffic and for the utilities diversion works.

7.5.24 Through engagement with stakeholders, the Applicant has committed to the creation of two Community Funds – one each covering affected communities to the north and south of the River Thames. This would be secured via Section 106 (S106) agreement (Application Document 7.3). Grants would be available for eligible community-led initiatives across four key themes identified based on the impacts/opportunities arising from the development, one of which is connecting communities and may include projects that enhance or encourage active travel. Eligible wards include those in close proximity to construction activities and funding would be available annually across the six years of construction and one year post construction.

Walking and cycling to school

7.5.25 Encouraging active travel among children and young people is particularly important to discourage sedentary lifestyles and the associated adverse health effects that may result. Primary and secondary schools within a 500m distance from the Order Limits are shown on ES Figure 13.1: Population and Human Health Baseline – Population and Human Health Baseline (Application Document 6.2). Many of these schools have active travel programmes in place for students, encouraging them to walk or cycle to school on a regular basis.

- 7.5.26 Access or egress to schools is not affected by the Project. The oTMPfC (Application Document 7.14) lists local schools as one of the groups of stakeholders that must be considered when designing traffic management measures for the construction phase and transportation plans, and itemises factors that must be addressed in developing the TMP as a minimum. The oTMPfC notes the requirements for local schools to have unhindered and safe walking and cycling routes.
- 7.5.27 A School Engagement Plan is in place for the Project, accompanied by a register of engagement activities undertaken with individual schools which records feedback about matters/concerns that individual schools express. The engagement programme has been used to discuss various environmental matters, including those relating to access/travel to school.
- 7.5.28 The CoCP (Application Document 6.3, ES Appendix 2.2) states that the Contractor's Engagement and Communications Plan (ECP) will specify a detailed programme of community engagement for specific stakeholder groups, including schools, identifying proposed methods and likely timing of consultation activities during the construction period. Community Liaison Groups (CLGs) are proposed to be open to attendance from the local community, which would include school representatives. Local community leaders from the CLGs will be identified and invited to attend the Traffic Management Forums proposed for the areas to the south and north of the River Thames (this could include school representatives). This range of activities would ensure that schools have an appropriate mechanism to feedback any concerns they may have about opportunities for active travel during the construction period.
- 7.5.29 To the north of the River Thames, there is a current proposal to establish a specific Schools Working Group in view of the number of schools in the vicinity of/accessed from St Mary's Lane. The remit of the Schools Working Group is yet to be established but would be expected to incorporate active travel issues as a priority in order to understand concerns in more detail and ensure they are reflected appropriately as the Project progresses.

Construction Workforce

- 7.5.30 The key aims of the FCTP (Application Document 7.13) are to minimise adverse local disruption or traffic impacts on the highway network from worker and visitor travel to and from construction worksites, compounds and ULHs by reducing the number of single-occupancy vehicle trips and encouraging the uptake of sustainable and active modes of travel. Promoting active travel among the construction workforce would have additional benefits for the health and wellbeing of this population. Research into the health characteristics of construction workers has identified a propensity for unhealthy lifestyles resulting in a range of adverse health outcomes.
- 7.5.31 The FCTP (Application Document 7.13) presents key tasks required as a minimum to be achieved across all construction areas and compounds during the construction period. These include a commitment to, among other measures, maintenance of agreed walking/cycling routes and a regular review of active travel facilities within the vicinity of each site.
- 7.5.32 The FCTP (Application Document 7.13) presents a framework for developing robust site specific targets and influencing travel behaviour of the workforce

though the preparation of a series of Site Specific Travel Plans (SSTPs). It is acknowledged that different locations may be more or less appropriate for encouraging active travel by the construction workforce. SSTPs would therefore need to recognise the surroundings and context for each location they are developed for and would present measures and targets that are tailored for that specific location. Any walking and cycling trips to sites would only be encouraged where these modes can be used safely. Contractors would be required to appoint a Travel Plan Co-ordinator (TPC) to develop and implement the relevant SSTPs, including procuring, implementing, and actively promoting travel plan measures set out in the SSTP.

- 7.5.33 A series of tiered measures are set out in the FCTP (Application Document 7.13); measures contained within tier 1 should be seen as a minimum set of interventions that would be applied across all SSTPs. One of the measures within this tier relates to the provision of cycle training and maintenance for all levels of cyclists, to encourage new cyclists to switch to this form of active travel and promote safety and awareness of cycling travel.
- 7.5.34 The health of the workforce would be promoted through targets which focus on increasing walking and cycling trips to construction worksites, compounds and ULHs, either as part of the journey or for the full trip.

Health outcomes assessment – active travel (construction)

- 7.5.35 Communities of **high** sensitivity that are potentially affected by changes to the ability of people to walk and cycle during the construction period comprise Westcourt, Singlewell and Painter’s Ash to the south of the River Thames, and Ockendon, Little Thurrock Blackshots, and Tilbury St Chads to the north of the River Thames.
- 7.5.36 Populations identified as having a **high** sensitivity to changes in the potential for active travel are people in low-income households, children and young people, women, those without access to private transport and pedestrians/cyclists. The construction workforce is a further group identified as being a sensitive population and for whom health benefits may be achieved.
- 7.5.37 The assessment of likely health outcomes as a result of Project construction in relation to active travel is summarised in Table 7.18.

Table 7.18 Health outcome – active travel (construction)

Community/ population	Assessment summary
Residents within wards potentially affected by changes to the PRoW network. People in low-income households,	A number of PRoWs would be impacted during construction, both in terms of their route and the amenity of users. The number of routes either closed for a significant period of time, or permanently, and for which no diversion has been proposed, is small. Where possible, diversion routes have been identified; in many instances these routes are proposed to be constructed or available for users either prior to the closure of the original route or within a short period of time. It is noted that there are instances where this period of time may be over two years, however, alternative routes are available for the local community to use.

Community/ population	Assessment summary
<p>children and young people, women, those without access to private transport and pedestrians/cyclists</p>	<p>A range of measures are in place to ensure that active travel routes for children are not adversely impacted by the Project and to enable communication and engagement with individual schools.</p> <p>User surveys undertaken in 2019 showed that the majority of affected PRoWs have low levels of usage. Impacts on physical activity are therefore likely to be low.</p> <p>There is strong evidence setting out the links between active travel and health and wellbeing, particularly in relation to the health benefits of an active lifestyle (including on people’s mental health and wellbeing).</p> <p>The number of people that would be impacted by changes to the active travel environment is medium.</p> <p>The duration of potential impact varies according to location along the Project route, from short-term weekend closures of an individual route through to long-term closures.</p> <p>Local health, wellbeing and equalities strategies reference the importance of promoting walking and cycling among local residents for a variety of purposes, whether this is for commuting, school or leisure purposes.</p> <p>The health outcome for affected communities/sensitive populations as a result of changes in active travel during construction of the Project is assessed as neutral.</p>
<p>Construction workforce</p>	<p>The Project has identified a number of measures designed to encourage members of the construction workforce to use active modes of travel to access their workplace. It has been noted that some locations are more suited to active modes of travel than others, but that Site Specific Travel Plans would be developed for individual construction compounds and work sites.</p> <p>As noted above, the evidence between active travel and health and wellbeing is strong; construction workers are known for less healthy lifestyles and behaviours. Given that up to 45% of the construction workforce are intended to be from within 20 miles of the Project route, promoting active travel among this cohort would have the potential for positive health outcomes among a local population.</p> <p>The duration of potential impact would be long-term (i.e. the length of the construction phase).</p> <p>The health outcome for the construction workforce as a result of promotion of active travel during construction of the Project is assessed as positive although not likely to be significant.</p>

Equality impact assessment – active travel (construction)

- 7.5.38 Changes to journey times and travel patterns may arise from temporary closures and diversions of PRoWs as a result of temporary possession of land or the need to accommodate construction activities. Even small changes can adversely impact protected characteristics such as the older people and people with disabilities. Extensive consultation has taken place to date with walking and cycling groups to the north and south of the River Thames. Ongoing engagement will be necessary with representatives of the local community (through Community Liaison Groups) to identify and confirm diversion routes.
- 7.5.39 No disproportionate or differential impact has been identified on protected characteristics in relation to active travel during construction.

Active travel impacts and mitigation during operation

- 7.5.40 New walking and cycling infrastructure is proposed as part of the Project design to help improve connectivity and increase opportunities for active travel. New and improved routes include routes for recreational purposes and those which link people with jobs, services and facilities. New provision for WCH is described in detail in Part E of the Project Design Report (Application Document 7.4). In summary, the Project would provide:
- 27km of improved footpaths, of which 10km are also cycle paths.
 - 37km of new footpaths of which 29km are also cycle paths.
 - New bridges such as over the M25, A127, and Mardyke.
 - The creation of green bridges at Thong Lane, Brewers Road, North Road, Muckingford Road, Hoford Road and Green Lane. The purpose of the green bridges is to maintain and enhance connectivity for WCH as well as creating habitat corridors.
 - Eight new Pegasus crossings.
 - Seven new signalised pedestrian and cycle crossings.
- 7.5.41 All severed PRowS, bridleways and cycle routes would be re-linked across the Project, unless better quality routes can be provided nearby; the route can be rationalised to better link communities with the places they want to go to; or realigned routes provide better connectivity into the existing WCH network.
- 7.5.42 Work to review existing walking and cycling routes to the south and north of the River Thames and highlight opportunities for new connections, revealed the following:
- To the south of the River Thames, access to nearby countryside is the main focus for walking and cycling trips, with locations such as Shorne Woods Country Park providing a draw. Exceptions to this include access to areas of employment such as Bluewater and central Gravesend via east–west routes National Cycle Route (NCR)177 and the A226 Gravesend Road, although the M2/A2–HS1 corridor is seen as a barrier to north–south connectivity.
 - To the north of the River Thames, the main urban areas of Thurrock, Tilbury and Grays are framed by the A1089 and A13 separating them from a predominantly rural zone. There are high levels of containment in urban areas, with older and more car reliant populations in rural areas. There appears to be a latent demand to walk and cycle in the Tilbury area. Key inter-urban connectivity takes place along Muckingford Road, the A1013 and Stifford Clays Road, with Lakeside and Tilbury Docks seen as major trip attractors. To the north of the A13, in a similar manner to south of the

Deleted: <#>A new car park, toilet facilities and cycle hire facility to the south of the River Thames to assist with accessing Shorne Woods Country Park. ¶

river, the inter-urban distances generally make regular walking trips prohibitive and restrict cycling to leisure use.

- 7.5.43 Through extensive engagement with stakeholders, the following key areas for improvement to the WCH network have been included as part of the Project design:
- a. National Cycle Route (NCR) 177 realignment: providing a permanently realigned east–west route south of HS1 minimising the need for over and underpasses across the Project route, HS1 and the M2/A2 corridor.
 - b. Recreational loops: providing links between key open areas and country parks surrounding the A2 junction and South Portal.
 - c. Muckingford Road: providing better links from Linford and East Tilbury to Chadwell St Mary, anticipating future development and mitigating the severance caused by the Project.
 - d. Stifford Clays Road: incremental improvements to extend cycle routes between Orsett and the nearest school (the William Edwards School).
 - e. A1013 and Rectory Road: re-providing and improving commuter cycle routes along A1013 between Stanford-le Hope, Orsett and Little Thurrock and providing an equestrian standard link across the A13.
 - f. Fenland access: providing better WCH access to the fenland and Mardyke by connecting existing PRoWs and upgrading them to new shared-use tracks.
 - g. North Road: mitigating the severance of informal off-road routes between North and South Ockendon anticipating future development of the area and improved connections between North and South Ockendon.
 - h. Addressing severance of the M25: countering historical severance caused by the M25 and to provide better recreational access to the fenland landscape from Thames Chase (referred to in further detail in Section 7.4).
 - i. A127 improvements: a further bridge over the A127 was introduced as a response to comments by a local cycle group and from the London Borough of Havering together with changes to improve connectivity to the A127 WCH bridge east.
- 7.5.44 More detailed information relating to active travel proposals by ward are highlighted in Table 7.19

Table 7.19 Active travel proposals by ward

Affected wards	Description of proposals
Shorne, Cobham and Luddesdown Singlewell Riverview Westcourt	<p>WCH improvements in the vicinity of the M2/A2/A122 Lower Thames Crossing junction include proposals for links through a newly landscaped setting to the west of the junction. Links provide a pedestrian and cycle connection to Michael Gardens as well as connections with Shorne Woods Country Park.</p> <p>Beneficiaries include communities to the eastern edge of Gravesend. Proposals also provide for enhanced north/south links between Gravesend and Jeskyns Community Woodland and Ashenbank Wood to the south of the A2 as well as provision of a traffic-free WCH route from Riverview Park to these destinations.</p>
Chalk Westcourt Riverview	<p>WCH routes in the area around the South Portal include a variety of access points and routes into the newly created Chalk Park. New Pegasus crossings facilitate access from Chalk across the A226 at two locations, with access more directly for residents from Riverview and Westcourt wards via new PRoW. A new 'eastern link' would connect the A226 to Thong Lane on the eastern side of the Project alignment, further improving north/south connectivity.</p>
East Tilbury Chadwell St Mary	<p>The main focus in the area in the vicinity of the North Portal is on recreational walks (for example the Two Forts Way). Proposed WCH routes in this area aim to link Two Forts Way and the new country park at Tilbury Fields to the PRoW network further north, and to create walks that link the heritage assets in areas such as Coalhouse Fort, East Tilbury Battery and Bowater Battery.</p> <p>The communities of Linford and East Tilbury have previously been isolated from areas of employment and services to the west (Chadwell St Mary) from an active travel perspective, as a result of relatively few connecting PRoW in this area. This situation is improved as a result of new connections such as the Hoford Road green bridge (with associated improved connectivity via High House Lane) and provision of a shared pedestrian–cycle track along Muckingford Road.</p> <p>These proposals may tap into a latent demand for cycling in this area, where there are younger populations with a higher propensity to cycle.</p>
Orsett Little Thurrock Blackshots Chadwell St Mary	<p>WCH routes in the A13 junction area have been designed to improve east–west commuter connections and increase the opportunity for WCH to cross the A13. A variety of interventions are proposed at this location. North/south connectivity is improved for residents of Orsett and Chadwell St Mary via the Rectory Road bridge. The replacement bridge includes a shared pedestrian–cycle track and connects to a new Pegasus crossing of the A1013 and on to the shared pedestrian–cycle track to the south side of the A1013.</p> <p>Better connections with Little Thurrock and NCR137 would be experienced by residents of Baker Street as a result of a shared pedestrian–cycle track along the eastern side of Baker Street itself.</p> <p>Stifford Clays Road is well used by commuter and recreational cyclists, as well as connecting Baker Street residents with William</p>

Affected wards	Description of proposals
	Edwards Secondary School and jobs/services in Grays. The proposed realignment of Stifford Clays Road presents an opportunity to extend the cycle track and thereby form a more complete pedestrian–cycle link to the school as well as to areas of employment in Grays and Chafford Hundred.
Ockendon Belhus	<p>A predominantly rural area with an older population, characterised by low accessibility and high car ownership. Connectivity across the rural area is maintained by bridges (for example as part of the FP136 alignment enabling connectivity between South Ockendon and Bulphan). A variety of opportunities would significantly increase PRow access to the Mardyke from both North and South Ockendon.</p> <p>While North Road is currently used by cyclists, there are sections where the road is narrow and busy, limiting use by WCH. A new green bridge is proposed over the Project alignment together with a new shared WCH track on the eastern side of the realigned length of North Road. The new route improves connectivity with existing routes, providing a safer route for cyclists using North Road.</p>
Upminster	<p>A range of proposals have been designed to improve access between the various parts of Thames Chase Forest, located on either side of the M25. As such, FP230 would be realigned across the M25 via a new bridge which retains the existing permissive access arrangements and would therefore be appropriate for cycle and horse rider use. Proposals also include for an improved connection between Thames Chase Forest Centre and Ockendon Road for WCHs.</p> <p>The WCH strategy in this area aims to rectify historic severance caused by the M25 and A127. Two new bridges are proposed to facilitate the crossing of the A127 together with a proposed route through the junction to enable east–west connectivity.</p>

7.5.45 The new facilities for WCH increase opportunities for active travel and levels of physical activity. An active travel mode assessment has been undertaken using the May 2022 version of DfT’s Active Mode Appraisal Toolkit (AMAT) (Department for Transport, 2022c). The findings of the assessment are reported in the Economic Appraisal Report within Appendix D of the ComMA (Application Document 7.7). The active travel mode assessment estimates the physical activity benefits of the Project for the number of new active mode users which comprise walkers and cyclists. These benefits include:

- a. Health benefits for people using the new and improved facilities and a decrease in their absenteeism from work
- b. Benefits from users’ perceptions of the improved quality of the facilities provided
- c. Benefits from having fewer vehicles on the road, as some of the users of the new facilities would otherwise have used a car or taxi for their journey

7.5.46 For these people there would be a decrease in their mortality rate and, on average, the number of deaths among these new users would reduce very slightly in any given year. Improved health for these new users from increased walking and cycling activity would also lead to reductions in short term absences from work.

Health outcomes assessment – active travel (operation)

7.5.47 Communities of **high** sensitivity that are potentially affected by changes to active travel opportunities proposed as part of the Project design comprise Westcourt, Singlewell and Painter’s Ash to the south of the River Thames, and Ockendon, Little Thurrock Blackshots, and Tilbury St Chads to the north of the River Thames.

7.5.48 Populations identified as having a **high** sensitivity to changes in the potential for active travel are people in low-income households, children and young people, women, those without access to private transport and pedestrians/cyclists.

7.5.49 The assessment of likely health outcomes as a result of Project operation in relation to active travel is summarised in Table 7.20.

Table 7.20 Health outcome – active travel (operation)

Community/ population	Assessment summary
<p>Residents within wards potentially affected by changes to the PRoW network.</p> <p>People in low-income households, children and young people, women, those without access to private transport and pedestrians/cyclists</p>	<p>A wide range of improvements are proposed as part of the Project design, improving connectivity, filling missing links in the PRoW network and enhancing the safety of routes through the provision of shared pedestrian–cycle tracks along key routes. The proposals do not create new severance between communities to the west and east of the Project alignment and opportunities for walking and cycling are enhanced through the provision of green bridges and footbridges at appropriate locations. Historic severance created as a result of the construction of the M25 is mitigated through the creation of new pedestrian and cycle links. The network of new routes may encourage walking and cycling, including among communities in close proximity to these routes; this includes populations in more deprived communities such as those to the south and east of Gravesend as well as communities in parts of Thurrock. In many instances, the quality of routes is improved, making it more attractive for people to walk and cycle, with associated health benefits.</p> <p>There is strong evidence setting out the links between active travel and health and wellbeing, particularly in relation to the health benefits of an active lifestyle (including on people’s mental health and wellbeing).</p> <p>The number of people that would be impacted by changes to the active travel environment is high, in that the proposals tap into latent demand for walking and cycling routes in a number of locations.</p> <p>The duration of potential impact would be permanent.</p> <p>Local health, wellbeing and equalities strategies reference the importance of promoting walking and cycling among local residents for a variety of purposes, whether this is for commuting, school or leisure purposes.</p> <p>The health outcome for affected communities/sensitive populations as a result of changes in active travel during Project operation is assessed as positive and significant.</p>

Equality impact assessment – active travel (operation)

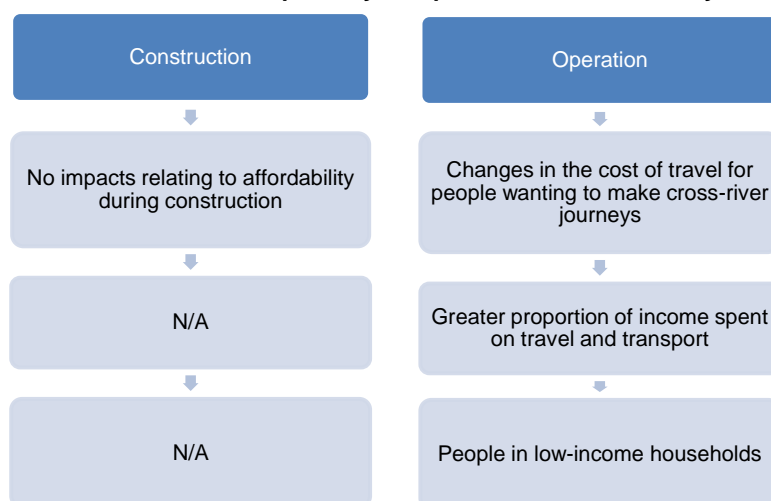
7.5.50 A beneficial impact has been identified for people from low-income households (who may not have access to a car) as a result of the variety of new connections and routes planned. Beneficial impacts are also identified for people with protected characteristics including children, older people and people with disabilities.

7.6 Affordability

Overview

7.6.1 The relationship between income and health is well documented, with people in lower income groups typically reporting poorer health. Income is a critical factor which drives health inequalities. This section describes the likely impacts arising from changes in affordability as a result of the Project. The relationship between affordability and outcomes on health and equality is summarised in Plate 7.10.

Plate 7.10 Source-pathway-receptor model – affordability



Evidence base

7.6.2 In 2019/20, 42% of total disposable household income (before housing costs) in the UK went to the fifth of individuals with the highest household incomes, while 7% went to the bottom fifth (House of Commons Library, 2021). The health profile for England (PHE, 2021) notes that there is a social gradient across many of the determinants of health, with poorer individuals experiencing worse health outcomes than people who are better off. Life expectancy is closely related to people’s socio-economic circumstances and is often lowest in the most deprived areas (Williams *et al*, 2022).

7.6.3 Household income varies significantly between regions of the UK as well as between ethnic groups and disability status (House of Commons Library, 2021). Changes in the cost of living as a result of factors including supply chain issues

and rising energy prices mean the cost of living will become more expensive for the lowest income households (Institute for Fiscal Studies, 2021).

- 7.6.4 Much of the evidence around affordability relates to public transport and the role this can play; affordability is a key driver for the type of transport people use, with those on lowest incomes taking twice as many bus trips as those in the highest income groups (The Health Foundation, 2018). Key factors in transport promoting social inclusion include affordability and that no-one should be priced out (Cooper *et al.*, 2019). Improving access to, and affordability of, transport services can help to address social exclusion (Campaign for Better Transport, 2012).
- 7.6.5 International research into the social impacts of road pricing found that low-income households regard car usage as a necessity to reach basic needs and services and would be unlikely to change their pattern of use as a result of road charging, thereby resulting in increased hardship for the poorest drivers (International Transport Forum, 2018).

Relevant themes from local health and equality strategies

- 7.6.6 The policy and strategic context for health and equalities is set out in Appendix A. Local priorities of relevance to affordability are summarised below:
- a. Reducing health inequalities – specified as a priority in a number of Health and Wellbeing Strategies. The London Health Inequalities Strategy (GLA, 2018) references the importance of developing and promoting London as a healthy place for all. The Kent Joint Health and Wellbeing Strategy (Kent County Council, undated) identifies tackling health inequalities as one of four priorities. Key areas of focus of the Essex Joint Health and Wellbeing Strategy include influencing conditions and behaviours linked to health inequalities (Essex County Council, 2022). Reducing health inequalities is an overarching theme of the Brentwood Health and Wellbeing Strategy 2020–2023 (Brentwood Borough Council, 2020).
 - b. Levelling up life chances for residents – one of twenty commitments set out in 'Everyone's Essex' (Essex County Council, 2022) which seeks to level up the economy by addressing the drivers of socio-economic inequality based on the foundation of good jobs and a higher skilled and healthier workforce. Improving outcomes and access for all are set out in equality strategies and policies for Gravesham (Gravesham Borough Council, 2021) and Thurrock (Thurrock Council, undated).

Findings from consultation

- 7.6.7 Affordability comments raised during consultation relate primarily to proposals for road user charging during operation. Comments include:
- a. Concerns over the need for road user charging with members of the public expressing a desire for it to either not be charged at all, or for there to be a gradient of road user charging (for example free during the evenings or at weekends)

- b. Impacts of road user charging on particular areas, for example Thurrock and Gravesham potentially benefiting from a discount scheme whereas residents outside of these local authorities would be disproportionately impacted
- c. Disparities noted between east and west London in terms of income distribution and presence of free versus charged crossing infrastructure
- d. Requests for any discount scheme to operate as an extension of the existing Dartford Crossing road user charging scheme (Dart Charge) so that people can use both crossings interchangeably.

Findings from baseline review

7.6.8 Relevant features of the baseline data include the following:

- a. Economic activity rates by wards closest to the Project are generally lower than for their respective local authorities as a whole (Census, 2011).
- b. Claimant counts (people who are claiming for example Universal Credit or Jobseeker's Allowance) are notably high in a number of wards, including Riverside and Westcourt to the south of the River Thames (6.1% and 5.3% respectively, compared to 3.9% for England as a whole); and Tilbury St Chads, Tilbury Riverside and Belhus wards to the north of the River Thames (6.2%, 6.7% and 5.3% respectively) (ONS, 2022).
- c. Areas highlighted as deprived in the Indices of Deprivation 2019 (Ministry of Housing, Communities and Local Government, 2019) under the income domain include communities such as Westcourt, Riverside, areas of Strood, Tilbury and Grays.
- d. Data relating to car availability shows that wards such as Riverside in Gravesham and the Littlebrook and Joyce Green wards in Dartford have higher proportions of households with no access to a car (around a third of households); to the north of the River Thames, wards where there are a high proportion of households without access to a car or van include Tilbury Riverside and Thurrock Park (34.2%) and Tilbury St Chads (28.6%) (Census, 2011).

Affordability impacts and mitigation during construction

7.6.9 Generally, the Project would not result in affordability impacts during construction. Impacts relating to housing are considered in Section 7.11; this includes reference to concerns highlighted by stakeholders around impacts associated with demand for private rented accommodation by construction workers and related impacts on affordability.

Affordability impacts and mitigation during operation

- 7.6.10 Where there are few travel alternatives, transport costs can have a disproportionate effect on personal affordability, especially where income levels preclude car ownership and use. The latter is particularly relevant for low-income households which are non-car owning. Currently, the River Thames is a barrier to movement and a deterrent for cross-river trips. There is an existing personal affordability issue for residents in the Lower Thames area who must pay a user charge to use the Dartford Crossing, although those residents who live in the local authority areas of Dartford and Thurrock are eligible for a residents' discount.
- 7.6.11 The Road User Charging Statement (Application Document 7.6) sets out the road user charging regime for the tunnel area of the Project. This would be aligned with the Dart Charge at the Project's opening, and on an ongoing basis. This includes details such as the hours during which the charges apply, the vehicles charged, the approach to concessions and discounts for account holders, and any exemptions granted. Exemptions include emergency and military vehicles, local bus services, vehicles that are tax exempt because they are registered for the use of a disabled person, and motorcycles. The Road User Charging Statement (Application Document 7.6) states that *'without prejudice to any decision by the Secretary of State on the grant of development consent, the Department for Transport has reviewed details of the proposed road user charging regime for the Project and has confirmed that they are in line with government policy'*.
- 7.6.12 Eligibility for the Local Residents' Discount Scheme (LRDS) is specific to each crossing. Project proposals as set out in the Road User Charging Statement (Application Document 7.6) are for Gravesham residents to be eligible for discounts for the use of the Lower Thames Crossing, Dartford residents to continue to be eligible for discounts for Dartford Crossing, and Thurrock residents to be eligible for discounts for both crossings. Thurrock residents would only need to apply once and pay one account fee in order to benefit from discounts at both crossings.
- 7.6.13 The DIA (Appendix D of the ComMA (Application Document 7.7)) reports that the level of user benefits with the Project is substantially greater than the level of disbenefits across all income quintiles. Locations shown to receive the greatest benefits are mainly near the Project in Thurrock and Gravesham, but also areas further afield including Dartford, Havering, Chelmsford and parts of the Medway towns. Locations which receive an overall disbenefit include areas adjacent to the A228 in south-west Medway, Sevenoaks in Kent, Rainham and Braintree in Essex.
- 7.6.14 In terms of personal affordability specifically, the DIA assumes that the only impacts would be experienced by residents of Gravesham (as the only new population who would be eligible for a road user discount scheme). Personal affordability impacts for Gravesham residents are reported as beneficial, with the lowest income households who would make the most relative gain in personal affordability located in the centre of Gravesend, near to Northfleet station and west of Whitehill Road.

Health outcomes assessment – affordability (operation)

- 7.6.15 Communities/populations identified as having a **high** sensitivity to changes in affordability relate primarily to people in low-income households. Wards which include areas within the most deprived income categories (according to the Indices of Multiple Deprivation 2019 (Ministry of Housing, Communities and Local Government, 2019)) include:
- a. Gravesham – Riverside, Westcourt and Singlewell
 - b. Medway – Strood South
 - c. Dartford – Temple Hill
 - d. Thurrock – Ockendon, Belhus, Chadwell St Mary, Tilbury St Chads, Tilbury Riverside and Thurrock Park, Aveley and Uplands, West Thurrock and South Stifford.
- 7.6.16 The assessment of likely health outcomes as a result of the Project in relation to affordability is summarised in Table 7.21.

Table 7.21 Health outcome – affordability (operation)

Community/ population	Assessment summary
People in low-income households	<p>The road user charging strategy for the Project is aligned with that for the Dartford Crossing, including current discounts and exemptions. Residents from Thurrock and Gravesham would be eligible for a LRDS. The benefits of the Project support the future economic development and transformation of the Lower Thames area. Promoting access to employment and wider economic benefits may help to reduce inequality.</p> <p>There is strong evidence setting out the links between income levels and health outcomes, particularly in relation to health inequalities.</p> <p>The number of people that would be impacted by changes to affordability is high.</p> <p>The duration of potential impact is considered to be permanent.</p> <p>Local health, wellbeing and equalities strategies reference the importance of addressing inequality and levelling up life chances for residents.</p> <p>Residents in low-income households are currently less likely to make cross-river trips as a result of a range of factors including the cost of travel and levels of car ownership. Although low-income residents would be able to participate in the LRDS, the poorest households would be unlikely to do so; these groups may instead benefit from the wider economic growth and associated benefits that the Project may bring to the area.</p> <p>The health outcome for affected communities/sensitive populations as a result of changes in affordability during operation of the Project is assessed as positive as a result of increased access to opportunity, although not significant in terms of health outcomes.</p>

Equality impact assessment – affordability (operation)

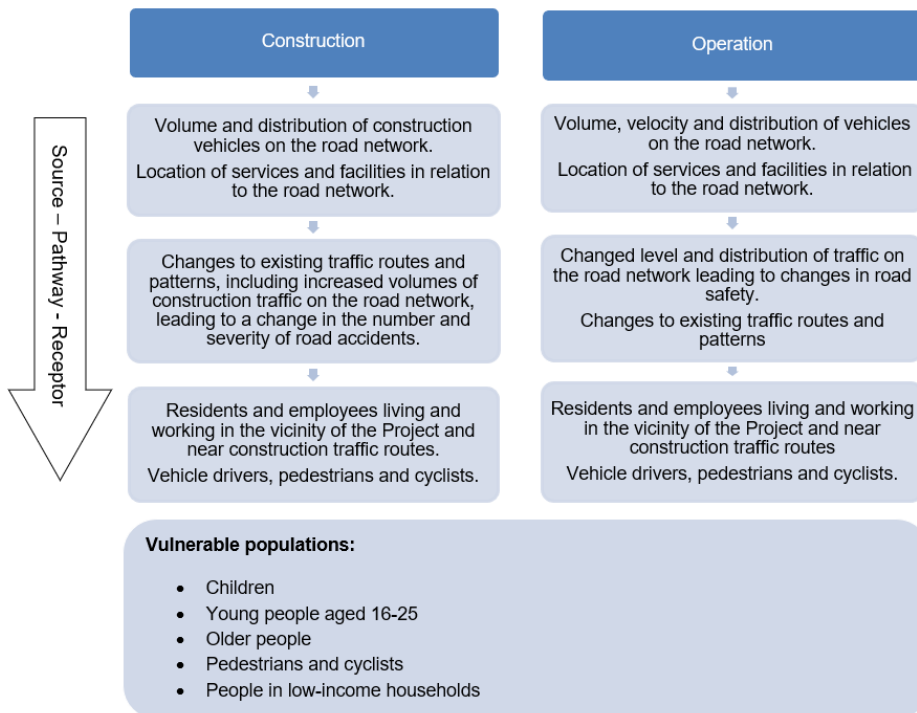
- 7.6.17 No disproportionate or differential impact has been identified on people with protected characteristics in relation to affordability during operation.

7.7 Road safety

Overview

- 7.7.1 Reductions in road safety could directly impact on the health and wellbeing of the population. During construction, road safety may potentially be affected by changes in traffic flows and patterns, including a change in the number of construction vehicles using the road network. During operation, changes to the road network and traffic flows can influence road safety. Groups who may be particularly sensitive to change include children, older people, people in low-income households/areas of social deprivation as well as pedestrians and cyclists.
- 7.7.2 This section describes the likely impacts on road safety as a result of the Project during both the construction and operational phases. The relationship between road safety and outcomes on health and equality is summarised in Plate 7.11

Plate 7.11 Source-pathway-receptor model – road safety



Evidence base

- 7.7.3 The safety of roads directly affects health, particularly road traffic related injuries. There is a significant causal relationship between higher levels of motorised transport and greater numbers of road casualties and deaths (Ward *et al.*, 2007).
- 7.7.4 The most vulnerable users, or groups with greater sensitivity, include children, older people and disabled people. The risk of being injured or killed in road traffic accidents is also proven to be greater in low-income neighbourhoods (Steinbach *et al.*, 2011).
- 7.7.5 Pedestrians and cyclists travelling on the road network are found to carry greater risks of injury than those travelling by private car (Smith, Chowdhury and Hammond, 2019).
- 7.7.6 A driver's mood is proven to influence driving behaviour. Emotions such as anger, particularly in younger drivers, is associated with a greater number of errors made, as well as aggressive and riskier driving (Zhang and Chan, 2016).
- 7.7.7 Driver stress can affect driving behaviour. There are three main components – frustration, fear of potential accidents and uncertainty relating to the route being followed. Frustration can be experienced as a result of unforeseen congestion, traffic diversions or roadworks. Uncertainty around issues such as travel route can be a feature of both construction and operational phases. Research into driver behaviour (Brake, 2021) highlighted that most drivers (84%) admit feeling stressed or angry at least occasionally while driving, with 8% of drivers experiencing these emotions on every journey. Younger drivers were particularly likely to feel stressed or angry. Stressed or angry drivers are more likely to change their driving behaviour, and may suffer from a form of cognitive distraction that may affect their judgment and reaction times (Kowalski-Trakofler and Vaught, 2003).
- 7.7.8 Adverse weather conditions are shown to increase road traffic accident frequency and severity.
- 7.7.9 Evidence suggests road safety influences mental health and wellbeing outcomes. While research concerning mental health and road safety is sparser than for physical health outcomes, this topic is beginning to be more widely considered.
- 7.7.10 A multitude of evidence surrounds injury reduction interventions in health and transport research, supported by a range of legislative measures shown to lead to reductions in road injuries (Thomson *et al.*, 2008). Evidence suggests new major urban roads have a statistically insignificant effect on injury incidence (Egan *et al.*, 2003).
- 7.7.11 Issues associated with becoming trapped in traffic for long periods as a result of unforeseen delays can be far more significant for disabled road users (Highways England, 2018b).

Relevant themes from local health and equality strategies

- 7.7.12 The policy and strategic context for health and equalities is set out in Appendix A. Local priorities of relevance to road safety are summarised below:

- a. Reducing health inequalities – specified as a priority in a number of Health and Wellbeing Strategies. The London Health Inequalities Strategy (GLA, 2018) references the importance of developing and promoting London as a healthy place for all. The Kent Joint Health and Wellbeing Strategy (Kent County Council, undated) identifies tackling health inequalities as one of four priorities. Key areas of focus of the Essex Joint Health and Wellbeing Strategy include influencing conditions and behaviours linked to health inequalities (Essex County Council, 2022). Reducing health inequalities is an overarching theme of the Brentwood Health and Wellbeing Strategy 2020–2023 (Brentwood Borough Council, 2020).
- b. Focus on children/young people – ‘giving every child a good start’ is an area of focus for Medway, Kent and Brentwood Health and Wellbeing Strategies. Enabling Gravesham to be a healthy and safe place is a core objective of the Gravesham Borough Council Draft Youth and Community Health and Wellbeing Strategy 2022–2027 (Gravesham Borough Council, undated).
- c. Creating safe environments – Domain Five of Thurrock Council’s Health and Wellbeing Strategy identifies the importance of homes and places in Thurrock providing environments where everyone feels safe, healthy, connected and proud (Thurrock Council, 2022).

Findings from consultation

- 7.7.13 Issues have been raised by stakeholders and members of the public during various public consultations for the Project with regard to road safety during both the construction and operational phases.
- 7.7.14 During construction, concerns primarily relate to levels of construction traffic using the local road network and implications for road safety for people living in the immediate vicinity of construction routes. Specific concerns have been raised in relation to:
- a. Local roads being used as ‘rat-runs’ for traffic avoiding congestion or road closures. Examples highlighted have included Lower Higham Road to the south of the River Thames.
 - b. Implications of construction traffic in the vicinity of schools.
 - c. Impacts of construction traffic on specific communities, for example Orsett, Gravesend, West Tilbury and Ockendon.
- 7.7.15 Once the Project is operational, consultation findings with regard to road safety have included the following:
- a. The Project is expected to improve road safety in the wider area, by reducing traffic and the potential for accidents. Many respondents have referred to the rate of accidents at Dartford and the implications of this for congestion and delay.

- b. Concerns have been raised about the absence of a hard shoulder along the Project with reference to potential safety and/or congestion implications.
- c. Specific junctions/locations where concerns have been raised about the potential for accidents (for example as a result of perceived junction complexity or where there are existing accident blackspots which could potentially worsen due to increased traffic volumes) include the A2/Project junction, the A13/A1014 junction and the Bluebell Hill area.

Findings from baseline review

- 7.7.16 Road accident data has been obtained by local authority/parliamentary constituency as relevant and is presented in Appendix C.
- 7.7.17 The Transport Assessment (Application Document 7.9) sets out accident data which shows their location and severity on the strategic and local road networks near proposed junctions with the Project between 2015 and 2019. The majority of all collisions recorded are slight, with few serious collisions. The only fatal collisions within the vicinity of the Project were at the A13/A1089 junction, where four fatal collisions have been recorded over a five-year period.
- 7.7.18 Demographic data presented in Appendix C shows the distribution of population by age group (including under 16s and over 70s).

Road safety impacts and mitigation during construction

- 7.7.19 The oTMPfC (Application Document 7.14) provides an overview of the approach that will be followed when undertaking temporary traffic management for the safe construction of the Project. The oTMPfC will be used to inform the TMP, which the Applicant will have to submit to the Secretary of State for approval before commencing the relevant part of the Project if the DCO is granted.
- 7.7.20 Engagement with key stakeholders has fed into the development of the oTMPfC (Application Document 7.14), which responds to many of the concerns raised in relation to construction traffic. Construction HGV bans would be applied on a number of roads in order to mitigate local concerns, as follows:
 - a. Brewers Road
 - b. Thong Lane
 - c. The Street
 - d. Lower Higham Road
 - e. Rectory Road
 - f. School Lane
 - g. High Road
 - h. Prince Charles Avenue, Orsett

- i. Castle Lane
 - j. Church Lane
- 7.7.21 Children and older people have both been identified as vulnerable groups in terms of road safety. The oTMPfC (Application Document 7.14) specifies that the following would be addressed as a minimum in the TMP:
- a. In relation to local schools – HGV movements would not be allowed to pass school entrances during drop off/pick up, in order to facilitate unhindered and safe walking and cycling routes for children.
 - b. In relation to local care homes – safe crossings and pedestrian lights would be provided to ensure safe access and egress for staff, patients and visitors.
- 7.7.22 Temporary traffic management would be used to manage the flow of traffic while construction works are taking place nearby. Measures would aim to minimise disruption by maintaining road capacity as far as possible while ensuring safety to road users and the construction workforce. Measures include narrow lanes, exclusion zones and road closures where necessary.
- 7.7.23 The Statement of Actions and Commitments Register (SAC-R) (Application Document 7.21) includes a commitment for the Main Works Contractors to develop and provide an educational road safety programme for school aged children at relevant local schools along the Project route.
- 7.7.24 The CoCP (Application Document 6.3, Appendix 2.2) states that Community Liaison Groups would be established in those communities likely to be most impacted by construction activities, and would be designed to keep communities informed of the construction works and provide an opportunity for community members to raise issues. CLGs would meet regularly before and during the construction period.
- 7.7.25 The two TMFs, covering roads in Kent and roads north of the Thames, would consist of the Contractors, utility companies, local authorities, local highway authorities, public transport operators, emergency services, National Highways maintenance providers and any other affected stakeholders depending on the planned construction phases (as set out in the oTMPfC (Application Document 7.14)). The TMF would review the performance of implemented traffic management with a focus on areas including direct impacts to the travelling public (including WCH) and impacts on local businesses and communities. Local community leaders of the CLGs would be invited to the Traffic Management Forum. These measures would help to manage driver stress arising from frustration and uncertainty during the construction phase.
- 7.7.26 There are a limited number of strategic road network routes. Options for strategic construction traffic movements for the Project would be restricted to the A2 and A226 in the south, and the A13, A1089 and the M25 in the north. The local road network is also limited across the Project alignment, constraining construction traffic to a relatively small number of routes.
- 7.7.27 Measures have been proposed to reduce construction vehicle movements, including the use of offsite build/modular construction processes and

consolidation of deliveries. These would be outlined further in the TMP. The TMP would detail how construction traffic movements will be managed, including for example one-way systems, managing reversing movements, haul route crossings and pedestrian segregation.

- 7.7.28 The FCTP (Application Document 7.13) sets out a framework with regard to the implementation of travel planning for the movement of personnel to and from the construction worksites and compounds (including ULHs) during the construction phase of all works related to the Project. Contractors would be required to develop SSTPs for the sites for which they are responsible. The intent of the SSTPs would be to identify, mitigate and appropriately manage negative travel impacts that may be generated by travel to and from construction sites. SSTPs would be expected to adhere to principles which promote the use of sustainable transport including supporting walking and using sustainable forms of transport at sites where travel can be completed in a lit highway environment, with footways for pedestrians.
- 7.7.29 The outline Materials Handling Plan (oMHP) (Application Document 6.3, Appendix 2.2, Annex B) presents the outline strategy for handling construction materials required for the construction of the Project, including the handling of excavated materials and the delivery of large and/or frequent materials defined as bulk deliveries. It also includes the approach which the Project intends to take to reduce the impact of construction-related movements, including HGVs on the road network.

Health outcomes assessment – road safety (construction)

- 7.7.30 The sensitivity of the general population to changes in road safety is assessed as **high**. The sensitivity of vulnerable populations identified, to changes in road safety, is assessed as **high**.
- 7.7.31 The assessment of likely health outcomes as a result of Project construction in relation to road safety is summarised in Table 7.22.

Table 7.22 Health outcome – road safety (construction)

Community/ population	Assessment summary
General population Sensitive populations/ communities	<p>A variety of measures are proposed to manage the impacts of construction traffic on the road network and thereby reduce adverse impacts for key receptors (such as schools and care homes) as well as for local residents (for example arising from driver stress or frustration). These measures are secured in the FCTP (Application Document 7.13), oTMPfC (Application Document 7.14) and oMHP (Application Document 6.3, ES Appendix 2.2, Annex B). The Statement of Actions and Commitments Register (SAC-R) (Application Document 7.21) includes a commitment for the Main Works Contractors to develop and provide an educational road safety programme for school aged children at relevant local schools along the Project route. Local community leaders of Community Liaison Groups would be invited to the Traffic Management Forum. These measures would help to manage driver stress arising from frustration and uncertainty during the construction phase.</p> <p>There is strong evidence setting out the links between road safety and people's health and wellbeing.</p>

Community/ population	Assessment summary
	<p>The number of people that may potentially be affected is high, due to the number of routes across the study area. The duration of potential impact is likely to be medium to long-term depending on location (given the different timescales associated with construction phasing ranging from several months to a couple of years per phase).</p> <p>Local health, wellbeing and equalities strategies reference the importance of external environmental factors and the influence these can have on people's health and wellbeing.</p> <p>The health outcome for affected communities/sensitive populations as a result of changes in road safety during construction of the Project is assessed as neutral.</p> <p>The health outcome for users of the local and strategic road network as a result of driver stress is assessed as negative (but not significant).</p>

Equality impact assessment – road safety (construction)

- 7.7.32 No disproportionate or differential impact has been identified on protected characteristics in relation to road safety during construction.

Road safety impacts and mitigation during operation

- 7.7.33 The Project would be built to current design and safety standards for motorway class roads. Improved journey times and reductions in congestion would prove beneficial for driver behaviour, resulting in a reduction in driver stress.
- 7.7.34 An accident appraisal was carried out for the Project using DfT's Cost and Benefit to Accidents – Light Touch (COBALT) software program. As a new transport corridor, the Project is forecast to result in significant changes in traffic flows and speeds, and HGV use. Further information regarding the COBALT assessment is provided in the Economic Appraisal Report (Application Document 7.7, Appendix D) and the Transport Assessment (Application Document 7.9).
- 7.7.35 As a new transport corridor, the Project is forecast to result in significant changes in traffic flows. Overall, the COBALT analysis predicts an absolute increase in accidents, due to the increased number of kilometres driven. However, the accident rate per million vehicle km and overall number of accidents per km reduce with the provision of the Project.
- 7.7.36 The accidents appraisal set out in the DIA within Appendix D of the ComMA (Application Document 7.7) identifies that a total of 14 links are predicted to have over 50 casualties over a five-year period with the Project. These links are shown in Table 7.23.

Table 7.23 Change in accidents by link (With Project compared to Without Project)

Link	% change in casualties
A13 London Road between A129 and A1158 (westbound)	-1
A13 London Road between A129 and A1158 (eastbound)	-1
M2 between junction 2 and junction 3 (southbound)	17
M2 between junction 3 and junction 2 (northbound)	25
M2 between junction 6 and junction 5 (westbound)	5
M2 between junction 6 and junction 5 (eastbound)	2
M20 between junction 1 and junction 2 (northbound)	-22
M20 between junction 1 and junction 2 (southbound)	-10
M20 between junction 8 and junction 9 (southbound)	1
M20 between junction 9 and junction 8 (northbound)	1
M25 between junction 2 and junction 3 (southbound)	-1
M25 between junction 27 and junction 28 (southbound)	3
M25 between junction 28 and junction 27 (northbound)	10
M25 between junction 3 and junction 2 (northbound)	-5

Source: COBALT analysis for modelled 2030 opening year

7.7.37 The DIA considers the casualty rate for vulnerable groups (pedestrians, cyclists, motorcyclists, children under 16, 16–25 year old males, and people over 75) for affected links where there is a change of over 50 casualties over a five-year period and a greater than 5% change in the accident rate compared to that forecast in the ‘without Project’ scenario in the 2030 opening year. Table 7.23 shows that five links are forecast to fall into this category (the M2, M20 and M25). As these impacted links are motorways, pedestrians and cyclists were not considered further as part of the distributional analysis. Equally, the distribution of accidents was not considered across social population groups by residence because motorway users would not necessarily be from the local areas and therefore the analysis would not be representative.

7.7.38 The casualty rate for all motorway links forecast to experience a change in over 50 casualties is within 12% of that for motorways for both the regional study area and the UK for all vulnerable groups. All links have been assessed as experiencing a medium impact, with no distributional impact for vulnerable user groups, using the criteria set out in transport analysis guidance (Department for Transport, 2020b).

Health outcomes assessment – road safety (operation)

7.7.39 The assessment of likely health outcomes as a result of the Project during operation in relation to road safety is summarised in Table 7.24.

Table 7.24 Health outcomes – road safety (operation)

Community/ population	Assessment summary
<p>General population Sensitive communities/ populations</p>	<p>While the number of accidents and casualties over the Project’s 60-year operational phase is predicted to rise due to the increased volume of traffic on the road network, the accident rate per vehicle km is forecast to reduce. Fourteen locations are predicted to have over 50 casualties over a five-year period with the Project. Five of these locations are predicted to have a change in the expected number of casualties of greater than 5%, compared to the Without Project scenario. There are two locations which are predicted to have a decrease in casualties and three locations which are predicted to have an increase in casualties, due to changes in traffic flows with the Project.</p> <p>The distribution of accidents has not been considered across social population groups by residence, because users would not necessarily be from local areas and therefore the analysis would not be representative.</p> <p>There is strong evidence setting out the links between road safety and people’s health and wellbeing. As a new transport corridor, the Project is forecast to result in significant changes in traffic flows.</p> <p>The number of people that may potentially be affected is high, due to the number of routes across the study area. The duration of potential impact is permanent.</p> <p>Local health, wellbeing and equalities strategies reference the importance of external environmental factors and the influence these can have on people’s health and wellbeing.</p> <p>The health outcome for affected communities/sensitive populations as a result of changes in road safety during operation of the Project is assessed as neutral.</p>

Equality impact assessment – road safety (operation)

7.7.40 No disproportionate or differential impact has been identified on protected characteristics in relation to road safety during operation.

7.8 Air quality

Overview

7.8.1 The potential effects of air quality changes on health and wellbeing have been raised as a significant concern by stakeholders. Key pollutants in relation to road assessments are nitrogen dioxide (NO₂) and particulate matter (PM₁₀); these pollutants have the greatest impact on human health. Exposure to elevated concentrations of NO₂ has been linked with a range of respiratory symptoms; particulate matter is the constituent most closely associated with adverse health effects. The health impacts from larger particulates depend on the toxicity of the particles, their size and the level of exposure experienced.

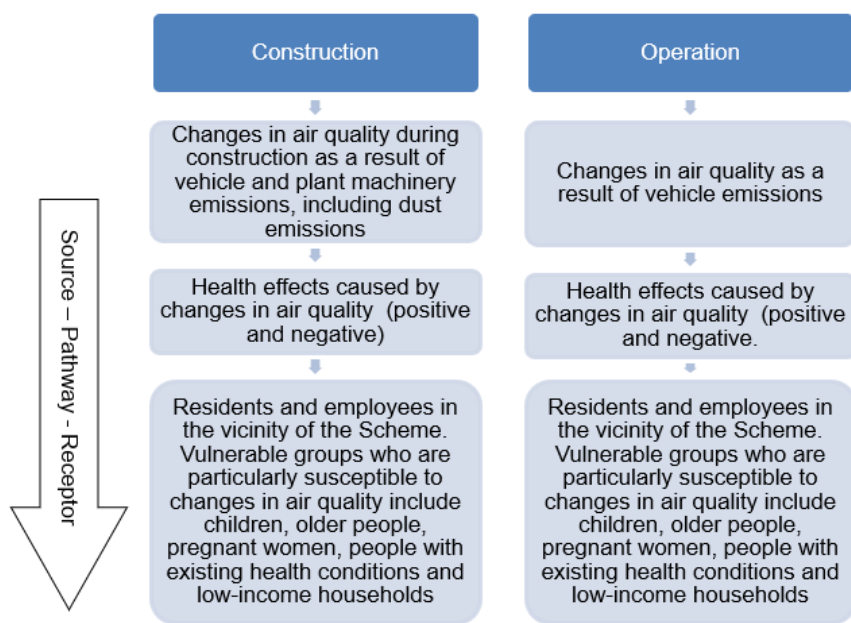
7.8.2 Populations who are particularly vulnerable to changes in health as a result of decreases in air quality include children, pregnant women, older people, people who may be disabled by existing health conditions (for example respiratory diseases) as well as people in low-income households.

7.8.3 Construction activities can have a short-term negative impact on air quality as a result of emissions from construction vehicles as well as dust emissions from

site works. Evidence on the links between road traffic emissions and respiratory health is well established, based on numerous research studies.

- 7.8.4 This section describes the likely impacts on air quality as a result of the Project during both the construction and operational phases. The relationship between changes in air quality and outcomes on health and equality is summarised in Plate 7.12.

Plate 7.12 Source-pathway-receptor model – air quality



Evidence base

- 7.8.5 Air pollution is widely cited as an environmental risk to health. Air pollution can be associated with a number of health conditions, including strokes, cancers, miscarriage and mental health problems (Schraufnagel *et al.*, 2019). Recent research suggests that almost every cell in the body may be affected by pollutants in the air (Wei *et al.*, 2019). Air pollution exposure may also increase the incidence of and mortality from a larger number of diseases than those currently considered, such as Alzheimer’s and other neurological diseases (Peters *et al.*, 2019). In 2021, the World Health Organization published new air quality guidelines on the basis of a systematic review of the latest scientific evidence of how air pollution damages human health. The WHO provides evidence of links between exposure to air pollution and type 2 diabetes, obesity, systemic inflammation, Alzheimer’s disease and dementia (WHO, 2021).
- 7.8.6 Air pollution is one of the 20 leading risk factors for disease and contributed more than 2% of the annual disability-adjusted life years lost in the UK in the 2010 Global Burden of Disease comparative risk assessment (Burnett *et al.*,

- 2014). This study estimated that in the UK over 360,000 disability-adjusted life years were lost to ambient air pollution in 2010, due to air pollutants, typically small particulates (PM_{2.5}), increasing the risk of heart and lung conditions.
- 7.8.7 Particulate matter (PM) comprises a mixture of solid and liquid particles suspended in the air. PM_{2.5} particles have a large surface area to volume ratio and thus carry more toxic pollutants which can pass into the bloodstream. PM_{2.5} particles can be easily inhaled deep into the lungs where they may accumulate, react, be cleared or absorbed. Following this process there are several mechanisms within the body which can be stressed, damaged or inflamed (Donaldson, 2003). Some population groups are more vulnerable to air pollution particles, such as those with pre-existing lung or heart diseases (WHO, 2013).
- 7.8.8 Evidence suggests that living near major roads and/or heavy traffic can adversely affect cognition and specifically increase the incidence of dementia (Chen *et al.*, 2017). Air pollution, and in particular PM_{2.5}, is associated with reduced cognitive function, delayed psychomotor development and stymied lung development in childhood, leading to lung impairment in adulthood (Schraufnagel *et al.*, 2019).
- 7.8.9 Long-term exposure to PM_{2.5} is the key air pollution contributor to excess mortality. There is also evidence that short-term PM_{2.5} can impact people's activity levels – resulting in days of missed work, absences from school and other more minor reductions in daily activity.
- 7.8.10 It is generally accepted that particles greater than 10µm in diameter (PM₁₀) do not penetrate the lungs to cause respiratory health problems. However, dust can cause eye, nose and throat irritation and lead to deposition on cars, windows and property (GLA, 2006).
- 7.8.11 Road transportation accounts for approximately 70% of air pollutants in urban areas, leading to widening levels of health inequalities for those living in urban areas (WHO, 2013). Pollution hotspots include urban areas and arterial/trunk roads, with proximity to roads shown to have an adverse effect on health. The most vulnerable groups to air pollution include young children and older people (WHO, 2013).
- 7.8.12 Evidence suggests that traffic-related air pollution has contributed to widening health inequalities in urban areas, as emissions tend to be more concentrated in the most heavily trafficked roads, which are used more by disadvantaged people as places where they live, work and shop (Walton *et al.*, 2015).
- 7.8.13 A study led by King's College London, Queen Mary University of London and the University of Edinburgh in 2018 found that children exposed to air pollution showed significantly smaller lung volume, linked to annual exposures of nitrogen dioxide, other nitrogen oxides and particulate matter (Mudway *et al.*, 2018).
- 7.8.14 The inquest into the death of Ella Adoo-Kissi-Debrah concluded on 16 December 2020 that the medical cause of death was: 1a) Acute respiratory failure; 1b) Severe asthma; and 1c) Air pollution exposure (Courts and Tribunals Judiciary, Regulation 28 Report to Prevent Future Deaths, 2021). Air pollution was highlighted in the Coroner's report as '*a significant contributory factor to both the induction and exacerbations of her asthma*'.

- 7.8.15 Sensitive receptors to major roads include residential properties, schools or residential care homes. More vulnerable population groups include populations living in the most deprived income quintiles (i.e., the population with the 20% lowest incomes), children and older people. The effect of air quality changes on these receptors could further increase health inequalities. Research suggests that people of lower socio-economic status tend to live, work and go to school in places with worse air quality (European Environment Agency, 2020).

Relevant themes from local health and equality strategies

- 7.8.16 The policy and strategic context for health and equalities is set out in Appendix A. Local priorities of relevance to the air quality topic are summarised below:
- a. Reducing health inequalities – specified as a priority in a number of Health and Wellbeing Strategies. The London Health Inequalities Strategy (GLA, 2018) references the importance of developing and promoting London as a healthy place for all. The Kent Joint Health and Wellbeing Strategy (Kent County Council, undated) identifies tackling health inequalities as one of four priorities. Key areas of focus of the Essex Joint Health and Wellbeing Strategy include influencing conditions and behaviours linked to health inequalities (Essex County Council, 2022). Reducing health inequalities is an overarching theme of the Brentwood Health and Wellbeing Strategy 2020–2023 (Brentwood Borough Council, 2020).
 - b. Focus on children/young people – ‘giving every child a good start’ is an area of focus for Medway, Kent and Brentwood Health and Wellbeing Strategies. Enabling Gravesham to be a healthy and safe place is a core objective of the Gravesham Borough Council Draft Youth and Community Health and Wellbeing Strategy 2022–2027 (Gravesham Borough Council, undated).
 - c. Creating healthier environments – the role of the wider environment in improving health outcomes is highlighted across health and wellbeing strategies. The London Borough of Havering defines ‘the communities and places we live in’ as one of four pillars focused on in the Health and Wellbeing Strategy. The importance of supporting improvements in air quality is highlighted within the Thurrock Joint Health and Wellbeing Strategy (Thurrock Council, 2022); Domain Five of the Strategy (Thurrock Council, 2022) relates to housing and the environment, including goals to ensure that regeneration and future developments will seek to improve physical and mental health and reduce exposure to air pollution.
 - d. Achieving equality objectives – Essex County Council’s equality outcomes for the residents of Essex includes that children get the best start in life and that people can enjoy good health and wellbeing (Essex County Council, 2022). The London Borough of Havering includes reducing inequalities in health and wellbeing across communities in Havering as an overarching cohesion priority (London Borough of Havering, 2018).

Findings from consultation

7.8.17 A summary of issues raised by stakeholders and members of the public with regard to air quality is provided below for both the construction and operational phases.

Construction

- a. The need to control construction dust levels at construction compounds, worksites and on local roads and footpaths
- b. Concerns regarding emissions from HGVs on local roads

Operation

- a. Reducing congestion and stationary traffic at and around the Dartford Crossing is expected to improve air quality and therefore be beneficial for local communities and improve the lives of local residents. Many consultation responses have described the current poor air quality at Dartford and the role the Project will play in alleviating traffic congestion and improving air quality here.
- b. Concerns that the Project will impact on the health and wellbeing of local residents, particularly in relation to higher levels of pollution, for example respiratory diseases. There are already relatively high rates of COPD and childhood asthma in the area. Concerns that the Project will place an increased burden on local healthcare providers as a result of increases in COPD cases and worsening of other conditions such as asthma.
- c. Concerns that air quality is already very poor in parts of Thurrock such as Grays, Tilbury and Chadwell St Mary, with reference made to 'the Toxic Triangle'. Concerns that the Project will result in further deterioration of air quality. Potential impacts on rural areas in terms of perceived reductions in air quality, for example Orsett in Thurrock and Great Warley in Brentwood. Concerns about worsening air quality around the A13 corridor (Stifford Clays and Chafford and North Stifford wards) as well as areas around Upminster.
- d. Communities who have raised specific concerns in relation to air quality impacts to the south of the River Thames include Higham and Shorne. Comments raised have included air quality impacts in the vicinity of schools (for example Gads Hill School) and the risk that the Project may create exceedances on the A228 and near to junction 1 of the M2.
- e. Engagement with schools located in close proximity to the Project route have raised concerns around air quality impacts (for example Singlewell Primary School, Treetops School, Beacon Hill Post 16 and Orsett Heath Academy).

- f. Comments made in relation to the importance of mitigation and monitoring for air quality.

Findings from baseline review

- 7.8.18 The combined construction and operational assessment study area for air quality covers 29 local authorities. Within this study area, there are 41 AQMAs (areas indicative of exceedances of Air Quality Strategy (AQS) objectives). Two AQMAs (Havering AQMA and Gravesham A2 AQMA) fall within the Order Limits for the Project and have been declared for exceedances of the annual mean NO₂ AQS objective. Havering AQMA has also been declared for exceedances of the 24-hour mean PM₁₀ AQS objective.
- 7.8.19 Air quality monitoring data from local authorities, the Applicant and the Project-specific surveys indicate that NO₂ concentrations exceed the annual mean NO₂ objective at many roadside locations throughout the study area. The base year NO₂ predictions at human health receptors are also consistent with the monitoring data, with exceedances of the annual mean AQS objective predicted at many receptors. No exceedances of PM₁₀ AQS objectives have either been monitored or predicted at human health receptors across the study area.
- 7.8.20 Background pollutant concentrations and emissions from newer vehicles (alternative fuelled and Euro 6/VI) are expected to improve air quality over time, as older, more-polluting vehicles are replaced in the vehicle fleet. Air quality is therefore predicted to improve in the future.
- 7.8.21 Further detail relating to the baseline can be found in ES Chapter 5: Air Quality (Application Document 6.1).
- 7.8.22 Demographic analysis presented in Appendix C has identified where there are higher proportions of vulnerable groups within the population (for example children and older people). Information has been collated for people with pre-existing health conditions, which has identified the following:
 - a. Deaths from respiratory disease (Standardised Mortality Ratios) are worse than the England average for Medway (122.3), Dartford (102.3), Thurrock (119.0), Havering (104.6) and Southend-on-Sea (113.6). At ward level, the Standardised Mortality Ratio for deaths from respiratory disease is highest in Tilbury St Chads (187.6), Painters Ash (171.0), Riverside (166.2), Aveley and Uplands (160.4), Belhus (154.5) and West Thurrock and South Stifford (150.2) (Office for Health Improvement and Disparities, 2022).
 - b. Quality and Outcomes Framework prevalence data for asthma (aged 6+ years) is presented in Appendix C for each of the former Clinical Commissioning Group areas (CCGs). Data is also presented by former CCG area relating to emergency hospital admissions for asthma and for COPD.

Air quality impacts and mitigation during construction

- 7.8.23 Construction phase good practice measures for air quality are outlined in the REAC (Application Document 6.3, Appendix 2.2), which includes measures to reduce the air quality effects associated with construction dust as well as

emissions from non-road mobile machinery and construction vehicles. Many of these mitigation measures respond to comments raised during consultation, including:

- a. Vehicle and plant emissions (for example, all on-road heavy vehicles to comply with standards set within the London Low Emission Zone (LEZ) across all sites within the Order Limits for the relevant class of vehicle, and use of low emission vehicles and plant where reasonably practicable).
- b. Good practice relating to reduction of dust during construction works (for example using water suppression for dust control during demolition operations, ensuring sand and other aggregates are stored in bunded areas and not allowed to dry out, using water-assisted dust sweepers on the access and local roads, and undertaking onsite and offsite inspections to monitor dust).
- c. Air quality and baseline dust monitoring during construction – Contractors shall determine the level of any dust and particulate monitoring carried out on Project construction sites by means of a risk based approach. If required, further commitments are included in the REAC in relation to actions that would be taken in cases of air quality monitoring exceedances.

- 7.8.24 The risk of adverse dust effects occurring at any given receptor will vary widely along the Project route depending on the nature of construction activities occurring near the receptor and the distance of the receptor from those activities. With the implementation of the mitigation measures, ES Chapter 5: Air Quality (Application Document 6.1) states that the impact of construction dust is not expected to trigger a significant air quality effect.
- 7.8.25 In terms of construction plant, emissions from non-road mobile machinery would be temporary and minimised through the application of mitigation measures, and similarly are unlikely to trigger exceedances of AQS objectives and a significant air quality effect.
- 7.8.26 A construction road traffic and traffic management assessment was carried out. The assessment (set out in ES Chapter 5: Air Quality (Application Document 6.1)) concluded that impacts during the construction phase would not lead to a significant effect on local air quality on human health receptors. Key findings from the assessment are as follows:
- a. One receptor (a hotel located at junction 30 of the M25/A282) is predicted to exceed the Annual Mean AQS objective of $40\mu\text{g}/\text{m}^3$ throughout the 2025–2030 construction period.
 - b. There are no receptors where the increase in pollutant concentration causes a new exceedance of any of the relevant long term AQS Objectives for NO_2 , PM_{10} or $\text{PM}_{2.5}$.
 - c. The largest increase in annual mean NO_2 as a result of construction is at a receptor located on West Road in South Ockendon, which is subject to re-

routed traffic as a result of nearby traffic management measures on B186 North Road during the construction phase.

- d. There are no receptors which are expected to exceed the annual mean PM₁₀ AQS objective.

7.8.27 ES Chapter 5: Air Quality (Application Document 6.1) states that, as the impacts of the construction activities would be temporary and the assessment is considered to be worst-case, the air quality effects during the construction phase are not considered to be significant.

7.8.28 In order to ensure that impacts on communities are kept to a minimum as much as is reasonably practicable, there are a range of mechanisms by which communities local to the construction works would be kept informed and have an opportunity to raise issues. The CoCP (Application Document 6.3, Appendix 2.2) states that Community Liaison Groups would be established in those communities likely to be most impacted by construction activities. A Community Engagement Plan will set out the process by which CLGs will be established and administered together with an initial schedule of planned meetings according to key work stages. CLGs will meet regularly before and during the construction period.

Health outcomes assessment – air quality (construction)

7.8.29 Communities identified as having a **high** sensitivity to changes in air quality during construction include those located close to the Project and/or construction traffic routes.

7.8.30 Within these communities, sensitive populations include children, older people, people with pre-existing respiratory health conditions such as asthma, people in low-income households and people living in areas which exhibit poor health indicators.

7.8.31 The assessment of likely health outcomes as a result of the Project during construction in relation to changes in air quality is summarised in Table 7.25.

Table 7.25 Health outcome – air quality (construction)

Community/ population	Assessment summary
<p>Communities living in proximity to construction compounds, construction routes and sites of construction activity</p> <p>Sensitive populations include: children, older people, people with pre-existing</p>	<p>A range of mitigation measures described in the REAC, which forms part of the CoCP (Application Document 6.3, Appendix 2.2) ensure the effective management of construction dust, and appropriately manage emissions from construction plant and construction traffic. ES Chapter 5: Air Quality (Application Document 6.1) has assessed impacts arising from constructive activities and concluded that, with mitigation as described, there would be no significant effects on air quality. As a result there would be no discernible health impacts for communities living in proximity to construction activities more generally, or those groups of particularly high sensitivity to change which have been identified.</p> <p>It is noted that potential health impacts associated with dust emissions and changes in air quality as a result of construction traffic and activities remains a concern of local communities and other stakeholders (for example schools located in close proximity to construction activities), as evidenced through</p>

Community/ population	Assessment summary
respiratory health conditions such as asthma, people in low-income households and people living in areas which exhibit poor health indicators	<p>consultation responses made during the various Project consultations and as part of wider engagement. The proposals for ongoing community engagement during construction works via the establishment of CLGs provides a mechanism by which specific concerns can continue to be raised and addressed.</p> <p>There is strong evidence setting out the links between changes in air quality and health outcomes.</p> <p>The number of people that would be impacted by changes in air quality during construction is low as a result of the mitigation measures identified.</p> <p>The duration of potential impact would be medium-term (six months to two years in duration), taking into account individual construction phases.</p> <p>Local health and wellbeing strategies reference the importance of the wider environment on both mental and physical health and wellbeing, with improvements in air quality identified specifically as a priority area in a number of strategies.</p> <p>No physical health impacts have been identified as a result of changes in air quality during construction; it is acknowledged that dust emissions in particular continue to be a cause for concern for people and this is addressed further in Section 7.12.</p> <p>The health outcome for affected communities/sensitive populations as a result of changes in air quality during construction is assessed as neutral.</p>

Equality impact assessment – air quality (construction)

- 7.8.32 No disproportionate or differential impact has been identified on protected characteristics in relation to changes in air quality during construction.

Air quality impacts and mitigation during operation

- 7.8.33 The changes in NO₂ and PM₁₀ predicted at receptors are attributable to Project-related changes in traffic and the addition of new road infrastructure. During operation, the redistribution of traffic around the road network would result in both improvements and deteriorations in terms of air quality.
- 7.8.34 Plate 7.13 and Plate 7.14 show the difference in terms of NO₂ levels and PM₁₀ levels at receptors for the Do Minimum (i.e., without the Project) and Do Something (i.e. with the Project) scenarios. The Do Minimum plates show where there are currently exceedances of the AQS objectives (i.e., where the annual mean for NO₂ and PM₁₀ exceeds 40µg/m³).

Plate 7.13 Difference in NO₂ levels at receptors for Do Minimum and Do Something scenarios

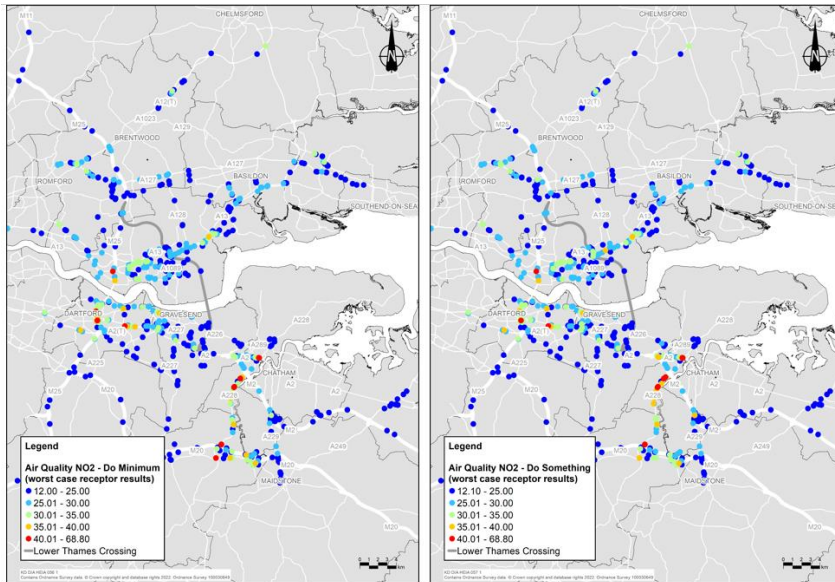
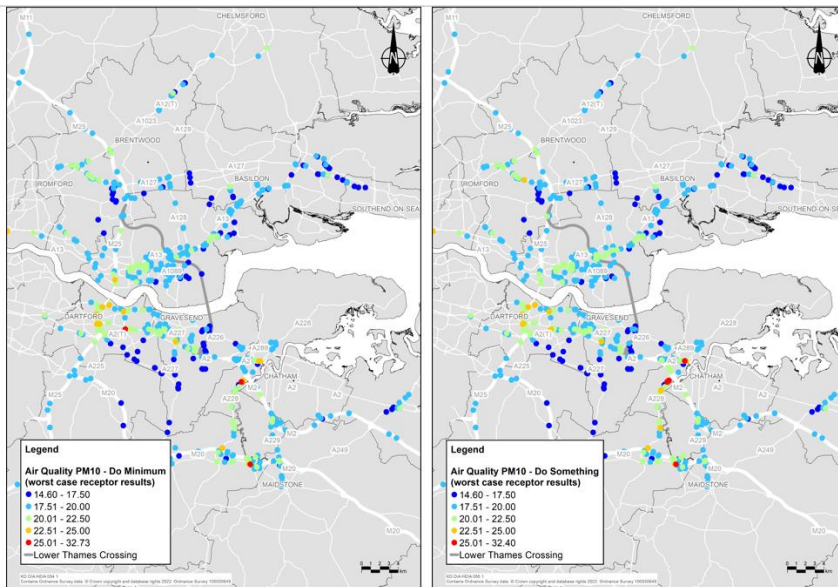


Plate 7.14 Difference in PM₁₀ levels at receptors for Do Minimum and Do Something scenarios



- 7.8.35 A full description of operational air quality impacts can be found in ES Chapter 5: Air Quality (Application Document 6.1). The description is divided between:
- a. Those receptors that inform the judgement of significance (receptors which are predicted to exceed AQS objectives in either the Do Minimum or Do Something scenario, and also have greater than imperceptible changes in annual mean NO₂ (changes greater than 1% of the annual mean AQS objective, i.e. >0.4µg/m³))
 - b. The remainder of receptors across the air quality study area (predominantly focusing on receptors with the highest concentrations and concentration changes from the Project)
- 7.8.36 A summary of the findings from the air quality assessment for NO₂ for those receptors that inform the judgement of significance is set out in Table 7.26 grouped into four geographical areas.

Table 7.26 Summary of findings – receptors that inform the judgement of significance for air quality impacts (NO₂)

Area	Assessment summary
A282 Dartford Crossing	There are four receptors in this area which experience a reduction in annual mean NO ₂ in the Do Minimum scenario as a result of the predicted reduction in traffic flow. The exceedance of the annual mean AQS objective is removed from two of these receptors as a result of the improvement. One receptor, a hotel located by junction 30 of the M25/A282, would experience a small improvement in annual mean NO ₂ of 1.2µg/m ³ , however this would still result in an exceedance of the annual mean NO ₂ AQS objective. Because the receptor is a hotel and does not therefore have permanent residents associated with it, it is not included as part of the significance assessment.
A2 London Road, Strood	Small increases in annual mean NO ₂ would be experienced at four receptors along the A2 London Road as a result of a forecast increase in traffic flow of approximately 1,100 Annual Average Daily Traffic (AADT) next to these receptors. No additional receptors are predicted to exceed the annual mean AQS objective on the A2 London Road in the Do Something scenario.
M25 Holmesdale Tunnel	Seven receptors in the vicinity of the Holmesdale Tunnel which exceed the annual mean AQS objective would see a small improvement in the Do Something scenario. This is because although the Project is forecast to lead to an approximate increase in traffic flow of 4,000 AADT on the adjacent section of M25, a change in speed band from high speed to free flow in the inter-peak traffic period, would lead to a reduction in per vehicle emissions.
A228 (between M20 junction 4 and M2 junction 2)	The Project is forecast to lead to an increase in traffic on the A228 (between Leybourne Way and M2 junction 2) ranging from approximately 1,100 to 3,200 AADT. A large proportion of the increase is associated with Heavy Duty Vehicles (HDVs), which increase by up to 1,600 AADT. This increase in traffic leads to an increase in annual mean NO ₂ of 2.4 to 3.1µg/m ³ (medium worsening) at four receptors which exceed the objective on Rochester Road/Sundridge Hill. It should be noted that three of these four receptors already exceed the objective in the Do Minimum scenario. An

Area	Assessment summary
	<p>increase in annual mean NO₂ of 4.2µg/m³ (large worsening) is predicted at a further receptor on Rochester Road, which also already exceeds the objective in the Do Minimum scenario.</p> <p>A decrease in HDV flows of 1,600 per day is forecast on the A228 Castle Way (between Leybourne Way and M20 junction 4), and this leads to a decrease in annual mean NO₂ of 1.1 to 1.3µg/m³ (small improvement) at five receptors which exceed the objective in the Do Minimum scenario. This reduction in HDVs occurs due to these vehicles being forecast to travel north from the Leybourne Way junction to the M2 instead of travelling south to the M20.</p>

7.8.37 A summary of the findings from the air quality assessment for NO₂ for the remainder of receptors across the air quality study area is set out in Table 7.27.

Table 7.27 Summary of findings by area – air quality (NO₂)

Area	Assessment summary
M25 junction 25 to junction 28	<p>With the exception of worst-case receptors close to Holmesdale Tunnel, all receptors modelled in this discussion area are predicted to experience a change in annual mean NO₂ of 0.4µg/m³ or less (i.e. 'imperceptible' magnitude of change).</p> <p>The largest change in this area is reported at two receptors located within 30m of the M25, which are both reported to experience a decrease in NO₂ of 0.5µg/m³.</p>
M11 junction 6 to junction 8	<p>Imperceptible changes in annual mean NO₂ predicted at receptors in this discussion area, which reflect the small forecast increase in traffic on the M11 as result of the Project and the fact that receptors are set far back from the motorway (30 to 160m away).</p>
A12 junction 11 to junction 19	<p>All receptors located along the A12 experience an imperceptible change in annual mean NO₂ as a result of the Project.</p>
A127, A12 and surrounding roads	<p>Imperceptible changes in annual mean NO₂ at receptors in this discussion area with the exception of a receptor on Folkes Lane (located approximately 20m from A127 Arterial Road) which would see an increase of 1.6µg/m³, a receptor located approximately 12m south of A127 Arterial Road which would see an increase of +1.4µg/m³ and a receptor on Front Lane (approximately 7m east of this road) which would see an increase of 0.61.6µg/m³.</p>
M25 junction 28 to junction 30	<p>Receptors located north of where the Project joins the M25 junction would experience a deterioration in air quality (the largest increase is predicted to be 1.2µg/m³), whereas receptors south would experience an improvement as a result of the Project (the largest reduction in NO₂ is predicted to be -0.4µg/m³).</p>
A282 Dartford Crossing	<p>The Project is forecast to result in a reduction in traffic flow of approximately 21,700 to 31,700 AADT on the A282, which leads to a reduction in NO₂. The greatest reduction in annual mean NO₂ (-3.4µg/m³) is predicted at a receptor on Hardwicke Crescent.</p>
A13 and surrounding roads	<p>The forecast changes in annual mean NO₂ on roads surrounding the A13 are generally less than 0.4µg/m³. The largest changes in annual mean NO₂ are forecast around new links at the A13/A1089/A122 Lower Thames</p>

Area	Assessment summary
	<p>Crossing junction. The largest increase in annual mean NO₂ predicted here is 1.7µg/m³. This receptor is located to the east of the Project route, approximately 8m from Buckingham Hill Road and 40m from the A13; this receptor is associated with a potential residential development and has been modelled at the closest point between the Application Site and Buckingham Hill/A13, which is likely to overestimate impacts at residential receptors.</p>
<p>A2 and surrounding roads</p>	<p>On the A2 between M25 junction 2 and the A223 junction, there is a predicted increase in traffic flow ranging from 2,200 to 700 AADT which lead to an imperceptible change in annual mean NO₂ at receptors. The largest change (worsening) is predicted at a receptor on Gravel Hill Close (0.3µg/m³).</p> <p>On the A2 between the A2/A122 Lower Thames Crossing junction and the M25 (junction 2), there is a forecast reduction in traffic flow ranging from approximately 15,200 to 22,800 AADT, resulting in an improvement in air quality (a reduction in annual mean NO₂ of 2.2µg/m³ is predicted as a result of the Project at a receptor on the A2 Watling Street).</p>
<p>M2 junction 1 to junction 7 and A2 Boughton Bypass/Dover Road</p>	<p>Receptors predicted to experience a medium magnitude worsening in NO₂ as a result of the Project are located in Squires Close (within 20m of the M25 (junction 2) and on Maidstone Road (close to the M2 junction 3 eastbound off-slip).</p> <p>On the A2 Boughton Bypass/Dover Road between M2 junction 7 and Geddinge Lane there is a forecast increase in traffic of approximately 1,500 to 1,100 AADT and the predicted change in NO₂ is imperceptible at all receptors.</p>
<p>M20 junction 1 to junction 6</p>	<p>The Project is predicted to lead to a reduction in traffic flow of approximately 5,800 to 13,300 AADT between M20 junction 1 and junction 6. This reduction in traffic would reduce annual mean NO₂ at receptors. The largest reduction in NO₂ is predicted at a receptor within 10m of the M20, where a decrease of -0.8µg/m³ is forecast.</p>
<p>M26</p>	<p>The Project is predicted to lead to a decrease in traffic flow on the M26 of between 1,600 and 1,700 AADT, resulting in a reduction in NO₂ at receptors. The imperceptible changes reflect the relatively small change in traffic predicted on the M26 as a result of the Project, and the distance between the receptors and motorway which allows good dispersion.</p>
<p>A228 and A229</p>	<p>While a larger increase in traffic is predicted on the A229 than on the A228, there are no predicted exceedances of the AQS objective along the A229, as receptors are set further back from the carriageway along the A229 compared with the A228. A receptor at the A228 Formby Way (within approximately 8m of the A228) is predicted to experience a deterioration in NO₂ of 3.7µg/m³.</p>
<p>M25 junction 2 to junction 6</p>	<p>An increase in traffic is predicted to result in an increase in annual mean NO₂ at receptors, although these are all less than 0.4µg/m³, and so imperceptible in magnitude.</p> <p>There is a reduction in traffic flow of approximately 5,500 AADT as a result of the Project between M25 junction 2 and 3, as a result of the decrease in traffic joining the M25 from the M20 (at junction 3). This decrease in traffic leads to an imperceptible change in NO₂ at all receptors along this section of the M25.</p>

Area	Assessment summary
A102	The Project is forecast to lead to a decrease in traffic flow on the A102 of between 1,100 and 2,100 AADT, resulting in an imperceptible change in annual mean NO ₂ at all receptors.
A122	<p>The A122 would have an AADT flow of approximately 86,400 between the M2/A2/A122 Lower Thames Crossing junction and the A13/A1089/A122 Lower Thames Crossing junction. The Project would result in a deterioration in air quality at receptors next to the route. The worsening in annual mean NO₂ concentrations at receptors range between 0.3 and 4.8µg/m³. The largest increase of 4.8µg/m³ is forecast at a receptor located on High House Lane, approximately 30m from the proposed southbound carriageway of the Project road.</p> <p>No exceedances of the annual mean AQS objective are predicted at receptors along this corridor, largely as a result of the distance between receptors and the Project carriageway and the fact that background concentrations are low in this area, given the rural/suburban nature of the surrounding land use.</p>

- 7.8.38 No receptors are expected to exceed the annual mean PM₁₀ AQS objective, and as annual mean concentrations are below 32µg/m³ at all receptors, there are expected to be no exceedances of the 24-hour mean AQS objective for PM₁₀.
- 7.8.39 The largest modelled increase in PM₁₀ as a result of the Project is 1.3µg/m³, located at a receptor on Pilgrims Way within 4m of the A228 where there is a predicted increase in traffic flow of 2,600 AADT (1,600 HDVs). The largest modelled decrease in PM₁₀ due to the Project is -0.6µg/m³, predicted at a receptor located next to the A282 Dartford Crossing where AADT flows decrease by approximately 26,200.
- 7.8.40 PM_{2.5} has not been modelled as a separate pollutant but has been considered through the results of the PM₁₀ modelling, as PM_{2.5} is a component of PM₁₀. There are a number of receptors where predicted annual mean PM₁₀ concentrations are in excess of 25µg/m³ in the Project opening year. The annual mean AQS objective for PM_{2.5} is 25µg/m³. The maximum PM_{2.5} concentration predicted at a receptor is 20.1µg/m³, thus demonstrating that there would be no exceedances of the PM_{2.5} AQS objective.
- 7.8.41 In line with DMRB LA 105 Air Quality (Highways England, 2019b), no significant effect has been predicted for air quality. There is one receptor with a large worsening, four receptors with a medium worsening and four receptors with a small worsening in predicted annual mean NO₂. These receptors are located on the A228 and A2 London Road, Strood and experience an annual mean NO₂ concentration ranging from 41.9µg/m³ to 45.7µg/m³ in the Do Something scenario. Given these concentrations, there is unlikely to be exceedances of the 1-hour mean NO₂ AQS objective as a result of the Project (as all the annual mean concentrations are below 60µg/m³).
- 7.8.42 There is one receptor where a 4.2µg/m³ increase in annual mean NO₂ is predicted. This increase in NO₂ is at the low end of the magnitude range corresponding with the large magnitude category. The guideline bands for large changes in terms of number of receptors are 1 to 10 and therefore this receptor is at the bottom of the guideline band.

- 7.8.43 The Project leads to a small magnitude of improvement at 16 receptors (four near the Dartford Crossing, five on A228 Castle Street and seven near the M25 Holmesdale Tunnel). The exceedances of the annual mean AQS objective are removed at three of these receptors in the Do Something scenario as a result of this improvement.
- 7.8.44 The DIA within Appendix D of the ComMA (Application Document 7.7) identifies the number of properties within each income quintile which experience an increase, decrease or no change in air quality levels. The DIA shows that 134 (0.1%) properties are forecast to have a deterioration in NO₂ levels, while 373 (0.4%) properties are forecast to have improved NO₂ levels, for the Do Minimum and Do Something scenarios. There would be a net improvement in NO₂ for each income category apart from quintiles 4 and 5 (the highest income categories). The most deprived quintiles (quintiles 1 and 2) have the fewest properties forecast to have changes in NO₂ levels with the Project, with only two receptors identified as having worse air quality. Quintile 3 also has more properties forecast to have improved NO₂ levels than worse air quality. The DIA identifies that the impacts on population groups in quintiles one to three would be beneficial (with a score of large beneficial from quintiles 1 and 2) and the populations impacted are lower than the proportion of these groups in the total population within the air quality impact area.
- 7.8.45 The DIA records a net improvement in NO₂ levels for Lower Super Output Areas (LSOAs) that have above average percentages of children under 16, compared with the regional study area and with England and Wales. There are 70 schools within the assessment area for air quality, which includes receptors within a 200m buffer of the ARN. The DIA states that no schools within the assessment area were found to have a change above 0.4µg/m³, the level above which any change is considered perceptible. The distributional impact of the Project on air quality for children is assessed to be Slight Beneficial based upon 2030 analysis.
- 7.8.46 There has been no DIA appraisal of PM_{2.5} levels, as perceptible changes of 0.4µg/m³ were identified at only 34 properties (0.04%).

Health outcomes assessment – air quality (operation)

- 7.8.47 The assessment of likely health outcomes as a result of the Project during operation in relation to changes in air quality is summarised in Table 7.28.

Table 7.28 Health outcome – air quality (operation)

Community/ population	Assessment summary
General population	ES Chapter 5: Air Quality (Application Document 6.1) states that no significant effects have been predicted for air quality during operation of the Project.
Sensitive communities/ populations	Across the study area for air quality, there are locations predicted to experience both improvements and deteriorations in air quality. The majority of changes in air quality are forecast to be imperceptible or small at human receptors. While there is a deterioration in air quality at receptors next to the Project route, no exceedances of the annual mean AQS objective are predicted at receptors along the route corridor, largely as a result of the distance between receptors and the Project road and the fact that background concentrations are low in this area, given the rural/suburban nature of the

Community/ population	Assessment summary
	<p>surrounding land use. Air quality improvements are predicted at locations near the existing Dartford Crossing.</p> <p>Concerns highlighted during Statutory Consultation, Supplementary Consultation, Design Refinement Consultation, Community Impacts Consultation and Local Refinement Consultation have included anxiety around air quality impacts from emissions as a result of road traffic. This is considered further in Section 7.12 in relation to potential mental health and wellbeing impacts.</p> <p>There is strong evidence setting out the links between changes in air quality and health outcomes. Groups particularly sensitive to deteriorations or improvements in air quality and who may be more likely to experience changes to health outcomes as a result of air quality changes include children, older people and people with existing respiratory conditions. There are higher concentrations of people with existing health conditions such as respiratory disease and COPD within a number of the communities near the Project than is the case nationally.</p> <p>Local health and wellbeing strategies reference the importance of the wider environment on both mental and physical health and wellbeing, with improvements in air quality identified specifically as a priority area in a number of strategies.</p> <p>The number of people that would be impacted by changes in air quality during operation is likely to be high across the length of the Project route.</p> <p>ES Chapter 5: Air Quality (Application Document 6.1) concludes that there is no significant effect on human health as a result of the operation of the Project.</p> <p>The health outcome for both general and sensitive populations as a result of changes in air quality during operation is assessed as neutral.</p>

Equality impact assessment – air quality (operation)

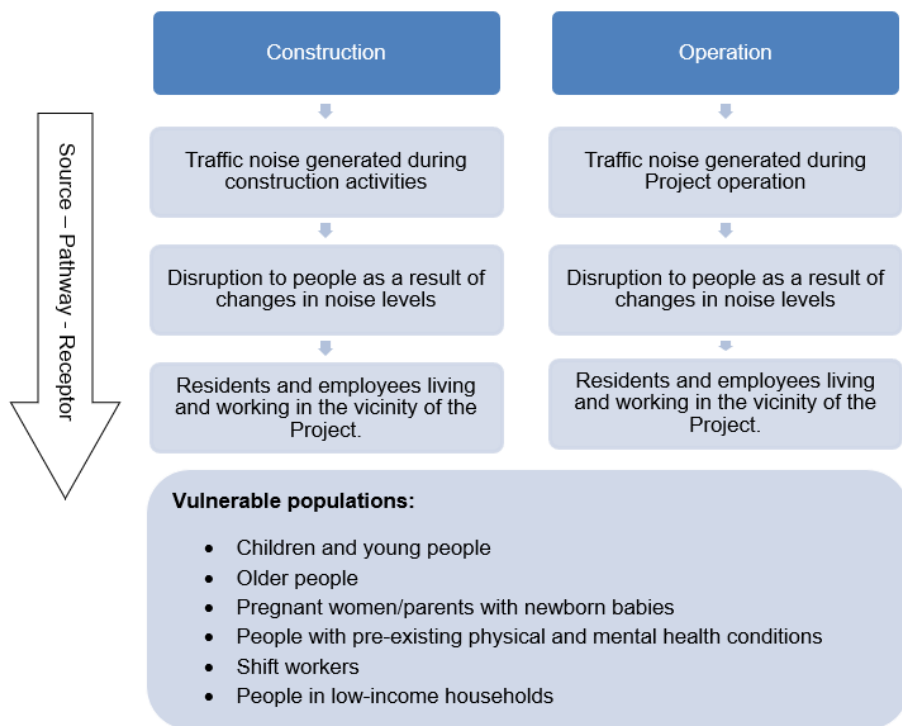
- 7.8.48 No disproportionate or differential impact has been identified on protected characteristics in relation to changes in air quality during operation.

7.9 Noise and vibration

Overview

- 7.9.1 Noise and vibration at levels generated by traffic can lead to a variety of health issues. Vulnerable populations considered particularly sensitive to noise-related health effects include children, older people, the chronically ill, people with hearing conditions (for example impairments, or those suffering from conditions such as tinnitus), people with mental illness (for example schizophrenia) and people with other conditions (such as autism).
- 7.9.2 This section describes the likely impacts of changes in noise levels as a result of the Project during both the construction and operational phases. The relationship between changes in noise levels and outcomes on health and equality is summarised in Plate 7.15

Plate 7.15 Source-pathway-receptor model – noise and vibration



Evidence base

- 7.9.3 Evidence suggests that the potential of noise pollution to impact on health outcomes is strong and highlights that people’s perception of noise can be as important as the actual noise levels. The level of effect from noise pollution can depend on the type of noise, nature of tasks being undertaken, and personal characteristics. Intermittent noise of relatively short duration has been found to be most disruptive, particularly where it interferes with cognitive tasks; in contrast, for conditions of continuous noise of longer duration, individuals can develop more effective coping strategies (Szalma and Hancock, 2011).
- 7.9.4 Road traffic is a common source of noise pollution. Evidence suggests that long-term exposure to noise and vibration can lead to greater risk of conditions including annoyance, sleep disturbance, and cardiovascular and physiological effects.
- 7.9.5 Vibrations transmitted from site activities can cause anxiety as well as annoyance, and can disturb sleep, work or leisure activities (British Standard (BS) 5228-2:2009+A1:2014 (British Standards Institution, 2014b)). BS 5228-2 notes that in any community, some individuals would be more sensitive to vibration than others.

- 7.9.6 The WHO Regional Office for Europe (2011) suggests that some people may be less able to cope with the impacts of noise exposure and be at greater risk for harmful effects. Vulnerable populations considered to be particularly sensitivity to noise-related health effects include children, older people, the chronically ill, people with hearing conditions (impairments, those suffering from tinnitus) and people with mental illness (for example dementia or schizophrenia) or conditions such as autism. A paper produced in 2017 found that a lack of control over noise actually intensifies the negative effects of noise pollution on people's mental health (Jariwala, 2017).
- 7.9.7 Evidence also suggests noise pollution may limit children's learning (Xia and Li, 2018). Research has suggested that unwanted or loud noise at school or home may cause children to experience more difficulty with concentration, communication and speech development, as well as cognitive performance. Noise and noise sensitivity are shown to be negatively associated with the mental health of children and adolescents, particularly in low-income groups (Lim *et al.*, 2018). Families with lower incomes tend to have lower mobility but greater exposure to adverse environmental conditions related to noise pollution (WHO Regional Office for Europe, 2011).

Relevant themes from local health and equality strategies

- 7.9.8 The policy and strategic context for health and equalities is set out in Appendix A. Local priorities of relevance to the topic of noise and vibration are summarised below:
- a. Reducing health inequalities – specified as a priority in a number of Health and Wellbeing Strategies. The London Health Inequalities Strategy (GLA, 2018) references the importance of developing and promoting London as a healthy place for all. The Kent Joint Health and Wellbeing Strategy (Kent County Council, undated) identifies tackling health inequalities as one of four priorities. Key areas of focus of the Essex Joint Health and Wellbeing Strategy include influencing conditions and behaviours linked to health inequalities (Essex County Council, 2022). Reducing health inequalities is an overarching theme of the Brentwood Health and Wellbeing Strategy 2020–2023 (Brentwood Borough Council, 2020).
 - b. Focus on children/young people – 'giving every child a good start' is an area of focus for Medway, Kent and Brentwood Health and Wellbeing Strategies. Enabling Gravesham to be a healthy and safe place is a core objective of the Gravesham Borough Council Draft Youth and Community Health and Wellbeing Strategy 2022–2027 (Gravesham Borough Council, undated).
 - c. Creating healthier environments – the role of the wider environment in improving health outcomes is highlighted across health and wellbeing strategies. The London Borough of Havering defines 'the communities and places we live in' as one of four pillars focused on in the Health and Wellbeing Strategy. Domain Five of the Thurrock Joint Health and

Wellbeing Strategy (Thurrock Council, 2022) relates to providing environments where everyone feels safe and healthy, with goals to ensure that regeneration and future developments seek to improve physical and mental health. Theme Four of Medway's Joint Health and Wellbeing Strategy 2018–2023 (Medway Council, 2018) is 'Improving Mental and Physical Health and Wellbeing', recognising that mental and physical health and wellbeing are affected by many wider issues in our day-to-day environment. Key performance indicators set out within the London Health Inequalities Strategy (GLA, 2018) also relate to healthy places, with all Londoners benefiting from an environment and economy that promote good mental and physical health.

- d. Achieving equality objectives – Essex County Council's equality outcomes for the residents of Essex includes that children get the best start in life and that people can enjoy good health and wellbeing (Essex County Council, 2022). The London Borough of Havering includes reducing inequalities in health and wellbeing across communities in Havering as an overarching cohesion priority (London Borough of Havering, 2018).

Findings from consultation

- 7.9.9 A summary of issues raised by stakeholders and members of the public with regard to noise and vibration is provided below for both the construction and operational phases.

Construction

- a. Concern about disruption to local communities arising from noisy construction activities. Comments have been raised by communities along the length of the Project route, particularly communities located in close proximity to construction compounds or construction traffic routes.
- b. Night-time noise levels from Tilbury Dock already cause difficulties/disruption for local communities at night.

Operation

- c. The Project is expected to reduce noise impacts in the Dartford area.
- d. Concerns regarding noise impacts on sensitive locations, for example users of recreational facilities such as the Shorne Woods Country Park.
- e. General concerns over the potential for noise pollution as a result of the Project.

Findings from baseline review

- 7.9.10 A total of 51 Noise Important Areas have been identified in the noise assessment study area. Residential and non-residential sensitive receptors (the latter group including, for example, hospitals, care homes, schools and

nurseries, and community facilities) have been identified. Further detail relating to the baseline can be found in ES Chapter 12: Noise and Vibration (Application Document 6.1).

- 7.9.11 Demographic analysis presented in Appendix C has identified where there are higher proportions of vulnerable groups within the population (for example children and the elderly). Information has been collated for people with pre-existing health conditions, including mental health conditions, although it is noted that local level data is not available for certain conditions, so information at either local authority or CCG level has been presented.

Noise and vibration impacts and mitigation during construction

- 7.9.12 Noise and vibration effects are described in ES Chapter 12: Noise and Vibration (Application Document 6.1) in relation to construction activities, construction traffic, construction vibration (piling activities) and ground-borne noise and vibration from the tunnel boring machine (TBM) and Micro-TBM equipment.

Construction noise

- 7.9.13 For construction noise, significant effects have been identified in accordance with DMRB LA 111 as where a 'major or moderate magnitude of impact will occur for a duration exceeding: 1) 10 or more days or nights in any 15 consecutive days or nights; 2) a total number of days exceeding 40 in any 6 consecutive months' (Highways England, 2020c). DMRB LA 111 states that a moderate magnitude of impact represents a level above or equal to Significant Observed Adverse Effect Level (SOAEL) and below SOAEL +5dB. The noise assessment undertaken for the ES (Chapter 12: Noise and Vibration, Application Document 6.1) states that activities have been assumed to occur for a full calendar month, which allows a robust consideration of effects.
- 7.9.14 ES Chapter 2: Project Description (Application Document 6.1) outlines arrangements regarding 24-hour working. This would be required in relation to tunnel boring activities, with the TBMs working on a 24-hour basis, supported by site activities on the surface which would take place 24 hours a day, seven days a week.
- 7.9.15 Potential effects as a result of construction noise, based upon reasonable worst-case assumptions are summarised in Table 7.29.

Table 7.29 Construction noise summary of potential impacts

Area	Significant (adverse) effects
South of the River Thames	<p>Five noise sensitive receptors (NSRs) could experience significant effects during the daytime period.</p> <p>Three NSRs could experience significant effects during the evening period.</p> <p>Eleven NSRs could experience significant effects during the night-time period.</p> <p>Of the above, only one NSR (a property in Thong Lane) could experience significant effects during all three periods.</p> <p>With the inclusion of the specific mitigation and Best Practicable Means (BPM) measures secured through the REAC (Application Document 6.3,</p>

Area	Significant (adverse) effects
	ES Appendix 2.2), it is concluded that construction noise would be suitably controlled to a level where it would not constitute a significant effect .
North of the River Thames to the A13	<p>Twenty NSRs could experience significant effects during the daytime period.</p> <p>Sixteen NSRs could experience significant effects during the evening period.</p> <p>Thirty-three NSRs could experience significant effects during the night-time period.</p> <p>From the above, a total of 10 NSRS could experience significant effects during all three periods. These relate to residential properties in Station Road, Muckingford Road, Linford, Grays and Heath Road.</p> <p>With the inclusion of the specific mitigation and BPM measures secured through the REAC (Application Document 6.3, ES Appendix 2.2), it is concluded that construction noise would be suitably controlled to a level where it would not constitute a significant effect.</p>
North of the A13 to the M25	<p>Seven NSRs could experience significant effects during the daytime period.</p> <p>Six NSR could experience significant effects during the evening period.</p> <p>Sixteen NSRs could experience significant effects during the night-time period.</p> <p>Of the above, a total of three NSRs could experience significant effects during all three periods. These NSRs are residential properties in Stifford Clays Road and Ockendon Road.</p> <p>With the inclusion of the specific mitigation and BPM measures secured through the REAC (Application Document 6.3, ES Appendix 2.2), it is concluded that construction noise would be suitably controlled to a level where it would not constitute a significant effect.</p>

- 7.9.16 BPM and other construction phase mitigation will be implemented through the controls inherent within the REAC (part of the CoCP (Application Document 6.3, ES Appendix 2.2)). Additionally, under the controls within the CoCP, when further details of the construction method and design are known, the Contractors will develop a Noise and Vibration Management Plan to control noise as far as reasonably possible under BPM. Specific mitigation and BPM include the following:
- a. Construction noise and vibration levels would be controlled in accordance with BS 5228:2009+A1:2014 (British Standards Institution, 2014a; 2014b).
 - b. Introduction of bunding/hoarding and localised acoustic screening as necessary under BPM.
 - c. Temporary noise barriers/screens to be erected around areas of known high noise construction activities.
 - d. Early construction and implementation of embedded mitigation measures to screen noise from construction activities.

- 7.9.17 ES Chapter 12: Noise and Vibration (Application Document 6.1) also describes in more detail specific measures that are applicable to individual NSRs.
- 7.9.18 With regard to evening and night-time impacts, these are primarily associated with short duration utilities and ‘tie in’ activities and do not occur for a duration of 10 or more days in any 15 consecutive day period or for more than 15 days in any six-month period.
- 7.9.19 Taking the above into account, the assessment for construction noise set out in ES Chapter 12: Noise and Vibration (Application Document 6.1) concludes that for all of the NSRs identified, construction noise would be suitably controlled to a level where it **would not constitute a significant effect**.
- 7.9.20 However, health effects as a result of changes in noise levels are likely to be experienced differentially across the population. For example, equal levels of noise can cause different magnitudes of annoyance or sleep disturbance within a population, again as a result of people having different sensitivities.
- 7.9.21 One of the NSRs identified in Table 7.29 relates to the Whitecroft Care Home, located at Orsett, Thurrock. The care home provides elderly and dementia care; residents are likely to have very different sensitivities to changes in noise level. The noise assessment identifies that unmitigated reasonable worst case construction noise levels at this receptor are predicted to have a moderate or greater impact during the daytime and during the night-time, with a maximum exceedance of 7.3dB(A) above the daytime SOAEL and a maximum exceedance of 10.5dB(A) above the night-time SOAEL. A range of BPM measures are identified for this location specifically, including acoustic screening between construction works (including compounds and haul routes) and the care home (which in itself is anticipated to result in up to a 10dB reduction in noise at this location. With the inclusion of BPM mitigation measures secured through the REAC (Application Document 6.3, ES Appendix 2.2), daytime construction noise at this NSR would be suitably controlled to a level where it would **not constitute a significant effect**.

Construction traffic noise

- 7.9.22 ES Chapter 12: Noise and Vibration (Application Document 6.1) includes a summary of locations where a temporary moderate or major adverse change in road traffic noise level would lead to a significant level of effect, by each year of construction. This information is summarised in Table 7.30.

Table 7.30 Construction traffic noise – locations where significant effects experienced by construction year

Construction year	NSRs experiencing temporary moderate or major adverse change in road traffic noise
2025	<p>NSRs located on Calcutta Road, Dennis Road, Dock Road and Pea Lane. Other Sensitive Receptors (OSRs) identified to experience significant adverse effects comprise:</p> <ul style="list-style-type: none"> • Convent of Mercy (Communal Residence) • Grapecroft Care Home (Care Home) • Lansdowne Primary Academy (School) • Little Angels Day Nursery (Nursery)

Construction year	NSRs experiencing temporary moderate or major adverse change in road traffic noise
	<ul style="list-style-type: none"> Stifford Hall Hotel (Hotel)
2026	NSRs located on Pea Lane, Medebridge Road and Pike Lane. OSRs identified to experience significant adverse effects comprise: <ul style="list-style-type: none"> Stifford Hall Hotel (Hotel)
2027	NSRs located on Warren Road, Medebridge Road, Cobhambury Road, Dennis Road, Pea Lane and Pike Lane. OSRs identified to experience significant adverse effects comprise: <ul style="list-style-type: none"> Stifford Hall Hotel (Hotel)
2028	NSRs located on Bush Road, Cobhambury Road, Warren Road, Pike Lane and Medebridge Road. OSRs identified to experience significant adverse effects comprise: <ul style="list-style-type: none"> Cuxton Community Church URC (Place of Worship) Stifford Hall Hotel (Hotel)
2029	NSRs located on Medebridge Road. OSRs identified to experience significant adverse effects comprise: <ul style="list-style-type: none"> Stifford Hall Hotel (Hotel)
2030	No adverse significant effects as a result of changes in road traffic noise during this construction year are predicted to occur

7.9.23 The above significant adverse effects for construction traffic noise are predicted to occur within the following wards, with construction years shown for each ward:

- a. Gravesham – Shorne, Cobham and Luddesdown (2027 and 2028 only)
- b. Medway – Cuxton and Halling (2028 only)
- c. Thurrock – Tilbury Riverside and Thurrock Park (2025 only), Ockendon (2025 and 2027 only), Chafford and North Stifford (2025 to 2029), Stifford Clays (2026 to 2029)
- d. Havering – Upminster (2025 to 2028)

7.9.24 Of the above wards, there are slightly higher proportions of older people than the national average (who may be more susceptible to health issues) within the Shorne, Cobham and Luddesdown and Stifford Clays wards. Stifford Clays also sees a greater proportion of people with limited long-term illness and disabilities. There are higher proportions of both children (under 16) and people in low-income households within Ockendon and Tilbury Riverside and Thurrock wards (the latter ward also has lower male and female life expectancies than the national average). These groups may be more susceptible to increases in noise levels. Ockendon, Stifford Clays and Tilbury Riverside and Thurrock Park are all wards which have been attributed a high sensitivity by virtue of the health and socio-economic characteristics of their residents.

7.9.25 As set out in relation to construction noise, it is anticipated that through the use of BPM, noise at sensitive receptors would be suitably controlled to an

appropriate level. ES Chapter 12: Noise and Vibration (Application Document 6.1) notes that it has been reasonably concluded that the significant adverse impacts on health and quality of life would be avoided through the implementation of BPM and other specifically identified mitigation strategies, secured through the REAC (Application Document 6.3, ES Appendix 2.2).

Construction vibration (piling activities)

- 7.9.26 ES Chapter 12: Noise and Vibration (Application Document 6.1) provides an assessment of percussive/vibratory piling activities, taking into account the generated vibration levels and durations, to conclude significant effects in line with DMRB LA 111 (Highways England, 2020c). As stated in DMRB LA 111, a moderate magnitude of impact occurs when the construction vibration is at or above the SOAEL up to 10mm/s peak particle velocity (PPV). All piling activities associated with the Project are limited to daytime operations only.
- 7.9.27 Construction vibration levels have been predicted at vibration sensitive receptors (VSRs). Significant effects are summarised in Table 7.31.

Table 7.31 Construction vibration (piling activities) – summary of significant effects

Area	Significant (adverse) effects
South of the River Thames	<ul style="list-style-type: none"> Only one VSR would exceed construction vibration levels when works are within approximately 65m (percussive piling only). No significant effects have been identified for vibratory piling techniques.
North of the River Thames to the A13	<ul style="list-style-type: none"> Significant effects have been identified at three VSRs (percussive or vibratory piling). Significant effects have been identified at three VSRs (percussive piling techniques only).
North of the A13 to the M25	<ul style="list-style-type: none"> Significant effects have been identified at nine VSRs (percussive piling only). Significant effects have been identified at two VSRs (percussive or vibratory piling).

- 7.9.28 ES Chapter 12: Noise and Vibration (Application Document 6.1) highlights that further specific mitigation and control measures would be necessary, associated with the piling activities, within the specified distance and time frames identified, beyond BPM defined under BS 5228-2. These would be implemented in accordance with the REAC NV017 (part of the CoCP (Application Document 6.3, ES Appendix 2.2)) and secured under the DCO.
- 7.9.29 The above **significant adverse** effects for construction vibration (piling activities) are all predicted to occur within Orsett ward, Thurrock. Orsett is characterised as a ward of medium sensitivity by virtue of health and socio-economic population characteristics; the ward has a higher than average proportion of older people (who may be more susceptible to health issues).

TBM ground-borne noise and vibration

- 7.9.30 TBM and Micro-TBM activity associated with the Project's construction could generate both ground-borne noise and vibration impacts. ES Chapter 12: Noise

and Vibration (Application Document 6.1) states that ground-borne noise impacts are predicted to be of negligible magnitude (as defined in BS 5228) and are therefore **not considered to be significant**. Similarly, TBM and Micro-TBM ground-borne vibration levels predicted at identified sensitive receptors are **not considered to be significant**.

Noise and vibration management and monitoring

7.9.31 The CoCP and REAC (Application Document 6.3, ES Appendix 2.2) outline key control parameters relative to construction. The CoCP would be supported by a Noise and Vibration Management Plan which would be prepared and agreed with local authorities before starting any construction.

7.9.32 Noise and vibration mitigation measures proposed during the Project's construction include, but would not be limited to, the following:

- a. Use of best practice working methods for the control of construction noise and vibration, referred to as Best Available Techniques.
- b. Notification of local residents of particularly noisy work before starting those works. Effective communication would be established, keeping residents informed of the type and timing of works involved.
- c. Noise monitoring at agreed sensitive receptors (to be defined through development of the CoCP (Application Document 6.3, ES Appendix 2.2) and Noise and Vibration Management Plan) to ensure that the mitigation measures suggested are working effectively. Monitoring would be undertaken at locations identified in consultation with the relevant Environmental Health Officers before works start.

7.9.33 The CoCP (Application Document 6.3, ES Appendix 2.2) also includes information regarding proposed working hours (including night-time working).

7.9.34 The REAC (Application Document 6.3, ES Appendix 2.2) includes measures relating to noise and vibration monitoring during the construction phase (REAC Ref. NV009), including the identification of a framework should noise exceedances occur (REAC Ref. NV015).

Health outcomes assessment – noise (construction)

7.9.35 Communities identified as having a **high** sensitivity to changes in noise levels include those located close to the Project and/or construction traffic routes. Within these communities, sensitive populations include children and young people, older people, pregnant women/parents with newborn babies, people with pre-existing aural health conditions, people with cardiovascular conditions, people with mental health conditions, shift workers and people in low-income households.

7.9.36 The assessment of likely health outcomes as a result of the Project during construction in relation to noise is summarised in Table 7.32.

Table 7.32 Health outcomes – noise (construction)

Community/ population	Assessment summary
<p>General population Sensitive communities/ populations</p>	<p>ES Chapter 12: Noise and Vibration (Application Document 6.1) has assessed the effects of construction traffic and construction activities on noise levels. Temporary moderate or major adverse changes in construction road traffic noise levels have been identified at a number of noise sensitive receptors to the north and south of the River Thames. A range of mitigation measures have been set out in the CoCP (Application Document 6.3, ES Appendix 2.2) to ensure the effective management of site-based construction noise and to appropriately manage construction traffic.</p> <p>Concerns highlighted during Statutory Consultation, Supplementary Consultation, Design Refinement Consultation, Community Impacts Consultation and Local Refinement Consultation have included anxiety around noise impacts from construction activities. This is considered further in Section 7.12 in relation to potential mental health and wellbeing impacts.</p> <p>Adverse effects may be experienced by sensitive populations including older people, children, people with pre-existing health conditions/disabilities and shift workers. Many people within these groups are likely to be within their homes for longer periods of time and therefore exposed to construction noise for more of the time. It has been noted that people may experience noise effects differentially within a population and that even relatively small changes in noise levels can have a disproportionate effect on people’s wellbeing/quality of life.</p> <p>There is strong evidence setting out the links between changes in noise levels and health outcomes.</p> <p>The number of people that would be impacted by changes in noise levels during construction is likely to be low as a result of the mitigation measures identified.</p> <p>The duration of potential impact would be medium-term (six months to two years in duration), taking into account individual construction phases.</p> <p>Local health and wellbeing strategies reference the importance of the wider environment on both mental and physical health and wellbeing.</p> <p>Potential health outcomes associated with changes in noise levels are likely to relate to anxiety/stress as a result of changes in the local environment, in addition to sleep disturbance for residents located in close proximity to particular activities.</p> <p>The health outcome for affected communities as a result of changes in noise levels during construction is assessed as negative and significant.</p>

Equality impact assessment – noise (construction)

7.9.37 Significant adverse noise effects have been identified as a result of construction activities, including from construction noise, construction traffic and percussive piling activities. Analysis of areas within which adverse effects are predicted include wards where there are greater concentrations of older people than the local authority average (Shorne, Cobham and Luddesdown; Riverview; and Chalk), slightly higher proportions of children under 16 (within Singlewell, East Tilbury and Chadwell St Mary wards) and slightly higher proportions of people with life-limiting conditions or disabilities (the wards of Chalk and Ockendon). These groups may be more susceptible to increases in noise levels.

- 7.9.38 A range of mitigation measures would be in place during construction to reduce impacts associated with construction noise (these are set out in further detail in ES Chapter 12: Noise and Vibration (Application Document 6.1) and the CoCP (Application Document 6.3, ES Appendix 2.2)). Examples of embedded mitigation include the following:
- a. The earthworks and engineering design would keep the Project road low in the landscape and screen it from view where possible through earthworks features. Earthworks and bunding necessary for the operational design would be established at an early stage of the construction programme to allow later activities to be undertaken behind them, allowing these design elements to provide acoustic screening.
- 7.9.39 Other mitigation measures relevant the construction phase include the following:
- a. Pre-construction noise monitoring surveys would be undertaken and agreed with the relevant local authorities to establish a pre-construction baseline for the derivation of construction noise limits.
 - b. Following any changes to the design, the Contractors would ensure that an updated noise assessment has been carried out to ensure there would be no additional, or increase in, negative effects on nearby receptors.
 - c. Careful consideration of the location and layout of construction compounds to separate noise-generating equipment from sensitive receptors and the use of mains electricity as opposed to generators where possible.
 - d. Minimisation of construction vehicle traffic by, where practicable, selection of local suppliers along the Project route, using local workforces and by minimising the amount of material transported to construct the earthworks along the Project route.
- 7.9.40 Planned community liaison groups would help to disseminate information to local communities regarding the programme for construction activities.
- 7.9.41 Assessment of potential noise impacts have been undertaken for all travellers sites potentially affected by construction activities. This includes sites located off Rochester Road in Gravesham (View Point Place); a site located at the end of Lower Crescent, Linford; Gammon Field Travellers Site; and sites within Havering including Fair oak Showman's Quarters, Railway Sidings and Tyas Stud Farm.
- 7.9.42 In order to mitigate the potential for significant effects, best practice measures (BPM) and other construction phase mitigation would be implemented through the controls inherent within the REAC (Section 7 of the CoCP (Application Document 6.3, Appendix 2.2)). Additionally, under the controls within the CoCP, when further details of the construction method and design are known, the Contractors would develop a Noise and Vibration Management Plan (REAC NV002) to control noise as far as reasonably possible under BPM. As such it can be concluded that construction noise would be suitably controlled to a level where it would not constitute a significant effect at any of the traveller's sites identified and assessed.

Noise impacts and mitigation during operation

- 7.9.43 General design principles for the Project have sought to keep the road as low in the environment as possible, thereby using landforms to act as noise (and landscape) mitigation. Significant earth bunding, cuttings and false cuttings have been designed into the Project. These are identified on ES Figure 12.6: Operational Road Traffic Noise Mitigation (Application Document 6.2). Where earthworks measures were not practicable and additional mitigation was deemed necessary, acoustic fencing and low noise road surfacing have been identified as essential mitigation measures.
- 7.9.44 ES Chapter 12: Noise and Vibration (Application Document 6.1) describes the findings of the noise assessment, which has identified the following:
- a. Direct impacts associated with changes in road traffic noise from the Project itself due to the new alignment passing through an area of predominantly existing low-level road traffic noise
 - b. Indirect impacts associated with changes in road traffic noise as a result of changes in traffic flow and composition on the existing road network
- 7.9.45 Mitigation identified for the operational phase of the Project includes the following:
- a. All new and altered roads associated with the Project will be surfaced with a Thin Surface Course or Low Noise Surface (LNS).
 - b. Reflective acoustic barriers are proposed at six locations. These locations are shown on ES Figure 12.6: Operational Road Traffic Noise Mitigation (Application Document 6.2) and comprise the following:
 - i. 137m long acoustic barrier (2m high) positioned to protect residential amenity at isolated properties on Station Road/Love Lane to the West of East Tilbury (barrier reference AB1).
 - ii. 667m long acoustic barrier (1m high) at Tilbury Viaduct positioned to provide noise mitigation to outlying residential properties to the western extent of East Tilbury (barrier reference AB2).
 - iii. 667m long acoustic barrier (1m high) at Tilbury Viaduct positioned to provide noise mitigation to residential amenity of properties on Low Street Lane (barrier reference AB3).
 - iv. 95m long acoustic barrier (3m high) positioned to protect residential amenity at Brook Farm Cottages as a result of two receptors reporting unmitigated levels above a SOAEL during the night-time period (barrier reference AB4).
 - v. Acoustic barriers positioned on either side of the Mardyke Viaduct (1,399m long (barrier reference AB5) and 1,434m long (barrier reference AB6) respectively. Barriers (both 1m high) provide noise

mitigation to isolated sensitive receptors and areas of tranquillity within this area.

- 7.9.46 Once operational, the Project would result in both significant beneficial and adverse permanent noise effects. Health impacts associated with increases in noise levels range from annoyance through to cardiovascular effects. Some people are less able to cope with impacts of noise exposure and may therefore be at greater risk of harmful effects. Some receptors are already located in Noise Important Areas. Moderate to major beneficial (and thereby significant) impacts relating to road traffic noise changes, predominantly along the bypassed network, have been identified.
- 7.9.47 Locations where receptors are predicted to experience a significant effect (either adverse or beneficial) in either assessment period (daytime or night-time) are summarised by ward in Table 7.33.

Table 7.33 Locations where a significant adverse or beneficial effect is predicted

Ward	Significant adverse effect	Significant beneficial effect
South of the River Thames		
Shorne, Cobham and Luddesdown	Henhurst Road, Thong Lane, Wykeham Close, Genesta Glade, Glenrosa Gardens, Gazelle Glade, Astra Drive. Jeskyns Road, The Street, Sole Street, Fairfields	Watling Street, Thong Lane, Brewers Road, Squires Close, Old Watling Street
Singlewell	–	Virginia Walk, Thistledown, Ifield Way, Kilndown, The Glades, Mackenzie Way, The Hollies, Sheldon Heights, Watling Street, Ruffets Wood, Cobsdene, Abbotsfield
Westcourt	St Aidan's Church	Valley Drive
Riverview	Thong Lane, Vigilant Way, Astra Drive	–
Woodlands	–	Hever Court Road, Epsom Close
Painters Ash	–	Dene Holme Road, Gainsborough Drive, Painters Ash Lane
Higham	–	Old Watling Street
Strood South	–	Squires Close
Cuxton and Halling	Pilgrims Way, Sundridge Hill, Anderson Close, Rochester Road, Kent Road, The Glebe, Ashbee Close, Coombe Close, Hillcrest Drive, Aspdin Close, Brooks Place, May Street, Hollycroft, Vicarage Road, Essex Road, Stanford Way, Acre Grove, Sandways, Lambarde Close, Stake Lane, Britannia Close,	–

Ward	Significant adverse effect	Significant beneficial effect
	Carroll Close, Bush Road, Sylvestre Close, Germander Avenue, Station Road, Conveyor Drive, Cantium Place, Formby Terrace, Brook Street, Holborough Road, Willowside, The Glebe, High Street, Jackdaw Way, Delamere Gardens, Saltings Road, Waghorn Road	
Snodland East	Waghorn Road, Holborough Road, Willowside, Jackdaw Way, Saltings Road, Cantium Place, High Street, Simpson Road, Brook Lane, Lakeside, Lakeview close, Brook Street, Church Field, Cantium Place, Willowside	–
Longfield New Barn and Southfleet	–	Green Street, Green Road
North of the River Thames		
Chadwell St Mary	Brentwood Road, Hornsby Lane, Courtney Road, Alexandra Close, Godman Road, St Francis Way, Cole Avenue	River View, Heath Road
East Tilbury	Church Road, Muckingford Road, Station Road, Low Street Lane, Meadow Close, Pipit Close, Shearwater Avenue, High House Lane, Love Lane, Lower Crescent, Pintail Close	–
Little Thurrock Blackshots	–	Lodge Lane, Premier Avenue
Ockendon	North Road	Dennises Lane, Erriff Drive
Orsett	Fen Lane, Stifford Clays Road, Green Lane	Stanford Road, Stifford Clays Road, Baker Street, Woolings Close, High Road, Mill Lane, Shelford Close, High Road
South Chafford	–	Stifford Clays Road, Mayflower Road, Grenville Road, John William Close, Parnell Close, Hopewell Close, Lancaster Road, Maunder Close, Galleon Road, Lennox Close, Plymouth Road, Parr Close, Philip Sidney Road, Hodges Close, Chichester Close, Norfolk Place, Hedingham Road, Lodges Close
Stifford Clays	–	Silverwood Close, Stifford Clays Road, Nutberry Close, Long Lane

Ward	Significant adverse effect	Significant beneficial effect
Little Thurrock Rectory	–	Southend Road, Lodge Lane
Belhus	–	Hamble Lane, Irvine Gardens, Humble Avenue, Gatehope Drive
Aveley and Uplands	–	Park Lane
Upminster	–	Dennis Road, Clay Tye Road, Pike Lane, Church Lane, Pea Lane, St Mary's Lane, Ockendon Road
Cranham	–	Folkes Lane
Warley	–	Church Lane, Warley Road, Beredens Lane
Brent	–	Gore Road

- 7.9.48 Of the above wards, the following have been attributed a high sensitivity by virtue of the health and socio-economic characteristics of their population:
- Singlewell, Westcourt and Painter's Ash in Gravesham – these wards are only predicted to see **significant beneficial effects** for residential properties as a result of changes in road traffic noise.
 - Strood South in Medway – again this ward is only predicted to see **significant beneficial effects** as a result of changes in road traffic noise.
 - Chafford St Mary, Little Thurrock Blackshots, Ockendon, Stifford Clays, Belhus and Aveley and Uplands – the wards of Chafford St Mary and Ockendon both experience **significant adverse** as well as **significant beneficial effects** as a result of changes in road traffic noise. The other wards listed here are predicted to experience only **significant beneficial effects**.
 - Snodland East in Tonbridge and Malling is predicted to see **significant adverse** effects as a result of changes in road traffic noise.

- 7.9.49 Noise Sensitive Receptors where a **significant beneficial effect** has been identified are as follows:
- St Luke's Hospice Care Home, located to the west of Basildon, is predicted to experience a moderate beneficial change in road traffic noise during the daytime period.
 - Harris Primary Academy located off Mayflower Road in Chafford Hundred is predicted to experience a moderate or greater beneficial change in road traffic noise during the daytime period.

7.9.50 Changes in noise levels (**not significant**) at schools and care homes are identified in Table 7.34. This includes both beneficial and adverse effects.

Table 7.34 Changes in noise levels at schools and care homes (beneficial and adverse)

Local authority	School/care home	Beneficial or Adverse Effect (not significant)
Gravesham	Helen Allison School	Beneficial
Gravesham	Singlewell Primary School	Beneficial
Medway	Beehive! And Buzz!	Adverse
Medway	Cuxton Community Infant School	Adverse
Medway	St Francis' Pre-School	Adverse
Tonbridge and Malling	Zoe Evans Childcare	Adverse
Thurrock	Beacon Hill Academy	Beneficial
Thurrock	Dilkes Academy	Beneficial
Thurrock	Great Child Day Nursery	Adverse
Thurrock	Orsett Heath Academy	Beneficial
Thurrock	St Mary's Catholic Primary School	Adverse
Thurrock	Treetops School	Beneficial
Thurrock	William Edwards School	Beneficial
Thurrock	AM Care Home	Beneficial
Thurrock	Hollyrose House	Beneficial
Thurrock	Whitcroft Care Home	Beneficial
Tonbridge and Malling	Birling House	Adverse
Tonbridge and Malling	Melanie Ann Trust Residential Home	Adverse

7.9.51 The DIA within Appendix D of the ComMA (Application Document 7.7) appraises noise impacts against income distribution as well as in relation to vulnerable groups (children under 16 and people aged over 70). It is noted that the assessment only considers daytime noise. Outcomes from the DIA can be summarised as follows:

- a. With regard to income distribution, the two most deprived quintiles report a large adverse assessment score and the least deprived quintile reports a slight adverse assessment score. One nursery (St Francis' Pre-School in Medway) would experience an increase in noise and is located within the most deprived income quintile Major Super Output area.
- b. The distribution of changes in noise for children under 16 is recorded as neutral. Out of 68 schools within the noise impact area for the DIA, eight schools or nurseries would experience a decrease in road traffic noise levels and six would experience an increase.

- c. The distribution of changes in noise in relation to the proportion of the population aged 70 and over is recorded as neutral. Of the 58 care homes located within the noise impact area for the DIA, four would experience a decrease in road traffic noise levels. These are all located within Thurrock and include the Whitecroft Care Home. Two care homes would experience an increase in road traffic noise levels; these are both located within Tonbridge and Malling. As previously noted in reference to the construction assessment, people in care homes may experience a variety of conditions, including dementia, and may be more sensitive to changes in noise level.

7.9.52 Health effects as a result of changes in noise levels (for example annoyance and sleep disturbance) would be experienced differentially across the population according to level of sensitivity.

Health outcomes assessment – noise (operation)

7.9.53 Communities identified as having a **high** sensitivity to changes in noise levels include those located close to the Project. Within these communities, sensitive populations include children, the elderly, pregnant women/parents with newborn babies, people with pre-existing aural health conditions, people with cardiovascular conditions and people with mental health conditions.

7.9.54 The assessment of likely health outcomes as a result of the Project during operation in relation to noise is summarised in Table 7.35.

Table 7.35 Health outcome – noise (operation)

Community/ population	Assessment summary
General population/ Sensitive communities and populations	<p>There are predicted to be both improvements and worsenings in noise levels during the operation of the Project. While mitigation measures have been incorporated into the Project design to reduce adverse effects (including embedded measures as well as measures such as acoustic barriers and low noise surfacing), worsenings are still experienced at a number of locations.</p> <p>A range of evidence has been reviewed which link changes in noise levels with health outcomes.</p> <p>The population exposed to potential changes in noise levels (both positive and negative) across the Project is high. A series of embedded and essential mitigation measures have been identified (for example the inclusion of low-noise surfacing and the locations for acoustic barriers).</p> <p>The duration of potential impact would be permanent.</p> <p>Local health and wellbeing strategies reference the importance of the wider environment on both mental and physical health and wellbeing.</p> <p>Potential health outcomes associated with changes in noise levels are likely to relate to anxiety/stress as a result of changes in the local environment, in addition to sleep disturbance for residents located in close proximity to particular activities.</p> <p>Negative health outcomes associated with increases in noise levels greater than 3dB are identified in a number of wards. While noise effects can be experienced differentially among a population, worsenings could potentially</p>

Community/ population	Assessment summary
	<p>result in adverse health effects including increases in annoyance and sleep disturbance.</p> <p>Wards affected include:</p> <ul style="list-style-type: none"> • Shorne, Cobham and Luddesdown • Westcourt • Riverview • Cuxton and Halling • Snodland East • Chadwell St Mary • East Tilbury • Ockendon • Orsett <p>Positive health outcomes (associated with reductions in noise levels) are identified for the following wards:</p> <ul style="list-style-type: none"> • Shorne, Cobham and Luddesdown • Singlewell • Westcourt • Woodlands • Painters Ash • Higham • Strood South • Longfield New Barn and Southfleet • Chadwell St Mary • Little Thurrock Blackshots • Ockendon • Orsett • Stifford Clays • South Chafford • Aveley and Uplands • Little Thurrock Rectory • Belhus • Upminster • Cranham • Warley • Brent

Equality impact assessment – noise (operation)

7.9.55 There are predicted to be changes in noise levels due to the operation of the Project. Adverse effects have been identified at a number of sensitive receptors which may have an impact on people with protected characteristics, notably older people (through adverse effects forecast at a number of care homes),

children (through adverse effects forecast at a number of schools/nurseries), and within the wider population. Children may also be affected differentially by changes in noise levels, for example as a result of sleep disturbance impacting on behaviour and schooling, although it is not considered that noise increases would be such that they would be likely to cause these effects during operation. Adverse effects are likely to be experienced disproportionately by the following:

- a. Low-income households (as highlighted by the distributional appraisal of noise impacts)
- b. Pregnant women/parents with newborn babies (who may already be suffering from sleep disturbance and for whom an increase in noise levels may result in an additional effect)

7.9.56 The findings of ES Chapter 12: Noise and Vibration (Application Document 6.1) concluded that there would be some significant effects as a result of the Project. Post-construction monitoring and evaluation would therefore be undertaken for the Project as set out in DMRB LA 111 (Highways England, 2020c).

7.9.57 The tables below set out the predicted levels and change in road traffic noise in the opening year of the Project (2030) during the daytime and night-time periods at travellers sites within proximity of the Project. For the Gammon Field Travellers Site, an assessment has been undertaken for each pitch; the operational day-time and night-time impacts for all pitches has been assessed as moderate beneficial.

Table 7.36 Operational day-time impacts

Site	DM 2030	DS 2030	Noise Level Difference	Magnitude of Impact
View Point Place	54.1	54.0	-0.1	Negligible
End of Lower Crescent, Linford	45.0	50.9	+5.9	Major Adverse
Laburnham Stables	58.3	56.6	-1.7	Minor Beneficial
Fairoak Showman's Quarters	65.6	61.8	-3.8	Moderate Beneficial
Railway Sidings	58.8	56.8	-2.0	Minor Beneficial
Tyas Stud Farm	68.8	62.7	-6.1	Major Beneficial
Willow Tree Lodge	66.5	67	+0.5	Negligible

Table 7.37 Operational night-time impacts

Site	DM 2030	DS 2030	Noise Level Difference	Magnitude of Impact
View Point Place	51.3	51.2	-0.1	Negligible
End of Lower Crescent, Linford	43.4	48.5	+5.1	Major Adverse
Laburnham Stables	55.0	53.5	-1.5	Minor Beneficial

Fairoak Showman's Quarters	61.3	58.0	-3.3	Moderate Beneficial
Railway Sidings	55.4	53.7	-1.7	Minor Beneficial
Tyas Stud Farm	64.1	58.8	-5.3	Major Beneficial
Willow Tree Lodge	62.1	62.5	+0.4	Negligible

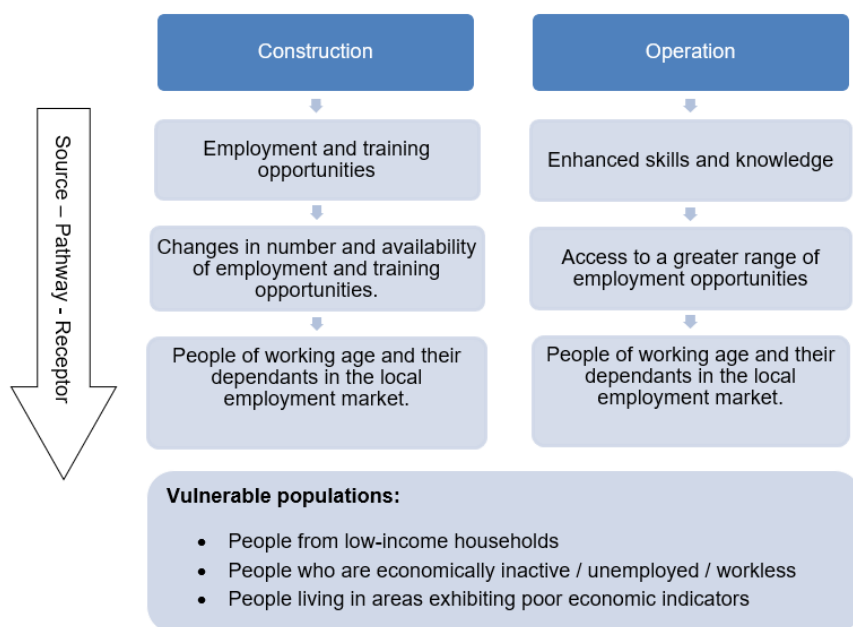
- 7.9.58 One site (End of Lower Crescent, Linford) is predicted to experience a major adverse change in road traffic noise level during the daytime and night-time. Adverse impacts at this location would be mitigated as far as reasonably possible through the Project design via low noise surfacing with a road surface influence of -7.5dB(A) and a 4m false cutting adjacent to the Project main alignment. This is shown in Figure 12.6: Operational Road Traffic Noise Mitigation (Application Document 6.2). Resultant road traffic noise levels would be below a SOAEL during the daytime and night-time, but as a result of the magnitude of the change would constitute a significant adverse environmental effect. However, in terms of health and quality of life, as defined under the policy considerations of the National Networks National Policy Statement (Department for Transport, 2014):
- a. Daytime: as the changes occur below a LOAEL these impacts would not be expected to have an adverse effect on health and quality of life as defined under UK Policy on noise
 - b. Night-time: as the changes occur above a LOAEL these impacts would be expected to have an adverse effect on health and quality of life as defined under UK Policy on noise. However, as they are below a SOAEL they would not be classified as significant.

7.10 Work and training

Overview

- 7.10.1 The Marmot Review (Marmot *et al.*, 2010) identified the importance of work for health, stating that '*being in good employment is protective of health. Conversely, unemployment contributes to poor health.*' This section considers opportunities relating to skills and training which may arise from the Project during construction, together with the health effects of potential job losses as a result of the acquisition of land. Access to employment during construction and operation has been considered in Section 7.2 as part of the wider topic of accessibility (including the health effects associated with reduced congestion and improvements in journey time/reliability during the operational phase).
- 7.10.2 The relationship between work and training, and outcomes on health and equality is summarised in Plate 7.16.

Plate 7.16 Source-pathway-receptor model – work and training



Evidence base

- 7.10.3 Unemployment contributes to poor health and can lead to poverty, illness and a decrease in personal and social esteem. The long-term unemployed carry a greater burden of disease, particularly mental illness, than employed persons and those who are unemployed only for a short time. The vicious circle of unemployment and disease can be broken by the combined effects of health care, special health-promoting measures and social interventions (Milner, Page and LaMontagne, 2013). Unemployment can have financial and also emotional and social impacts on family relationships, and on activities of other members of the family (for example education, work, leisure time and social activities) (WHO, 2000).
- 7.10.4 The Marmot Review (2010) emphasised that unemployment and poor quality work are major drivers of inequalities in physical and mental health. Rates of unemployment are highest among those with no or few qualifications and skills. Inequalities in educational outcomes affect physical and mental health, as well as income, employment and quality of life. The relationship between socio-economic position and educational outcome has significant implications for subsequent employment, income, living standards, behaviours, and mental and physical health. Training and employment positively affect health and wellbeing, contributing to a healthy standard of living (Marmot *et al.*, 2010).
- 7.10.5 Evidence suggests that there is a correlation between income inequality and health problems; in particular, those on higher incomes tend to experience

better health outcomes. Measures to reduce income inequality by raising the income of the most disadvantaged are, therefore, likely to improve general health and help reduce health inequalities (Rowlingson, 2011).

- 7.10.6 'The Marmot Review Ten Years On' (Marmot *et al.*, 2020) identified that, in the 10 years since the original review took place, there have been '*profound shifts in many aspects of the labour market and employment practices in England*' including increases in low-paid, unskilled and short-term work. The review highlighted that, while employment rates have been rising, more people in poverty are now in work than out of work due to low increases in rates of pay. This situation is likely to be exacerbated by the current cost of living crisis.
- 7.10.7 The risk of unemployment remains unequal between different groups in society, with minority ethnic groups, women, lone parents and people with disabilities experiencing lower employment rates (Marmot *et al.*, 2020). Those with lower socio-economic position, younger people, those in lower paid jobs and non-white people are more likely to experience poor quality work (Marmot *et al.*, 2020).
- 7.10.8 Poor job security can also be harmful to health – the numbers of people employed on zero hours contracts has risen over the period 2015 to 2022, with higher proportions of people in lower skilled/lower paid occupations being employed in this way (ONS, 2022).
- 7.10.9 To maximise health benefits, jobs need to be sustainable, offer a minimum level of quality, pay a living wage, provide opportunities for in-work development, provide flexibility to enable people to have a work and family life balance, and offer protection from adverse working conditions that can damage health.

Relevant themes from local health and equality strategies

- 7.10.10 The policy and strategic context for health and equalities is set out in Appendix A. Local priorities of relevance to access to work and training are summarised below:
- a. Reducing health inequalities – specified as a priority in a number of Health and Wellbeing Strategies. The London Health Inequalities Strategy (GLA, 2018) references the importance of developing and promoting London as a healthy place for all reducing income inequality and the negative consequences of relative poverty. The Kent Joint Health and Wellbeing Strategy (Kent County Council, undated) identifies tackling health inequalities as one of four priorities. Key areas of focus of the Essex Joint Health and Wellbeing Strategy include influencing conditions and behaviours linked to health inequalities (Essex County Council, 2022). Reducing health inequalities is an overarching theme of the Brentwood Health and Wellbeing Strategy 2020–2023 (Brentwood Borough Council, 2020).
 - b. Promoting opportunity – for example the London Health Inequalities Strategy (GLA, 2018), has regard to the importance of increasing opportunities for people to access potential benefits of good work and other meaningful activity. Domain Four of Thurrock Council's Health and

Wellbeing Strategy includes an ‘Opportunity for All’ goal, supporting people in Thurrock to be aspirational, resilient and able to access high quality education and training (Thurrock Council, 2022). The Southend-on-Sea Health and Wellbeing Strategy includes provision of accessible services as a priority for the borough (Southend-on-Sea Borough Council, 2021).

- c. Creating healthier environments – accessibility priorities of Thurrock Council’s Health and Wellbeing Strategy include the importance of providing access to services to residents across the borough through affordable and well-connected public transport, active travel and the provision of local based services and support (Thurrock Council, 2022). Key performance indicators set out within the London Health Inequalities Strategy (GLA, 2018) also relate to healthy places, with all Londoners benefiting from an environment and economy that promote good mental and physical health. Theme Four of Medway’s Joint Health and Wellbeing Strategy 2018–2023 (Medway Council, 2018) is ‘Improving Mental and Physical Health and Wellbeing’, recognising that mental and physical health and wellbeing are affected by many wider issues in our day-to-day environment.
- d. Achieving equality objectives – Essex County Council’s equality outcomes for the residents of Essex include that people have aspirations and achieve their ambitions through education, training and lifelong learning; and that people can live independently and exercise control over their lives (Essex County Council, 2022). The London Borough of Havering includes reducing inequalities in health and wellbeing across communities in Havering as an overarching cohesion priority (London Borough of Havering, 2018). Strategic equality priorities and objectives for Thurrock and Gravesham include access to services and access to all respectively.

Findings from consultation

- 7.10.11 Issues raised by stakeholders and members of the public with regard to access to work and training relate primarily to the potential for the creation of employment during construction together with enhancing employment opportunities and commuter connections during operation.
- 7.10.12 Health stakeholders have highlighted the importance of training local residents in the skills needed for the construction phase and recruiting from the local workforce in order to help tackle the wider determinants of health by increasing skills and reducing worklessness. Local training and recruitment will also assist with reducing the number of workers who move into the area temporarily, adding to the potential burden on local health and other services.
- 7.10.13 Extensive stakeholder engagement has been undertaken as part of the development of a Skills, Education and Employment (SEE) Strategy for the Project – understanding where there are skills gaps in the community, highlighting issues and working with local organisations (such as local

authorities, the South East Local Enterprise Partnership and representatives of the local supply chain) to identify key priorities.

- 7.10.14 Engagement has revealed that there are a high proportion of adults with no formal qualifications, with Essex particularly high, and higher proportions of people working in lower skilled activities. Wages in the area are also low. COVID-19 has led to a large increase in people receiving benefits. The Project presents opportunities to create further demand for skills as well as for upskilling locally with new jobs and work for businesses.

Findings from baseline review

- 7.10.15 Relevant features of the baseline data include the following:
- Economic activity rates by wards closest to the Project are generally lower than for their respective local authorities as a whole (Census, 2011).
 - Claimant counts are notably high in a number of wards, including Riverside and Westcourt to the south of the River Thames (6.1% and 5.3% respectively, compared to 3.9% for England as a whole); and Tilbury St Chads, Tilbury Riverside and Belhus wards to the north of the River Thames (6.2%, 6.7% and 5.3% respectively) (ONS, 2022).
 - Higher education attainment is considerably below the average for England in Medway, Gravesham and Thurrock (the percentage of residents with NVQ4 or above level qualifications is 28% for Medway and Gravesham, and 26% for Thurrock, compared to 39% for England). Percentages are also lower than the England average in Havering (30%) and Brentwood (33%) (Census, 2011).
 - Areas highlighted as deprived in the Indices of Deprivation 2019 (Ministry of Housing, Communities and Local Government, 2019) under both the education and skills training domain and the income domain include communities such as Westcourt, Riverside, areas of Strood, Tilbury and Grays.

Work and training impacts during construction

Employment creation and upskilling

- 7.10.16 Construction of the Project requires a range of employment skills and types. Direct employment needs include, for example, engineers, construction personnel, project managers, administrative staff, supervisors and commercial/finance staff. The scale and nature of the Project is such that a much greater variety of professional and non-technical disciplines would be required over time. There would also be a range of indirect employment created (with resultant skills and employment needs), for example in manufacturing, accommodation, catering, logistics and retail.
- 7.10.17 Over the six-year building phase, the Skills, Education and Employment (SEE) Strategy (further details of which can be found in Application Document 7.3) identifies that the Project will support more than 22,000 jobs, including 10,000

alone during the peak year of construction, and work for hundreds of businesses, both locally and nationally.

- 7.10.18 An assessment has been made of the skills necessary to deliver the Project, profiled over time, and with likely skills gaps identified. This assessment was supported by stakeholder engagement to identify local skills priorities, high-priority target groups, and opportunities to work in partnership to upskill local communities. Lessons learnt from other projects and opportunities were also used to complement this work. Many of the roles are forecast to require high levels of skills, defined as at least degree-level or equivalent (NVQ4+).
- 7.10.19 The overarching objectives of the SEE Strategy are to:
- a. Create a skills legacy – address the skills gap, create a higher skilled community and change training standards for building low carbon infrastructure. The Applicant continues to work closely with stakeholders to identify the criticality and market scarcity of the likely skills gaps and identify upskilling opportunities for the local community.
 - b. Bring people closer to jobs – create life changing opportunities for local people through new inclusive jobs and placements. This includes developing an approach that provides job roles which are accessible to disadvantaged or under-represented groups; and identifying opportunities for seldom-heard groups such as NEETs (Not in Education, Employment or Training), ex-military, ex-offenders, the homeless, care leavers and Special Educational Needs and Disability support programmes.
 - c. Inspire future careers – assemble the next generation of talent through effective engagement with local students and educators. Engagement is being prioritised towards education providers that would be most affected by the Project, areas of socio-economic disadvantage and education providers that deliver a large proportion of work-related project-based learning.
 - d. Support business growth – provide local businesses and Small and Medium sized Enterprises (SMEs) with the tools to win new work and maximise economic benefits during and after construction. This includes providing training and mentoring to local businesses, supporting enabling agencies such as local authorities to use the Project as an opportunity to boost growth and mentoring activities to ensure value can be demonstrated to communities and the local economy.
- 7.10.20 The Applicant will undertake reasonable endeavours to implement the principles and measures set out within the SEE Strategy, which is secured via S106 agreement (Application Document 7.3). The Strategy is to be updated bi-annually to ensure it responds to changing needs and priorities. Targets set out in the SEE Strategy include for the Applicant to:

- a. Achieve a target of at least 20% of employees to be from within the 'hosting boroughs' (Gravesham, Medway, Dartford, Thurrock, Havering and Brentwood)
- b. Achieve a target of at least 45% of employees to be from within 20 miles of the Project route (including employees within the 'hosting boroughs')

7.10.21 Further targets and activities are set in relation to education and training. For example, the Project's Contractors are targeted to provide 7,000 hours of school engagement through both the education and work placement programmes. Through these programmes, the Project aims to encourage more new talent into early career roles. There will be a further target for the number of local students engaged through the work placement programmes (at least 470 people). Minimum targets for a range of activities set out in the SEE Strategy are shown in Table 7.38.

Table 7.38 Minimum Targets set out in the SEE Strategy

Activity	Minimum target
Training for local communities	350 people
Sector skills qualification	500 people
Apprentices	437 people
Graduates/trainees	291 people
Newly employed	500 people
Pre-employment programmes	650 people
Education engagement	5,000 hours
Support to educators	2,000 hours
Work placements	470 people
SME spend	£1 in every £3
Business upskilling	1,000 businesses
Supply chain payment	Within maximum of 30 days

Impacts on existing businesses during construction

7.10.22 A small number of businesses would be lost during construction of the Project as a result of the permanent acquisition of land. ES Chapter 13: Population and Human Health (Application Document 6.1) estimates that around 30 jobs would be lost as a result of businesses subject to property demolition, primarily to the south of the River Thames.

Health outcomes assessment – work and training (construction)

7.10.23 The sensitivity of the general population to changes in access to work and training is assessed as **medium** as a result of the number of potential jobs created compared with the extent of the local labour market. Communities identified as having a **high** sensitivity to work and training-related impacts include people in low-income households, people who are economically inactive

or unemployed, children and young people (who may be affected by changes in household income), people who are unable to work due to ill health, lone-parent families, carers and migrant/itinerant workers.

7.10.24 The assessment of likely health outcomes as a result of the Project during construction in relation to work and training is summarised in Table 7.39.

Table 7.39 Health outcomes – work and training (construction)

Community/ population	Assessment summary
<p>General population/ Sensitive communities and populations</p>	<p>The Project would provide a significant number of new employment opportunities over the course of the construction period, both in terms of direct and indirect employment. The number of job losses as a result of the permanent acquisition of land for the Project (businesses lost to property demolition) is low in the context of the local labour market.</p> <p>There is strong evidence setting out the links between employment and training and both physical and mental wellbeing.</p> <p>The number of people that would experience beneficial changes as a result of the creation of new employment and training opportunities is high – supporting more than 22,000 jobs in the areas to the south and north of the River Thames, with 45% of employees to be from within 20 miles of the Project route, including within the host local authorities of Gravesham, Medway, Dartford, Thurrock, Havering and Brentwood. The catchment area of 20 miles from the Project route includes some of the most deprived communities, including for example Westcourt and Riverside wards to the south of the River Thames.</p> <p>The duration of impact would be long-term (i.e. more than two years in duration). Creating a skills legacy is one of the ambitions for the Project as set out in the SEE Strategy.</p> <p>Local health and wellbeing strategies reference the importance of work and training as one of the wider social determinants of health. The proposals are in line with the UK Government’s Levelling Up plans to unlock economic growth through job creation, new work for businesses and higher skilled workers. This aligns with tackling health inequality which is a priority for local authorities.</p> <p>The SEE Strategy, which will be secured via S106 agreement, contains a range of targets for employment and training.</p> <p>The SEE Strategy includes the implementation of inclusive and accessible recruitment processes designed to attract, recruit, and retain people from a range of backgrounds; irrespective of gender, race, disability, sexual orientation, religion or belief, age, transgender status, pregnancy and maternity, marriage or civil partnership, or socio-economic status (this list is not exhaustive). Priority groups identified through engagement with stakeholders include care leavers, NEETs, ex-military, people who are homeless/at risk of homelessness, ex-offenders, adult learners and women returners (again, this list is not exhaustive).</p> <p>Contractors would be partnered with a cluster of local schools with which they will be required to prioritise their engagement. These clusters will be made up of education providers most impacted by the project and with those from areas of socio-economic disadvantage.</p> <p>The health outcome for affected communities/populations during construction is considered to be positive and significant.</p>

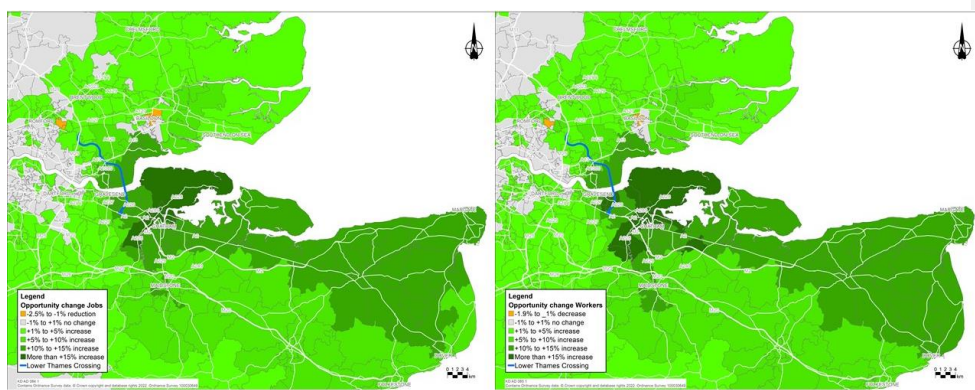
Equality impact assessment – work and training (construction)

- 7.10.25 No disproportionate or differential impact has been identified on protected characteristics in relation to work and training during construction.
- 7.10.26 The Project would adopt an inclusive procurement process, which would encourage work and training opportunities to be accessible to disadvantaged or under-represented groups in the local community (as stated in Table 7.39).

Work and training impacts during operation

- 7.10.27 The Need for the Project (Application Document 7.1) states that the Project is likely to enable wider economic impacts, such as people moving to more or less productive jobs and agglomeration based on dynamic clustering (businesses moving closer to one another) in the Lower Thames local area and wider region. Such impacts can be expected to increase productivity as businesses benefit from agglomeration through dynamic clustering, better job matching and lower costs due to the re-organisation of their business activities. The Project may also encourage the development of new homes and additional employment spaces. During operation, the Project is anticipated to add over £7 billion to the economy and create over 5,000 new jobs.
- 7.10.28 The Wider Economic Impacts Report contained within Appendix D of the ComMA (Application Document 7.7) has assessed the likely improvement in accessibility due to the Project using a continuous weighted opportunity measure based upon modelled highway travel times from the LTAM model. This shows the impacts of the Project on available jobs (for workers) and available workers (for employers).
- 7.10.29 Plate 7.17 shows the change in accessibility as a result of the Project at a zonal level. The map on the left shows the change in access to jobs and the map on the right shows the change in access to workers. It is clear that most areas within the wider Lower Thames region are expected to see improvements in accessibility to jobs and workers with the greatest improvements in Grays, Tilbury, Rochester, Gillingham and the Hoo Peninsula in Medway.

Plate 7.17 Change in number of jobs (left) and workers (right)



7.10.30 In terms of direct employment opportunities during the operational phase of the Project, the operational tunnel would be unmanned, but there would be a need for staff to operate and manage the user charging mechanism. In addition, there would be a need for the ongoing maintenance and management of the tunnels and ancillary structures, necessitating staff on a full-time basis.

7.10.31 One of the areas of ambition highlighted in paragraph 7.10.19 in relation to skills and training is with regard to ensuring a skills legacy for the highways and construction sector, including developing a lasting legacy of skilled and capable businesses ready to service a pipeline of other major infrastructure projects. Planned activities to upskill local residents and undertake school engagement activities are intended to have a continuing legacy post-completion of the Project.

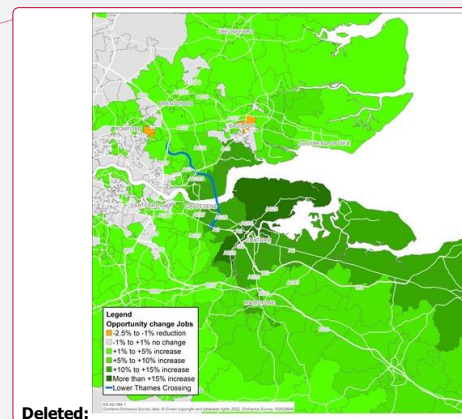
Health outcomes assessment – work and training (operation)

7.10.32 The sensitivity of the general population to changes in access to work and training is assessed as **medium** as a result of the number of potential jobs created compared with the extent of the local labour market. Communities identified as having a **high** sensitivity to work and training-related impacts include people in low-income households, people who are economically inactive or unemployed, children and young people (who may be affected by changes in household income), people who are unable to work due to ill health, lone-parent families, carers and migrant/itinerant workers.

7.10.33 The assessment of likely health outcomes as a result of the Project during operation in relation to work and training is summarised in Table 7.40.

Table 7.40 Health outcome – work and training (operation)

Community/ population	Assessment summary
General population/ Sensitive populations and communities	<p>The analysis shows that there are clearly anticipated to be improvements in accessibility to jobs across the Lower Thames region.</p> <p>The Project intends to create a skills legacy for the region, providing people with the tools to access higher skilled jobs, reducing the skills gap and maximising opportunities for local people to gain more meaningful employment.</p> <p>There is strong evidence setting out the links between employment and training and both physical and mental wellbeing.</p> <p>The number of people that would experience beneficial changes as a result of the creation of new employment and training opportunities is high. Legacy activities include the development of a significant education programme, aligned to the needs of local education providers and delivering science, technology, engineering and maths (STEM) workshops and activities in schools to educate and inspire future careers in construction, including future skills needs and carbon/sustainability education.</p> <p>The duration of impact would be long-term (i.e. more than two years in duration). Creating a skills legacy is one of the ambitions for the Project as set out in the SEE Strategy.</p> <p>Local health and wellbeing strategies reference the importance of work and training as one of the wider social determinants of health. The proposals are in line with the UK Government’s Levelling Up plans to unlock economic growth</p>



Community/ population	Assessment summary
	<p>through job creation, new work for businesses and higher skilled workers. This aligns with tackling health inequality which is a priority for local authorities.</p> <p>The SEE Strategy, which will be secured via S106 agreement, contains a range of targets for employment and training. Sensitive populations and communities will continue to benefit from the legacy based approach to skills and training. Engagement with local schools, including those from areas of socio-economic disadvantage, further emphasises the legacy approach.</p> <p>The health outcome for affected communities/populations during operation is considered to be positive and significant.</p>

Equality impact assessment – work and training (operation)

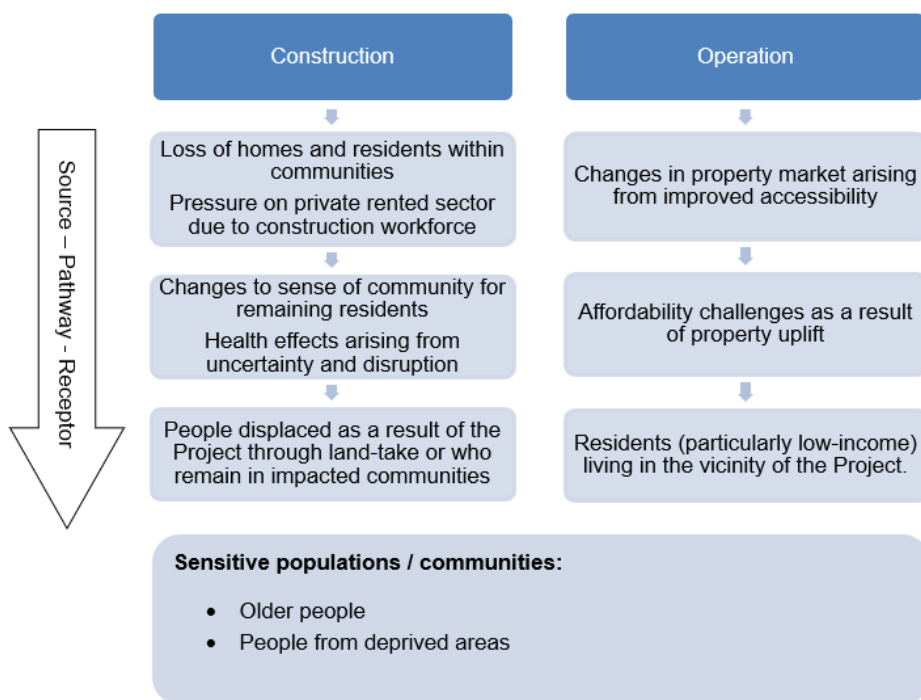
- 7.10.34 No disproportionate or differential impact has been identified on protected characteristics in relation to work and training during operation.

7.11 Housing and community services impacts

Overview

- 7.11.1 This section considers evidence related to the impacts of major infrastructure projects on homes and communities, including the displacement of people as a result of the acquisition of land or the loss of homes during the Project's construction, together with the regeneration benefits and disbenefits arising from the operation of the Project. The topic has links with community cohesion, social capital and how a community may function. The relationship between changes to housing and outcomes on health and equality is summarised in Plate 7.18.

Plate 7.18 Source-pathway-receptor model – housing and community services impacts



Evidence base

- 7.11.2 Housing is inextricably linked to health, as it provides physical shelter, a sense of security and comfort. The home and neighbourhood environment provide structural and social security, without which health can be negatively impacted.
- 7.11.3 Health outcomes from the compulsory relocation and displacement of people to new homes are poorly evidenced. Much of the current literature surrounding displacement and relocation predominately assesses the effects among the elderly or those of housing-led regeneration schemes.
- 7.11.4 Evidence suggests that when people move to new or improved homes in differing and better-quality neighbourhoods, mental health can improve, particularly if the move leads to populations being moved out of areas with high levels of deprivation (Robinson and Adams, 2008). Sources suggest that this can lead to increases in self-reported good or excellent health, lower levels of mental health conditions including depression and an improvement in wider determinants of health (Gibson *et al.*, 2011).
- 7.11.5 Conversely, other sources report that those with longstanding illnesses or who experience problems with their new home or neighbourhood report more

negative experiences (Egan *et al.*, 2015), and there is the potential for widening inequality in the populations left behind (McCartney *et al.*, 2017).

- 7.11.6 Evidence suggests that those under threat of eviction present poorer mental and physical health outcomes, which can include depression, anxiety and poorer self-reported health (Vasquez-Vera *et al.*, 2017).
- 7.11.7 There is evidence surrounding potential issues associated with regeneration activities such as gentrification, revisualisation and the destabilisation of existing community organisations (McCartney *et al.*, 2017). One large-scale UK example of a regeneration programme, involving a mixture of demolition and rehousing, took place in Glasgow from 2003 and 2016. The impacts on health for those rehoused have been mixed and limited to small improvements in self-reported mental health.
- 7.11.8 Social capital, defined as ‘the links, shared values and understandings in society that enable individuals and groups to trust each other and so work together’ (Organisation for Economic Co-operation and Development, 2007), is difficult to quantify, but relates to the existence of social networks, levels of social participation and people’s satisfaction with living in an area. Communities and their networks can create strong social capital, which can have a positive contribution to a range of factors that support wellbeing, including personal wellbeing and health.
- 7.11.9 Social cohesion has been identified as having a potential protective effect against depression (Urzua *et al.*, 2019). Studies to analyse the levels of, and associations, between social cohesion, mental wellbeing, and physical and mental health-related quality of life have identified a significant association between social cohesion and mental wellbeing (Williams *et al.*, 2020). Disadvantaged groups can have lower levels of social capital which can be affected by poor mobility or restrictions to access.

Relevant themes from local health and equality strategies

- 7.11.10 The policy and strategic context for health and equalities is set out in Appendix A. Local priorities of relevance to housing are summarised below:
- a. Reducing health inequalities – specified as a priority in a number of Health and Wellbeing Strategies. The London Health Inequalities Strategy (GLA, 2018) references the importance of developing and promoting London as a healthy place for all. The Kent Joint Health and Wellbeing Strategy (Kent County Council, undated) identifies tackling health inequalities as one of four priorities. Key areas of focus of the Essex Joint Health and Wellbeing Strategy include influencing conditions and behaviours linked to health inequalities (Essex County Council, 2022). Reducing health inequalities is an overarching theme of the Brentwood Health and Wellbeing Strategy 2020–2023 (Brentwood Borough Council, 2020).
 - b. Creating healthier environments – the role of the wider environment in improving health outcomes is highlighted across health and wellbeing strategies. The London Borough of Havering defines ‘the communities and places we live in’ as one of four pillars focused on in the Health and

Wellbeing Strategy. Domain Five of Thurrock Council's Joint Health and Wellbeing Strategy (Thurrock Council, 2022) relates to housing and the environment, including goals to ensure that regeneration and future developments will seek to improve physical and mental health.

- c. Achieving equality objectives – for example, Essex County Council's equality outcomes for the residents of Essex include that people enjoy good health and wellbeing (Essex County Council, 2022). The London Borough of Havering includes reducing inequalities in health and wellbeing across communities in Havering as an overarching cohesion priority (London Borough of Havering, 2018). Strategic equality priorities and objectives for Thurrock and Gravesham include access to services and access to all respectively.

Findings from consultation

- 7.11.11 Issues raised by stakeholders and members of the public with regard to housing during the construction phase have primarily focused on people's concerns and anxieties around the potential loss of property from demolition and the impacts of blight on housing causing a decrease in house prices and associated opportunities for financial compensation.
- 7.11.12 Stakeholders have raised concerns that there is currently not enough support to enable Local Authorities to adequately respond to and prevent homelessness and support those in housing need as rental prices have increased faster than Local Housing Allowance (LHA) rates can react to, the housing market is constrained, and the cost of living has increased substantially. Local Authorities are concerned that the Project's non-local construction workforce may exacerbate this. Concerns have included the cumulative impact associated with other large construction schemes that may follow similar construction trajectories to the Project, thereby exacerbating the demand for accommodation from construction workers more generally. Other issues relate to potential demand for local health services arising from both the needs of the construction workforce and workers' families.
- 7.11.13 Health stakeholders have also raised issues relating to implications of the Project on gypsy and traveller sites during construction.
- 7.11.14 For the operational phase, consultation has highlighted issues around increases in property prices; while this may be beneficial for some, there are also concerns that areas may become too expensive for lower-income groups who are subsequently displaced to other, less accessible areas. Stakeholders have discussed perceived issues surrounding the connection between house prices and mental health (where houses may lose value as a result of the location of the Project).

Findings from baseline review

- 7.11.15 Demographic analysis presented in Appendix C has identified where there are higher proportions of vulnerable groups within the population (for example older people and people in low-income households). Information includes the characteristics of household tenure in each of the respective local authorities to

the south and north of the River Thames; data shows that each local authority has a higher proportion of households which own their home outright, when compared to England as a whole. There is significant variation at ward level with, for example, 92.8% of households in Istead Rise, Gravesham owning their property, compared to 44.7% of households in Riverside ward. Similarly, to the north of the River Thames, 83.9% of households in Orsett are owned outright, compared to 44.9% in Tilbury Riverside and Thurrock Park.

- 7.11.16 Appendix C also identifies the proportion of people describing themselves as 'Gypsy or Irish Traveller' within the population, with Thurrock and Gravesham in particular having relatively high proportions of travellers within their area (0.2% for both local authority areas). There are a number of traveller sites located near the Project, including the Denton Caravan Site, off Dering Way on the outskirts of Gravesend, the Gammon Field Travellers Site on Long Lane, within Thurrock and several sites within proximity to the Project route within Havering.
- 7.11.17 The Worker Accommodation Report (Application Document 7.18) contains a comprehensive baseline relating to accommodation types and commuting catchment.

Housing and community services impacts during construction

- 7.11.18 Potential impacts during construction relate to the following areas, which are described and assessed separately:
- a. Impacts relating to the loss of private property and the change in social capital or sense of community associated with this loss
 - b. Impacts on gypsy and traveller communities as a result of construction of the Project
 - c. Impacts of the construction workforce on local accommodation
 - d. Impacts of the construction workforce on community services and facilities (such as education and healthcare)

Loss of private property and associated changes in sense of community

- 7.11.19 A total of 35 residential properties would be subject to demolition as a result of the Project – four of these are located to the south of the River Thames, with the remaining 31 properties in locations to the north of the river. The Gammon Field Travellers Site (to the north of the River Thames) would also be relocated as a result of the Project.
- 7.11.20 Properties to the south of the River Thames subject to demolition are located along Henhurst Road and Watling Street; properties are relatively few in number in relation to the wider community and do not form a particular cluster of dwellings. To the north of the River Thames, however, there are two clear clusters of impacted communities: ten properties subject to demolition are clustered along Ockendon Road immediately adjacent to the M25, and 14 properties located in and around the small community of Baker Street.

- 7.11.21 The Ockendon Road properties form part of an extended North Ockendon community, a rural area with several clusters of properties on both the west and east side of the M25 over which Ockendon Road passes. The part of the community to the west of the M25 would be displaced in its entirety as a result of the Project; the impact on North Ockendon as a whole is likely to be lower due to the dispersed nature of properties making up the village. Potential impacts are likely to largely relate to mental health and wellbeing effects for property owners and/or tenants (discussed further in Section 7.12).
- 7.11.22 Loss of properties at Baker Street would represent the loss of a larger proportion of the local community. Woolings Row and Woolings Close to the north of the existing A13 would be particularly impacted through the loss of six properties; the impact on the community here has been lessened through the Project design process as fewer properties are now required to be demolished. Nevertheless, other properties would also be impacted elsewhere within Baker Street (for example Whitfield Cottages to the west of the village, Grays Corner to the south and three properties to the east along Stanford Road).
- 7.11.23 Impacts relate both to residents being displaced and the loss of sense of community for those remaining. The Applicant has engaged with all landowners and occupiers with a view to acquiring their land interest by agreement. Freeholders, leaseholders and tenants can claim a number of types of compensation when their land or property is being compulsorily purchased, including for example the market value of the land, disturbance compensation and injurious affection compensation (where the construction or use of the Project has reduced the value of the remaining land).
- 7.11.24 Impacts on remaining residents who feel their property may be blighted as a result of the Project may also experience stress and anxiety. This type of impact is considered further in Section 7.11.

Impacts on gypsy and traveller communities

- 7.11.25 The Project impacts a number of gypsy and traveller communities along its route. The Gammon Field Travellers Site located to the west of Baker Street would be lost in its entirety as a result of the Project. The site currently has 21 pitches and provision for an onsite office. Land has been incorporated into the Project design to replace the travellers' site. This is directly to the west of the existing site and is equivalent to the existing site in terms of size, quality and access arrangements from Long Lane. Consultation and engagement with members of the community living at the Gammon Field Travellers Site has been ongoing throughout the course of the Project to raise awareness of the proposals, to gather information regarding the suitability of the replacement site and to inform design of the new site.
- 7.11.26 During the design process, engagement has taken place with both Thurrock Council and the residents of the travellers' site themselves. The latter engagement has used a combination of social media (through the creation of a private Facebook group) and one-to-one telephone calls; the site manager working on behalf of Thurrock Council has also liaised directly with the residents as required.
- 7.11.27 The requirement to provide a replacement travellers' site here is secured as Requirement 13 of the draft DCO (Application Document 3.1). The Design

Principles (Application Document 7.5) includes a design principle for the relocation of residents of the Gammon Field Travellers Site to a new purpose built site, with the replacement site developed to meet current building legislation and standards. The design of the new site would be guided by the Designing Gypsy and Traveller Sites – Good Practice Guide (Department for Communities and Local Government, 2008) and principles of designing out crime as recommended by Essex Police.

- 7.11.28 Other private travellers' sites directly affected by the Project include a site located at the end of Lower Crescent in Linford, Thurrock. The Project necessitates the temporary possession of rights over this site in relation to utilities works.
- 7.11.29 There are a number of other private travellers' sites located within or in close proximity to the Order Limits and which may experience indirect impacts during the construction phase as a result of environmental change (for example in relation to noise or changes in air quality). These include two sites within Gravesham (located to the south-east of Chalk, and home to a maximum of eight caravans; although the majority of both sites are outside the Order Limits, a 10m strip of each property's title fronting the main road is within the Order Limits to allow for the diversion of utilities) and a further five sites in Havering (various locations, two of which overlap or are within the Order Limits, notably a site to the south of M25 junction 9 (known as Tyas Stud Farm) and a site situated to the west of the M25 and Ockendon branch railway, known as Railway Sidings).
- 7.11.30 Impacts relating to these sites have been considered in Section 7.9 (Noise).

Impacts of the construction workforce on local accommodation, services and facilities

- 7.11.31 The predicted construction workforce for the Project would peak at 4,514 people in 2027, although it is noted that the peak number of workers may take place at different times in the respective areas to the north and south of the River Thames. An assessment of the potential impacts of accommodating the construction workforce has been undertaken, with findings set out in the Worker Accommodation Report (Application Document 7.18) and assessed for significance of impact in ES Chapter 13: Population and Human Health (Application Document 6.1). The assessment has taken into account existing socio-economic characteristics of the local areas to the north and south of the River Thames, existing levels of accommodation in the private rented and visitor accommodation sectors, pressures on local accommodation associated with future planned residential and commercial developments, and current employment dynamics (for example the proportions of workers who would be locally employed).
- 7.11.32 The Worker Accommodation Report (Application Document 7.18) provides analysis of the supply of properties across various accommodation categories against demand, supported by modelling to assist with assessing the Project's impacts at a local authority level. Conclusions from the analysis are that:
- a. There is unlikely to be a noticeable effect on the owner-occupied sector, given the scale of supply and annual turnover compared to demand, and the fact that any sales would be within the control of the occupier.

- b. The area within a 60-minute journey time from the Project's main construction compounds has a substantial supply of rental accommodation (this is based on 2011 data and is therefore likely to be a substantial underestimate of today's supply given housing growth in the interim period). Demand from construction workers for accommodation within the private rental sector is unlikely to be significant at the macro-scale. Sensitivity testing has been used to reduce the study area to a 30-minute journey time, and even at that scale the analysis demonstrates that demand would represent a very small proportion of supply and remains well within the level of frictional vacancy available.
- c. The Worker Accommodation Report (Application Document 7.18) includes sensitivity testing in relation to other projects; the assessment concludes that even in the extremely unlikely event that all infrastructure projects in the vicinity of the Project were to have a peak workforce at the same time, the market would be able to adjust and cope.

7.11.33 The Worker Accommodation Report (Application Document 7.18) demonstrates that there is sufficient capacity in the local accommodation market for temporary workers. Given concerns raised by local authorities about localised effects on some parts of the accommodation market, the Applicant is nonetheless proposing a number of pro-active measures to monitor and manage the uptake of accommodation. These are secured via the Framework Construction Travel Plan (FCTP) (Application Document 7.13) and are as follows:

- a. An Accommodation Helpdesk – operated by National Highways as a tool to assist workers with finding appropriate accommodation near the Project, and to support prospective providers of accommodation in understanding the Project and its workforce and managing tenancies safely and legally. It would help guide contractors and workers to accommodation that is suitable and available for their individual needs. It would also oversee collation of monthly data from the Contractors and produce accommodation monitoring reports which would in turn inform where workers could be directed/recommended via the helpdesk.
- b. Contractors would be required to create and maintain a live database that monitors the accommodation being used by the workforce in terms of the type of accommodation (on-site project accommodation, private rented, spare rooms/latent, owner-occupied or tourist/visitor) and the location of this accommodation (postcode). The contractors would mandate that its workforce, and those of its suppliers, regularly update their information related to the database for every worker. This database would be reported on monthly to members of the Workforce Accommodation Working Group (WAWG).
- c. Workforce Accommodation Working Group (WAWG) – this would include representatives from National Highways, its Contractors, and local

authorities. The WAWG would receive monthly workforce accommodation monitoring reports from the helpdesk, and regular updates and information from the Project including 'look-ahead' for potential workforce implications over a 12-month period led by National Highways and Delivery Partners. The findings of the workforce accommodation monitoring report would be considered alongside other relevant information gathered from other sources of monitoring secured by the Project via the FCTP, and SEE Strategy (Appended to s106 Agreement, Application Document 7.3) and information provided by authorities on market conditions and other developments in the local area.

- 7.11.34 Contractors would also be required to propose further reasonably practicable measures which encourage local workforce participation and incentivise workers to areas which have higher capacity. Measures would be presented to the WAWG, and National Highways would have due regard to comments raised at that group on the measures to be undertaken

Impacts of the construction workforce on community services and facilities

- 7.11.35 Stakeholders have also raised concerns around the potential impacts of the construction workforce on local services and facilities, notably on education and primary healthcare services. ES Chapter 13: Population and Human Health (Application Document 6.1) identifies a lack of capacity for primary healthcare in the study areas to the north and south of the River Thames. Key points from this analysis include:
- a. Data based on the former CCG boundaries from May 2022 shows that those CCGs within the study area to the north and south of the River Thames and through which the Project route passes (Thurrock, Kent and Medway, Basildon and Brentwood, and Mid Essex) have some of the highest numbers of patients per GP in the country. A crude average list size for a single GP is around 1,600 patients; figures for Thurrock and Kent and Medway CCGs show an average list size of 2,297 patients per GP and 2,292 patients per GP respectively (Nuffield Trust, 2022).
 - b. Areas through which the Project route passes include populations which have poor health outcomes and high levels of health need (as reflected in the baseline data set out in Appendix C to this HEqIA).
 - c. Although there are plans for some new provision within the study areas to the north and south of the River Thames (for example the Tilbury Integrated Medical Centre is planned to be operational from 2024), this is to resolve existing capacity and resourcing issues rather than to meet additional healthcare needs from new populations such as migrant construction workers.
 - d. It is assumed that 35% of the Project construction workforce would be existing residents in the local area and would therefore be already

registered with existing GP practices. However, when the construction workforce is at its peak (2027), this would still leave nearly 3,000 construction workers additional to the area who would require access to primary and acute healthcare services.

- 7.11.36** Taking the above into account, the Project has secured a commitment in the REAC (PH002) (Application Document 6.3, ES Appendix 2.2) whereby the Contractor will provide an appropriate range of medical and occupational healthcare services to meet the physical and mental health needs of the construction workforce. At this stage, it is noted that the range of services will be agreed with the Applicant, following engagement with Integrated Care Partnerships. With this mitigation in place, ES Chapter 13: Population and Human Health (Application Document 6.1) considers the impact on primary healthcare services to the south of the north of the River Thames to be **minor adverse and not significant**.

Health outcomes assessment – housing and community services (construction)

- 7.11.37 Communities identified as having a **high** sensitivity to impacts on housing and community services include people within directly impacted communities, older people, members of the travelling community and people from low-income households.
- 7.11.38 The assessment of likely health outcomes as a result of the Project during construction in relation to housing and community services is summarised in Table 7.41.

Table 7.41 Health outcomes – impacts on housing and community services (construction)

Impacts associated with the loss of private property and associated change in sense of community	
Community/ population affected	Assessment summary
People within impacted communities (Baker Street, North Ockendon) Older people People in low-income households	Impacts associated with property loss and the need for relocation as a result of the Project cause disturbance to people’s lives, which can in turn create stress and anxiety. The sensitivity of a population depends on factors including age (with older people often being more worried and finding it difficult to adapt) as well as younger groups (for example families with school-age children may face challenges if there is a need to move schools or if there is an increase in journey times). People within impacted communities which are more rural in nature (such as Baker Street and North Ockendon) may find relocation more difficult due to well established community networks and lack of choice regarding alternatives premises. Effects are likely to be compounded by issues of uncertainty regarding likelihood and timescale. Residents are able to claim various types of financial compensation if they are directly affected by property loss or blight.

Impacts associated with the loss of private property and associated change in sense of community	
Community/ population affected	Assessment summary
	<p>There is strong evidence around the importance of housing as a determinant of health, although the links between community cohesion and health are less well documented.</p> <p>The number of people that would experience change directly as a result of loss of private property is low, however the number of people who may experience an indirect change in the sense of community as a result of that property loss would be higher.</p> <p>The duration of impact would be permanent (loss of private property) and medium-term (six months to two years in duration) for changes in sense of community.</p> <p>Local health and wellbeing strategies reference the importance of the wider environment on both mental and physical health and wellbeing. Health impacts are likely to be primarily associated with mental wellbeing. The health outcome for affected communities/populations as a result of loss of private property and associated change in sense of community during construction is considered to be negative but not significant.</p>
Impacts on gypsy and traveller communities	
Community/ population affected	Assessment summary
Travellers	<p>The Gammon Field Travellers Site located to the west of Baker Street would be lost in its entirety as a result of the Project, with the requirement to provide a replacement site on adjacent land secured as part of the DCO. The traveller community may be more vulnerable to adverse health effects as a result of perceived lack of control or choice over relocation. Close consultation has taken place with the community and via Thurrock Council dedicated officers. Relocation is to an adjacent site, with a similar quality and quantity of provision.</p> <p>Impacts on other gypsy and traveller communities are discussed as part of the noise assessment within this document.</p> <p>There is strong evidence around the importance of housing as a determinant of health.</p> <p>The number of people that would be impacted as a result of changes to the travellers' site is low.</p> <p>The duration of impact would be medium-term (i.e. between six months and two years in duration), based on the time taken to relocate and adjust to the new site.</p> <p>Local health and wellbeing strategies reference the importance of the wider environment on both mental and physical health and wellbeing. Health impacts are likely to be primarily associated with mental wellbeing; extensive engagement has taken place to date to ensure members of the traveller community have been involved in the decision-making process and this will continue as designs are progressed and to reduce disruption to the community (Design Principle S11.12 (Application Document 7.5) requires the Contractor to consult with Thurrock Council and the residents of the Gammon</p>

Impacts associated with the loss of private property and associated change in sense of community	
Community/ population affected	Assessment summary
	Field Travellers Site throughout the design development and construction of the site). The health outcome for affected communities/populations during construction is considered to be neutral .
Impacts of construction workforce on local accommodation	
Community/ population affected	Assessment summary
<p>People in low-income households</p> <p>People living in close proximity to the main construction compounds</p>	<p>The Project is considered to have a negligible impact on local accommodation. The private rental sector is the accommodation category where level of impact is likely to be greatest, although even here the Worker Accommodation Report (Application Document 7.18) concludes that demand would represent a very small proportion of supply. The Project has set out a range of measures, including operation of an accommodation helpdesk and monitoring arrangements in order to overcome stakeholder concerns relating to supply/demand issues (these are secured as part of the FCTP (Application Document 7.13)).</p> <p>There is strong evidence around access to housing as a determinant of health.</p> <p>The number of people potentially impacted is high and geographically diverse (covering areas within a 60 minute drive from the main construction compounds).</p> <p>The duration of impact would be long-term (i.e. more than two years in duration) due to the length of the construction programme.</p> <p>Local health and wellbeing strategies reference the importance of the wider environment on both mental and physical health and wellbeing. Health impacts are likely to be primarily associated with mental wellbeing and concerns that people are unable to access appropriate housing within their local area, or that increased demand creates affordability issues through rental increases. People in low-income households are particularly vulnerable to changes in affordability and are more likely to have poorer quality of health. There is potential for adverse impacts in terms of widening health inequalities as a result of workforce impacts on accommodation. The health outcome for affected communities/populations during construction is considered to be neutral. A monitoring framework would be established (and is secured by S106 agreement within the DCO) to ensure that the proposed accommodation helpdesk is effective.</p>
Impacts of construction workforce on healthcare services and facilities	
Community/ population affected	Assessment summary
<p>People with pre-existing health conditions or disabilities</p> <p>Older people</p>	<p>There is strong evidence around access to community services and facilities (such as healthcare services) as a determinant of health.</p>

Impacts associated with the loss of private property and associated change in sense of community	
Community/ population affected	Assessment summary
People living in close proximity to the main construction compounds	<p>The number of people potentially impacted is high and geographically diverse (construction workers may reside in areas within a 60 minute drive from the main construction compounds).</p> <p>The duration of impact would be long-term (i.e. more than two years in duration) due to the length of the construction programme.</p> <p>Local health and wellbeing strategies reference the importance of the wider environment on both mental and physical health and wellbeing.</p> <p>Health impacts may relate to worsening health conditions as a result of residents being unable to access healthcare services in a timely way. Older people and people with pre-existing conditions may be particularly vulnerable. The Project incorporates a commitment for onsite medical and occupational healthcare services to be provided for members of the construction workforce (secured in the REAC (PH002) (Application Document 6.3, ES Appendix 2.2). The nature of services provided would be informed by engagement with Integrated Care Partnerships.</p> <p>The health outcome for affected communities/populations during construction is therefore considered to be neutral.</p>

Equality impact assessment – impacts on housing and community services and facilities (construction)

- 7.11.39 The local area within which both Baker Street and North Ockendon are located is characterised by older age groups (for example, at Lower Super Output Area level, the Baker Street area has a population over 65 years of age of 20.1%, compared to 12.7% for Thurrock as a whole (Census, 2011)). Older people are likely to be impacted more by the changes to the local community and social networks (both for those potentially relocated and for those remaining) than other population groups.
- 7.11.40 Younger families with school-age children may experience changes as a result of moving schools or changes in journey times to education facilities.
- 7.11.41 Travellers would be directly impacted by the Project, with the loss of their existing site at Gammonfields Way and relocation to an adjoining area. Ongoing consultation and engagement will continue to ensure appropriate provision of replacement facilities. A further travellers' site at Linford would be temporarily impacted during construction due to works associated with utilities diversions, however this is not considered to be significant in terms of duration or type of activity.

Housing and community services impacts during operation

- 7.11.42 Impacts during operation of the Project relate to changes in property values that may occur within the wider area, and improvements to accessibility. While there is evidence of property uplift as a result of infrastructure improvements and resultant creation of regeneration benefits, there is also potential to increase inequality rather than create greater cohesion through people on low incomes

becoming 'priced out' of an area and with in-migration from more affluent groups in society.

- 7.11.43 Improvements in accessibility to employment and services have been reported in Section 7.10. Wards identified within the local study area that may experience a particular improvement in terms of accessibility to employment (greater than 10%), comprise the following:
- a. Gravesham wards – Ebbsfleet, Gravesham Central, Chalk, Higham, Riverside, Riverview, Singlewell and Westcourt.
 - b. Medway wards – all wards may experience a large improvement of more than 10% in terms of accessibility to employment, with Strood North, Strood South and Strood Rural experiencing particularly beneficial improvements.
 - c. Thurrock wards – Chadwell St Mary, East Tilbury, Little Thurrock Rectory, Stanford East and Corringham Town, Stanford-le-Hope West, Tilbury Riverside and Thurrock Park, and Tilbury St Chads.
- 7.11.44 These areas in particular may see changes in property values as a result of accessibility improvements. A number of wards are known to be the focus for planned areas of housing and employment growth, such as proposals in Ebbsfleet and the development of opportunity areas in Gravesend. A significant volume of planned housing and employment growth in the future is also expected for Thurrock, although details are not currently available in relation to the scale and locations of growth areas.
- 7.11.45 A number of the wards identified above include higher proportions of social disadvantage, for example Tilbury Riverside and Thurrock Park, Tilbury St Chads, Westcourt and Riverside. Residents within these wards, while potentially benefiting from improvements in access to employment, may also be at risk from displacement as a result of property uplift.

Health outcomes assessment – impacts on housing and community services and facilities (operation)

- 7.11.46 Communities identified as having a **high** sensitivity to impacts on housing and community services and facilities during operation relate primarily to people from low-income households.
- 7.11.47 The assessment of likely health outcomes as a result of the Project during operation in relation to housing is summarised in Table 7.42.

Table 7.42 Health outcomes – impacts on housing and community services and facilities (operation)

Community/ population	Assessment summary
General population People in low-income households	The Project would be likely to result in improvements to accessibility which may in turn result in property market changes, particularly for those locations where accessibility improvements are greatest. There is significant planned regeneration and housing growth across local authorities in the wider region.

Community/ population	Assessment summary
	<p>Health effects are likely to be associated with improved security and mental wellbeing.</p> <p>Potential adverse effects may arise where people from lower-income households find themselves unable to compete in the property market and relocate further from jobs/services. There is a risk that health inequalities may widen as a result of increased affordability issues.</p> <p>There is strong evidence around the importance of housing as a determinant of health.</p> <p>The number of people potentially impacted is high and geographically diverse.</p> <p>The duration of impact would be long-term (i.e. more than two years in duration).</p> <p>Local health and wellbeing strategies reference the importance of the wider environment on both mental and physical health and wellbeing.</p> <p>The health outcome for affected communities/populations during operation is considered to be neutral.</p>

Equality impact assessment – impacts on housing and community services and facilities (operation)

- 7.11.48 People in lower-income households may be disproportionately affected during the Project’s operation as a result of property market changes such that they need to relocate to more affordable locations which may be further from jobs/services. Local authority intervention in the form of provision of appropriate choice, range and type of housing would help to mitigate these effects.

7.12 Mental health and wellbeing

Overview

- 7.12.1 Mental health and wellbeing is inextricably linked to physical health outcomes. The WHO, for example, states that ‘*there is no health without mental health*’ (WHO, 2005). Mental health problems are unevenly distributed across society, with disproportionate impacts on vulnerable populations, for example people living in poverty. In the same way that projects and plans can impact on the physical health of people and communities, so too can they impact on mental wellbeing. Mental health and wellbeing have been referred to at a number of points within this HEqIA and is intrinsically linked with other topic areas. The purpose of this section is to identify the resilience of communities to cope with effects associated with the Project.

Evidence base

- 7.12.2 The mental health of every individual is influenced by their social setting, such as having the ability to earn enough money and feeling part of a community (Faculty of Public Health, 2016). Community resilience can reduce the prevalence of mental health problems, increase the prevalence of good mental health and improve recovery and support for individuals (PHE, 2019).
- 7.12.3 A toolkit (Cooke *et al*, 2011) developed to assess and improve projects from the perspective of mental health and wellbeing identified four areas for

consideration: enhancing control, increasing resilience, facilitating participation and promoting social inclusion.

- 7.12.4 Stress and anxiety within a local population can be caused by a lack of awareness or information about a project and planned construction activities; people can feel they do not have a voice or lack control over how to raise issues and concerns they may have. Poverty can further diminish an individual's sense of control. People in the lowest 20% of household incomes have an almost threefold increased risk of mental illness; a similar pattern is seen with unemployment (McManus *et al.*, 2016). A further area relates to the control people feel they have over their physical environment, for example in relation to topics such as noise pollution or air quality. Poverty and inequality have been described as having both a material dimension (such as a lack of income or goods) as well as a non-material dimension (poor physical and mental health) (Sheffield Hallam University, 2014).
- 7.12.5 Factors affecting community resilience include levels of physical health (people in good physical health tend to be more resilient), behavioural factors (for example substance misuse), educational attainment, access to open space and a network of community facilities, housing tenure and employment/income factors.
- 7.12.6 Employment is a protective factor when considering mental health (Pickett *et al.*, 2006), and the financial and social implications associated with loss of employment, job insecurity and low pay can adversely impact mental health. At an individual level, there are many factors that can influence people's emotional wellbeing/self-worth, including access to employment. Low educational attainment is a risk factor for common mental health problems. Notably, participation in education has strong positive effects on mental wellbeing and can improve resilience in adolescence.
- 7.12.7 There is an association between poor mental health and levels of crime and disorder, although stress arising from fear of crime and safety issues can be greater than direct experiences (Cooper *et al.*, 2008).
- 7.12.8 Populations that may be particularly vulnerable to mental health issues include those that are homeless and those with poor living conditions; people with a disabling, long-term or chronic illness; people from ethnic minority groups; the long-term unemployed; and people with a history of drug and/or alcohol misuse. Mental wellbeing is of particular importance to children and young people, influencing the way in which they cope with important life events (PHE, 2019).
- 7.12.9 The construction workforce is a further vulnerable group in terms of mental health and wellbeing. Research undertaken by The Chartered Institute of Building in 2019 highlighted factors in the construction industry such as job insecurity, long hours, time away from families, lack of support from human resources and late payments as all contributing to a 'silent crisis' (The Chartered Institute of Building, 2020). The 'macho', male-dominated culture which has characterised the construction industry has led to construction workers adopting unhealthy coping mechanisms and not seeking help. Statistics highlighted by the Construction Industry Training Board in 2021 include that the risk of suicide among some site-based male construction workers was three times the national average. Greater understanding of these issues and progressing solutions is reflected in the development of guidance

such as Thriving at Work (Department for Work and Pensions & Department of Health & Social Care, 2017).

Relevant themes from local health and equality strategies

- 7.12.10 The policy and strategic context for health and equalities is set out in Appendix A. Local priorities of relevance to mental health and wellbeing are summarised below:
- a. Reducing health inequalities – specified as a priority in a number of Health and Wellbeing Strategies. The Kent Joint Health and Wellbeing Strategy (Kent County Council, undated) identifies tackling health inequalities as one of four priorities. Key areas of focus of the Essex Joint Health and Wellbeing Strategy include influencing conditions and behaviours linked to health inequalities (Essex County Council, 2022). Reducing health inequalities is an overarching theme of the Brentwood Health and Wellbeing Strategy 2020–2023 (Brentwood Borough Council, 2020).
 - b. Improved mental health and wellbeing – the Kent Joint Health and Wellbeing Strategy includes supporting people with mental health issues to ‘live well’ as a key outcome (Kent County Council, undated). Improving mental health and wellbeing are key themes or areas of focus set out within Health and Wellbeing Strategies for Essex, Medway, Brentwood and Thurrock. Key performance indicators set out within the London Health Inequalities Strategy (GLA, 2018) also relate to healthy places, with all Londoners benefiting from an environment and economy that promote good mental and physical health.
 - c. Achieving equality objectives – Essex County Council’s equality outcomes for the residents of Essex include that people can live in a high quality and sustainable environment and that they can live independently and exercise control over their lives (Essex County Council, 2022). The London Borough of Havering includes reducing inequalities in health and wellbeing across communities in Havering as an overarching cohesion priority (London Borough of Havering, 2018). Strategic equality priorities and objectives for Thurrock and Gravesham include access to services and access to all respectively.

Findings from consultation

- 7.12.11 Many of the issues raised by stakeholders and members of the public have focused on people’s concerns and anxieties relating to property issues, for example in relation to potential loss of, or blight to, properties, or concerns around perceived effects associated with environmental change, notably changes in air quality or noise levels (potentially leading to people not venturing outside and thereby exacerbating issues associated with loneliness/social isolation).

- 7.12.12 Construction activities have been highlighted as a cause of anxiety in terms of their duration and uncertainty about when/where they will occur. Specific areas of concern relate to the presence of the construction workforce in small community areas and the potential impacts this could have on perceived safety for more vulnerable populations such as older people. Other anxieties relate to how people might access health or other community services as a result of road closures or traffic congestion during the construction period.
- 7.12.13 Mental health and wellbeing issues raised by local residents and stakeholders are not restricted to particular geographies, but are common to communities along the length of the Project route.

Findings from baseline review

- 7.12.14 The baseline analysis set out in Appendix C contains data relating to factors which may affect community resilience, including a description of levels of physical health at ward level, educational and employment data, housing tenure data, identification of areas of deprivation (income and other deprivation domains), data relating to walkability/cyclability and access to open space. The data points to locations and populations where community resilience may be lower, for example in more deprived wards such as Westcourt, and Tilbury Riverside and Thurrock Park, and in areas where there may be greater concentrations of older people (such as Chalk) or people with poor physical health (such as Orsett).
- 7.12.15 Appendix C also contains data at local authority level relating to mental health and wellbeing. Self-reported wellbeing data shows that residents in Thurrock and Medway have higher anxiety scores than the national average; OHID data also shows that both local authorities record a higher prevalence of common mental health disorders among the general population (aged 16+) than is the case nationally. Suicide rates per 100,000 population are higher than is the case for England in Gravesham, Tonbridge and Malling, Dartford and Basildon.

Mental health and wellbeing impacts and mitigation during construction

- 7.12.16 Individual areas of impact have been discussed under many of the specific topic areas already within this HEqIA. The purpose of this section is to consider impacts on mental health and wellbeing holistically for both the construction and operational phases. Table 7.43 identifies potential impacts of the Project during construction in relation to each of the protective factors for mental health and wellbeing set out in the National Mental Health Development Unit (Cooke *et al*, 2011) toolkit.

Table 7.43 Impacts on mental health and wellbeing during construction

Protective factor	Potential impacts of the Project
Enhancing control – individual/lifestyle factors (e.g. ability to make healthy choices, opportunities for self-help); community/social factors (e.g. opportunities to influence decisions)	The Project is not likely to have an impact on an individual’s ability to make healthy choices or to access opportunities for self-help. The Project would provide opportunities for local residents to be involved during construction through awareness-raising and information provision. The CoCP (Application

Protective factor	Potential impacts of the Project
<p>in the community, consultation processes, local democracy); socio-economic factors (e.g. financial security, employment); and environmental factors (e.g. control over the physical environment)</p>	<p>Document 6.3, ES Appendix 2.2) describes the preparation and role of a Communications and Engagement Plan, which would summarise measures needed to keep the community informed of construction activities. These measures would help the community understand what is happening and give a direct link to the Contractor, enabling them to raise concerns they may have. The establishment of CLGs during the construction phase would help ensure that local concerns can be raised and information about construction activities disseminated locally. Local community leaders of the CLGs will be invited to attend the relevant Traffic Management Forum, as described in the oTMPFC (Application Document 7.14).</p> <p>A number of existing businesses would be impacted by the acquisition of land as a result of the Project, but these are few in number and the number of employees directly affected would be low. Equally, there are likely to be local businesses which see an increase in their customer base as a result of the presence of construction workers (notably in relation to service businesses such as cafés/food outlets).</p> <p>Importantly, the Project would provide an opportunity to promote the local development of skills and training programmes and for local employment to be facilitated through the promotion of procurement activities with local companies.</p> <p>A final area relates to the control people feel they have over their physical environment. Loss of control may relate to permanent land acquisition and the loss of private properties as a result of the Project (described in more detail in Section 7.11). The Applicant has engaged with all landowners and occupiers with a view to acquiring their land interest by agreement. However, findings from consultation have highlighted the stress and anxiety experienced by people as a result of uncertainties about the Project route and the direct and indirect impacts this may have.</p> <p>Other areas for consideration from a mental health and wellbeing perspective are environmental factors such as visual impacts, air quality and noise impacts. The assessed impacts associated with changes to these attributes have been set out within relevant sections of this HEqIA (Section 7.4, Section 7.8 and Section 7.9, respectively). Negative health outcomes have been identified in relation to the effects of noise disturbance during construction on sensitive populations in particular, arising from both construction activities and from the presence of construction traffic. Construction phase mitigation has been identified and is included in the REAC (Application Document 6.3, ES Appendix 2.2).</p>

Protective factor	Potential impacts of the Project
	<p>Concerns highlighted during consultation have included anxiety around air quality impacts from construction activities (such as dust emissions). Construction phase good practice measures for air quality are also set out in the REAC (Application Document 6.3, ES Appendix 2.2), including measures to reduce the air quality effects associated with construction dust as well as emissions from non-road mobile machinery and construction vehicles.</p> <p>Mitigation for adverse visual impacts is set out in ES Chapter 7: Landscape and Visual (Application Document 6.1) and includes measures to screen construction compounds from nearby residential areas.</p> <p>How this information would be communicated to local residents, together with how residents would be able to communicate concerns to the Contractor, would form part of the Engagement and Communications Plan.</p>
<p>Increasing resilience – Individual/lifestyle (e.g. emotional wellbeing/self-worth, cognitive and social functioning, spirituality, learning and development, arts and creativity); community/social (e.g. trust and safety, social networks and social support); and socio-economic/environmental (e.g. shared public spaces, a robust local economy, ease of access to services).</p>	<p>Factors affecting emotional wellbeing and self-worth include access to employment and educational attainment. Areas close to the Project route exhibit high levels of social and economic deprivation, as set out in Appendix C. These communities are likely to be less resilient as a whole to change in their local environment; however, they may also form part of the targeted skills and legacy strategy being developed for the Project. As such, individuals may benefit from skills and training programmes, employment and resultant improved feelings of self-worth. Activities in this area may help to reduce inequalities, which is a priority area for all host authorities.</p> <p>The presence of construction workers may have an impact on people's feelings of personal safety and security. Residents living close to construction compounds may feel particularly concerned about the influx of construction workers to the area and potential impacts relating to the perception of anti-social behaviour/perceptions of community safety. The main construction works for the Project are planned to last up to six years, with the construction workforce predicted to reach a peak of 4,514 workers in April 2027. Up to 18 construction compounds are planned at locations along the Project route. The Project's Skills, Employment and Education Strategy (which will be secured via S106 agreement) however affirms an intention for 45% of the workforce to be people who already live within a 20 mile radius of the Project. The CoCP (Application Document 6.3, ES Appendix 2.2) states that Contractors shall sign up to and adhere to the Considerate Constructors Scheme.</p> <p>The Project is not likely to have an impact on people's cognitive/social functioning, spirituality or opportunity for arts and creativity. Participation in key life activities and</p>

Protective factor	Potential impacts of the Project
	<p>the continuation of social networks are not anticipated to be affected during construction. Impacts of the Project on the provision of housing, health or social care services for local residents have been identified (as set out in Section 7.11. The Applicant has committed to providing an accommodation helpdesk and other monitoring measures, secured in the DCO by the FCTP (Application Document 7.13) to ensure any potential impacts are effectively monitored. Similarly, the Project has made provision through the REAC (PH002) (Application Document 6.3, ES Appendix 2.2) to provide onsite primary and occupational healthcare services for construction workers, thus removing pressures on community services and facilities.</p> <p>People without access to private vehicles may experience an adverse impact in relation to accessing areas of open space and nature during the construction period, due to fewer alternatives being available to them within a reasonable journey time. Even small changes to journey times and travel patterns that may arise from temporary closures and diversions of PRoWs as a result of temporary possession of land or the need to accommodate construction activities can adversely impact sensitive groups such as children, older people and people with certain disabilities.</p>
<p>Facilitating participation – individual/lifestyle (e.g. having a valued role, sense of belonging, feeling involved); community/social (e.g. activities that bring people together, opportunities to get involved, processes/delivery that supports social contact); socio-economic/environmental (e.g. economic, transport networks and access, access to goods and services, cost).</p>	<p>The Project is a source of discussion/debate among local residents and may therefore have indirectly created or enhanced social interaction and a sense of 'being involved'. The CLGs proposed in the CoCP (Application Document 6.3, ES Appendix 2.2) would provide an opportunity for community members to come together and discuss construction activities.</p> <p>Impacts on local transport networks during construction identified in the Transport Assessment (Application Document 7.9) have included increases in journey time for bus services running on routes affected by road closures or traffic management measures. Lack of access may have a corresponding negative effect on mental health and wellbeing, particularly for more vulnerable groups who are more reliant on public transport such as older age groups.</p> <p>Access to sports and community facilities would be maintained during construction (with the exception of impacts on the SVGC, which would be affected by permanent land acquisition, although it is noted that this is a private facility which is now closed).</p>
<p>Promoting social inclusion – individual/lifestyle (e.g. trust others, feel safe at home, positive identities); community/social (e.g. practical support, low levels of crime, conflict resolution); socio-economic/environmental (e.g.</p>	<p>The Project is not likely to have an impact on people's ability to trust others, feel safe at home or engender positive identities. There are not anticipated to be any changes to public transport waiting or interchange areas that may affect user perceptions of personal security. Although no material impacts/changes are anticipated as a result of the Project, certain sensitive groups such as</p>

Protective factor	Potential impacts of the Project
challenging stigma of mental illness, discrimination and tackling inequalities).	<p>older people may perceive there to be an issue as a result of the presence of construction workers/activity in an area. The Communications and Engagement Plan and dissemination of information to local communities during the construction period can play a valuable role here in reassuring people about activities that are ongoing; the helpline would provide people with an opportunity to raise any concerns they may have. The CoCP (Application Document 6.3, ES Appendix 2.2) states that Contractors shall sign up to and adhere to the Considerate Constructors Scheme.</p> <p>The Project is not likely to have any impact on challenging the stigma of mental illness or challenging discrimination.</p> <p>The Project may help to tackle inequalities through the development of targeted skills and training programmes and through the creation of local employment. Legacy activities include the development of a significant education programme, aligned to the needs of local education providers and delivering STEM workshops and activities in schools to educate and inspire future careers in construction, including future skills needs and carbon/sustainability education. These are focused on schools throughout the study area, with a focus particularly on deprived areas and local need.</p>

7.12.17 The Applicant understands the impacts that a six year construction programme may have on people’s lives and the concerns it may present. The above table has identified a range of interventions and mitigation measures designed to reduce impacts and potential disruption to local communities. Through engagement with stakeholders, National Highways has committed to the creation of two Community Funds – one each covering affected communities to the north and south of the River Thames – which would provide a further mechanism by which some of the unforeseen impacts of the Project could be addressed. This would be secured via S106 agreement (Application Document 7.3).

7.12.18 Grants would be available for eligible community-led initiatives across four key themes identified based on the impacts/opportunities arising from the development, one of which is mental health and wellbeing. Eligible wards include those in close proximity to construction activities and funding would be available annually across the six years of construction and one year post construction.

Mental health and wellbeing of the construction workforce

7.12.19 The health and wellbeing of the construction workforce – both physical and mental – is a priority for the Project. The construction workforce would comprise a significant proportion of local people (45% of the workforce may already live within a 20 mile radius of the Project) as well as people moving to the area on a temporary or permanent basis. As noted in the evidence review set out earlier in this section, the construction workforce is a vulnerable population in itself, with mental health and wellbeing issues in the construction industry more widely referred to as ‘a silent crisis’.

- 7.12.20 The Project has adopted a health, safety and wellbeing first approach, focusing on the proactive and preventative management of mental health throughout all phases of construction, with access to provisions for early intervention and resilience through a holistic health and wellbeing programme based on health needs assessment. Project requirements and expectations align with National Highway’s best practice guidance documents (Home Safe and Well Strategy (Highways England, 2019c), Mental Health Common Intent (Highways England, 2020f) and Raising the Bar (Highways England, 2014)) as well as the Thriving at Work mental health core standards (Farmer and Stevenson, 2017).
- 7.12.21 The Project has developed a scope of works for occupational health and mental wellbeing and Contractors would be required to develop and implement a wellbeing programme aligned to Project expectations. This would include the provision of site-based health and wellbeing services as set out in the REAC (PH002) (Application Document 6.3, ES Appendix 2.2). All Contractors would need to demonstrate their commitment to mental health through registration and membership of a scheme such as Mates in Mind or Building Mental Health.

Health outcomes assessment – mental health and wellbeing (construction)

- 7.12.22 Communities located in close proximity to construction routes or construction activities are likely to be particularly sensitive to impacts on their mental health and wellbeing.
- 7.12.23 Populations within and outside of these communities identified as having a **high** sensitivity to mental health and wellbeing impacts include people in low-income households and the long-term unemployed, people in poor living conditions, people with a long-term or chronic illness or disability, people from ethnic minority groups, people with a history of drug and/or alcohol misuse, lone-parent families and people with existing mental health conditions or needs.
- 7.12.24 The construction workforce is a further population identified as being of **high** sensitivity.
- 7.12.25 The assessment of likely health outcomes as a result of the Project during construction in relation to mental health and wellbeing is summarised in Table 7.44.

Table 7.44 Health outcomes – mental health and wellbeing (construction)

Community/ population	Assessment summary
Communities located in close proximity to construction routes and activities Populations within and outside of these communities with a high sensitivity	The potential impacts of the Project during construction in relation to mental health and wellbeing have been assessed for each of the protective factors as set out in the National Mental Health Development Unit (Cooke, <i>et al</i> , 2011) toolkit. This has identified potential issues in addition to the various mitigation measures and other interventions that the Project would put in place to reduce impacts on communities and people’s lives. The assessment has identified that there are likely to be both positive and negative impacts relating to mental health and wellbeing in particular: <ul style="list-style-type: none"> • Positive effects may result from the construction phase including job creation, the introduction of skills and training programmes and a comprehensive education programme. These activities may particularly

Community/ population	Assessment summary
to mental health and wellbeing impacts	<p>benefit some of the most sensitive populations (for example people in low-income households and the long-term unemployed) and thereby help to reduce inequalities.</p> <ul style="list-style-type: none"> Negative effects may be experienced particularly in relation to people's sense of control and resilience. While effects would be experienced differentially across communities, due to a range of individual factors, the baseline data suggests that less-resilient groups are present in higher proportions within certain wards along the Project route. Negative effects are likely to be compounded by issues of uncertainty regarding likelihood and timescale. Measures designed to reduce negative effects include the comprehensive community liaison arrangements set out in the CoCP (Application Document 6.3, ES Appendix 2.2). <p>The number of people potentially exposed to both positive and negative effects is likely to be high and geographically diverse.</p> <p>There is strong evidence setting out the links between wider environmental factors and mental health and wellbeing.</p> <p>Local health and wellbeing strategies reference the importance of the wider environment on both mental and physical health and wellbeing.</p> <p>The duration of impact is considered to relate to the entire construction period and is therefore described as long-term (more than two years duration). Individuals may not, however, experience negative effects throughout this duration – for example anxieties around uncertainty may diminish once construction is underway or when local activities are complete.</p> <p>Health outcomes are therefore described as both positive and negative. Both positive and negative health outcomes are likely to be significant.</p>
Construction workforce	<p>The construction industry is characterised by factors including job insecurity, long hours, time away from families, lack of support and often a male-dominated culture, all of which can contribute to poor mental health for construction workers. The Project has adopted a range of measures to ensure that mental health and wellbeing is at the centre of contractor activities.</p> <p>There is strong evidence setting out the links between poor mental health and wellbeing and construction workers.</p> <p>The number of people potentially exposed to adverse health effects is likely to be high (i.e. to relate to the whole construction workforce).</p> <p>Local health and wellbeing strategies reference the importance of mental and physical health and wellbeing.</p> <p>The duration of impact relates to the entire construction period and is therefore described as long-term (more than two years duration).</p> <p>Through proactive and preventative management of mental health throughout all phases of construction, the health outcome for the construction workforce is described as positive.</p>

Equality impact assessment – mental health and wellbeing (construction)

7.12.26 No disproportionate or differential impact has been identified on protected characteristics in relation to mental health and wellbeing during construction.

Mental health and wellbeing impacts and mitigation during operation

7.12.27 Impacts on mental health and wellbeing during the operational phase are summarised in Table 7.45 in relation to each of the protective factors for mental health and wellbeing set out in the National Mental Health Development Unit toolkit (Cooke *et al*, 2011).

Table 7.45 Impacts on mental health and wellbeing during operation

Protective factor	Potential impacts of the Project
<p>Enhancing control – individual/lifestyle factors (e.g. ability to make healthy choices, opportunities for self-help); community/social factors (e.g. opportunities to influence decisions in the community, consultation processes, local democracy); socio-economic factors (e.g. financial security, employment); and environmental factors (e.g. control over the physical environment).</p>	<p>The Project is not likely to have an impact on an individual's ability to access opportunities for self-help or in relation to local decision-making/democracy during operation.</p> <p>The Project may have beneficial outcomes in terms of providing opportunities to make healthy lifestyle choices, notably in relation to active travel and physical activity through the range of environmental improvements associated with new and enhanced WCH opportunities.</p> <p>Legacy benefits of the Project may arise from the development of skills and training programmes and creation of local employment. These may have long-term beneficial impacts on the mental health and wellbeing of members of the local population.</p> <p>Local residents may continue to feel loss of control over their physical environment in terms of effects such as visual impacts, air quality and noise. The assessed impacts associated with changes to each of these attributes have been set out within relevant sections of this HEqIA (Section 7.4, Section 7.8 and Section 7.9, respectively).</p> <p>Negative health outcomes have been identified in relation to the effects of noise disturbance on sensitive populations in particular. Mitigation relating to noise disturbance is set out in ES Chapter 12: Noise and Vibration (Application Document 6.1). Embedded mitigation includes the design of much of the Project in cutting or false-cutting. Other measures include locations for acoustic barriers and the use of low noise surfacing.</p> <p>Although no exceedances of air quality standards have been identified, local residents are likely to continue to feel concerned about air quality in their local area.</p> <p>Mitigation for adverse visual impacts is set out in ES Chapter 7: Landscape and Visual (Application Document 6.1) and includes measures to screen residential areas from the Project.</p>
<p>Increasing resilience – Individual/lifestyle (e.g. emotional wellbeing/self-worth, cognitive and social functioning, spirituality, learning and development, arts and</p>	<p>Factors affecting emotional wellbeing and self-worth include access to employment and educational attainment. As noted in relation to construction, communities that are less resilient to change in their local environment may form part of the targeted skills and</p>

Protective factor	Potential impacts of the Project
<p>creativity); community/social (e.g. trust and safety, social networks and social support); and socio-economic/environmental (e.g. shared public spaces, a robust local economy, ease of access to services).</p>	<p>legacy strategy being developed for the Project, which may create a beneficial effect and help to reduce inequalities (in line with health and wellbeing priorities and strategies of local authorities across the study area). Similarly, the benefits of the Project support the future economic development and transformation of the Lower Thames area, which is set out in a number of local strategic and economic plans. Promoting access to employment and wider economic benefits may help enhance the resilience of communities and again assist with reducing inequality.</p> <p>The Project is not likely to have an impact on people's cognitive/social functioning, spirituality or opportunity for arts and creativity. Participation in key life activities and the continuation of social networks are not anticipated to be affected during operation.</p> <p>Uplift in property prices may occur as a result of the Project, with the effects on more vulnerable populations identified earlier in this HEqIA (Section 3.2).</p>
<p>Facilitating participation – individual/lifestyle (e.g. having a valued role, sense of belonging, feeling involved); community/social (e.g. activities that bring people together, opportunities to get involved, processes/delivery that supports social contact); socio-economic/environmental (e.g. economic, transport networks and access, access to goods and services, cost).</p>	<p>The Project is not likely to have an impact on facilitating participation as a result of feeling involved or bringing people together.</p> <p>The additional connectivity offered by the Project would improve the ability for local traffic to cross the River Thames for leisure and non-business purposes. The Project would also enable local traffic to make more use of the less congested Dartford Crossing by improving journey time reliability. In so doing, the Project would assist in facilitating participation, although it is acknowledged that this would not be experienced equally across socio-economic groups.</p>
<p>Promoting social inclusion – individual/lifestyle (e.g. trust others, feel safe at home, positive identities); community/social (e.g. practical support, low levels of crime, conflict resolution); socio-economic/environmental (e.g. challenging stigma of mental illness, discrimination and tackling inequalities).</p>	<p>The Project is not likely to have an impact on people's ability to trust others, feel safe at home or engender positive identities. The Project is not expected to have any material impact on security/crime during operation. There are not anticipated to be any changes to public transport waiting or interchange areas that may affect user perceptions of personal security.</p> <p>The Project is not likely to have any impact on challenging the stigma of mental illness or challenging discrimination.</p> <p>The Project may help to tackle inequalities through the development of targeted skills and training programmes and through the creation of local employment.</p>

Suicide prevention

7.12.28 National Highways' Suicide Prevention Strategy (Highways England, 2017b) states that '*suicide is never inevitable, it is always preventable*' and includes the vision that '*no-one attempts to take their life on our roads*'. The current preliminary design of the Project has considered aspects of suicide prevention in relation to design of structures and other features. The future detailed design

of the Project would incorporate recommendations from the National Highways Suicide Prevention Toolkit.

Health outcomes assessment – mental health and wellbeing (operation)

- 7.12.29 Communities located in close proximity to the Project route are likely to be particularly sensitive to impacts on their mental health and wellbeing.
- 7.12.30 Populations within and outside of these communities identified as having a **high** sensitivity to mental health and wellbeing impacts include people in low-income households and the long-term unemployed, people in poor living conditions, people with a long-term or chronic illness or disability, people from ethnic minority groups, people with a history of drug and/or alcohol misuse, lone parent families and people with existing mental health conditions/needs.
- 7.12.31 The assessment of likely health outcomes as a result of the Project during operation in relation to mental health and wellbeing is summarised in Table 7.46.

Table 7.46 Health outcomes – mental health and wellbeing (operation)

Community/population	Assessment summary
<p>Communities in close proximity the Project route</p> <p>Populations within and outside of these communities with a high sensitivity to mental health and wellbeing impacts</p>	<p>The potential impacts of the Project during operation in relation to mental health and wellbeing have been assessed for each of the protective factors as set out in the National Mental Health Development Unit (Cooke, <i>et al</i>, 2011) toolkit. This has identified potential issues in addition to the various mitigation measures and other interventions that the Project would put in place to reduce impacts on communities and people’s lives. The assessment has identified that there are likely to be both positive and negative impacts relating to mental health and wellbeing in particular:</p> <p>Negative effects may continue in relation to people’s sense of control over their physical environment (although for the majority of people, these effects are likely to lessen over time as the Project becomes embedded in people’s lives and mitigation measures, for example landscaping and planting, mature). While effects would be experienced differentially across a community, due to a range of individual factors, the baseline data suggests that less-resilient groups are present in higher proportions within certain wards along the Project route. Detailed design measures would incorporate recommendations from the National Highways Suicide Prevention Toolkit; it is noted that a number of local authorities through which the Project route passes have higher than average suicide rates.</p> <p>Equally, there are potential positive effects including legacy effects associated with job creation and the introduction of skills and training programmes. These may particularly benefit some of the most sensitive populations (for example, people in low-income households and the long-term unemployed). Further benefits relate to the raft of improvements to WCH routes near the Project which would encourage physical activity and enable access to open spaces and nature, both of which are proven to have positive effects in relation to mental health and wellbeing.</p> <p>The number of people potentially exposed to both positive and negative effects is likely to be high and geographically diverse.</p>

Community/population	Assessment summary
	<p>There is strong evidence setting out the links between wider environmental factors and mental health and wellbeing.</p> <p>Local health and wellbeing strategies reference the importance of the wider environment on both mental and physical health and wellbeing.</p> <p>The duration of impact is likely to be permanent, although individuals may experience a lessening of negative effects over time as the Project matures.</p> <p>Health outcomes are therefore described as both positive and negative. Both positive and negative health outcomes are likely to be significant.</p>

Equality impact assessment – mental health and wellbeing (operation)

- 7.12.32 No disproportionate or differential impact has been identified on protected characteristics in relation to mental health and wellbeing during operation.

7.13 Pollution and flood-risk

Overview

- 7.13.1 Land/water contamination and flood-risk can pose risks to public health and the environment. Risk assessments aim to establish possible pollutant pathways and identify all necessary mitigation measures, as appropriate, to eliminate or reduce the risk to an acceptable level. Light pollution is considered separately in Section 7.14.

Evidence base

- 7.13.2 Localised contamination could occur during the construction phase from accidental spills and road runoff, changes in groundwater levels, or the pollution of nearby water bodies. During operation, contamination could arise as a result of drainage contaminated with vehicle emission particulates, grit/salt spreading residues and as a result of fuel/chemical spillages following major traffic accidents. Soil and water pollution can lead to public health impacts directly when people come into contact with water and soil through recreation activities and indirectly through the use of water for gardens or other green spaces.

Relevant themes from local health and equality strategies

- 7.13.3 The policy and strategic context for health and equalities is set out in Appendix A. Local priorities of relevance to sources and pathways of potential pollution are summarised below:
- a. Reducing health inequalities – specified as a priority in a number of Health and Wellbeing Strategies. The Kent Joint Health and Wellbeing Strategy (Kent County Council, undated) identifies tackling health inequalities as one of four priorities. Key areas of focus of the Essex Joint Health and Wellbeing Strategy include influencing conditions and behaviours linked to health inequalities (Essex County Council, 2022). Reducing health

inequalities is an overarching theme of the Brentwood Health and Wellbeing Strategy 2020–2023 (Brentwood Borough Council, 2020).

- b. Creating healthier environments – the role of the wider environment in improving health outcomes is highlighted across health and wellbeing strategies. The London Borough of Havering defines ‘the communities and places we live in’ as one of four pillars focused on in the Health and Wellbeing Strategy. Domain Five of the Thurrock Joint Health and Wellbeing Strategy (Thurrock Council, 2022) relates to providing environments where everyone feels safe and healthy, with goals to ensure that regeneration and future developments seek to improve physical and mental health. Theme Four of Medway’s Joint Health and Wellbeing Strategy 2018–2023 (Medway Council, 2018) is ‘Improving Mental and Physical Health and Wellbeing’, recognising that mental and physical health and wellbeing are affected by many wider issues in our day-to-day environment. Key performance indicators set out within the London Health Inequalities Strategy (GLA, 2018) also relate to healthy places, with all Londoners benefiting from an environment and economy that promote good mental and physical health.

Findings from baseline review

- 7.13.4 ES Chapter 10: Geology and Soils (Application Document 6.1) provides baseline information relating to contamination sources of various risk categories to the south and north of the River Thames.
- 7.13.5 Phase 2 ground investigation works targeted the main route alignment and areas where proposed intrusive works are planned as part of the construction phase. Soil samples, soil leachates and groundwater samples were analysed for a suite of contaminants. The results showed that widespread contamination is not present across the Project. Where exceedances are present, they are localised and generally reflect Made Ground. The results of the Generic Quantitative Risk Assessment (GQRA) have been assessed in terms of identified credible sources of contamination to refine the Conceptual Site Model (CSM) for the Project. This resulted in the identification of six high risk and 33 medium risk sites, with the remaining credible sources being rated as low risk.
- 7.13.6 Ten medium-risk credible contamination sources were identified to the south of the River Thames, with the remaining 23 medium-risk and six high-risk credible contamination sources identified to the north of the River Thames. Five of the six high-risk sources that were identified are landfill sites, including Goshems Farm, East Tilbury (two sources), Low Street and Low Street Brickworks. High and medium risk sites are presented on ES Figure 10.5: Conceptual Site Model: Credible Contamination Sources (Application Document 6.2).
- 7.13.7 ES Chapter 10: Geology and Soils (Application Document 6.1) notes that the majority of the route is classified as the lowest risk for radon (*‘less than 1% of homes are estimated to be at or above the Action Level’*). Some of the route is classified as an intermediate probability area (*‘1 to 3% of homes are estimated*

to be at or above the Action Level). The risk from radon gas is considered to be low.

- 7.13.8 Five potentially significant sources of Unexploded Ordnance (UXO) hazard have been identified along the Project route and these areas have been assigned a moderate UXO hazard level. Further information is presented in Appendix 10.10: UXO Desk Study and Risk Assessment (Application Document 6.3).
- 7.13.9 ES Chapter 14: Road Drainage and the Water Environment (Application Document 6.1) sets out baseline data in relation to areas including existing surface water, groundwater quality and flood-risk. Fluvial and tidal flood risk zones and flood defence assets are illustrated in ES Appendix 14.6: Flood Risk Assessment (Application Document 6.3).
- 7.13.10 Future baseline is also of particular relevance in relation to flood-risk. The UK Government forecasts that it is likely that Flood Zones 2 and 3 would increase in area coverage in the future baseline scenario, therefore introducing flood risk to areas previously unaffected. However, this may be counteracted by implementation of some of the flood risk management policies set out in the Thames Estuary 2100 Plan (Environment Agency, 2012), including, for example, a new Thames barrage.

Findings from consultation

- 7.13.11 Issues raised during consultation with stakeholders and members of the public on the topic of pollution (excluding air pollution) and flood-risk have included:
- General comments relating to flooding, including about areas through which the Project route passes being prone to flooding and the impact the Project may have on this accordingly
 - The need to ensure flood risk has been adequately assessed in relation to the tunnel in particular
 - Concerns about risks of contamination during construction as a result of disturbance of areas such as former landfill sites, with associated pollution impacts

Pollution and flood-risk – impacts and mitigation during construction

- 7.13.12 A range of mitigation measures and construction good practice have been identified in ES Chapter 10: Geology and Soils (Application Document 6.1) in relation to soil and groundwater contamination, and in ES Chapter 14: Road Drainage and the Water Environment (Application Document 6.1) in relation to flood-risk. Baseline conditions have helped inform the siting of construction compounds, the construction approach and the development of the Project design to avoid areas of contamination concern and to reduce flood-risk.
- 7.13.13 Good practice mitigation measures of relevance to health and wellbeing include procedures for the management of UXO prior to construction, including preparation of emergency response procedures; and the need to carry out a gas assessment (investigation and monitoring) in the area proposed for

construction workforce accommodation and welfare facilities to determine the need for appropriate gas protection measures. The North Portal is located within an area historically used for landfill and as a result gas monitoring would be undertaken for the launch and use of the TBM to detect changes in the gas regime as a safeguard to protect construction workers.

- 7.13.14 ES Chapter 14: Road Drainage and the Water Environment identifies that the potential for an impact on the integrity of the River Thames flood defences due to ground movement during tunnelling would be reduced by adopting good tunnelling practice, such as continuous working, erecting linings immediately after excavation, grouting, management of the tunnel face pressures and the measurement of excavated material quantities.
- 7.13.15 Mitigation measures are described in further detail in the CoCP and the REAC within it (Application Document 6.3, ES Appendix 2.2).
- 7.13.16 With the implementation of appropriate design and mitigation measures, no significant effects have been identified in relation to soil, groundwater or surface water contamination. Potential effects relevant to human health include the following:
- a. Exposure to potentially contaminated fugitive dust – this could be generated by excavation/earth movements during the construction of the Project. Depending on weather conditions, this could be blown into nearby residential and commercial properties, as well as into public open spaces. It is noted that much of the Project is through a rural setting, and therefore the risk of exposure to fugitive dust would vary across the Project. Exposure to soils via inhalation of wind-blown dust from earthworks activities could present health risks to residents living close to the Project and users of public open space. This potential risk is likely to be short-term and restricted to specific areas when significant earthwork movements are taking place. Relevant mitigation measures (e.g. dust suppression and covering vehicles to avoid dust being spread during transport) have been identified to manage such impacts and are detailed in the CoCP (Application Document 6.3, ES Appendix 2.2). Taking mitigation into account, impacts on human health are **not considered to be significant**.
 - b. Disturbance to unidentified UXO – during construction, there is a risk of disturbance of UXO which may be present across the Project route. The main risk is to construction workers and nearby residents. This potential risk is likely to be short-term and limited to periods of major earthwork movements and piling activities. With the implementation of the UXO mitigation detailed in the CoCP (Application Document 6.3, ES Appendix 2.2), the magnitude of impact on human health receptors (residents, users of public open space) is considered to be negligible.
- 7.13.17 Potential impacts considered in relation to surface water and groundwater contamination include those from accidental spillages of oils, chemicals, cement and fuels from the movement of construction traffic and the storage of chemicals; from construction activities such as topsoil stripping, excavations

and general earthworks activities causing contaminants to become mobilised and in turn migrate into the surface water environment via runoff; from mobilisation of pre-existing contamination due to the construction of a temporary haul road at East Tilbury landfill; or from the construction of the North Portal causing contaminated water/leachate from the East Tilbury landfill site to be drawn into the wider groundwater environment.

- 7.13.18 In the event of an accidental spillage or a pollution incident caused by extreme weather conditions, protocols would be in place to allow containment and rapid clean up, and the predicted significance of effect is slight adverse.
- 7.13.19 A detailed Flood Risk Assessment (FRA) (Application Document 6.3, ES Appendix 14.6) has been prepared that has assessed flood risk to the Project, and any impacts of the Project, during its construction and operation. Construction compounds at the A226 Gravesend Road and Milton would be located in the defended floodplain of the River Thames. All other aspects of construction, including proposed utilities works, would be located in Flood Zone 1, at low risk of flooding from rivers and the sea.
- 7.13.20 North of the River Thames, the Project would require construction work to be carried out in Flood Zones 2 and 3, areas at medium to high risk of flooding from rivers and/or the sea. Existing flood defences would be relied upon for protection against tidal inundation during the construction phase. These defences would be monitored during construction to detect any effects on their condition or integrity, with remedial actions put in place if any impact were to be identified. The Contractor would prepare site-specific flood risk assessments and emergency response measures for construction activities in the floodplain and to demonstrate that site compounds within Flood Zone 3 are set up and temporary works comply with the requirements of the National Planning Policy Framework (NPPF).

Health outcomes assessment – pollution and flood-risk (construction)

- 7.13.21 Communities/populations identified as being of high sensitivity with regard to sources and pathways of potential pollution during construction include the following:
- a. Local residents and land users near significant earthwork movements
 - b. Construction workers
- 7.13.22 The assessment of likely health outcomes as a result of the Project, in relation to pathways of potential pollution during construction, is summarised in Table 7.47.

Table 7.47 Health outcome – pollution and flood-risk (construction)

Community/ population	Assessment summary
Local residents and land users near significant earthwork movements	ES Chapter 10: Geology and Soils (Application Document 6.1) identifies a negligible magnitude of impact in relation to pollution arising from potentially contaminated fugitive dust, resulting in a slight adverse significance of effect for residents in close proximity and a negligible significance of effect for users of public open space.

Community/ population	Assessment summary
	<p>The number of people potentially exposed to such pollution would be very low and would depend on factors including weather conditions. A range of mitigation measures and good practice construction methods have been identified.</p> <p>There is strong evidence setting out the links between contamination, pollution and flood-risk and human health.</p> <p>The duration of impact would depend on the nature of the construction activity and would likely be short to medium-term at different locations depending on the activity being undertaken.</p> <p>Local health and wellbeing strategies reference the importance of the wider environment on both mental and physical health and wellbeing.</p> <p>Health impacts are likely to be primarily associated with mental wellbeing and the perception of a potential issue. The health outcome is considered to be neutral.</p>
Construction workers	<p>Construction workers are at risk of exposure to potential contaminated land/water during earthworks and other construction activities, including exposure to potentially contaminated soils, pollution arising from potentially contaminated fugitive dust, deep trench excavation and exposure to UXOs.</p> <p>ES Chapter 10: Geology and Soils (Application Document 6.1) identifies a negligible magnitude of impact in relation to these areas, resulting in a slight adverse significance of effect. A range of mitigation measures and good practice construction methods have been identified.</p> <p>ES Chapter 14: Road Drainage and the Water Environment (Application Document 6.1) states that where construction work is being carried out in Flood Zones 2 and 3, site-specific flood risk assessments and emergency response measures would be developed.</p> <p>The number of people potentially exposed would be very low (the construction workforce is spread along the Project route).</p> <p>There is strong evidence setting out the links between contamination, pollution and flood risk and human health.</p> <p>The duration of impact would depend on the nature of the construction activity and location in which it was being undertaken and would likely be short to medium-term as appropriate.</p> <p>Local health and wellbeing strategies reference the importance of the wider environment on both mental and physical health and wellbeing.</p> <p>The health outcome is considered to be neutral.</p>

Equality impact assessment – pollution and flood-risk (construction)

- 7.13.23 No disproportionate or differential impact has been identified on protected characteristics in relation to sources and pathways of pollution during construction.

Pollution and flood-risk – impacts and mitigation during operation

- 7.13.24 A range of mitigation measures and good practice has been identified in ES Chapter 10: Geology and Soils (Application Document 6.1) in relation to soil

and groundwater contamination, and in ES Chapter 14: Road Drainage and the Water Environment (Application Document 6.1).

- 7.13.25 Potential impacts in terms of land and water contamination during operation have been identified in ES Chapter 10: Geology and Soils (Application Document 6.1). For each of the following areas of potential impact, the chapter reports that, with the implementation of appropriate design and mitigation measures, impacts would be **slight adverse** and **not significant**. Potential impacts are as follows:
- a. Exposure to contaminated soils – the risk of exposure to contaminated soils by human health receptors is low as the road itself would create a barrier to underlying soils. In addition, mitigation and measures implemented to manage the risk of pre-existing contamination during the construction phase would further reduce the risk to human health receptors during the operation phase. The risk of exposure to contaminated soils by road users is low, but if road users need to stop and be on the roadside (e.g. as a result of breakdown or accident), slight exposure could occur although the magnitude of impact associated with this is considered to be negligible.
 - b. Migration of ground gases – landfill sites are present along the Project route and especially in the area of the North Portal. High concentrations of ground gases could be present in such areas, posing a risk to end users of the tunnel and portal areas. Taking account of the ground gas prevention measures included within the design of confined spaces and the North tunnel portal as detailed in ES Chapter 10: Geology and Soils (Application Document 6.1), the magnitude of impact is considered to be negligible.
- 7.13.26 In relation to surface water or groundwater contamination, potential impacts considered include those from road spray and pollution incidents associated with the road usage/traffic accidents. ES Chapter 14: Road Drainage and the Water Environment (Application Document 6.1) notes that, with appropriate design and mitigation measures in place, **no significant effects** have been identified.
- 7.13.27 In relation to surface water and groundwater quality during operation, pollution risks to groundwater bodies that would receive discharges of highway drainage, via soakaways, have been assessed. ES Chapter 14: Road Drainage and the Water Environment (Application 6.1) identifies **no significant effects** during operation.
- 7.13.28 Pollution risks to surface water bodies that would receive discharges of highway drainage from the Project have been assessed. Subject to the detailed design of treatment measures, discharges of highway runoff are predicted to result in a **negligible** magnitude of impact on the water quality attributes of receiving watercourses, and overall, the effect is considered to be **not significant**. Routine runoff and the risk of pollution being caused by an accidental spillage incident have been appraised, and the detailed results are presented in ES Appendix 14.3: Operational Surface Water Drainage Pollution Risk Assessment (Application Document 6.3).

- 7.13.29 The accidental spillage risk assessment concludes that the calculated percentages of a spillage causing a serious pollution incident are below the set thresholds, except for two drainage catchments: one discharging to the Mardyke West Tributary and one to an unnamed tributary of the Mardyke, both having medium value for water quality. When risk reduction factors are taken into account, to reflect the proposed drainage design, the two catchments achieve compliance with the assessment criteria and the magnitude of impact is therefore assigned as no change. The risk of pollution associated with an accident is therefore assessed as having a permanent **neutral** overall effect, which is **not significant**.
- 7.13.30 A detailed FRA has been prepared, which is presented in ES Appendix 14.6 (Application Document 6.3), and which has appraised risks of flooding to the Project, as well as any effects the Project could cause. This includes a surface water drainage strategy that details how rainfall runoff generated from the highway would be managed to prevent surface water flooding of the Project during its operational phase. The strategy also describes how impacts on the watercourses and groundwater bodies receiving discharges of highway drainage would be mitigated to ensure no increases in flood risk elsewhere.
- 7.13.31 To the south of the River Thames, ES Chapter 14: Road Drainage and the Water Environment (Application Document 6.1) notes that isolated areas along the existing M2/A2 corridor have a history of surface water flooding. Junction reconfiguration and new drainage provisions provided by the Project would eliminate existing surface water flood risk in these localised areas. The operational drainage design would ensure no increases in rainfall runoff rates or volumes, with rainfall encouraged to infiltrate to ground.
- 7.13.32 To the north of the River Thames, between the North Portal and Chadwell St Mary, some parts of the Project would be in Flood Zone 3, at residual risk of tidal flooding should defences, including walls and sluice gates, along the Thames overtop or breach. Mitigation measures described in Section 14.5 of ES Chapter 14: Road Drainage and the Water Environment (Application Document 6.1), and further detailed in Part 6 of ES Appendix 14.6: Flood Risk Assessment (Application Document 6.3), would make the Project safe over its lifetime without increasing flood risk elsewhere.
- 7.13.33 Along the Ockendon link, the Project would cross three main rivers and their floodplains (the Mardyke, Golden Bridge Sewer and Orsett Fen Sewer). The Project would contribute to reducing baseline flood risk in the Mardyke catchment through the proposed wetland restoration in Orsett Fen, which would hold back and slow down the flow of water, thereby reducing flood risk on a catchment scale. In the Mardyke West catchment, the Project would contribute to a beneficial impact by reducing baseline flood risk in the Mardyke catchment through the proposed reduction in discharge rates from existing M25 drainage catchments. A reduction of existing rates by a minimum of 50%, in line with Essex County Council policy (Essex County Council, 2012), would be achieved, which is assessed as a moderate beneficial magnitude of impact.

Health outcomes assessment – pollution and flood-risk (operation)

- 7.13.34 Communities/populations identified as being of **high** sensitivity with regard to pollution and flood-risk during operation include the following:

- a. Road users
- b. Maintenance workers

7.13.35 The assessment of likely health outcomes as a result of the Project during operation in relation to pollution and flood-risk is summarised in Table 7.48.

Table 7.48 Health outcome – pollution and flood-risk (operation)

Community/ population	Assessment summary
Road users Maintenance workers	<p>ES Chapter 10: Geology and Soils (Application Document 6.1) identifies a negligible magnitude of impact in relation to pollution arising from exposure to contaminated soils and the migration of ground gases at landfill sites along the Project route and at the North Portal. Exposure to contaminants could occur through various pathways, including through dermal contact, ingestion, and inhalation. However, once the Project has been constructed, the risk of exposure to contaminated soils by human health receptors is low as the road itself would create a barrier to underlying soils. In addition, mitigation and measures implemented to manage the risk of pre-existing contamination during the construction phase would further reduce the risk to human health receptors during the operation phase. Owing to this, it is unlikely that a pathway to residential receptors and users of open space would exist.</p> <p>ES Chapter 14: Road Drainage and the Water Environment (Application Document 6.1) does not identify any significant effects in relation to surface water and groundwater quality during the Project's operation. The Project would contribute to reducing baseline flood risk in the Mardyke catchment through the proposed wetland restoration in Orsett Fen.</p> <p>There is strong evidence setting out the links between contamination, pollution and flood-risk and human health.</p> <p>The number of people potentially exposed to pollution would be very low. A range of mitigation measures have been identified setting out how accidental spillages, for example, would be dealt with.</p> <p>The duration of potential impacts would be short-term and relate to individual pollution or flooding events should they occur.</p> <p>Local health and wellbeing strategies reference the importance of the wider environment on both mental and physical health and wellbeing.</p> <p>It is unlikely that a pathway to communities/populations would exist and as a result no health impacts have been identified. The health outcome is therefore considered to be neutral.</p>

Equality impact assessment – pollution and flood-risk (operation)

7.13.36 No disproportionate or differential impact has been identified on protected characteristics in relation to sources and pathways of potential pollution during operation.

7.14 Light pollution

Overview

- 7.14.1 Light pollution can adversely affect human health by causing sleep disturbance and interfering with everyday life/enjoyment, especially in areas with intrinsically dark landscapes.

Evidence base

- 7.14.2 Evidence suggests that exposure to light at night can lead to associated problems, including psychological stresses, increased cancer rates, disruption in sleeping patterns and negative impacts on immune systems. Disruption of the circadian clock can be linked to several medical disorders in humans, including depression, insomnia and cardiovascular disease (Chepesiuk, 2009). Glare from poorly shielded outdoor lighting is also harmful to health, because it decreases vision by reducing contrast; this can particularly affect the elderly.
- 7.14.3 The assessment of health and equalities impacts relating to light pollution has been informed by the Landscape and Visual Impact Assessment presented in ES Chapter 7: Landscape and Visual (Application Document 6.1) and ES Appendix 7.9: Schedule of Landscape Effects (Application Document 6.3).

Relevant themes from local health and equality strategies

- 7.14.4 The policy and strategic context for health and equalities is set out in Appendix A. Local priorities of relevance to the assessment of impacts of light pollution on human health and equalities are summarised below:
- a. Reducing health inequalities – specified as a priority in a number of Health and Wellbeing Strategies. The Kent Joint Health and Wellbeing Strategy (Kent County Council, undated) identifies tackling health inequalities as one of four priorities. Key areas of focus of the Essex Joint Health and Wellbeing Strategy include influencing conditions and behaviours linked to health inequalities (Essex County Council, 2022). Reducing health inequalities is an overarching theme of the Brentwood Health and Wellbeing Strategy 2020–2023 (Brentwood Borough Council, 2020).
 - b. Creating healthier environments – the role of the wider environment in improving health outcomes is highlighted across health and wellbeing strategies. The London Borough of Havering defines ‘the communities and places we live in’ as one of four pillars focused on in the Health and Wellbeing Strategy. Domain Five of the Thurrock Joint Health and Wellbeing Strategy (Thurrock Council, 2022) relates to providing environments where everyone feels safe and healthy, with goals to ensure that regeneration and future developments seek to improve physical and mental health. Theme Four of Medway’s Joint Health and Wellbeing Strategy 2018–2023 (Medway Council, 2018) is ‘Improving Mental and Physical Health and Wellbeing’, recognising that mental and physical health and wellbeing are affected by many wider issues in our day-to-day environment. Key performance indicators set out within the London Health

Inequalities Strategy (GLA, 2018) also relate to healthy places, with all Londoners benefiting from an environment and economy that promote good mental and physical health.

Findings from baseline review

7.14.5 Local Landscape Character Areas (LLCAs) have been identified to inform the landscape and visual assessment undertaken as part of the ES (ES Chapter 7: Landscape and Visual (Application Document 6.1)). Environmental Lighting Zones have been identified within each LLCAs, using professional judgement and based on site surveys undertaken as part of the baseline analysis. Environmental Lighting Zones specify whether an area is urban, suburban, rural, natural or protected and accord a lighting environment category to each. For example, a rural Environmental Lighting Zone may equate to 'low district brightness' (such as a village or relatively dark outer suburban location), whereas an urban Environmental Lighting Zone may equate to 'high district brightness' (such as a town or city centre with high levels of night-time activity). Environmental Lighting Zones defined by reference to LLCAs (together with an estimated percentage split for the area of each LLCA within each zone) are set out in Annex B of Appendix 7.5 (Local Landscape Character Baseline) of the ES (Application Document 6.3). A summary is provided in Table 7.49.

Table 7.49 Summary of environmental lighting zones by LLCA

LLCA	Environmental lighting zone baseline summary
West Kent Downs (sub area Cobham)	Predominantly Zone E1 (intrinsically dark).
West Kent Downs (sub area Shorne)	Predominantly Zone E1 (intrinsically dark).
Higham Arable Farmlands (sub area Gadshill)	Predominantly Zone E2 (intrinsically dark).
Shorne Wooded Slopes	Predominantly Zones E1 (intrinsically dark) and E2 (low district brightness).
Higham Arable Farmland (Thong)	Predominantly Zone E2 (low district brightness).
Istead Arable Farmlands	Predominantly Zone E2 (low district brightness).
Gravesend Southern Fringe	Predominantly Zone E2 (low district brightness).
Higham Arable Farmlands (sub area Chalk)	Predominantly Zone E2 (low district brightness).
Shorne and Higham Marshes	Classified as Zone E2 (low district brightness).
Mucking Marshes	Predominantly Zone E2 (low district brightness).
Tilbury Marshes	Predominantly Zone E2 (low district brightness).
Chadwell Escarpment Urban Fringe	Predominantly Zone E2 (low district brightness).
Dartford and Gravesend Fringe	Environmental light zones E2 and E3 (low and medium district brightness respectively).

LLCA	Environmental lighting zone baseline summary
West Tilbury Urban Fringe	Predominantly Zone E2 (low district brightness).
Linford/Buckingham Hill Urban Fringe	Predominantly Zone E2 (low district brightness).
White Croft/Orsett Heath Urban Fringe	Predominantly Zone E2 (low district brightness).
Orsett Lowland Farmland	Predominantly Zone E2 (low district brightness).
Thurrock Reclaimed Fen (sub area Mardyke)	Predominantly Zone E2 (low district brightness), with areas of intrinsic darkness in the core low-lying area.
Thurrock Reclaimed Fen (sub area Thames Chase)	Predominantly Zone E2 (low district brightness).
Belhus Lowland Quarry Farmland	Typically Zone E2 (low district brightness), with areas of Zone E3 (medium district brightness) at the residential urban areas.
Brentwood Wooded Hills	Predominantly Zone E2 (low district brightness).

Findings from consultation

- 7.14.6 Light pollution during both construction and operational phases was raised as an issue by members of the public during the various consultations which have been held. Concerns included lighting from construction compounds and how this might be mitigated in addition to concerns around directional highways lighting and lighting from vehicle headlights during the operational phase. Comments were raised by residents at various locations along the Project, including Grays, Orsett and Linford.

Light pollution impacts and mitigation during construction

- 7.14.7 Construction compounds would typically be lit when required in line with working hours defined in the CoCP (Application Document 6.3, ES Appendix 2.2). Lighting would also be required to facilitate certain construction works across the Project. Lighting shall be designed, positioned and directed to prevent or minimise light disturbance to nearby residents through measures such as inward-facing lighting equipment, minimising the height of lighting equipment and screening the worksite where possible. Good design would be incorporated into the layout and appearance of night-time lighting at compounds and during night-time construction activities to avoid light glare, light spill and light pollution.
- 7.14.8 Bunds are proposed to be created around the perimeter of the worksite at the South Portal. The bunds are intended to mitigate perceptions of noise but also create a barrier for site lighting for nearby residential areas.
- 7.14.9 For all LLCAs, with the exception of the Thurrock Reclaimed Fen (sub area Mardyke LLCA), the Landscape and Visual Impact Assessment (ES Chapter 7: Landscape and Visual (Application Document 6.1)) identifies that there would be limited perceived change in the night-time environment as a result of construction activity and construction light sources. For the Thurrock Reclaimed Fen (sub area Mardyke) LLCA, a perceived change in the night-time environment has been identified, due to the fact that this is a largely dark area.

Health outcomes assessment – light pollution (construction)

- 7.14.10 Communities/populations identified as being of **high** sensitivity regarding potential impacts from light pollution during the construction phase comprise the following:
- a. Residential populations located close to construction compounds/activities
 - b. Residential populations living in rural areas
 - c. Older people
 - d. Children and young people
 - e. People with sensory disabilities
 - f. People with mental health conditions
- 7.14.11 The assessment of likely health outcomes as a result of the Project during construction in relation to light pollution is summarised in Table 7.50.

Table 7.50 Health outcome – light pollution (construction)

Community/ population	Assessment summary
General population Sensitive populations/ communities	<p>ES Chapter 7: Landscape and Visual (Application Document 6.1) predicts limited perceived changes in the night-time environment across all LLCAs with the exception of one LLCA within Thurrock (the Mardyke area) as a result of the introduction of new light sources associated with construction activities. The magnitude of change is therefore considered to be low (Thurrock Reclaimed Fen (sub area Mardyke) LLCA) or negligible (all other LLCAs).</p> <p>The number of people that would experience changes in light pollution as a result of construction of the Project is considered to be low – limited to populations living in close proximity to construction compounds and ULHs or in rural areas within close proximity of the Project route.</p> <p>The duration of impact would be long-term (i.e. more than two years in duration).</p> <p>Local health and wellbeing strategies reference the importance of the wider environment on both mental and physical health and wellbeing.</p> <p>A range of good practice mitigation measures have been identified to prevent or minimise light disturbance to residents.</p> <p>The health outcome for both general and sensitive populations/communities as a result of changes in light pollution during construction is considered to be neutral.</p>

Equality impact assessment – light pollution (construction)

- 7.14.12 No disproportionate or differential impact has been identified on protected characteristics in relation to light pollution during construction.

Light pollution impacts and mitigation during operation

- 7.14.13 Light sources during operation include the introduction of new and replacement lighting columns as well as light from vehicle headlights.

- 7.14.14 ES Chapter 2: Project Description (Application Document 6.1) describes which sections of the Project road would be lit, notably:
- a. All highway areas from the South Portal southwards to the southern end of the Project at the M2
 - b. From the North Portal 200m northwards
 - c. The A13/A1089/A122 Lower Thames Crossing junction
 - d. All areas of the M25 involved in the Project
 - e. All of the All Purpose Trunk Roads (APTRs) tying into existing APTR sections with existing lighting.
- 7.14.15 New and replacement lighting (LED luminaires) would be on reduced height columns with reduced light spill and glow. New and replacement lighting may appear brighter than the baseline situation due to the white light.
- 7.14.16 Areas where there are perceived qualitative changes in the night-time environment have been identified during operation and these are described in more detail in ES Appendix 7.9: Schedule of Landscape Effects (Application Document 6.3). General points to note from the assessment include the following:
- a. There are areas where the introduction of new lighting sources, together with vehicle headlights arising from operational use of the Project, may be in an area which is typically unlit and of low district brightness (examples include the LLCAs of Higham Arable Farmlands, the White Croft/Orsett Heath Urban Fringe, and the Belhus Lowland Quarry Farmland LLCA (where the Project route is not screened in cutting or by false cutting slopes)). This results in perceived changes to the night-time environment.
 - b. Additional light sources would be present on green bridges and elevated viaduct structures, for example the Tilbury Viaduct. The assessment identifies that the establishment of new planting features on a number of these structures would limit increased perceptions of lighting by the design year (for example the establishment of hedgerows on Hoford Road green bridge).
 - c. Locations where there is likely to be increased perceptions of replacement LED lighting at opening year due to the removal of existing roadside planting, for example within Thurrock Reclaimed Fen (sub area Mardyke) LLCA, Orsett Lowland Farmland LLCA and the White Croft/Orsett Heath Urban Fringe LLCA. The establishment of mitigation planting in these areas would to some extent help reduce the effects of new lighting on the night-time environment between the opening and design years.
 - d. Locations where the perception of light sources would reduce over time following the establishment of new planting features. Examples include the

Higham Arable Farmlands LLCA following the establishment of new woodland planting at the M2/A2; the Lower Chadwell Escarpment Urban Fringe LLCA following establishment of new woodland features around Station Road; the establishment of hedgerows on the green bridge and adjacent woodland edge features in Linford/Buckingham Hill Urban Fringe LLCA; the establishment of new woodland features within and to the periphery of the A13/A1089/A122 Lower Thames Crossing junction in the White Croft/Orsett Heath Urban Fringe LLCA; the establishment of new woodland features in the Thurrock Reclaimed Fen (sub area Mardyke) LLCA; and new woodland features in the Belhus Lowland Quarry Lowland LLCA (although it is noted that initially here the presence of existing and new LED lighting sources along the M25 corridor and Project slip roads would be increased due to the removal of road-bounding vegetation).

- e. A beneficial change in the night-time environment has been identified for the Brentwood Wooded Hills LLCA due to the change in street lighting (LED luminaires).

7.14.17 Operational phase embedded mitigation includes a number of measures of relevance to lighting. These are set out within the Design Principles (Application Document 7.5) and include:

- a. A Project-wide measure to preserve the rural and historic nocturnal character of the landscape along the Project route. Design principles LST.02 and LST.03 state that only junctions and approaches to the portals shall be lit, that lighting will be minimised wherever it is reasonably practicable and safe to do so, and that lighting required at 'off-line' operational areas (such as the portals) shall be controllable, directional and as low-level as is practicable.
- b. Area-specific measures include Design Principle S11.03 (which relates to the White Croft/Orsett Heath Urban Fringe and Orsett Lowland Farmland LLCAs) whereby '*the design of the lighting on the elevated slip roads shall seek to minimise light pollution, subject to relevant standards*'.

Health outcomes assessment – light pollution (operation)

7.14.18 Communities/populations identified as being of **high** sensitivity with regard to light pollution during the construction and operational phases comprise the following:

- a. Residential populations living in rural areas
- b. Older people
- c. Children and young people
- d. People with sensory disabilities

e. People with mental health conditions

7.14.19 The assessment of likely health outcomes as a result of the Project during operation in relation to light pollution is summarised in Table 7.51.

Table 7.51 Health outcome – light pollution (operation)

Community/ population	Assessment summary
General population Sensitive populations/ communities	<p>ES Chapter 7: Landscape and Visual (Application Document 6.1) identifies that there would be a number of locations where a perceived change in the night-time environment would occur as a result of the removal of existing roadside vegetation; the presence of vehicle lights along the Project route where not screened in cutting or by false cutting slopes; or the introduction of new lighting at certain locations (for example junctions).</p> <p>The number of people that would experience changes in light pollution as a result of the Project is considered to be low – limited to populations in rural areas within close proximity of the Project route. Outside of these areas, changes to the night-time environment would be perceived in the context of existing lighting sources.</p> <p>The duration of impact would be long-term (i.e. more than two years in duration). Where a perceived change has been identified, this effect typically reduces between opening and design years due to the establishment of mitigation planting (an exception may be elevated structures such as the Tilbury Viaduct).</p> <p>Local health and wellbeing strategies reference the importance of the wider environment on both mental and physical health and wellbeing.</p> <p>Embedded mitigation includes a Project-wide design principle relating to minimising lighting along the Project route. Other measures relate to the reduced height of lighting columns and the use of LED luminaires with reduced light spill.</p> <p>Health impacts are likely to be primarily associated with mental wellbeing and the perception of a potential issue rather than a significant increase in light pollution itself.</p> <p>The health outcome for both general and sensitive populations/communities as a result of changes in light pollution during operation is considered to be neutral.</p>

Equality impact assessment – light pollution (operation)

7.14.20 No disproportionate or differential impact has been identified on protected characteristics in relation to light pollution during operation.

7.15 Climate change

Overview

7.15.1 Aspects of climate change which relate to health include how the Project responds to changes in temperature and extreme weather events.

Evidence base

7.15.2 Protecting and improving health, reducing health inequalities and the mitigation of climate change have a shared agenda, with many of the measures taken to

tackle one also responding to the other. Those most vulnerable to the health impacts of climate change are generally those already deprived by their level of income, quality of home and their health. More extreme weather could increase incidences of death and serious illness, particularly for at-risk age groups.

- 7.15.3 The Marmot Review (Marmot *et al.*, 2010) states that local areas should prioritise policies and interventions that ‘*reduce both health inequalities and mitigate climate change*’ because of the likelihood that people with the poorest health would be hit hardest by the impacts of climate change. People from deprived communities (for example low-income households), as well as people with disabilities and older people may be most vulnerable to the consequences of climate change, potentially lacking the resources or ability to be able to respond.
- 7.15.4 Similarly, The Marmot Review 10 Years On (Marmot *et al.*, 2020) notes that the twin problems of social inequalities and climate change have to be tackled at the same time and that addressing each is vital to creating a society that is just, and sustainable for current and future generations. The report notes that harm to health from climate change is increasing and will affect more deprived communities the most in future, thereby worsening inequalities.
- 7.15.5 Climate change consequences could affect the health of the population at a local level, particularly with an increase in flooding, summer temperatures, levels of solar radiation and frequency of extreme weather events. These could, for example, increase the numbers of fatalities, injuries, infectious diseases, heat-related deaths, skin cancer cases and cataracts.

Relevant themes from local health and equality strategies

- 7.15.6 In May 2019 the UK Parliament declared an environment and climate emergency. Four of the local authorities through which the Project route passes also declared climate emergencies on various dates in 2019 (Gravesend, Medway, Thurrock and Havering), as did the nearby authorities of Dartford and Southend-on-Sea.
- 7.15.7 The policy and strategic context for health and equalities is set out in Appendix A. Local priorities of relevance to the assessment of impacts of climate change on human health and equalities are summarised below:
- a. Reference to wider factors affecting both short and long-term physical and mental health, for example climate change resilience and air quality (Kent County Council, undated).
 - b. Reducing health inequalities – specified as a priority in a number of Health and Wellbeing Strategies. The Kent Joint Health and Wellbeing Strategy (Kent County Council, undated) identifies tackling health inequalities as one of four priorities. Key areas of focus of the Essex Joint Health and Wellbeing Strategy include influencing conditions and behaviours linked to health inequalities (Essex County Council, 2022). Reducing health inequalities is an overarching theme of the Brentwood Health and Wellbeing Strategy 2020–2023 (Brentwood Borough Council, 2020).

- c. Creating healthier environments – the role of the wider environment in improving health outcomes is highlighted across health and wellbeing strategies. The London Borough of Havering defines ‘the communities and places we live in’ as one of four pillars focused on in the Health and Wellbeing Strategy. Domain Five of the Thurrock Joint Health and Wellbeing Strategy (Thurrock Council, 2022) relates to providing environments where everyone feels safe and healthy, with goals to ensure that regeneration and future developments seek to improve physical and mental health (implementing the Council’s Climate Change Strategy forms part of Thurrock Council’s approach to achieving this goal and ‘levelling up the playing field’). Theme Four of Medway’s Joint Health and Wellbeing Strategy 2018–2023 (Medway Council, 2018) is ‘Improving Mental and Physical Health and Wellbeing’, recognising that mental and physical health and wellbeing are affected by many wider issues in our day-to-day environment. Key performance indicators set out within the London Health Inequalities Strategy (GLA, 2018) also relate to healthy places, with all Londoners benefiting from an environment and economy that promote good mental and physical health.

Findings from baseline review

- 7.15.8 ES Chapter 15: Climate (Application Document 6.1) sets out both the Project’s impact on greenhouse gas (GHG) emissions in addition to assessing the vulnerability of the Project to climate change during construction and operation. Baseline data is provided for both of these areas, summarised as follows:
- a. Greenhouse gas emissions – baseline data shows how GHG emissions associated with the use of the existing road network would change between the baseline year and future baseline years without the Project (considering the opening year of 2030, design year of 2045 and the 60-year appraisal period). In the opening year (2030), GHG emissions were found to be similar when compared to the baseline year emissions; in the design year (2045), there is expected to be a net decrease of 22% in the GHG emissions compared to those for the 2030 opening year (the downward trend suggests that decarbonisation of the UK’s fleet is overtaking the projected growth in traffic). Total (cumulative) GHG emissions over the full 60-year appraisal period were also forecast for the Do Minimum scenario, and show that the policies of the Transport Decarbonisation Plan (DfT, 2021a) would reduce road user emissions between 76% and 89% when compared to the estimates using the TAG emissions workbook (DfT, 2021b) and the Emissions Framework Toolkit (EFT) v11 (Defra, 2021).
 - b. Vulnerability of the Project to climate change – a variety of baseline data has been undertaken to understand climate and extreme weather impacts. More detailed information is provided in ES Appendix 15.2: Climate Resilience Baseline (Application Document 6.3). This includes a review of

Local Climate Impact Profiles (LCLIP) which have been developed to assess the vulnerability of local authorities' services to severe weather events for Kent County Council, Essex County Council, Thurrock Council and the London Borough of Havering. Fluvial and tidal flood risk zones and flood defence assets are illustrated in ES Appendix 14.6: Flood Risk Assessment (Application Document 6.3). Future baseline data is also provided in ES Chapter 15: Climate (Application Document 6.1) in relation to change in mean summer and winter air temperatures, precipitation rates and sea level rise.

Findings from consultation

- 7.15.9 Many comments made by stakeholders and members of the public have related to climate change and the perceived incongruity between road building and reducing GHG emissions, particularly concerns that the Project does not align with UK Government targets to reach net zero by 2050. Other comments have highlighted:
- a. The need to encourage active travel and public transport usage in order to reduce emissions and improve health
 - b. The additional resilience that the Project would provide, through reducing congestion at Dartford and providing an alternative to closures at Dartford as a result of extreme weather events
- 7.15.10 Health stakeholders have highlighted the impact of climate change on health inequalities, with more deprived communities being potentially more vulnerable to impacts.

Climate change impacts and mitigation

- 7.15.11 The assessment for climate change impacts has been divided into two sections. Firstly, the impact of the Project on health and wellbeing as a result of changes to greenhouse gas emissions has been combined into a single assessment for both construction and operation phases for simplicity and to avoid repetition. The impact on health and wellbeing as a result of the vulnerability of the Project to climate change has been considered separately for construction and operation phases, due to the different types of effect and mitigation required.

Greenhouse gas emissions (construction and operation)

- 7.15.12 ES Chapter 15: Climate (Application Document 6.1) states that the Applicant is committed to reducing GHG emissions from Project activities by implementing the hierarchy for GHG emissions (avoid and/or prevent, reduce, remediate). The ambition for the Project is to achieve carbon neutral construction. The Carbon and Energy Management Plan (Application Document 7.19) sets out the mechanisms and management arrangements the Applicant will use to lead the construction industry in the adoption of low carbon innovation and deliver the levels of carbon reduction required for the Project to support transition to net zero. Appendix D of the Carbon and Energy Management Plan (Application Document 7.19) identifies possible GHG emission reduction measures to meet the maximum carbon emission level; the actual route will be determined by

Contractors and their designers. Commitments in support of achieving carbon neutral construction are listed in Appendix F of the Carbon and Energy Management Plan (Application Document 7.19).

- 7.15.13 ES Chapter 15: Climate (Application Document 6.1) states that the Project fulfils criteria used to determine that GHG emissions from the Project are not significant in that:
- a. The GHG emissions from the Project do not have a material impact on the ability of the Government to meet carbon reduction targets.
 - b. The Project is compatible with (or goes beyond) the budgeted, science based 1.5°C trajectory of the Paris Agreement (in terms of rate of emissions reduction) and complies with up-to-date policy and ‘good practice’ reduction measures to achieve that.
- 7.15.14 The implementation of a PAS2080 compliant (global standard for managing infrastructure carbon) GHG emission monitoring and minimisation approach during construction is a REAC commitment (CC001) (Application Document 6.3, ES Appendix 2.2).

Health outcomes assessment – climate change (GHG emissions)

- 7.15.15 The sensitivity of the general population to changes arising from climate change is assessed as medium. Communities/populations identified as being of high sensitivity regarding potential impacts from climate change during the construction phase comprise people in low-income groups, people with disabilities, older people, people living in areas which exhibit poor economic/health indicators, people with long-term health conditions and people living in high flood risk zones.

Table 7.52 Health outcome – climate change (GHG emissions)

Community/ population	Assessment summary
General population/ Sensitive populations and communities	<p>ES Chapter 15: Climate (Application Document 6.1) states the ambition for the Project to achieve carbon neutral construction, with a variety of mechanisms and management arrangements set out in the Carbon and Energy Management Plan (Application Document 7.19). GHG emissions from the Project do not have a material impact on the ability of the Government to meet carbon reduction targets and the Project is compatible with (or goes beyond) the budgeted, science based 1.5°C trajectory of the Paris Agreement (in terms of rate of emissions reduction).</p> <p>There is strong evidence setting out the links between climate change and both physical and mental wellbeing.</p> <p>Local health and wellbeing strategies reference the importance of the wider environment and resilience to climate change on both mental and physical health and wellbeing; more deprived communities in particular are highlighted as being more vulnerable to climate change, resulting in health inequalities.</p> <p>Duration of potential impacts associated with climate change are considered to be long-term. The number of people potentially affected is high.</p>

Community/ population	Assessment summary
	The health outcome for both general and sensitive populations/communities as a result of climate change impacts arising from GHG emissions is considered to be neutral .

Equality impact assessment – climate change (GHG emissions)

7.15.16 No disproportionate or differential impact has been identified on protected characteristics in relation to climate change arising from GHG emissions as a result of the Project.

Vulnerability of the Project to climate change (construction)

7.15.17 Potential effects to the Project during construction arising from climate change, which are of relevance to health and wellbeing, include impacts on the construction workforce as a result of either increased projected mean daily rainfall, especially in winter months, which could lead to safety risks of slips, trips and falls to construction workers; and increased summer temperatures, and frequency of hot days and heatwaves leading to stress/heat exhaustion for workers. ES Chapter 15: Climate (Application Document 6.1) describes impacts arising from these scenarios as minor adverse and not significant. A range of good practice mitigation measures have been identified (for example the use of short to mid-term weather forecasting to plan key construction activities).

7.15.18 A Sustainability Statement (Application Document 7.11) has been prepared for the Project which provides a summary of where the preliminary design has met the aims of DMRB GG 103 Introduction and General Requirements for Sustainable Development and Design (Highways England, 2019a). This covers a range of sustainability matters under the headings of various economic, social and environmental subjects. In relation to climate change, the Sustainability Statement states that the intention has been to embed sustainable considerations into future decision making on the Project either by including concepts in the preliminary design, direct specification, challenging Contractors to competitively promote sustainable outcomes during the tender or including them in the REAC (Application Document 6.3, ES Appendix 2.2).

Health outcomes assessment – climate change (vulnerability of the Project during construction)

7.15.19 The sensitivity of the general population to changes arising from climate change is assessed as **medium**. Communities/populations identified as being of high sensitivity regarding potential impacts from climate change during the construction phase comprise people in low-income groups, people with disabilities, older people, people living in areas which exhibit poor economic/health indicators, people with long-term health conditions and people living in high flood risk zones (Table 7.53).

Deleted: .

Table 7.53 Health outcome – climate change (vulnerability of the Project during construction)

Community/ population	Assessment summary
General population/ Sensitive populations and communities	<p>ES Chapter 15: Climate (Application Document 6.1) describes potential impacts on the construction workforce as a result of more extreme weather events (for example increases in temperature and increases in rainfall). Mitigation measures would be in place to minimise these effects (REAC Ref. CC001), including the use of short to medium-term weather forecasting in planning construction activities, environmental controls and impact mitigation measures.</p> <p>There is strong evidence setting out the links between climate change and both physical and mental wellbeing.</p> <p>The number of people likely to experience impacts as a result of the vulnerability of the Project to climate change during construction is considered to be low, limited to members of the construction workforce.</p> <p>The duration of impact would be long-term (i.e. more than two years in duration).</p> <p>Local health and wellbeing strategies reference the importance of the wider environment and resilience to climate change on both mental and physical health and wellbeing; more deprived communities in particular are highlighted as being more vulnerable to climate change, resulting in health inequalities.</p> <p>The Project has a target of achieving at least 45% of employees to be from within 20 miles of the Project route; the SEE Strategy for the Project (appended to Application Document 7.3) also states that people from a variety of low socio-economic groups are priority groups for employment. These measures are designed to help tackle inequality.</p> <p>The health outcome for both general and sensitive populations/communities as a result of the vulnerability of the Project to climate change during construction is considered to be neutral.</p>

Equality impact assessment – climate change (vulnerability of the Project during construction)

7.15.20 No disproportionate or differential impact has been identified on protected characteristics as a result of the vulnerability of the Project to climate change during construction.

Vulnerability of the Project to climate change (operation)

- 7.15.21 ES Chapter 15: Climate (Application Document 6.1) identifies a variety of potential impacts on end users of the Project as a result of changes to the climate over a time period to 2080. Potential impacts include:
- a. Increases in extreme weather events resulting in increased rate of deterioration of assets and associated increases in maintenance workers being required to work in the carriageway
 - b. Increased rainfall/flooding and storm intensity which may discourage WCH and thereby lead to more road users
 - c. Potential for higher rates of vehicle collisions and disruption to the highway as a result of increased frequency and intensity of rainfall and flooding, as

well as increased incidences of ‘summer ice’ (caused by dry spells followed by heavy rainfall), or the presence of standing water on the carriageway

- d. Risk of vehicle breakdowns and fires as a result of increased mean temperatures and heatwaves

7.15.22 The overall conclusion of ES Chapter 15: Climate (Application Document 6.1) is that post-mitigation, all effects related to climate change would be **not significant** and that generally, the likelihood of these events occurring is low or very low. Embedded, good practice and essential mitigation measures for the operational phase primarily relate to flood-risk, drainage design and the implementation of standards, and are secured in the Environmental Masterplan (Application Document 6.2, ES Figure 2.4), the REAC (Application Document 6.3, ES Appendix 2.2) or the Design Principles (Application Document 7.5).

Health outcomes assessment – climate change (vulnerability of the Project during operation)

7.15.23 The sensitivity of the general population to changes arising from climate change is assessed as **medium**. Communities/populations identified as being of **high** sensitivity regarding potential impacts relating to vulnerability of the Project during the operation phase comprise people in low-income groups, people with disabilities, older people, people living in areas which exhibit poor economic/health indicators, people with long-term health conditions and people living in high flood risk zones (Table 7.54).

Deleted: .

Table 7.54 Health outcome – climate change (vulnerability of the Project during operation)

Community/ population	Assessment summary
General population/ Sensitive populations/ communities	<p>ES Chapter 15: Climate (Application Document 6.1) notes a variety of potential areas of impacts for end users of the Project as a result of changes in intensity and frequency of weather events. A range of mitigation measures have been secured and, post-mitigation, it is not considered that any of the impacts identified would be significant.</p> <p>There is strong evidence setting out the links between climate change and both physical and mental wellbeing.</p> <p>Local health and wellbeing strategies reference the importance of the wider environment and resilience to climate change on both mental and physical health and wellbeing; more deprived communities in particular are highlighted as being more vulnerable to climate change, resulting in health inequalities.</p> <p>The number of people who may potentially experience impacts as a result of the vulnerability of the Project to climate change during operation is high (end users of the Project).</p> <p>The duration of impact would be long-term (i.e. more than two years in duration).</p> <p>The likelihood of events occurring has been described as low or very low and a range of appropriate mitigation has been set out. The health outcome for both general and sensitive populations/communities as a result of the vulnerability of the Project to climate change during operation is therefore considered to be neutral.</p>

Equality impact assessment – climate change (vulnerability of the Project during operation)

- 7.15.24 No disproportionate or differential impact has been identified on protected characteristics as a result of the vulnerability of the Project to climate change during operation.

7.16 Electric and Magnetic Fields (EMFs)

Overview

- 7.16.1 EMFs arise from the generation, transmission, distribution and use of electricity. Electric fields (measured in V/m (volts per metre)) depend on the operating voltage of the equipment producing them. They are shielded by most common building materials, trees and fences and diminish rapidly with distance from the source. Magnetic fields are found in all areas where electricity is in use (e.g., offices and homes), arising from electric cabling and equipment in the area. They are measured in μT (microteslas) and depend on the electrical currents flowing, which vary according to the electrical power requirement at any given time. Magnetic fields are not significantly shielded by most common building materials or trees; as with electric fields, they diminish rapidly with distance from the source.
- 7.16.2 EMF effects can be categorised as direct and indirect. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) (1998) has set public exposure guideline limits to protect against direct effects of EMF exposure; the weight of scientific evidence is against EMFs causing ill health in humans at levels below the ICNIRP (1998) guideline limits. 'Indirect' effects that can occur as a result of exposure to EMFs may include interference with active implantable medical devices (AIMDs) and microshocks.

Evidence base

- 7.16.3 There has been extensive research in an attempt to establish whether or not long-term exposure to fields at lower levels than the ICNIRP (1998) guidelines might be a cause of ill health in humans; this research has been extensively reviewed by bodies such as Public Health England (National Radiological Protection Board, 2004) and the World Health Organization (World Health Organization, 2007). There is some evidence to suggest that high magnetic fields may be associated with an increased risk of one particular disease, childhood leukaemia. However, the weight of scientific evidence is against EMFs causing ill health in humans at levels below the ICNIRP (1998) guideline limits. The Government has addressed this uncertainty by adopting precautionary measures, set out in the Code of Practice on optimum phasing (Department of Energy and Climate Change (DECC), 2012), which National Grid follows.
- 7.16.4 The exposure guidelines discussed above are set to protect against known or direct effects of EMF exposure. Indirect effects, that can occur as a result of exposure to EMFs, such as interference with AIMDs and microshocks, are not explicitly covered by the exposure guidelines.
- 7.16.5 EMFs can affect AIMDs, such as pacemakers, insulin pumps and Implanted Cardiac Defibrillators (ICDs), if the external field strength exceeds the immunity

of the device. All modern AIMDs are required to be immune from interference from EMFs up to the ICNIRP General Public Reference Levels of 1999/519/EC (Council of the European Union, 1999) where the AIMD has been implanted and programmed in a standard manner. Neither the Medicines and Healthcare products Regulatory Agency (MHRA) or National Grid are aware of any instance of any electricity transmission infrastructure interfering with a correctly fitted modern AIMD.

- 7.16.6 Microshocks are indirect effects and as such are not directly covered by quantitative limits that protect against direct effects of electric fields. A separate Code of Practice on microshocks, developed jointly by industry and DECC, and containing details on practical measures which can be taken, is currently waiting for Ministerial approval.

Relevant themes from local health and equality strategies

- 7.16.7 The policy and strategic context for health and equalities is set out in Appendix A. Local priorities of relevance to the assessment of impacts of EMFs on human health and equalities are summarised below:
- a. Reducing health inequalities – specified as a priority in a number of Health and Wellbeing Strategies. The Kent Joint Health and Wellbeing Strategy (Kent County Council, undated) identifies tackling health inequalities as one of four priorities. Key areas of focus of the Essex Joint Health and Wellbeing Strategy include influencing conditions and behaviours linked to health inequalities (Essex County Council, 2022). Reducing health inequalities is an overarching theme of the Brentwood Health and Wellbeing Strategy 2020–2023 (Brentwood Borough Council, 2020).
 - b. Creating healthier environments – the role of the wider environment in improving health outcomes is highlighted across health and wellbeing strategies. The London Borough of Havering defines ‘the communities and places we live in’ as one of four pillars focused on in the Health and Wellbeing Strategy. Domain Five of the Thurrock Joint Health and Wellbeing Strategy (Thurrock Council, 2022) relates to providing environments where everyone feels safe and healthy, with goals to ensure that regeneration and future developments seek to improve physical and mental health. Theme Four of Medway’s Joint Health and Wellbeing Strategy 2018–2023 (Medway Council, 2018) is ‘Improving Mental and Physical Health and Wellbeing’, recognising that mental and physical health and wellbeing are affected by many wider issues in our day-to-day environment. Key performance indicators set out within the London Health Inequalities Strategy (GLA, 2018) also relate to healthy places, with all Londoners benefiting from an environment and economy that promote good mental and physical health.

EMF impacts and mitigation

- 7.16.8 There is no separate construction and operation assessment for EMFs. The overhead lines which would be modified as part of the Project are already *in situ* and producing EMFs. A total of five overhead line modifications are proposed to accommodate the Project at various locations. An assessment of the likely significant environmental effects of EMFs has been undertaken to support this work. The findings of the assessment are provided in Appendix D of this HEqIA.
- 7.16.9 The assessment contained in Appendix D concludes that modifications to existing overhead lines that would be necessary to accommodate the Project are deemed to be fully compliant with the current public exposure guidelines for EMFs documented in National Policy Statement (NPS) EN-5 (DECC, 2011). The proposed overhead line modifications meet the UK Government adopted exposure limits demonstrated using the principles set out in the DECC's Code of Practice on Compliance (DECC, 2012). **No significant EMF effects** are predicted from these proposed modifications.

Health outcomes assessment – EMFs (construction and operation)

- 7.16.10 No health impact has been identified in relation to EMFs as a result of the Project during both construction and operation phases, and as a result, the health outcome is recorded as **neutral**.

Equality impact assessment – EMFs (construction and operation)

- 7.16.11 No disproportionate or differential impact has been identified on protected characteristics in relation to EMFs as a result of the Project during both construction and operation phases.

7.17 Cumulative effects

- 7.17.1 This section describes cumulative health impacts that may arise as a result of the Project. These relate to both intra-project effects (impacts that can occur as a result of interrelationships between different assessment topics); and inter-project effects (due to the Project in combination with other existing and/or approved developments).

Intra-project effects

- 7.17.2 For health and equalities, intra-project health effects are most likely to arise in consideration of quality of life and wellbeing, taking into account aspects arising from stress, anxiety, mental wellbeing, sleep disturbance and uncertainty. Potential intra-project effects are summarised below for both the construction and operational phases.

Construction

- 7.17.3 Table 7.55 summarises the assessment of intra-project effects likely to be experienced by local residents at varying spatial scales from the Project. The effects identified take into account the various mitigation measures proposed in relation to individual assessment topics.

Table 7.55 Summary of intra-project effects – construction

Population	Intra-project effects
<p>Communities in close proximity to construction activities, compounds and construction traffic routes</p>	<p>For both the general and sensitive populations, the cumulative health outcome from Project construction is considered to be negative and significant.</p> <p>Although intra-project effects are likely to be temporary, the duration of effect may last for several years, particularly for those communities in closest proximity to certain construction activities and therefore effects are likely to be medium- to long-term in nature.</p> <p>This population would be most likely to experience the most significant noise effects, be affected by community change as a result of loss of property or perceptions of blight, be most affected by changes in journey times (however small) and be most affected by ongoing uncertainty. A range of measures would be in place to mitigate or reduce many of these issues – for example use of BPM to address noise impacts or measures associated with community engagement and communication to overcome uncertainty and provide local communities with a framework for dealing with issues and concerns.</p> <p>It should be noted that people within this population may respond differently depending upon the nature of the effect. For example, not all populations particularly sensitive to changes in noise level may necessarily be affected adversely by changes in air quality or changes in active travel.</p> <p>Some of the negative aspects of construction would be tempered by opportunities presented through job creation and access to education and training programmes; this would be particularly beneficial for certain of the more deprived communities in closest proximity to the construction route. However it is noted that, while presenting a significant benefit to communities, these opportunities would not be experienced equally by sensitive populations (for example retired people or people with life-limiting conditions).</p>
<p>Communities in wards located within 1km of the Project route</p>	<p>For both the general and sensitive populations, the cumulative health outcome from Project construction is considered to be negative but not significant.</p> <p>Although intra-project effects are likely to be temporary, the duration of effect may last for several years therefore effects are likely to be medium- to long-term in nature.</p> <p>Cumulative effects relate to combined influences arising from environmental change resulting from proximity to construction traffic effects (noise emissions, perceptions of safety, stress arising from traffic management measures or changes to journey times) as well as changes in physical activity arising from closure and/or diversions of walking and cycling routes/how green space or outdoor recreation may be accessed. A further aspect relates to changes as a result of construction workers within local communities and how this may contribute to people’s feelings of safety and security.</p> <p>As previously noted, positive effects would be experienced through job creation and access to education and training programmes, which would particularly benefit some of the more deprived communities within this wider area.</p>

Population	Intra-project effects
Communities within host local authority areas	<p>Different host local authorities would be impacted to different degrees by construction activities, with different intra-project health outcomes as a result as follows:</p> <p>Gravesham and Thurrock – as host authorities within which the greatest proportion of construction activities are taking place, the cumulative health outcome from Project construction is considered to be negative but not significant for both general and sensitive populations.</p> <p>Havering, Dartford, Medway, Brentwood and Tonbridge and Malling – at local authority level, the intra-project health outcome is considered to be neutral for both general and sensitive populations.</p>
Wider region	<p>The cumulative health effect for the wider region would be positive as a result of job creation and support in upskilling and educational programmes. There would also be spend in the local economy from the construction workforce and supply chain. The improvements in the economy would contribute to the UK Government’s Levelling Up agenda and would also help to reduce health inequalities at a wider, regional level.</p>

Operation

7.17.4 Table 7.56 summarises the assessment of intra-project effects likely to be experienced by local residents at varying spatial scales from the Project during the operational phase. The effects identified take into account the various mitigation measures proposed in relation to individual assessment topics.

Table 7.56 Summary of intra-project effects – operation

Population	Intra-project effects
Communities in close proximity to the Project route	<p>For both the general and sensitive populations, the cumulative health outcome from Project operation is considered to be negative although not significant. Effects may also vary according to location along the Project route depending on Project design and mitigation measures.</p> <p>The assessments have shown that communities in close proximity to the route would benefit from improvements to green space and active travel routes, thus enabling people to adopt more active lifestyles and access nature. Concerns around perceptions of poor air quality and associated health effects may prevent some people from using new routes, however the air quality assessment has shown there would be no significant health effects. Improvements in accessibility to jobs, community services and leisure provision would have population level benefits. Improvements in public transport journey times for the majority of bus routes (and only minor changes in journey times along other routes) would be beneficial for sensitive populations who may be more reliant on bus services.</p> <p>Duration of effects during the operational phase are considered to be permanent.</p> <p>As with the intra-project effects described during construction, it should be noted that people within this population may respond differently depending upon the nature of the effect.</p>
Communities in wards located	<p>For both the general and sensitive populations, the cumulative health outcome from Project operation is considered to be positive but not significant.</p>

Population	Intra-project effects
within 1km of the Project route	<p>Duration of effects during the operational phase are considered to be permanent.</p> <p>Cumulative effects relate to combined influences arising from improvements in accessibility to jobs and services, access to areas of green space (both new and areas of replacement land), active travel routes which would enable people to access areas of green space and also which complete missing links and areas of historic severance. This population is less likely to experience direct environmental impacts as a result of the Project road (noise, air quality or visual impacts for instance).</p> <p>Some communities in Dartford may see additional benefits resulting from improvements in air quality and noise emissions as well as from wider accessibility improvements. Some communities in Medway and Tonbridge and Malling may experience adverse effects arising from increased noise emissions in certain locations.</p> <p>As previously noted for the construction phase, positive effects would be experienced through job creation and access to education and training programmes, which would particularly benefit some of the more deprived communities within this wider area.</p>
Communities within host local authority areas	<p>Intra-project health outcomes for each of the host local authorities are considered to be positive and significant.</p> <p>Duration of effects during the operational phase are considered to be permanent.</p> <p>Inter-project effects are likely to be as described for communities within 1km of the Project route.</p>
Wider region	<p>The cumulative health effect for the wider region would be positive and significant as a result of improvements to accessibility and wider economic benefits. The improvements in the economy would contribute to the UK Government's Levelling Up agenda and would also help to reduce health inequalities at a wider, regional level.</p>

Inter-project effects

- 7.17.5 In addition to intra-project effects, cumulative impacts can also occur due to the Project in combination with other existing and/or approved developments. These are known as 'inter-project' effects. The short-list of projects identified for inclusion in the assessment of inter-project effects can be found in ES Appendix 16.2: Cumulative Effects Assessment (Application Document 6.3).
- 7.17.6 Projects included within the assessment are those identified as being in the 'Zone of Influence' for health; this is defined as those communities/wards directly and indirectly affected by the Project. The cumulative effects assessment provides a combined population health effect from across a range of health determinants. A review has taken place to identify where there is considered to be potential for negative or positive effects to occur during either the construction or operation phase, by virtue of proximity, scale or nature of the type of project.
- 7.17.7 Inter-project cumulative effects have been identified that may relate to the following areas (relevant to both general and sensitive populations):

- a. Environmental change arising from air quality or dust emissions which collectively may have an impact on either physical or mental health conditions
 - b. Changes in vehicle numbers potentially affecting road safety, severance or accessibility aspects (for example contributing to increased journey times to healthcare services or to schools/education)
 - c. Effects arising from influx of construction workers associated with multiple projects, including impacts on local housing accommodation, healthcare, education and other community services
 - d. Collective changes in environment or community identity that may affect the severity or incidence of mental health conditions (e.g. stress or anxiety)
 - e. Beneficial effects arising from the collective workforce (employment, local spend, training)
 - f. Beneficial effects that may give rise to increased opportunities for physical activity
- 7.17.8 Inter-project effects would depend on timescales of the various proposals coming forward. Developments within the Zone of Influence are also geographically spread along the length of the Project alignment.
- 7.17.9 Principal cumulative effects that are likely to occur relate to the construction phases of developments overlapping with the Project, resulting in impacts on residential amenity and access to services and facilities. This has the potential to lead to negative inter-project effects in certain locations depending on the nature and type of development. This is primarily due to the likely timescales and phasing of construction activities being different, together with the implementation of good practice mitigation measures by individual developments. Potential for a negative inter-project effect on access to services and facilities has been identified in relation to the Thames Freeport development during construction of the Project. The inter-project assessment also identified potential for positive cumulative effects in relation to employment creation during construction.
- 7.17.10 The inter-project assessment has identified potential for negative inter-project effects on human health in relation to changes in noise levels associated with the London Resort during construction of the Project.
- 7.17.11 Inter-project effects relating to the operation of specific projects are primarily concerned with human health outcomes as a result of new residential developments (and thereby new populations) in proximity to the Project. Effects on health outcomes may be experienced with residential schemes located close to the Project. Effects may relate to potential negative health outcomes associated with road traffic noise levels arising from the Project as well as positive health outcomes arising from the potential to create new green infrastructure that forms part of the wider network for walking and cycling opportunities.

- 7.17.12 Positive inter-project effects have been identified in relation to proposals for new employment sites and the associated potential increased accessibility for businesses and employment during the Project operation phase.

8 Summary

8.1.1 This HEqIA has set out likely health outcomes and equalities effects arising from the Project during both the construction and operational phases. A summary for each of the topics considered is provided in Table 8.1 for construction and Table 8.2 for operation.

Table 8.1 Summary of health outcomes and equalities effects (construction)

Topic	Health outcome	Equalities effect	Summary of mitigation
Accessibility	Neutral	Impacts may be experienced by groups who are more reliant on public transport (particularly bus services) for example women, those on low-incomes and people with protected characteristics such as age or disability. People with disabilities who are car users may experience impacts relating to increased journey times, although this would be in line with the general population and no differential or disproportionate impact is anticipated.	Measures contained within the oTMPfC (Application Document 7.14). Community engagement processes set out in the CoCP (Application Document 6.3, ES Appendix 2.2).
Traffic-related severance	Neutral – general population Negative – children, older people, people with disabilities and/or long-term health conditions, pedestrians, parents with young children/pushchairs, people in low-income households, people without access to private transport and those experiencing rural isolation	Certain groups (namely children, older people and people with disabilities and/or long-term health conditions) may experience temporary severance impacts as a result of changes in the local road network, for example as a result of increased traffic flows. The oTMPfC (Application Document 7.14) and TMP, together with appropriate communication with local residents and affected communities would help to reduce these impacts.	Measures contained within the FCTP (Application Document 7.13) and oTMPfC (Application Document 7.14). Community engagement processes set out in the CoCP (Application Document 6.3, ES Appendix 2.2).

Topic	Health outcome	Equalities effect	Summary of mitigation
Access to green space and outdoor recreation	Negative – general population and sensitive populations including people in low-income households, children and young people, those without access to private transport and pedestrians/cyclists.	No disproportionate or differential impact has been identified on people with protected characteristics in relation to changes to green space and outdoor recreation during construction.	Ongoing engagement would be necessary with representatives of the local community (through Community Liaison Groups) to identify and confirm diversion routes.
Active travel	Neutral – general population and sensitive populations including people in low-income households, children and young people, women, those without access to private transport and pedestrians/cyclists. Positive – construction workforce	Changes to journey times and travel patterns may arise from temporary closures and diversions of PRoWs as a result of temporary possession of land or the need to accommodate construction activities. Even small changes can adversely impact protected characteristics such as older people and people with disabilities. Extensive consultation has taken place to date with walking and cycling groups to the north and south of the River Thames. Ongoing engagement will be necessary with representatives of the local community (through Community Liaison Groups) to identify and confirm diversion routes. No disproportionate or differential impact has been identified on protected characteristics in relation to active travel during construction.	Measures contained within the FCTP (Application Document 7.13) and oTMPfC (Application Document 7.14). Community engagement processes set out in the CoCP (Application Document 6.3, ES Appendix 2.2).
Affordability	N/A	The Project would not result in affordability impacts during construction.	N/A
Road safety	Neutral (road safety) Negative (driver stress)	No differential or disproportionate effects identified.	Measures contained within the FCTP (Application Document 7.13) and oTMPfC (Application Document 7.14).
Air quality	Neutral	No differential or disproportionate effects identified.	Measures contained within the CoCP (Application Document 6.3, ES Appendix 2.2)

Topic	Health outcome	Equalities effect	Summary of mitigation
			in relation to air quality effects associated with construction dust as well as emissions from non-road mobile machinery and construction vehicles.
Noise and vibration	Negative and significant – General populations/sensitive communities including children and young people, older people, pregnant women/parents with newborn babies, people with pre-existing aural health conditions, people with cardiovascular conditions, people with mental health conditions, shift workers and people in low-income households	Significant adverse noise effects have been identified as a result of construction activities, including from construction noise, construction traffic and percussive piling activities. Analysis of areas within which adverse effects are predicted include wards where there are greater concentrations of older people than the local authority average (Shorne, Cobham and Luddesdown; Riverview; and Chalk), slightly higher proportions of children under 16 (within Singlewell, East Tilbury and Chadwell St Mary wards) and slightly higher proportions of people with life-limiting conditions or disabilities (the wards of Chalk and Ockendon). These groups may be more susceptible to increases in noise levels.	A range of mitigation measures would be in place during construction to reduce impacts associated with construction noise and would be set out in a Noise and Vibration Management Plan. Planned Community Liaison Groups would help to disseminate information to local communities regarding the programme for construction activities (CoCP (Application Document 6.3, ES Appendix 2.2)).
Work and training	Positive and significant	No disproportionate or differential impact has been identified on protected characteristics in relation to work and training during construction. The Project would adopt an inclusive procurement process, which would encourage work and training opportunities to be accessible to disadvantaged or under-represented groups in the local community.	N/A
Housing and community services impacts	Impacts associated with the loss of private property and associated change in sense of	The local area within which both Baker Street and North Ockendon are located is characterised by older age groups (for example, at Lower Layer Super Output Area level, the Baker Street area has a population over	Ongoing consultation and engagement with the traveller community to ensure appropriate provision of replacement facilities.

Topic	Health outcome	Equalities effect	Summary of mitigation
	<p>community – negative: people within impacted communities (Baker Street, North Ockendon), older people, people in low-income households</p> <p>Impacts on gypsy and traveller communities: neutral</p> <p>Impacts of construction workforce on local accommodation: neutral</p> <p>Impacts of construction workforce on healthcare services and facilities: neutral</p>	<p>65 years of age of 20.1%, compared to 12.7% for Thurrock as a whole (2011 Census)). Older people are likely to be impacted more by the changes to the local community and social networks (both for those potentially relocated and for those remaining) than other population groups.</p> <p>Younger families with school-age children may experience changes as a result of moving schools or changes in journey times to education facilities.</p> <p>Travellers would be directly impacted by the Project, with the loss of their existing site at Gammonfields Way and relocation to an adjoining area. Ongoing consultation and engagement will continue to ensure appropriate provision of replacement facilities. A further travellers' site at Linford would be temporarily impacted during construction due to works associated with utilities diversions, however this is not considered to be significant in terms of duration or type of activity.</p>	<p>Measures contained within the oTMPfC (Application Document 7.14).</p> <p>Community engagement processes set out in the CoCP (Application Document 6.3, ES Appendix 2.2).</p>
Mental health and wellbeing	Both positive and negative health outcomes would be experienced by communities located in close proximity to construction routes and activities in addition to populations within and outside of these communities with a high sensitivity to mental	No differential or disproportionate effects identified.	<p>Construction phase good practice measures for air quality and noise are outlined in the CoCP (Application Document 6.3, ES Appendix 2.2).</p> <p>How this information would be communicated to local residents, together with how residents would be able to communicate concerns to the Contractor, would form part of the Communications and Engagement Plan as set out in the CoCP.</p> <p>Mitigation for adverse visual impacts is set out in ES Chapter 7: Landscape and Visual</p>

Topic	Health outcome	Equalities effect	Summary of mitigation
	health and wellbeing impacts Impacts experienced by the construction workforce: positive		(Application Document 6.1) and includes measures to screen construction compounds from nearby residential areas.
Pollution and flood-risk	Neutral – local residents and land users near significant earthwork movements; construction workers	No differential or disproportionate effects identified.	Mitigation measures as set out in relation to geology and soils in ES Chapter 10: Geology and Soils, and drainage in ES Chapter 14: Road Drainage and the Water Environment (Application Document 6.1).
Light pollution	Neutral	No differential or disproportionate effects identified.	Mitigation measures as set out in relation to landscape and visual in ES Chapter 7: Landscape and Visual (Application Document 6.1).
Climate change	GHG emissions: neutral Vulnerability of the Project to climate change: neutral	No disproportionate or differential impact identified.	Commitments in support of achieving carbon neutral construction are listed in Appendix E of the Carbon and Energy Management Plan (Application Document 7.19).
EMFs	Neutral	No differential or disproportionate effects identified.	N/A

Table 8.2 Summary of health outcomes and equalities effects (operation)

Topic	Health outcome	Equalities effect	Summary of mitigation
Accessibility	Positive (significant) – general population, sensitive communities /populations	No differential or disproportionate effects identified. It is noted that disabled drivers may have particular needs within the tunnelled section of the Project. In designing the Project, the needs of different road user groups have been considered. Relevant design standards have included DMRB CD 352 Design of Road Tunnels (Highways England, 2020a) and the DfT’s Inclusive Mobility document (DfT, 2005); further, there has been consultation with the Disabled Road Users Forum. This has highlighted the range of travel needs across specific user groups.	N/A
Traffic-related severance	Neutral – general population, sensitive communities and populations	Both adverse and beneficial disproportionate impacts have been identified on the following protected characteristics in relation to severance during operation: <ul style="list-style-type: none"> • Older people – Forstal Road, Aylesford (Tonbridge and Malling), Elaine Avenue, Strood (Medway) and Brennan Road, Tilbury (Thurrock) are identified as areas where residents may experience a greater disbenefit as a result of increased severance. Areas where a greater proportion of older people may experience a benefit as a result of decreased severance are identified at Stanford Road, Grays (Thurrock) and Singlewell Road, Gravesend (Gravesham). • Children aged under 16 – the increase in severance on Wrotham Road, Gravesham has a larger than expected impact on the proportion of the population under 16 years, for the regional study area and England and Wales. The decrease in severance on Station Road, West Horndon and Lodge Lane, Chafford Hundred affects a larger than expected proportion of the population of children under 16 years, for the regional study area and England and Wales. • The severance identified is not considered to be significant, due to other factors, for example the presence of existing pedestrian 	A commitment has been made as part of the Section 106 Agreements Heads of Terms (Application Document 7.3) for further investigation at identified locations to discuss the need for, and provision of, pedestrian crossing infrastructure

Topic	Health outcome	Equalities effect	Summary of mitigation
		refuges and traffic-controlled crossings at relevant locations (notably to enable access to shops and services).	
Access to green space and outdoor recreation	Positive (significant) – general population, sensitive communities and populations including: users of existing and new areas of green space and outdoor recreation assets, children and young people, people in low-income households, people without access to private transport, people with mental health conditions, pedestrians and cyclists and older people.	A beneficial impact has been identified for people from low-income households (who may not have access to a car) as a result of the variety of new connections and routes planned. Beneficial impacts are also identified for people with protected characteristics including children, older people and people with disabilities.	N/A
Active travel	Positive (significant) – people in low-income households, children and young people, women, those without access to private transport and pedestrians/cyclists	A beneficial impact has been identified for people from low-income households (who may not have access to a car) as a result of the variety of new connections and routes planned. Beneficial impacts are also identified for people with protected characteristics including children, older people and people with disabilities.	N/A
Affordability	People in low-income households: positive	No disproportionate or differential impact has been identified on people with protected characteristics.	
Road safety	Neutral – general population, sensitive	No differential or disproportionate effects identified.	N/A

Topic	Health outcome	Equalities effect	Summary of mitigation
	communities and populations		
Air quality	Neutral – general population, sensitive communities and populations	No differential or disproportionate effects identified.	N/A
Noise and vibration	Positive and negative – general population, sensitive communities and populations	<p>There are predicted to be changes in noise levels due to the operation of the Project. Adverse effects have been identified at a number of sensitive receptors which may have an impact on people with protected characteristics, notably older people (through adverse effects forecast at a number of care homes), children (through adverse effects forecast at a number of schools/nurseries), and within the wider population. Children may also be affected differentially by changes in noise levels, for example as a result of sleep disturbance impacting on behaviour and schooling, although it is not considered that noise increases are likely to cause these effects during operation. Adverse effects are likely to be experienced disproportionately by the following:</p> <ul style="list-style-type: none"> • Low-income households (as highlighted by the distributional appraisal of noise impacts) • Pregnant women/parents with newborn babies (who may already be suffering from sleep disturbance and for whom an increase in noise levels may result in an additional effect) <p>Adverse noise effects have been predicted at a private travellers site at Linford Crescent, Linford.</p>	<p>Low noise road surfacing/ acoustic barriers</p> <p>The findings of ES Chapter 12 - Noise and Vibration (Application Document 6.1) concluded that there would be some significant effects as a result of the Project.</p>
Work and training	Positive (significant) – general population, sensitive communities and populations	No differential or disproportionate effects identified.	N/A

Topic	Health outcome	Equalities effect	Summary of mitigation
Housing and community services impacts	Neutral – general population, people in low-income households	People in lower-income households may be disproportionately affected during the Project's operation as a result of property market changes such that they need to relocate to more affordable locations which may be further from jobs/services.	Local authority intervention in the housing market by providing appropriate choice, range and type of housing would ameliorate impacts associated with growth and affordability.
Mental health and wellbeing	Negative (significant) – general population/ sensitive communities Positive (significant) – general population/ sensitive communities	No differential or disproportionate effects identified.	N/A
Pollution and flood-risk	Neutral – general population, sensitive communities and populations	No differential or disproportionate effects identified.	Mitigation measures as set out in relation to geology and soils in ES Chapter 10: Geology and Soils, and drainage in ES Chapter 14: Road Drainage and the Water Environment (Application Document 6.1).
Light pollution	Neutral – general population, sensitive communities and populations	No differential or disproportionate effects identified.	Mitigation measures as set out in relation to landscape and visual in ES Chapter 7: Landscape and Visual (Application Document 6.1).
Climate change	GHG emissions: neutral – general population, sensitive communities and populations	No differential or disproportionate effects identified.	N/A

Topic	Health outcome	Equalities effect	Summary of mitigation
	Vulnerability of the Project to climate change: neutral – general population, sensitive communities and populations		
EMFs	Neutral – general population, sensitive communities and populations	No differential or disproportionate effects identified.	N/A

8.1.2 Table 8.3 and Table 8.4 summarise the likely health outcomes by ward for sensitive populations for construction and operation.

Table 8.3 Summary of health outcomes by ward for sensitive populations (construction)

Construction phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)														
Ward	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
Gravesham															
Riverside	-	X	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Riverview	-	X	X	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Higham	-	-	X	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Chalk	-	X	X	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Westcourt	-	X	X	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Shorne, Cobham and Luddesdown	-	-	-	-	N/A	-	-	X	✓	-	✓/ X	-	-	-	-
Woodlands	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Singlewell	-	X	X	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Northfleet South	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Istead Rise	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-

Construction phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)														
	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
Ward															
Painters Ash	-	-	X	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Central	-	X	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Coldharbour	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Medway															
Cuxton and Halling	-	-	-	-	N/A	-	-	X	✓	-	✓/ X	-	-	-	-
Strood South	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Strood North	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Strood Rural	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Dartford															
Newtown	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Stone Castle	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Stone House	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Bridge	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Temple Hill	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-

Construction phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)														
	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
Ward															
Longfield, New Barn and Southfleet	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Tonbridge and Malling															
Snodland East	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Thurrock															
Ockendon	-	-	X	-	N/A	-	-	X	✓	X	✓/X	-	-	-	-
Belhus	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Orsett	-	-	-	-	N/A	-	-	X	✓	X	✓/X	-	-	-	-
Stifford Clays	-	-	X	-	N/A	-	-	X	✓	-	✓/X	-	-	-	-
Little Thurrock Rectory	-	-	-	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Little Thurrock Blackshots	-	-	X	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Chadwell St Mary	-	X	X	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Tilbury St Chads	-	X	X	-	N/A	-	-	-	✓	-	✓/X	-	-	-	-
Tilbury Riverside and Thurrock Park	-	-	-	-	N/A	-	-	X	✓	-	✓/X	-	-	-	-

Construction phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)															
	Ward	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
East Tilbury	-	-	X	-	N/A	-	-	X	✓	-	✓/ X	-	-	-	-	
Aveley and Uplands	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-	
West Thurrock and South Stifford	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-	
Chafford and North Stifford	-	-	-	-	N/A	-	-	X	✓	-	✓/ X	-	-	-	-	
Stanford-le-Hope West	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-	
Stanford East and Corringham Town	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-	
The Homesteads	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-	
Corringham and Fobbing	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-	
Havering																
Upminster	-	-	X	-	N/A	-	-	X	✓	-	✓/ X	-	-	-	-	
Cranham	-	-	X	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-	
Harold Wood	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-	
Rainham and Wennington	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-	

Construction phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)														
	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
Ward															
Gooshays	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Brentwood															
Warley	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
South Weald	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-
Herongate, Ingrave and West Horndon	-	-	-	-	N/A	-	-	-	✓	-	✓/ X	-	-	-	-

Table 8.4 Summary of health outcomes by ward for sensitive populations (operation)

Operation phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)														
Ward	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services impacts	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
Gravesham	Deleted Cells														
Riverside	✓	-	✓	-	✓	-	-	-	✓	-	✓/ X	-	-	-	-
Riverview	✓	-	✓	✓	✓	-	-	X	✓	-	✓/ X	-	-	-	-
Higham	✓	-	✓	✓	✓	-	-	✓	✓	-	✓/ X	-	-	-	-
Chalk	✓	-	✓	✓	✓	-	-	-	✓	-	✓/ X	-	-	-	-
Westcourt	✓	-	✓	✓	✓	-	-	✓/ X	✓	-	✓/ X	-	-	-	-
Shorne, Cobham and Luddesdown	✓	-	✓	✓	✓	-	-	✓/ X	✓	-	✓/ X	-	-	-	-
Woodlands	✓	-	✓	✓	✓	-	-	✓	✓	-	✓/ X	-	-	-	-
Singlewell	✓	-	✓	✓	✓	-	-	✓	✓	-	✓/ X	-	-	-	-
Northfleet South	✓	-	✓	-	✓	-	-	-	✓	-	✓/ X	-	-	-	-
Istead Rise	✓	-	✓	✓	✓	-	-	-	✓	-	✓/ X	-	-	-	-
Painters Ash	✓	-	✓	✓	✓	-	-	✓	✓	-	✓/ X	-	-	-	-
Central	✓	-	✓	-	✓	-	-	-	✓	-	✓/ X	-	-	-	-

Operation phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)														
	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services impacts	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
Ward															
Coldharbour	✓	-	✓	-	✓	-	-	-	✓	-	✓/X	-	-	-	-
Medway															
Cuxton and Halling	✓	-	✓	-	-	-	-	X	✓	-	✓/X	-	-	-	-
Strood South	✓	-	✓	-	-	-	-	-	✓	-	✓/X	-	-	-	-
Strood North	✓	-	✓	-	-	-	-	-	✓	-	✓/X	-	-	-	-
Strood Rural	✓	-	✓	-	-	-	-	-	✓	-	✓/X	-	-	-	-
Dartford															
Newtown	✓	-	✓	-	✓	-	-	-	✓	-	✓/X	-	-	-	-
Stone Castle	✓	-	✓	-	✓	-	-	-	✓	-	✓/X	-	-	-	-
Stone House	✓	-	✓	-	✓	-	-	-	✓	-	✓/X	-	-	-	-
Bridge	✓	-	✓	-	✓	-	-	-	✓	-	✓/X	-	-	-	-
Temple Hill	✓	-	✓	-	✓	-	-	-	✓	-	✓/X	-	-	-	-

Operation phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)														
	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services impacts	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
Ward															
Longfield, New Barn and Southfleet	✓	-	✓	-	✓	-	-	✓	✓	-	✓/X	-	-	-	-
Tonbridge and Malling															
Snodland East	✓	-	✓	✓	-	-	-	X	✓	-	✓/X	-	-	-	-
Thurrock															
Ockendon	✓	-	✓	✓	✓	-	-	✓/X	✓	-	✓/X	-	-	-	-
Belhus	✓	-	✓	✓	✓	-	-	✓	✓	-	✓/X	-	-	-	-
Orsett	✓	-	✓	✓	✓	-	-	✓/X	✓	-	✓/X	-	-	-	-
Stifford Clays	✓	-	✓	✓	✓	-	-	✓	✓	-	✓/X	-	-	-	-
Little Thurrock Rectory	✓	-	✓	✓	✓	-	-	✓	✓	-	✓/X	-	-	-	-
Little Thurrock Blackshots	✓	-	✓	✓	✓	-	-	✓	✓	-	✓/X	-	-	-	-
Chadwell St Mary	✓	-	✓	✓	✓	-	-	✓/X	✓	-	✓/X	-	-	-	-
Tilbury St Chads	✓	-	✓	✓	✓	-	-	-	✓	-	✓/X	-	-	-	-

Operation phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)															
	Ward	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services impacts	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
Tilbury Riverside and Thurrock Park	✓	-	✓	✓	✓	-	-	-	✓	-	✓/ X	-	-	-	-	
East Tilbury	✓	-	✓	✓	✓	-	-	X	✓	-	✓/ X	-	-	-	-	
Aveley and Uplands	✓	-	✓	-	✓	-	-	✓	✓	-	✓/ X	-	-	-	-	
West Thurrock and South Stifford	✓	-	✓	-	✓	-	-	-	✓	-	✓/ X	-	-	-	-	
Chafford and North Stifford	✓	-	✓	✓	✓	-	-	-	✓	-	✓/ X	-	-	-	-	
Stanford-le-Hope West	✓	-	✓	-	✓	-	-	-	✓	-	✓/ X	-	-	-	-	
Stanford East and Corringham Town	✓	-	✓	-	✓	-	-	-	✓	-	✓/ X	-	-	-	-	
The Homesteads	✓	-	✓	-	✓	-	-	-	✓	-	✓/ X	-	-	-	-	
Corringham and Fobbing	✓	-	✓	-	✓	-	-	-	✓	-	✓/ X	-	-	-	-	
Havinging																

Operation phase	Health outcome by determinant for sensitive populations (✓ = positive, X = negative, - = neutral)														
Ward	Accessibility	Traffic-related severance	Access to green space and outdoor recreation	Active travel	Affordability	Road safety	Air quality	Noise and vibration	Work and training	Housing and community services impacts	Mental health and wellbeing	Pollution and flood-risk	Light pollution	Climate change	EMFs
Upminster	✓	-	✓	✓	-	-	-	✓	✓	-	✓/ X	-	-	-	-
Cranham	✓	-	✓	✓	-	-	-	✓	✓	-	✓/ X	-	-	-	-
Harold Wood	✓	-	✓	-	-	-	-	-	✓	-	✓/ X	-	-	-	-
Rainham and Wennington	✓	-	✓	-	-	-	-	-	✓	-	✓/ X	-	-	-	-
Gooshays	✓	-	✓	-	-	-	-	-	✓	-	✓/ X	-	-	-	-
Brentwood															
Warley	✓	-	✓	-	-	-	-	✓	✓	-	✓/ X	-	-	-	-
South Weald	✓	-	✓	-	-	-	-	-	✓	-	✓/ X	-	-	-	-
Herongate, Ingrave and West Horndon	✓	-	✓	-	-	-	-	-	✓	-	✓/ X	-	-	-	-

References

- Alcock, I., White, M.P., Wheeler, B.W., Fleming, L.E., Depledge, M.H. (2014). Longitudinal effects on mental health of moving to greener and less green urban areas. *Environment, Science and Technology* 48(2) pp1247-1255
- Anciaes, P.R., Stockton, J., Ortegon, A. and Scholes, S. (2019). Perceptions of road traffic conditions along with their reported impacts on walking are associated with wellbeing. *Travel Behaviour and Society* 15 (2019) pp88-101.
- Appleyard, D. and Lintell, M. (1972). The environmental quality of city streets: the residents' viewpoint. *Journal of the American Institute of Planners*, 38(2), pp.84-101.
- Barton, H. and Grant, M. (2006) A health map for the local human habitat. *The Journal for the Royal Society for the Promotion of Health*, 126 (6). pp. 252-253. ISSN 1466-4240 developed from the model by Dahlgren and Whitehead, 1991.
- Barton, J. and Pretty, J. (2010). What is the best dose of nature and green exercise for improving mental health? A multi-study analysis. *Environment, Science and Technology* 44(10) pp3947-3955.
- Brake (2021). *Driver Behaviour. Direct Line & Brake Reports on Safe Driving.*
- Brentwood Borough Council (2020). *Health and Wellbeing Strategy 2020–2023.*
- British Standards Institution (2014a). BS 5228-1:2009+A1:2014: Code of practice for noise and vibration control on construction and open sites. Noise. London: British Standards Institution.
- British Standards Institution (2014b). BS 5228-2:2009+A1:2014: Code of practice for noise and vibration control on construction and open sites. Vibration. London: British Standards Institution.
- Burnett, R.T., Pope, C.A., Ezzati, M., Olives, C., Lim, S.S., Mehta, S., Shin, H.H., Singh, G., Hubbell, B., Brauer, M., Anderson, H.R., Smith, K.R., Balmes, J.R., Bruce, N.G., Kan, H., Laden, F., Pruss-ustun, A., Turner, M.C., Gapstur, S.M., Diver, W.R., and Cohen, A. (2014). An integrated risk function for estimating the global burden of disease attributable to ambient fine particulate matter exposure. *Environmental Health Perspectives*, 122(4). <http://dx.doi.org/10.1289/ehp.1307049>.
- Caldwell, L.L. (2005). Leisure and health: Why is leisure therapeutic? *British Journal of Guidance and Counselling*, 33(1): pp. 7–26.
- Campaign for Better Transport (2012). *Transport and Poverty: A Literature Review.*
- Chapman, A. and Phagoora, J. (2021). *Escaping green deprivation. New Economics Foundation.*
- Chen, H., Kwong, J.C., Copes, R., Tu, K., Villeneuve, P.J., Van Donkelaar, A., Hystad, P., Martin, R.V., Murray, B.J., Jessiman, B., Wilton, A.S., Kopp, A. and Burnett, R.T. (2017). Living near major roads and the incidence of dementia, Parkinson's disease, and multiple sclerosis: a population-based cohort study. *The Lancet*, 389(10070): pp. 718–726.
- Chepesiuk, R. (2009). *Missing the Dark: Health Effects of Light Pollution* 10.1289/ehp.117-a20

- Construction Industry Training Board (2021). *Mental Health and Construction: A Co-ordinated Approach*.
- Cooke, A., Friedli, L., Coggins, T., Edmonds, N., Michaelson, J., O'Hara, K., Snowden, L., Stansfield, J., Steuer, N., Scott-Samuel, A. (2011). *Mental Wellbeing Impact Assessment Toolkit*. 3rd ed., London: National MWIA Collaborative.
- Cooper, E., Gates, S., Grollman, C., Mayer, M., Davis, B., Bankiewicz, U. and Khambhaita, P. (2019). *Transport, health and wellbeing: an evidence review for the Department of Transport*.
- Cooper, R., Boyko, C. and Codinhoto, R. (2008). *Mental Capital and Wellbeing: Making the most of ourselves in the 21st century*. State of Science Review: SR-DR2 The Effect of the Physical Environment on Mental Wellbeing. Foresight Mental Capital and Wellbeing Project.
- Council of the European Union (1999). Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC). Official Journal of the European Communities L199/59, 30.7.1999.
- Courts and Tribunals Judiciary (2021). *Regulation 28: Report to Prevent Future Deaths*.
- Croucher, K., Myers, L. and Bretherton, J. (2007). *Greenspace Scotland Research Report – The links between greenspace and health: a critical literature review*.
- Dahlgren G, Whitehead M (1991). "The main determinants of health" model, version accessible in: Dahlgren G, and Whitehead M. (2007) *European strategies for tackling social inequities in health: Levelling up Part 2*. Copenhagen: WHO Regional Office for Europe http://www.euro.who.int/__data/assets/pdf_file/0018/103824/E89384.pdf.
- Department for Communities and Local Government (2008). *Designing Gypsy and Traveller Sites – Good Practice Guide*.
- Department for Environment, Food and Rural Affairs (Defra) (2021). *Emissions Factors Toolkit version 11*. Accessed December 2021. <https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit>.
- Department for Transport (DfT) (2005). *Inclusive Mobility*. Accessed December 2021. <https://www.gov.uk/government/publications/inclusive-mobility>.
- Department for Transport (DfT) (2014a). *National Policy Statement for National Networks*.
- Department for Transport (DfT) (2014b). *National Public Transport Access Nodes (NaPTAN)*. Accessed December 2019. <https://data.gov.uk/dataset/ff93ffc1-6656-47d8-9155-85ea0b8f2251/national-public-transport-access-nodes-naptan>.
- Department for Transport (DfT) (2019a). *The Road Safety Statement 2019: A Lifetime of Road Safety*. Accessed November 2019: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/817695/road-safety-statement-2019.pdf.
- Department for Transport (2019b). *walking-and-cycling-statistics-2019* (publishing.service.gov.uk).
- Department for Transport (2020b). *Transport Analysis Guidance Unit 4.2 Distributional Impact Appraisal*. Accessed October 2022. <https://www.gov.uk/government/publications/tag-unit-a4-2-distributional-impact-appraisal>.

Department for Transport (DfT) (2020c). TAG Unit 5.1. Active mode appraisal. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/940848/tag-a5-1-active-mode-appraisal.pdf.

Department for Transport (2021a). Decarbonising Transport: A Better, Greener Britain.

Department for Transport (2021b). TAG greenhouse gas emissions workbook. Accessed June 2021. <https://www.gov.uk/government/publications/tag-environmental-impacts-worksheets>.

Department for Work and Pensions (DWP) & Department of Health & Social Care (DHSC). Thriving at Work: a review of mental health and employers, 26 October 2017

Department of Energy and Climate Change (DECC) (2011). National Policy Statement for Electricity Networks (EN-5).

Department of Energy and Climate Change (DECC) (2012). Power Lines: Demonstrating compliance with EMF public exposure guidelines – A voluntary Code of Practice.

Department of Health (2010). Healthy Lives, Healthy People: Our strategy for public health in England.

Donaldson, K. (2003). The biological effects of coarse and fine particulate matter. *Occupational and Environmental Medicine*, 60(5): pp. 313–314.

Egan, M., Petticrew, M., Ogilvie, D. and Hamilton, V. (2003). New roads and human health: a systematic review. *American Journal of Public Health*, 93 (9): pp. 1463–1471.

Egan, M., Lawson, L., Kearns, A., Conway, E. and Neary, J. (2015). Neighbourhood demolition, relocation and health. A qualitative longitudinal study of housing-led urban regeneration in Glasgow, UK. *Health & place*, 33: pp.101–108.

Engemann, K, Pedersen. C.B, Arge, L, Tsirogiannis, C, Mortensen. P.B and Sveening, J.C, 2019. Residential green space in childhood is associated with lower risk of psychiatric disorders from adolescence into adulthood. *Environmental Sciences*, 116(11) pp 5188-5193.

Environment Agency (2012). Thames Estuary 2100 Plan.

Essex County Council (2012). Culvert Policy. Accessed March 2022. https://flood.essex.gov.uk/media/1263/essex_county_council_culvert_policy.pdf.

Essex County Council (2015). Essex County Council's Equalities Strategy 2015-18. Accessed August 2021. https://www.rochford.essex.sch.uk/adminarea/data/files/1%20EQUALITIES_POLICY.pdf.

Essex County Council (2022). Everyone's Essex.

European Environment Agency (2020). Healthy environment, healthy lives: how the environment influences health and well-being in Europe.

Faculty of Public Health (2016). Better mental health for all: A public health approach to mental health improvement.

Farmer, P. and Stevenson, D. (2017). Thriving at Work: The Independent Review of Mental Health and Employers.

Foresight (2009). Foresight Mental Capital and Wellbeing Project (2008). Final Project report. London: The Government Office for Science.

- Gibson, M., Petticrew, M., Bambra, C., Sowden, A.J., Wright, K.E. and Whitehead, M. (2011). Housing and health inequalities: a synthesis of systematic reviews of interventions aimed at different pathways linking housing and health. *Health Place* 17(1) pp175-84.
- Gill, S.E., Handley, J.F., Ennos, A.R. and Pauleit, S (2007). Adapting cities for climate change: the role of the green infrastructure. *Built environment*, 33(1), pp.115-133.
- Global Research Network on Urban Health Equity (2010). Improving urban health equity through action on the social and environmental determinants of health.
- Government Office for Science (2019). Future of Mobility: Inequalities in Mobility and Access in the UK Transport System.
- Gravesham Borough Council (2016). Open Space Standards Paper. Accessed April 2020. https://www.gravesham.gov.uk/__data/assets/pdf_file/0016/319111/Open-Space-Standards.pdf.
- Gravesham Borough Council (undated). Draft Youth and Community Health and Wellbeing Strategy 2022–2027.
- Greater London Authority (2006). The control of dust and emissions from construction and demolition Best Practice Guidance.
- Greater London Authority (2018). London Health Inequalities Strategy.
- Groundwork (2021). Out of bounds: equity in access to urban nature.
- Harner, L. (2004). Improving patient access to health services: a national review and case studies of current approaches. Health Development Agency.
- Healthy Urban Development Unit (2013). Planning for Health. Rapid Health Impact Assessment Tool. London: National Health Service, London Healthy Urban Development Unit.
- Higgsmith, M., Stockton, J., Anciaes, P., Scholes, S. and Mindell, S. (2022). Community severance and health – a novel approach to measuring community severance and examining its impact on the health of adults in Great Britain. *Journal of Transport and Health* Vol. 25 June 22 101368.
- Highways England (2014). Health and Safety: Raising the Bar.
- Highways England (2017a). Lower Thames Crossing, Environmental Impact Assessment – Scoping Report (Ref: HE540039-CJV-GEN-GEN-REP-ENV-00001).
- Highways England (2017b). Suicide Prevention Strategy.
- Highways England (2018a). Preliminary Environmental Information Report – Statutory Consultation (Ref: HE540039-CJV-GEN-GEN-REP-ENV-00015).
- Highways England (2018b). An Accessible Road Network? Disabled user experience on England's motorways and major 'A' roads November.
- Highways England (2019a). Design Manual for Roads and Bridges, GG 103 Introduction and General Requirements for Sustainable Development and Design. Accessed December 2021. <https://www.standardsforhighways.co.uk/dmrb/search/89d10ef2-7833-44df-9140-df85cd6382b9>.
- Highways England (2019b). Design Manual for Roads and Bridges, LA 105 Air Quality. Accessed December 2021.

<https://www.standardsforhighways.co.uk/dmrb/search/10191621-07df-44a3-892e-c1d5c7a28d90>.

Highways England (2019c). Home Safe and Well: Our approach to health, safety and wellbeing.

Highways England (2020a). Design Manual for Roads and Bridges, CD 352 Design of Road Tunnels. Accessed November 2021.

<https://www.standardsforhighways.co.uk/dmrb/search/987a669b-13a1-40b9-94da-1ea4e4604fdd>.

Highways England (2020b). Design Manual for Roads and Bridges, LA 104 Environmental Assessment and Monitoring. Revision 1. Accessed November 2021.

<https://www.standardsforhighways.co.uk/dmrb/search/0f6e0b6a-d08e-4673-8691-cab564d4a60a>.

Highways England (2020c). Design Manual for Roads and Bridges, LA 111 Noise and Vibration. Revision 2. Accessed November 2021.

<https://standardsforhighways.co.uk/dmrb/search/cc8cfcf7-c235-4052-8d32-d5398796b364>.

Highways England (2020d). Design Manual for Roads and Bridges, LA 112 Population and Human Health. Revision 1. Accessed November 2021.

<https://standardsforhighways.co.uk/dmrb/search/1e13d6ac-755e-4d60-9735-f976bf64580a>.

Highways England (2020e). Lower Thames Crossing, Environmental Impacts Update – Supplementary Consultation 2020.

Highways England (2020f). Mental Health Common Intent.

Hirst, D. (2020). Active travel: Trends, policy and funding. House of Commons Library briefing paper.

House of Commons Library (2021). Income inequality in the UK.

Houlden, V., de Albuquerque, J.P., Weich, S. and Jarvis, S. (2019). A spatial analysis of proximate greenspace and mental wellbeing in London. *Applied Geography*, 109: p. 102036.

Institute for Fiscal Studies (2021). The cost of living crisis – who is hit by recent price increases?

Institute of Environmental Management and Assessment (IEMA) (2017). Health in Environmental Impact Assessment – A Primer for a Proportionate Approach.

International Association of Impact Assessment and European Public Health Association (2020). Human health: ensuring a high level of protection. A reference paper on addressing human health in Environmental Impact Assessment.

International Commission on Non-Ionising Radiation Protection (ICNIRP) (1998). Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (Up to 300 GHz). *Health Physics*, 74(4): pp. 494–522.

International Transport Forum (2018). The social impacts of road pricing: summary and conclusions. Roundtable 170.

Jariwala, H, Syed., H., Pandya, M. and Gajera, Y. (2017). Noise pollution and human health: a review.

Kent County Council, (2016). Benefits of Active Travel.

- Kent County Council (undated). Health and Wellbeing Strategy.
- Knight, Kavanagh & Page (2016a). Gravesham Borough Council Open Space Assessment Report.
- Koohsari, M.J., Mavoa, S., Villanueva, K., Sugiyama, T., Badland, H., Kaczynski, A.T., Owen, N. and Giles-Corti, B. (2015). Public open space, physical activity, urban design and public health: Concepts, methods and research agenda. *Health & Place*, 33: pp. 75–82.
- Kowalski-Trakofler, K., and Vaught, C. (2003). Judgment and decision making under stress: an overview for emergency managers, National Institute for Occupational Safety and Health, Pittsburgh Research Laboratory.
- Landscape Institute (2013). Public Health and Landscape – Creating Healthy Places. <https://www.landscapeinstitute.org/policy/health>.
- Lee, A. (2010). The health benefits of urban green space: a review of the evidence. *Journal of Public Health*, 33(2): pp. 212–222.
- Lim, J., Kweon, K., Kim, H.W., Cho, S.W., Park, J. and Sim, C.S. (2018) Negative impact of noise and noise sensitivity on mental health in childhood. *Noise Health*. Sep-Oct 20(96) pp199-211.
- London Borough of Havering (2016). Open Space Assessment Report. Accessed April 2020. https://www.havering.gov.uk/download/downloads/id/1967/lbhlp36_open_space_assessment_report_2016.pdf.
- London Borough of Havering (2018). One Havering: Community Cohesion Strategy 2018-2022. Accessed October 2022. <https://democracy.havering.gov.uk/mgAi.aspx?ID=19276>.
- London Borough of Havering (2019). Havering Joint Health and Wellbeing Strategy 2019/20-2023/24. Accessed August 2021. https://www.havering.gov.uk/download/downloads/id/1533/havering_health_and_wellbeing_strategy_2017.pdf.
- Maas, J. (2006). Green space, urbanity and health: how strong is the relation? *Journal of Epidemiology and Community Health*, 60(7): pp. 587–592.
- Mackett, R.L. and Thoreau, R. (2015). Transport, social exclusion and health, *Journal of Transport and Health*, 2(4): pp. 610–617. <http://dx.doi.org/10.1016/j.jth.2015.07.006>.
- Maller, C.T. (2005). Healthy Nature Healthy People. *Health Promotion International*, 21(10).
- Marmot, M., Allen, J., Goldblatt, P., Boyce, T., McNeish, D. and Grady, M. (2010). Fair Society, Healthy Lives: The Marmot Review: Strategic Review of Health Inequalities in England post-2010. London: The Marmot Review.
- Marmot, M., Allen, J., Boyce, T., Goldblatt, P. and Morrison, J. (2020). Health Equity in England: The Marmot Review 10 Years On. London: Institute of Health Equity.
- McCartney, G., Hearty, W., Taulbut, M., Dryden, R. and Collins, C. (2017). Regeneration and health: a structured, rapid literature review. *Public Health*, 148: pp. 69–87. <https://doi.org/10.1016/j.puhe.2017.02.022>
- McManus, S., Bebbington, P., Jenkins, R. and Brugha, T. (eds.) (2016). Mental health and wellbeing in England: Adult Psychiatric Morbidity Survey 2014. Leeds: NHS Digital.

- Medway Council (2018). Medway Joint Health and Wellbeing Strategy 2018-2023. Accessed August 2021. https://www.medway.gov.uk/downloads/file/3710/joint_health_and_wellbeing_strategy_2018_to_2023.
- Mental Health Foundation (2013). Let's Get Physical: The impact of physical activity on wellbeing.
- Mental Health Foundation (2015). How to look after your mental health using exercise. Accessed December 2021. <https://www.mentalhealth.org.uk/publications/how-to-using-exercise>.
- Mental Health Foundation (2021). Nature research report.
- Milner, A., Page, A. and LaMontagne, A.D. (2013). Long-term unemployment and suicide: a systematic review and meta-analysis. *PLoS ONE* 8(1): e51333. <https://doi.org/10.1371/journal.pone.0051333>.
- Mindell, J.S. and Karlsen, S. (2012). Community severance and health: what do we actually know? *Journal of urban health*, 89(2): pp. 232–246.
- Ministry of Housing, Communities and Local Government (2015). English Indices of Deprivation 2015. Accessed December 2021. <https://www.gov.uk/government/statistics/english-indices-of-deprivation-2015>.
- Ministry of Housing, Communities and Local Government (2019). English Indices of Deprivation 2019. Accessed December 2021. <https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019>.
- Morency, P., Gauvin, L., Plante, C., Fournier, M. and Morency, C. (2012). Neighbourhood social inequalities in road traffic injuries: the influence of traffic volume and road design. *American Journal of Public Health*, 102(6): pp. 1112–1119.
- Morrison, D.S., Petticrew, M. and Thomson, H. (2003). What are the most effective ways of improving population health through transport interventions? Evidence from systematic reviews. *Journal of Epidemiology & Community Health*, 57(5): pp. 327–333.
- Mudway, I., Dundas, I., Wood, H., Marlin, N., Jamaludin, J., Bremner, S. et al (2018). Impact of London's low emission zone on air quality and children's respiratory health: a sequential annual cross-sectional study. *The Lancet Public Health Journal*, Vol. 4, Issue 1, E28-E40.
- National Health Service (NHS) (2019). NHS.uk. Accessed September 2019. <https://www.nhs.uk/live-well/exercise/>.
- National Institute for Health and Care Excellence (NICE) (2018). Physical activity and the environment – NICE guideline [NG90]. Accessed September 2019. <https://www.nice.org.uk/guidance/ng90/chapter/Recommendations>.
- National Radiological Protection Board (NRPB) (2004). Review of the Scientific Evidence for Limiting Exposure to Electromagnetic Fields (0–300 GHz). Documents of the NRPB, 15(3): pp. 1–215.
- Natural England (2021). The People and Nature Survey for England: Monthly indicators with specific weight for April 2020 - March 2021 (Official Statistics).
- Nuffield Trust (2021). How many patients per GP are there in England?

- Office for National Statistics (ONS) (2020). ONS Annual Population Survey. Accessed October 2022.
<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationanddemography/population-estimates>.
- Office for National Statistics (ONS) (2011). 2011 Census. Accessed October 2022.
<https://www.ons.gov.uk/census/2011census>.
- Office for National Statistics (ONS) (2022). People in employment on zero hours contracts. Accessed August 2022.
<https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/datasets/emp17peopleinemploymentonzerohourscontracts>.
- Oxley, J. and Whelan, M. (2008). It cannot be all about safety: the benefits of prolonged mobility. *Traffic Injury Prevention*, 9(4): pp. 367–378.
<https://doi.org/10.1080/15389580801895285>.
- Peters R, Ee N, Peters J, Booth A, Mudway I, Anstey KJ. (2019). Air pollution and dementia: a systematic review. *Journal of Alzheimer’s Disease* 70(s1)
- Pickett K, James O, Wilkinson R. Income inequality and the prevalence of mental illness: a preliminary international analysis. *Journal of Epidemiology and Community Health* (2006) 60(7):646-7
- Public Health England (2013). Obesity and the environment: increasing physical activity and active travel.
- Public Health England (PHE) (2014). Local action on health inequalities: Improving access to green spaces.
- Public Health England (PHE) (2016). Working Together to Promote Active Travel: A briefing for local authorities.
- Public Health England (PHE) (2019). Mental Health JSNA Toolkit. Mental Health: Environmental Factors.
- Public Health England (PHE) (2021). Health profile for England 2021.
- Office for Health Improvement and Disparities (OHID) (2021). Local Health. Accessed September 2022. www.localhealth.org.uk.
- Office for Health Improvement and Disparities (OHID) (2022) Fingertips: public health data. Accessed September 2022. <https://fingertips.phe.org.uk/>.
- Robinson, E. and Adams, R.M. (2008). Housing stress and the mental health and wellbeing of families. Australian Institute of Family Studies.
- Rowlingson, K. (2011). Does income inequality cause health and social problems? Birmingham: Joseph Rowntree Foundation.
- Royal Society for the Prevention of Accidents (2014). Road Safety and Public Health. Accessed November 2019. <https://www.rospa.com/rospaweb/docs/advice-services/road-safety/practitioners/rospa-road-safety-and-public-health.pdf>.
- Salvo, G., Lashewicz, B., Doyle-Baker, P. and McCormack, G. (2018). Neighbourhood built environment influences on physical activity among adults: a systematized review of qualitative evidence. *International Journal of Environmental Research and Public Health*, 15(5): p. 897.

Schraufnagel, D.E., Balmes, J.R., Cowl, C.T., De Matteis, S., Jung, S.H., Mortimer, K., Perez-Padilla, R., Rice, M.B., Riojas-Rodriguez, H., Sood, A. and Thurston, G.D. (2019). Air pollution and noncommunicable diseases: a review by the Forum of International Respiratory Societies' Environmental Committee, Part 2: air pollution and organ systems. *Chest*, 155(2): pp. 417–426.

Sheffield Hallam University Centre for Regional Economic and Social Research, (2014), *Regeneration and poverty: policy and practice review* (Sheffield: Sheffield Hallam University).

Sherrington, C., Fairhall, N., Kwok, W., Wallbank, G., Tiedemann, A., Michaelieff, Z., Ng, C. and Bauman, A. (2020). Evidence on physical activity and falls prevention for people aged 65+ years: systematic review to inform the WHO guidelines on physical activity and sedentary behaviour. *International Journal of Behavioural Nutrition and Physical Activity* 17, Article Number: 144(2020).

Smith, L., Chowdhury, S. and Hammond, J. (2019). *Health Mobility and Road Safety*.

Southend-on-Sea Borough Council (2021). *Health and Wellbeing Strategy*.

Southend-on-Sea Borough Council, Essex County Council and Thurrock Council (2017). *Southend, Essex and Thurrock Mental Health and Wellbeing Strategy 2017-2021*. Accessed August 2021.

<https://southend.moderngov.co.uk/documents/s8131/Appendix%201%20MH%20Strategy%20-%20Master%20Document%20MER%20V3a%20-%20SET%20003.pdf>

Steinbach, R., Grundy, C., Edwards, P., Wilkinson, P. and Green, J. (2011). The impact of 20 mph traffic speed zones on inequalities in road casualties in London. *Journal of Epidemiology and Community Health*, 65(10): pp. 921–926.

Szalma, J.L. and Hancock, P.A. (2011). Noise effects on human performance: a meta-analytic synthesis. *Psychological Bulletin*, 137(4): p.682–707.

The Chartered Institute of Building (2020). *Understanding Mental Health in the Built Environment*.

The Health Foundation (2018). *Why a transport system that better supports health and reduces inequalities is essential*.

Thomson, H., Jepson, R., Hurley, F. and Douglas, M. (2008). Assessing the unintended health impacts of road transport policies and interventions: translating research evidence for use in policy and practice. *BMC Public Health*, 8:339.

Thurrock Council (2006). *Open Spaces Strategy 2006 – 2011: Thurrock Greengrid Strategy*. Accessed June 2020.

<https://www.thurrock.gov.uk/sites/default/files/assets/documents/eb.063.pdf>.

Thurrock Council (2022). *Health and Wellbeing Strategy*.

Thurrock Council (undated). *Thurrock Collaborative Communities Framework*. Accessed August 2021.

<https://democracy.thurrock.gov.uk/documents/s29327/Collaborative%20Communities%20Framework%202021-2025%20-%20Appendix%201.pdf>

Vasquez-Vera, H., Palencia, L., Magna, I., Mena, C., Neira, J. and Borrell, C. (2017). The threat of home eviction and its effects on health through the equity lens: A systematic review. *Social Science & Medicine*, 175: pp. 199–208.

<https://doi.org/10.1016/j.socscimed.2017.01.010>.

- Walton, H., Dajnak, D., Beevers, S., Williams, M., Watkiss, P. and Hunt, A. (2015). *Understanding the Health Impacts of Air Pollution in London*. London: Kings College London.
- Ward, H., Lyons, R., Christie, N., Thoreau, R., & Macey, S. (2007). *Fatal injuries to car occupants: analysis of health and population data*. London: Department for Transport.
- Wei Y., Wang Y., Di Q., Choirat C., Wang Y., Koutrakis P., Zanobetti, A., Dominici, F. and Schwartz, J.D. (2019). Short term exposure to fine particulate matter and hospital admission risks and costs in the Medicare population: time stratified, case crossover study. *BMJ*, 2019;367:l6258.
- Wales Health Impact Assessment Support Unit (WHIASU) (2021). *Health Impact Assessment – A Practical Guide*. HIA_Tool_Kit_V2_WEB-1.pdf (phwwhocc.co.uk)
- White et al (2019). Spending at least 120 minutes a week in nature is associated with good health and wellbeing. *Scientific Reports*.
- Wildlife and Countryside Link (2022). *Policy briefing nature for everyone campaign*.
- Williams *et al.* (2020). Social cohesion, mental wellbeing and health-related quality of life among a cohort of social housing residents in Cornwall: a cross sectional study.
- Williams, E., Buck, D., Babalola, G. and Maguire, D. (2022) *What are health inequalities?* King's Fund.
- World Health Organization (WHO) (1948). Preamble to the Constitution of WHO as adopted by the International Health Conference, New York, 19 June – 22 July 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of WHO, no.2 p100) and entered into force on 7 April 1948.
- World Health Organization (WHO) (2000). *Mental health and work: Impact, issues and good practices*.
- World Health Organization (WHO) (2005). *European Declaration on Mental Health*.
- World Health Organization (WHO) Regional Office for Europe (2011). *Burden of disease from environmental noise: Quantification of healthy life years lost in Europe*.
- World Health Organization (WHO) (2013). *Review of evidence on health aspects of air pollution (REVIHAAP)*.
- World Health Organization (WHO) (2018). *Global action plan on physical activity 2018–2030: more active people for a healthier world*.
- World Health Organization (WHO) (2021). *WHO global air quality guidelines. Particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide*. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO.
- World Health Organization (WHO) (2022a). *Mental disorders factsheet*.
- World Health Organization (WHO) (2022b). *European Regional Obesity Report 2022*. Copenhagen: WHO Regional Office for Europe; 2022. Licence: CC BY-NC-SA 3.0 IGO
- Xia, N. and Li, H. (2018). Loneliness, social isolation, and cardiovascular health. *Antioxidants & Redox Signalling*, 28(9): pp. 837–851.
- Zhang, T. and Chan, A.H. (2016). The association between driving anger and driving outcomes: A meta-analysis of evidence from the past twenty years. *Accident Analysis & Prevention*, 90: pp. 50–62. <https://doi.org/10.1016/j.aap.2016.02.009>.

Glossary

Term	Abbreviation	Explanation
Active implantable medical devices	AIMDs	An active medical device intended to be totally or partially introduced into the human body for diagnostic or therapeutic purposes and is to remain in place, for example pacemakers, insulin pumps and Implanted Cardiac Defibrillators (ICDs).
Adequacy of Consultation Representations	AoCRs	Before a decision can be made on whether to accept an application for examination, under section 55 of the Planning Act local authorities may make representations to the Secretary of State concerning the adequacy of the applicant's consultation, which the Secretary of State must regard.
Affected Road Network	ARN	This is the road network impacted by the Project.
Air Quality Management Area	AQMA	An area, declared by a local authority, where air quality monitoring does not meet Defra's national air quality objectives.
Air Quality Strategy objective	AQS objective	Objective set by the Air Quality Strategy for England, Scotland, Wales and Northern Ireland to improve air quality in the UK in the medium term. Objectives are focused on the main air pollutants to protect health.
AM Peak Period		The period between 06:00–09:00 in the Project traffic model (LTAM)
Active Mode Appraisal Toolkit	AMAT	DfT's Active Mode Appraisal Toolkit.
Annual Average Daily Traffic	AADT	An estimate of the average daily traffic along a defined segment of road. This value is calculated from short-term counts taken along the same section, which are then factored to produce the estimate of AADT.
Area of Outstanding Natural Beauty	AONB	Statutory designation intended to conserve and enhance the ecology, natural heritage and landscape value of an area of countryside.
Bluewater		Bluewater Shopping Centre, an out-of-town shopping centre in Stone, Kent, outside the M25 Orbital motorway, 17.8 miles (28.6km) east-south-east of London's centre.
Best Available Techniques		Use of best practice working methods.
Best Practicable Means	BPM	A term used under the Control of Pollution Act 1974 and Environmental Protection Act 1990 to refer to measures which are reasonably practicable, having regard to local conditions and circumstances, to the current state of technical knowledge and to financial implications, concerning the mitigation of noise and other potential nuisance.
Bridleway	BR	A route along which the general public has rights to travel on foot or horseback. Cyclists may use a bridleway but are obliged to give way to other users on foot or horseback.
British Standard	BS	Standards produced by the British Standards Institution, which is incorporated under royal charter and formally designated as the national standards body for the UK.

Term	Abbreviation	Explanation
Chronic Obstructive Pulmonary Disease	COPD	An obstructive lung disease characterised by chronically poor airflow that typically worsens over time.
Clinical Commissioning Groups	CCGs	Clinically-led statutory NHS bodies responsible for the planning and commissioning of health care services for their local area. CCGs were created following the Health and Social Care Act in 2012, and replaced Primary Care Trusts on 1 April 2013. CCGs have since been replaced by Integrated Care Partnerships in 2022.
Code of Construction Practice	CoCP	Contains control measures and standards to be implemented by the Project, including those to avoid or reduce environmental effects.
Combined Modelling and Appraisal Report	ComMA	The purpose of the Combined Modelling and Appraisal Report is to inform decision makers and stakeholders on how the evidence underpinning the business case has been developed, from the initial identification of the underlying problem through the collection of data and the production of any supporting traffic models and forecast impacts of the Project on traffic to the eventual economic appraisal.
Community Liaison Groups	CLGs	A group of representatives from National Highways, Contractors and the local community to ensure local residents are appropriately informed and therefore prepared for forthcoming changes to construction activities.
Conceptual Site Model	CSM	Refers to the source-pathway-receptor (SPR) linkage approach for identifying pollutant linkages. Development and refinement of the CSM is part of the process defined in Environment Agency guidance Land Contamination: Risk Management (Environment Agency, 2020).
Conservation Area	CA	An area of special environmental or historic interest or importance, of which the character or appearance is protected by law against undesirable changes (Section 69 of the Planning (Listed Buildings and Conservation Areas) Act 1990).
Considerate Constructors Scheme		A not-for-profit, independent organisation founded in 1997 to raise standards in the construction industry.
Construction Logistics and Community Safety	CLOCS	This is a national Standard which defines the primary requirements placed upon key stakeholders associated with a construction project.
Cost and Benefit to Accidents – Light Touch	COBALT	New 'light touch' version of COBA, Cost Benefit Analysis computer program, DfT's tool for estimating accident benefits. The COBA program compares the costs of providing road schemes with the benefits derived by road users.
Department for Transport	DfT	The government department responsible for the English transport network and a limited number of transport matters in Scotland, Wales and Northern Ireland that have not been devolved.

Term	Abbreviation	Explanation
Design Manual for Roads and Bridges	DMRB	A comprehensive manual which contains requirements, advice and other published documents relating to works on motorway and all-purpose trunk roads for which one of the Overseeing Organisations (National Highways, Transport Scotland, the Welsh Government or the Department for Regional Development (Northern Ireland)) is the highway authority. The DMRB has been developed as a series of documents published by the Overseeing Organisations of England, Scotland, Wales and Northern Ireland. For the A122 Lower Thames Crossing, the Overseeing Organisation is National Highways.
Development Consent Order	DCO	Means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects (NSIP) under the Planning Act 2008.
Distributional Impact	DI	The variance of transport intervention impacts across different social groups. The appraisal of DIs is mandatory in the appraisal process and is a constituent of the Appraisal Summary Table (AST).
Distributional Impact Appraisal	DIA	n/a
Do Minimum		A future year scenario in LTAM which includes changes to the road network and planned development that is forecast to go ahead, but not the Lower Thames Crossing.
Do Something		A future year scenario in LTAM which includes changes to the road network and planned development that is forecast to go ahead, and the Lower Thames Crossing.
Eastbound	EB	Direction of travel.
Electric and Magnetic Fields	EMF	An area of moving electric charges that arise whenever electrical energy is used. These fields can come from natural sources such as thunderstorms, or they may be generated by human activity such as the use of electrical power and lighting.
Environmental Impact Assessment	EIA	A process by which information about the environmental effects of a proposed development is collected, assessed and used to inform decision making. For certain projects, EIA is a statutory requirement, reported in an Environmental Statement.
Environmental Statement	ES	A document produced to support an application for development consent that is subject to Environmental Impact Assessment (EIA), which sets out the likely impacts on the environment arising from the proposed development.
European Union	EU	A politico-economic union of 27 member states that are located primarily in Europe.
Fleet Operator Recognition Scheme	FORS	A voluntary accreditation scheme for fleet operators which aims to raise the level of quality within fleet operations and to demonstrate which operators are achieving exemplary levels of best practice in safety, efficiency and environmental protection.
Flood Risk Assessment	FRA	An assessment of the risk of flooding from all flooding mechanisms, the identification of flood mitigation measures, and identification of actions to be taken before and during a flood.
Footpath	FP	n/a
Framework Construction Travel Plan	FCTP	Framework with regard to the implementation of travel planning for the movement of personnel to and from the construction areas and compounds during the construction phase of the Project.

Term	Abbreviation	Explanation
General Practitioner	GP	A medical doctor who treats acute and chronic illnesses and provides preventive care and health education to patients.
Generic Quantitative Risk Assessment	GQRA	Tier 2 of the risk assessment process according to LCRM guidance on the assessment of land contamination. A GQRA uses generic assessment criteria and assumptions to estimate risk.
Greater London Authority	GLA	n/a
Greenhouse Gas	GHG	Gases able to absorb infrared radiation emitted from Earth's surface and reradiate it back to Earth's surface, thus contributing to the greenhouse effect. Carbon dioxide, methane, and water vapour are the most important greenhouse gases.
Health and Equalities Impact Assessment	HEqIA	A systematic process used to identify the potential health and equalities impacts arising from policies, plans, programmes and projects, to identify the distribution of those effects among the population and to identify mitigation measures to address these effects, thereby minimising adverse effects on the local population.
Hectares	Ha	n/a
Heavy Duty Vehicles	HDVs	Freight vehicles of more than 3.5 tonnes (e.g. lorries) or passenger transport vehicles of more than 8 seats (e.g. buses).
Heavy Goods Vehicle	HGV	A large, heavy motor vehicle used for transporting cargo.
High Speed 1	HS1	A 109km high-speed railway between London and the UK end of the Channel Tunnel. The line carries international passenger traffic between the UK and continental Europe; it also carries domestic passenger traffic to and from stations in Kent and east London, as well as Berne gauge freight traffic.
Implanted Cardiac Defibrillators	ICD	A cardiac therapy device which can take the form of a small battery-powered device placed in the chest to detect and stop irregular heartbeats (arrhythmias).
International Commission on Non-ionizing Radiation Protection	ICNIRP	The ICNIRP aims to protect people and the environment against adverse effects of non-ionizing radiation. ICNIRP develops and disseminates science-based advice on limiting exposure to non-ionizing radiation.
Index of Multiple Deprivation	IMD	Official measure of relative deprivation for 32,844 small census areas in England. A rank of 1 equates to the most deprived area.
Indices of Deprivation	IoD	A measure of the relative levels of deprivation. In England this considers 32,844 small areas or neighbourhoods, called Lower Layer Super Output Areas. The IoD 2019 is based on 39 separate indicators, organised across seven distinct domains of deprivation; these relate to income, employment, education, health, crime, living environment and barriers to housing and services.

Term	Abbreviation	Explanation
Institute of Environmental Management and Assessment	IEMA	Tier 2 of the risk assessment process according to LCRM guidance on the assessment of land contamination. A GQRA uses generic assessment criteria and assumptions to estimate risk.
Inter-peak	IP	An average hour within the Lower Thames transport model (LTAM) to represent an hour within the period 09:00–15:00.
Landscape and Visual Impact Assessment	LVIA	A tool used to identify the significance of and the effects of changes resulting from a project on both the landscape as a resource and on people's views and visual amenity.
Landscape Character Area	LCA LLCA	The ' <i>discrete geographical areas of particular landscape type</i> ' (source of definition: GLVIA3). Note: Local Landscape Character Area is referred to as LLCA.
Light-emitting diode	LED	A semiconductor device that emits visible light when an electric current passes through it.
Light Goods Vehicle	LGV	Vehicles meeting the Department for Transport VEH04 criteria.
Lesbian, gay, bisexual or transgender	LGBT	n/a
Local Climate Impact Profiles	LCLIP	A simple tool designed to help organisations assess their exposure to the weather. It can be used as a standalone tool, or as a step in a risk-based framework.
Local Residents' Discount Scheme	LRDS	A scheme which offers a discount on the crossing charge for vehicles to those residents who can confirm they are eligible.
Low Emission Zone	LEZ	A defined area where access by some polluting vehicles is restricted or deterred with the aim of improving air quality.
Lower Super Output Areas	LSOAs	A geographic hierarchy used to report statistics for small areas with an average population of 1,500 people in England and Wales.
Lower Thames Area Model	LTAM	Transport model designed to forecast impacts of providing additional road based capacity across the River Thames at locations at or east of the existing Dartford Crossing.
Mobile Information Centre	MIC	Mobile van used by National Highways as a way of engaging with members of the public.
National Cycle Route	NCR	A cycle route part of the National Cycle Network created by Sustrans to encourage cycling throughout Britain.
National Health Service	NHS	The name of the public health services of England, Scotland and Wales, also commonly used in Northern Ireland.
National Institute for Health and Care Excellence	NICE	The NICE provides national guidance and advice to improve health and social care.

Term	Abbreviation	Explanation
National Planning Policy Framework	NPPF	A framework published in March 2012 by the UK's Department of Communities and Local Government, consolidating previously issued documents called Planning Policy Statements (PPS) and Planning Practice Guidance Notes (PPG) for use in England. The NPPF was updated in February 2019 and again in July 2021 by the Ministry of Housing, Communities and Local Government.
National Policy Statement	NPS	There are 12 designated National Policy Statements (NPSs), setting out government policy on different types of national infrastructure development, including energy, transport, water and waste. NPSs provide the framework within which Examining Authorities make their recommendations to the Secretary of State.
National Policy Statement for National Networks	NPSNN	Sets out the need for, and Government's policies to deliver, development of Nationally Significant Infrastructure Projects (NSIPs) on the national road and rail networks in England. It provides planning guidance for promoters of NSIPs on the road and rail networks, and the basis for the examination by the Examining Authority and decisions by the Secretary of State.
National Public Transport Access Nodes	NaPTAN	A national dataset of all public transport 'stops' in England, Scotland and Wales. This includes bus stops and railway stations, tram, metro and underground stop and airports and ferry terminals.
National Vocational Qualification Level 4	NVQ4	NVQ level that is equivalent to a degree level education.
Nationally Significant Infrastructure Project	NSIP	Major infrastructure developments in England and Wales, such as proposals for power plants, large renewable energy projects, new airports and airport extensions, major road projects etc. that require a development consent under the Planning Act 2008.
NEETs		Young people not in education, employment or training.
Nitrogen dioxide	NO₂	n/a
Noise and Vibration Management Plan	NVMP	Incorporates measures proposed and procedures for the management of noise and vibration arising during the construction phase.
Noise Important Area	NIA	Defra published noise maps for England's roads in 2008, with the noise action plans following two years later in 2010. The action plans set out a framework for managing noise, rather than propose specific mitigation measures, and were designed to identify 'Important Areas' that are impacted by noise from major sources and therefore must be investigated. NIAs are where the 1% of the population that are affected by the highest noise levels from major roads are located, according to the results of Defra's strategic noise maps.
Noise sensitive receptor	NSR	Receptors which are potentially sensitive to noise, such as dwellings, hospitals, schools, and community facilities.
Non-motorised users(s)	NMU	Users of non-motorised vehicles (eg cyclists, horse riders) and pedestrians

Term	Abbreviation	Explanation
Non-road mobile machinery		Any mobile machine, item of transportable industrial equipment, or vehicle – with or without bodywork – that is not intended for carrying passengers or goods on the road and is installed with an internal combustion engine.
Northbound	NB	Direction of travel.
Office for Health Improvement and Disparities	OHID	n/a
Office for National Statistics	ONS	The executive office of the UK Statistics Authority, a non-ministerial department which reports directly to the UK Parliament.
Origin-destination	OD	Origin-destination data (also known as flow data) includes the travel-to-work and migration patterns of individuals, cross-tabulated by variables of interest (for example occupation).
Other Sensitive Receptor	OSR	Noise sensitive receptor which is not a dwelling (hospitals, healthcare facilities, education facilities, community facilities, quiet areas or potential quiet areas under the Environmental Noise Directive (END), international and national or statutorily designated sites, Public Rights of Way and cultural heritage assets).
outline Materials Handling Plan	oMHP	Provides the principles of handling waste associated with the Project. It provides further detail of waste generated from the Project's earthwork activities within the Order Limits.
Particulate matter	PM	The sum of all solid and liquid particles suspended in air, many of which are hazardous. This can include both organic and inorganic particles, such as dust, pollen, soot, smoke and liquid droplets. These particles vary greatly in size, composition and origin.
Particulate matter (10µm)	PM₁₀	Particulate matter with a diameter between 2.5 and 10 micrometres.
Particulate matter (2.5µm)	PM_{2.5}	Particulate matter with a diameter equal to or less than 2.5 micrometres.
Peak Particle Velocity	PPV	A measurement of the magnitude of ground vibration, which is the greatest instantaneous velocity of particles in the ground through which the ground vibration wave travels during a given time interval, measured in millimetres per second (mm/s).
PM Peak		Evening peak period of traffic.
Preliminary Environmental Information Report	PEIR	An early output of the EIA process, and part of the DCO application process.
Project		A122 Lower Thames Crossing: A proposed new crossing of the Thames Estuary linking the county of Kent with the county of Essex, at or east of the existing Dartford Crossing.
Public Information Event		An event where members of the public are informed and, where appropriate, consulted regarding a development scheme. National Highways held a total of 24 Public Information Events in 20 locations during the six-week public consultation period between January and March 2016; almost 13,000 people attended.

Term	Abbreviation	Explanation
Public Health England	PHE	Was an executive agency of the Department of Health and Social Care in the UK that began operating on 1 April 2013. PHE's mission was 'to protect and improve the nation's health and to address inequalities'. From 1 October 2021, PHE's health protection functions were formally transferred into the UK Health Security Agency, while its health improvement functions were transferred to the Office for Health Improvement and Disparities, NHS England and NHS Digital.
Public Right of Way	PRoW	A right possessed by the public to pass along routes over land at all times. Although the land may be owned by a private individual, the public may still gain access across that land along a specific route. The mode of transport allowed differs according to the type of Public Right of Way, which can consist of footpaths, bridleways and open and restricted byways.
Quality and Outcomes Framework	QOF	A voluntary annual reward and incentive programme for all doctor (GP) surgeries in England, detailing practice achievement results. The QOF contains four main components, known as domains, which are Clinical, Public Health, Public Health – Additional Services, and Quality Improvement.
Ramsar site		A wetland of international importance, designated under the Ramsar Convention.
Register of Environmental Actions and Commitments	REAC	The REAC identifies the environmental commitments that would be implemented during the construction and operational phases of the Project if the Development Consent Order is granted, and forms part of the Code of Construction Practice (Application Document 6.3, ES Appendix 2.2).
Science, Technology, Engineering and Mathematics	STEM	A term used to group together these academic disciplines.
Significant Observed Adverse Effect Level	SOAEL	The level above which significant adverse effect on health and quality of life occur.
Site of Special Scientific Interest	SSSI	A conservation designation denoting an area of particular ecological or geological importance.
Site Specific Travel Plans	SSTPs	Travel Plans for each construction compound and ULH, or group of compounds and ULHs where these are closely located with similar levels of accessibility. To be developed by the Contractors as set out in the Requirements and produced following the latest guidance and best practice.
Skills, Education and Employment	SEE	n/a
Small and Medium Sized Enterprise	SME	The UK definition of SME is generally a small or medium-sized enterprise with fewer than 250 employees. The EU also defines an SME as a business with fewer than 250 employees, a turnover of less than €50 million, or a balance sheet total of less than €43 million.
Southbound	SB	Direction of travel.
South East Local Enterprise Partnership:	SELEP	The business-led, public/ private body established to drive economic growth across East Sussex, Essex, Kent, Medway, Southend and Thurrock.

Term	Abbreviation	Explanation
Southern Valley Golf Club	SVGC	Golf course located on Thong Lane, Gravesend.
Special Protection Area	SPA	A designation under EU Directive 2009/147/EC on the Conservation of Wild Birds.
Standardised Mortality Ratio	SMR	This is the ratio of observed number of deaths within a cohort to the number of deaths that would be expected, for example on the basis of age- and sex-specific death rates in the general population.
Strategic road network	SRN	The core road network in England managed by National Highways.
Stakeholder Actions and Commitments Register	SAC-R	n/a
STATS19 Data		A database of all road traffic accidents that resulted in a personal injury and were reported to the police within 30 days of the accident. The data are collected by the police at the roadside or when the accident is reported to them by a member of the public in a police station.
Sustainable Drainage System	SuDS	A drainage system designed to reduce the potential impact of new and existing developments with respect to surface water drainage discharges.
Thin Surface System		A process of laying asphalt material not exceeding 15mm in thickness and incorporating a polymer modified binder technology. Known to have beneficial influence on tyre/surface interface noise.
Traffic Management Forums	TMFs	Traffic management forum consisting of the main works Contractors, utility companies, local authorities, local highway authorities, public transport operators, emergency services, National Highways maintenance providers and any other affected stakeholders depending on the planned construction phases.
Traffic Management Plan for Construction	TMP	A plan setting out the strategy and measures to be adopted with respect to highway and transportation issues for the Project.
Travel Plan Co-ordinator	TPC	A role to develop and implement the relevant SSTPs.
Travel to work area	TTWA	n/a
Tunnel boring machine	TBM	Machine used to excavate tunnels with a circular cross-section.
Utility Logistics Hub	ULH	Temporary compounds required for specific utility works. They would receive, store and distribute the plant machinery and materials for specific utility works. They may include offices, welfare facilities, refuelling stations, security hubs, vehicle/wheel washing sites and parking areas similar in size to the main works satellite compounds.
Unexploded ordnance	UXO	Explosive ammunition that did not explode when they were deployed and still pose a risk of detonation. Sometimes referred to as UXBs.

Term	Abbreviation	Explanation
United Kingdom Health and Security Agency	UKHSA	The UKHSA is responsible for UK-wide public health protection and infectious disease capability, replacing Public Health England.
Vibration sensitive receptor	VSR	Receptors which are potentially sensitive to vibration, such as dwellings, hospitals, schools, and community facilities.
Wales Health Impact Assessment Support Unit	WHIASU	An all-Wales service responsible to Public Health Wales and funded by Welsh Government as a part of a wider strategy to improve health and reduce inequalities.
Walkers, cyclists and horse riders	WCH	n/a
Westbound	WB	Direction of travel
Without Scheme/ With Scheme		Without Scheme: Appraisal scenario that excludes a proposed intervention such as a project, programme or policy. With Scheme: Appraisal scenario that includes a proposed intervention such as a project, programme or policy.
World Health Organization	WHO	The WHO is a specialised agency of the United Nations that is concerned with international public health.

If you need help accessing this or any other National Highways information, please call **0300 123 5000** and we will help you.

© Crown copyright 2023.

You may re-use this information (not including logos) free of charge in any format or medium, under the terms of the Open Government Licence. To view this licence:

visit www.nationalarchives.gov.uk/doc/open-government-licence/

write to the **Information Policy Team, The National Archives, Kew, London TW9 4DU**, or email psi@nationalarchives.gsi.gov.uk.

Mapping (where present): © Crown copyright and database rights 2023 OS 100030649. You are permitted to use this data solely to enable you to respond to, or interact with, the organisation that provided you with the data. You are not permitted to copy, sub-licence, distribute or sell any of this data to third parties in any form.

If you have any enquiries about this publication email info@nationalhighways.co.uk or call **0300 123 5000**.*

*Calls to 03 numbers cost no more than a national rate call to an 01 or 02 number and must count towards any inclusive minutes in the same way as 01 and 02 calls.

These rules apply to calls from any type of line including mobile, BT, other fixed line or payphone. Calls may be recorded or monitored.

Printed on paper from well-managed forests and other controlled sources when issued directly by National Highways.

Registered office Bridge House, 1 Walnut Tree Close, Guildford GU1 4LZ

National Highways Limited registered in England and Wales number 09346363