The Norfolk County Council (Norwich Northern Distributor Road (A1067 to A47(T))) Order

6.2 Environmental Statement: Volume II: Chapter 22. Health Impact Assessment

Planning Act 2008

Infrastructure Planning

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

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This document is submitted in relation to the application for a proposed development by Norfolk County Council to the Planning Inspectorate, under the Planning Act 2008.

The application is for the Norfolk County Council (Norwich Northern Distributor Road (A1067 to A47(T))) Order, to grant development consent for the construction of a new highway running west-east between the A1067 Fakenham Road and the A47 Trunk Road at Postwick, including improvements to the existing highway network to the north and north east of Norwich.

This document comprises part of the application documents and relates to Regulation 5(2)(a) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009.

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A. Health Impact Assessment

A.1 Introduction

A.1.1 Overleaf is the Health Impact Assessment, produced to support the Development Consent Order for the proposed Scheme.

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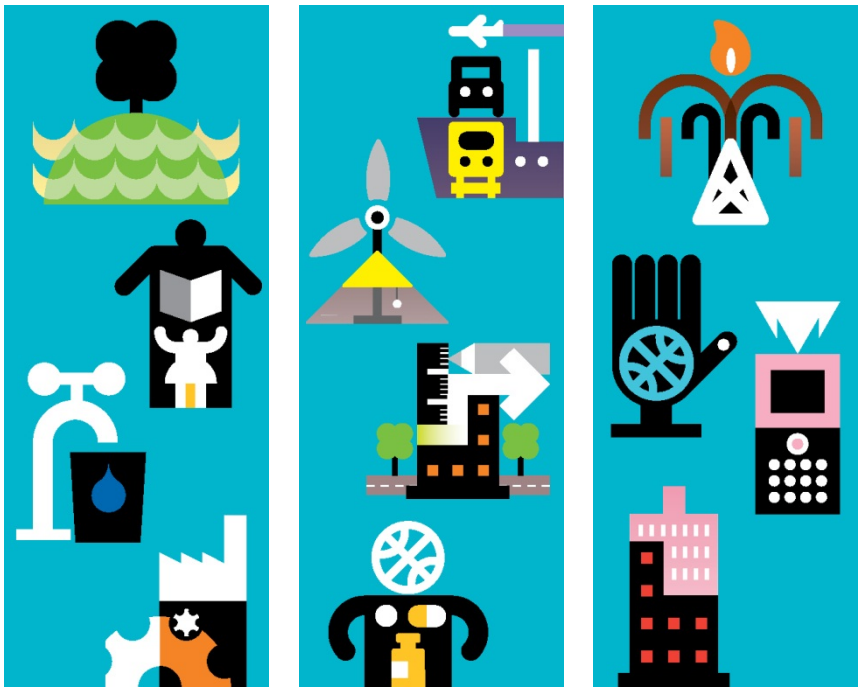

Northern Distributor Road

Health Impact Assessment

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1 Introduction

1.1 Overview

Mott MacDonald has been appointed by Norfolk County Council (NCC) to provide support for the development and delivery of the Northern Distributor Road scheme (NDR), which is a new road comprising dual carriageway, running from the A47 Trunk Road to the east of Norwich around the north side of the city to the A1067.

As part of this work it is prudent to consider whether NDR would lead to effects on health and well-being. As such a Health Impact Assessment (HIA) has been commissioned.

1.2 The Proposed Scheme

The proposed Scheme (the Norwich Northern Distributor Road, known as “the NDR”) is a dual carriageway all-purpose strategic distributor road, to be classified as the A1270 Principal Road, which would link the A1067 Fakenham Road, near Attlebridge, to the A47 Trunk Road (T) at Postwick. This will be over a length of approximately 20.4 km. See the scheme General Arrangement Plans in Volume 1 Appendix A for further information on the scheme.

The route of the NDR is, for the majority of its length, within Broadland District. It does, however, for a short stretch close to Norwich International Airport, fall within the administrative area of Norwich City Council. A very small part of the works at Postwick falls within the administrative area of The Broads Authority. The new road from west to east runs through the following parishes:

- Attlebridge;
- Taverham;
- Drayton;
- Horsford;
- Horsham St. Faith and Newton St.Faith;
- Spixworth;
- Beeston St. Andrew;
- Sprowston;
- Rackheath;
- Great and Little Plumstead; and
- Postwick with Witton.

1.3 The Health Impact Assessment

The purpose of an HIA is to ensure that policy and decision-makers consider the positive and negative effects of their proposals on health. The HIA also assesses whether health consequences will affect the whole population within the spatial scope under consideration, or just certain sections of that population.

The objectives of the HIA are:

- To identify the potential positive and negative health effects associated with the changes resulting from the construction and operation of the NDR scheme;

- To identify opportunities for improving health and promoting health equity; and
- To identify opportunities to mitigate negative effects on health, vulnerable sections of society and reduce health inequalities.

Further information on the approach to the HIA is set out in the following section.

1.4 Structure of this report

This document sets out the findings of a HIA of the NDR. The remainder of the report is set out as follows:

- Chapter 2 outlines the approach and methodology for the HIA process.
- Chapter 3 describes the policy context for the NDR in the context of health.
- Chapter 4 provides a community profile of the study area identified within the methodology.
- Chapter 5 provides analysis of the health impacts of the NDR.
- Chapter 6 provides a set of conclusions and health management measures.
- Appendices to the document include a summary literature review and the health profile indicators from Public Health England.

2 Approach and methodology

2.1 Introduction

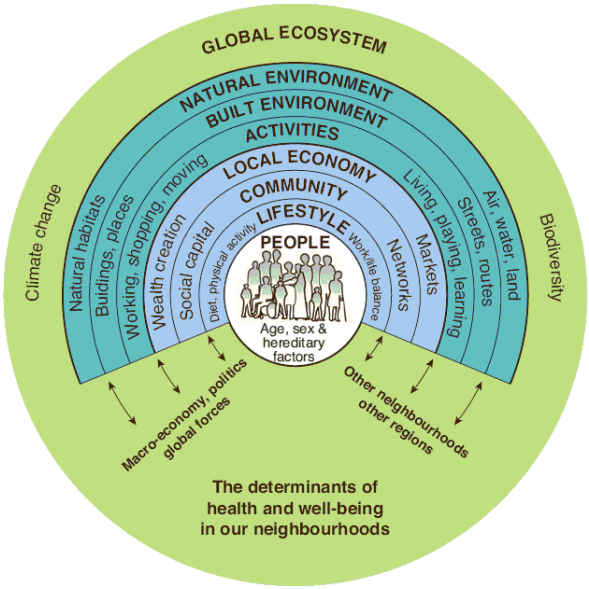
This chapter provides a brief overview of the HIA, including details of the stages of the HIA process and the tasks undertaken as part of this assessment.

2.2 Approach to the HIA

HIA is a systematic process used to assess the potential health effects arising from policies, plans, programmes and projects and to help reduce health inequalities. HIA generally uses the World Health Organisation (WHO) definition of health as a 'state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'.

There are a number of determinants of health, as illustrated in the figure below, which can affect individuals directly or indirectly. The primary role of the HIA is to examine how a policy or project influences these determinants and the likely effects on the health of communities and individuals.

Figure 2.1: Determinants of health and well-being

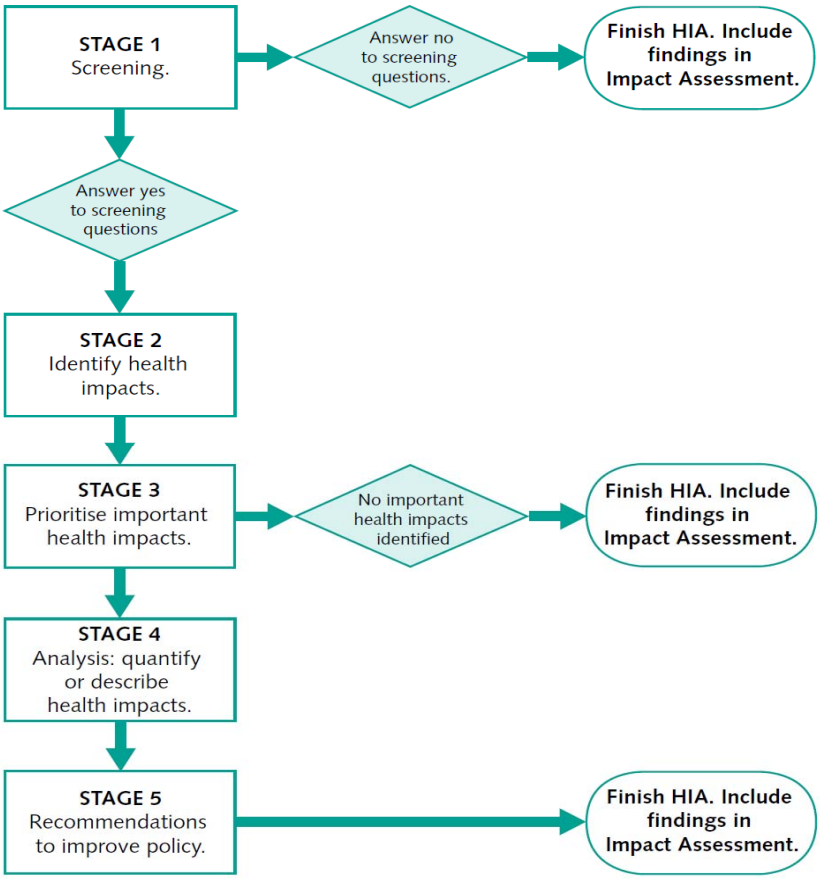


Source: Based on the Whitehead and Dahlgren (1991) diagram as amended by Barton and Grant (2006) and the UK Public Health Association (UKPHA) Strategic Interest Group (2006)

HIA is a specific impact test within the mandatory impact assessment process. The Department of Health (DoH) sets out guidelines on HIA of Government Policy. These guidelines establish an HIA methodology as illustrated in the figure below and described below.

These guidelines serve as a guide for the review of potential health impacts within this document as (a) the proposed development will enable implementation of Government policy; and (b) the guidelines provide the framework for scoping which are used in this document.

Figure 2.2: HIA Stages



Source: Department for Health (2010) 'Health Impact Assessment of Government Policy'

Typically, the key stages of HIA involve:

- Stage 1: Screening – determining whether or not an HIA is necessary;
- Stage 2: Identify health impacts – developing a long list of all of the potential impacts on the health of the population;
- Stage 3: Identify impacts with important health outcomes – determining whether impacts are universal or affect some community groups disproportionately; are permanent or reversible; are short, medium or long term; could be publicly sensitive; or could have cumulative or synergistic effects;
- Stage 4: Quantify or describe important health impacts – reaching a qualitative and quantitative judgement about the important health impacts and their potential costs and benefits; and
- Stage 5: Recommendations to achieve most health gains – setting out how the policy or project could be amended to maximise health benefits and reduce health inequalities.

Some elements of the process are sequential, although there is a large amount of interaction between the various stages.

The remainder of this section sets out the components of the methodology used to undertake the HIA.

2.3 Screening

This methodology section addresses Stage 1 of the DoH HIA guidance. Equalities issues are considered in parallel – the DoH HIA guidance recommends consideration of effects on socio-economic or equalities groups. The screening process determines and documents whether to proceed with a HIA and the populations that may be affected. The likely equality issues associated with NDR are reported separately.

The DoH HIA guidance sets out five screening questions that help identify whether or not to proceed with the subsequent stages of the HIA process. These questions are set out in the table below.

- Will the proposal have a direct impact on health, mental health and wellbeing?;
- Will the policy have an impact on social, economic and environmental living conditions that would indirectly affect health?;
- Will the proposal affect and individual's ability to improve their own health and wellbeing?;
- Will there be a change in demand for or access to health and social care services?; and
- Will the proposal have an impact on global health?

Whilst the DoH guidance applies specifically to policy, the guidance relating to screening is equally as helpful and applicable to projects such as NDR and provides a robust way in which to determine whether a full HIA should be undertaken.

Through answering the DoH screening guidance questions in relation to the identified socio-economic and equalities groups, it was determined that an HIA would be undertaken of the proposed NDR scheme.

2.4 Scoping

2.4.1 Scoping objectives

This section addresses Stages 2 and 3 of the DoH HIA guidance. HIA scoping identifies all of the potential effects on the health of the populations, characterises the potential effects and then prioritises those for further assessment. The scoping process has drawn on the DoH guidance on HIA (and specifically the scoping exercise fields) to identify potential health effects:

- What activities associated with the construction or operation of NDR could result in health effects?
- Which determinants of health would potentially experience a change?
- What health conditions would be expected to be experienced?
- Which communities or demographic groups would experience the effects?
- Will the activity or potential health issue is something that would arise (or is relevant) to NDR?
- Will the health effects be difficult to remedy or have an irreversible effect?
- What are the timescales associated with potential health effects?
- Are the health effects likely to generate public concern?
- Are the health effects likely to generate cumulative effects, i.e. when considered alongside other schemes?

2.4.2 Study area

The study area for the HIA has been identified as that of 'Greater Norwich'. This includes the district boundaries of Norwich, Broadland and South Norfolk. The NDR has been assessed based on its impact upon the health of individuals (direct impacts) and the determinants of health (indirect impacts) within that area.

This area represents the greatest geographic area that health effects attributable to the proposed changes could be felt. Each topic/issue being assessed will have its own study area that is relevant to the extent of the likely effects; the definition of this study area will be made clear for each topic/issue.

2.4.3 Scoping methodology

In completing the scoping exercise the following factors were considered:

- Details of the development works to allow the implementation of the NDR and operation of the route, resulting in changes to traffic management and congestion levels across the specified route;
- Focusing the HIA on the potential health effects that are likely to experience the greatest change and/or have the greatest effect on the determinants of health.
- The geographic scale of the NDR and the study area;
- The time period over which effects may act, including consideration of: baseline, construction and operational conditions; and
- Considering the 'with development' scenario against the 'no development' scenario.

Based on the responses to the questions in the table, potential health issues were classified as follows:

- If the potential effects would result in prioritised health outcomes, the potential effect is 'scoped in' meaning that it will be considered for further assessment; and
- If the potential effect is not considered to result in important health outcomes, the potential effect is 'scoped out' meaning that it will not be considered for further assessment.

2.4.4 Scoping summary findings

The potential health impacts for both the construction and operation phases have been set out, and grouped thematically, in the table below.

Table 2.1: Potential health effects identified in the scoping exercise

Phase	Theme	Typical features of highway projects	Potential health effect
Construction	Air quality	construction activity could generate dust at construction sites; and construction traffic could generate additional emissions	potential change in respiratory and cardiovascular conditions
	Noise	construction activity could generate noise at construction sites and along the route	potential change in levels of annoyance, concentration and stress
	Road safety	construction traffic could increase risk	potential change in numbers of deaths

Phase	Theme	Typical features of highway projects	Potential health effect
		of road traffic accidents	or injuries from road traffic accidents
	Access to healthcare facilities	diversions and severance could restrict access to healthcare facilities	potential change in ability of populations to access healthcare
	Access to employment	diversions and severance could restrict access to employment facilities; and new employment opportunities for construction workers	potential change in ability of populations to access employment; and promotes good mental health and (in general) improved standard of living
	Physical fitness and access to recreation facilities	land take of recreational open space for temporary construction sites.	risk of chronic illnesses and management of stress, anxiety and mental illness
Operation	Air quality	change in traffic could generate additional emissions	potential change in respiratory and cardiovascular conditions
	Noise	change in traffic could generate additional noise	potential change in levels of annoyance, concentration and stress
	Road safety	change in traffic could increase risk of road traffic accidents	potential change in numbers of deaths or injuries from road traffic accidents
	Access to healthcare facilities	change in accessibility of healthcare facilities	potential change in ability of populations to access healthcare
	Access to employment	change in accessibility of employment sites	promotes good mental health and (in general) improved standard of living
	Physical fitness and access to recreation facilities	change in accessibility of recreational facilities; and change in mode of transport	risk of chronic illnesses; and management of stress, anxiety and mental illness

2.4.5 Scoping summary

The scoping study concluded that the development of the NDR is likely to have health effects resulting from:

- noise, vibrations and emissions during construction;
- changes in accessibility to strategic health facilities, employment and strategic leisure facilities;
- changes in the levels of accidents, both on the newly constructed carriageway and on roads in northern Norwich likely to experience changes in traffic volumes; and
- changes in air quality as a result of altered traffic flows due to operation of the NDR.

The total effect of the proposed changes is not likely to increase as experienced by the population as a whole, but the effects will be redistributed. Therefore some populations will benefit through reduced effects and some populations will experience new or increased effects. Analysis for the HIA will attempt to identify whether this redistribution is more or less equitable; and whether the redistribution of health effects would reduce or widen existing health inequalities.

2.5 Analysis of Health Impacts

2.5.1 Focusing on potential health impacts

This section addresses Stage 3 and 4 of the DoH guidance. For each theme identified at the scoping stage, the table below identifies the issues that will be assessed as part of the HIA.

Table 2.2: Analysis of potential impacts

Theme	Impact to be assessed
Air quality	change in pollutant levels (such as NO2) as a result of NDR (construction and operation); and population groups likely to be most susceptible to changes (children, older people, people with existing health conditions).
Noise	change in noise levels as a result of NDR scheme (construction and operation); and population groups likely to be most susceptible to changes in noise level (e.g. working people, children, people with mental health conditions).
Road safety	change in road accidents along the NDR corridor (including incidents where people have been killed or seriously injured (KSI)); and population groups likely to be most susceptible to change sin road safety (e.g. children and young people)'.
Access to healthcare facilities	change in journey times to key health facilities in Norwich (including Hospitals, General Practitioner's (GPs) surgeries and health centres); and population groups likely to be most susceptible to changes in journey times to healthcare (e.g. people from deprived communities, older people, people with existing health conditions).
Access to employment	change in journey times to strategic employment sites in Norwich (including the city centre, key business parks and major employers); and population groups likely to be most susceptible to changes in journey times to employment (e.g. younger people, people from deprived communities).
Physical fitness and access to recreation facilities	change in journey times to key leisure and recreational facilities in Norwich (including playing fields, sports facilities and leisure centres); and population groups likely to be most susceptible to changes in journey times to leisure and recreation (e.g. children and younger people).

The analysis will draw upon the work undertaken as part of the Environmental Statement (ES), relevant to the themes below. For those topics where effects are assessed in the ES, the conclusions on the level of significance of effects will inform the analysis of potential health impacts. This provides a good indication of the likely direction and magnitude of potential health effects.

2.6 Conclusions and Recommendations

Following the analysis of the health effects, conclusions are drawn and any recommendations to improve positive health outcomes or mitigate negative health outcomes are presented.

3 Policy context

3.1 Introduction

This section sets out the European and National, sub-national and local policy context for transport, development and health policy relevant to NDR.

3.2 European and National strategy

Department for Transport: Creating Growth, Cutting Carbon - Making Sustainable Local Transport Happen (2011) - the DfT's White Paper states its vision is 'for a transport system that is an engine for economic growth, but one that is also greener and safer and improves quality of life in our communities.'

Local transport faces a sustainability challenge: excess delay is costing urban economies £11 billion per annum, and carbon emissions impose costs to society of up to £4 billion per annum. The costs to public health are even greater – up to £25 billion per year on the costs of physical inactivity, air quality and noise, and £9 billion on road traffic accidents.

Sustainable growth is one of the country's biggest challenges. Solutions need to jointly address economic, environmental and community values and aspirations for the future. The transport sector's role in this is hugely important – sustainable means of getting people to work and to services such as education and healthcare providers - as well to leisure activities and shops, are crucial to quality of life as well as to enhancing people's spending power.

While transport's economic benefits are clear, the White Paper also notes that congestion acts as a drag on the economy: a recent study placed the cost of excess delays in urban areas at £10.9 billion per annum. Similarly, on the supply-side of the economy access to employment, education and healthcare, as well as ending child poverty, all have a key impact on life chances and social mobility, and ultimately on growth. The White Paper notes various studies have revealed that:

- 40% of jobseekers say lack of transport is a barrier to getting a job, and 25% jobseekers said the cost of transport is a significant issue;
- 6% of 16–24 year olds turn down training or further education because of transport problems; young people in rural areas, and those with learning difficulties and disabilities, are more likely to cite costs of transport as a constraint in pursuing post-16 learning; and
- 44%of workless households did not have a car or van in 2008 (compared with 22% of all households).

Undertaking an HIA is not a statutory requirement under UK or European law. However, at the European level, HIA is recognised as an important approach in a number of contexts, for example Article 152 of the Amsterdam Treaty calls for the European Union to examine the possible impact of major policies on health. At the national level, the role of HIA was specifically highlighted in the cross-government public health strategy: Saving Lives: Our Healthier Nation. The value and importance of HIA has been strongly endorsed or signalled by a range of other national policies, programmes and guidance.

3.3 Regional and Sub-regional policy and plans

Joint Core Strategy for Broadland, Norwich and South Norfolk - one of the principal local policy frameworks to emerge in recent years has been the JCS for Broadland, Norwich and South Norfolk adopted in March 2011.

The strategy was facilitated by the Greater Norwich Development Partnership (GNDP), and sets out an over-arching strategy for growth across the three districts. It also identifies key locations for growth and sets out policies to ensure that future development is sustainable.

The strategy contains twelve over-riding objectives, which underpin the spatial vision of creating some 36,820 new homes and 27,000 new jobs between 2008 and 2026 in the Norwich urban area, as well as mixed use urban extension into the Old Catton, Sprowston, Rackhealth and Thorpe St Andrew growth triangle. This vision also reflects the targets for employment creation and new housing numbers stipulated within the Regional Spatial Strategy for the period 2008-2031. The NDR would have a role in supporting development in the area and in relation to the following spatial planning objectives:

- Allocating enough land for housing, and affordable housing, in the most sustainable settlements – whereby new housing, employment, and services to be planned in a way that they are grouped together ensuring that the land is used efficiently and community needs are met
- Promoting economic growth and diversity, and providing a wide range of jobs - this involves not only safeguarding existing employment sites but also allocating sufficient levels of land to meet the needs of inward investors.
- To promote regeneration and reduce deprivation - growth will be used to bring benefits to deprived neighbourhoods in Norwich and deprived rural settlements
- To make sure people have ready access to services - wherever new homes and jobs are developed there will be a need to provide adequate supporting services
- To enhance transport provision to meet the needs of existing and future populations while reducing travel need and impact - supports the co-location of housing and employment land uses alongside other community and service uses; also supports improved use of public transport and recognises that the state of the strategic road network is fundamental to the health of the local economy.
- To encourage the development of healthy and active lifestyles - giving people better opportunities to make healthy travel choices as part of their daily lives.

Norfolk Joint Health and Wellbeing Strategy (2013/14) – Norfolk's Health and Wellbeing Board have prepared this strategy which guides the promotion of healthy lifestyles and the reduction of health inequalities across the county. The basis of the strategy is formed around 11 key priorities for action, of which the following are directly relevant to this HIA:

- Alcohol misuse;
- Smoking;
- Healthy eating and weight management;
- Supporting independent living for the elderly and care for older people;
- Mental health and employment; and
- Creating good outcomes for all children and young people.

3.4 Local policy and plans

Greater Norwich Economic Strategy 2009-2014 - this strategy sets out the current economic vision and priorities for Greater Norwich to equip the area for facilitating its growth potential.

A number of key challenges to growth for the Greater Norwich area have been outlined, which are significant factors in determining the areas growth potential. These include:

- The provision of sufficient jobs in accordance with population increases;
- A diverse economic base with varied knowledge sectors to create new employment;
- Stimulate entrepreneurship, increasing business start-up rates;
- Improving international, national and regional connectivity to promote sustainable transport;
- The development of an appropriate range of employment sites.

As one of England's major city regions, the sustained development of Greater Norwich is vital; the NDR development is closely aligned with the following main development objectives within this strategy:

- Strengthening the area's economy and diversifying employment – one of the priorities within this objective is to support the growth of the knowledge economy by encouraging key sectors and facilitating the attraction of businesses that can exploit the research potential of the local universities. The sectors identified include engineering, environment, and life sciences.
- Ensuring that the area has the necessary infrastructure to attract and retain investment - developing improved and sustainable transport and communications infrastructure to support planned growth and development; maintaining an appropriate supply of suitably located employment sites; and ensuring investment in required public utilities infrastructure.
- To raise the profile of Norwich as a place to live, work and visit - if the proposed development were to succeed it would help to develop a stronger image for the area, and act as a catalyst for further investment.

Healthy Norwich programme - this programme sets out the vision and strategic priorities towards making Norwich a healthier city by addressing health inequalities. Created via a partnership including Norwich City Council, Norwich Clinical Commissioning Group (CCG), Norfolk's Drug and Alcohol Action Team (DAAT) and Norfolk and Waveney Public Health, this programme sets out seven major themes which form the backbone of the Healthy Norwich scheme which are all relevant to this HIA.

These themes cover:

- Improving levels of physical activity;
- Supporting people to maintain healthy diet, nutrition and weight;
- Reducing the number of people not receiving education, training or development;
- Improving sexual health;
- Helping people to combat smoking, alcohol and drug misuse;
- Improving access to health screening and prevention; and
- Making health and wellbeing a key consideration in urban planning.

Norwich Health and Wellbeing Strategy – this strategy sets the aims and ambitions of Norwich Clinical Commissioning Group for the health and wellbeing of the people of Norwich. It presents a series of strategic goals, setting out the main areas of focus for the next five years, which will enable healthcare practitioners to deliver their vision for year on year improvements health and wellbeing for all people living in Norwich. Its key goals are as follows:

- Continuously improve and assure the quality and safety of healthcare
- Continuously improve the health and wellbeing of the population
- Reduce health inequalities – the health gap between different communities
- Manage resources responsibly and ethically, and deliver value for money for the taxpayer

4 Community profile

4.1 Introduction

This chapter provides an overview and analysis of the population that could potentially be affected by the NDR. It identifies any groups particularly vulnerable to negative health impacts, as well as any groups whose health may benefit from the scheme.

4.2 Spatial scope

The overall spatial scope of this HIA is the district boundaries of 'Greater Norwich'. This covers the districts of Norwich, Broadlands and South Norfolk, although the geographical scope varies for each of the topics being considered. The NDR has been assessed based on its impact upon the health of individuals (direct impacts) and the determinants of health (indirect impacts) within that area.

4.3 Population profile

Demographic information on the community has been collated. In defining the community and identifying potential groups that may be exposed to potential health impacts, the community datasets relevant to the HIA are:

- population density;
- children (under-16);
- older people (aged over 65);
- people from Black, Asian and Minority Ethnic (BAME) communities (all non-White British);
- disabled people (including people with physical, sensory or mental health issues); and
- people from deprived communities

A full population profile by community group is provided for Norwich, Broadland and South Norfolk in Appendix A.

4.4 Health profile of the study area

Health profiles of each local authority area are produced annually by the Department of Health. The health profile 2012 indicators for Norwich, Broadland and South Norfolk are included as Appendix B.

As identified in these documents, life expectancy trends across the study area are fairly similar, with males having a slightly lower life expectancy than females. There are no significant differences in life expectancy across the area; life expectancy for females across all three local authority areas is on par with that of Norfolk average, and life expectancy for males is broadly similar with only Norwich slightly less than the Norfolk average.

Table 4.1: Life expectancy

Variable	Norwich	Broadland	South Norfolk	Norfolk	England	England Worst	England Best
Life expectancy –	77.8	80.3	80.3	79.5	78.6	73.6	85.1

Variable	Norwich	Broadland	South Norfolk	Norfolk	England	England Worst	England Best
male							
Life expectancy – female	83.5	83.2	83.3	83.3	82.6	79.1	89.8

Lower life expectancy as compared with the national average can be linked to the following key lifestyle variables:

- Physical activity;
- Diet;
- Smoking;
- Drug use;
- Alcohol use;
- Sexual behaviour;
- Accidents; and
- Stress at home or work.

In addition to this, health inequalities across the study area mirror that of national health inequality trends. For instance, people living in less deprived communities within are more likely to live longer than those living in deprived areas.

The table below compares the overall performance of Norwich, Broadland and South Norfolk for a number of key lifestyle variables with regional and national averages.

As shown in the table, all localities in the study area perform better than the Norfolk average in terms of physically active adults and smoking during pregnancy. There are no localities which perform worse than the Norfolk average across the board and, overall, the study area only performs worse (on average) than Norfolk for levels of binge drinking amongst adults and deaths from smoking.

Table 4.2: Health indicators for the study area

Department of Health Question 2 Variable	Indicator	Norwich	Broadland	South Norfolk	Norfolk	England Average	Value
Physical activity	Physically active adults	11.7	10.9	12.5	10.3	11.2	%
Diet	Healthy eating adults	27.7	31.1	32.2	29.2	28.7	%
	Obese adults	21.7	25.1	24.5	24.8	24.2	%
Smoking	Adults who smoke	23.6	18.6	15.3	21.3	20.7	%
	Deaths from smoking	227	157	190	182	211	Per 100,000 population aged 35 and over
	Smoking in pregnancy	14.7	14.7	14.0	16.1	13.7	%
Drug use	Drug misuse	15.9	4.5	3.8	8.2	8.9	%
Alcohol use	Binge drinking adults	23.5	23.6	18.1	23.1	22.3	%
	Hospital stays for alcohol related harm	1806	1292	1128	1677	1895	Per 100,000 population
Sexual behaviour	Acute sexually transmitted infections	1058	532	-	636	775	Per 100,000 population
Accidents	Road injuries and deaths	28.8	43.1	58.7	44.4	44.3	%

Source: Public Health Observatory – Health Profiles for Norwich, Broadland and South Norfolk 2011/12

Key	Colour
Worse than Norfolk	
Better than Norfolk	

Norwich has the worst health profile out of the three localities in the study area – performing worse than the Norfolk average on the majority of health variables (7 out of 11). In comparison, both Broadland and South Norfolk perform better than the Norfolk average on the majority of health variables (9 out of 11 respectively).

It is expected that the most relevant indicators for this scheme are physical activity and road safety. As stated previously, all localities perform well in terms of physical activity in comparison with the Norfolk and England averages. Both Norwich and Broadland also perform well for road safety, whereas South Norfolk performs worse than the county and national averages for this variable.

4.5 Norfolk Joint Strategic Needs Assessment

The Norfolk Health and Wellbeing Board alongside Norfolk County Council produced the latest Joint Strategic Needs Assessment (JSNA) documents, which include data on a range of health and wellbeing indicators.

The key issues identified in the JSNA that are relevant to the HIA include:

- In common with most other parts of the country, Norfolk has an aging population. Numbers of people aged 65 years and over are expected to see the most significant increase, accounting to 64 per cent of the population increase within the county. North Norfolk in particular is projected to have one of the largest proportions of older people in the country, with 32 per cent aged 65 and over by 2016. This will see significant impacts on local health service demand and prevalence of age related conditions such as dementia.
- Around one in eight Norfolk residents are income deprived and one in ten are employment deprived. Almost 47,400 Norfolk residents live in areas within the 10 per cent most deprived in England; in comparison, 29,700 children within Norfolk live in poverty. Between Jun 2010 and June 2011, Norfolk's unemployment rate was 4.5 per cent, with around 57,200 people claiming key out-of-work benefits.
- Levels of physical activity in Norfolk are lower in comparison with the East of England regional average, with less than one fifth of adults in Norfolk doing the recommended weekly amount of exercise. In relation to this, cardiovascular disease, heart attacks, strokes and cancers have the biggest impact upon the health of people in Norfolk; together these account for two thirds of the deaths across Norfolk.
- One in seven adults in Norfolk is estimated to binge drink, with an estimated 120,000 people suffering with alcohol dependence. The effects of alcohol misuse are more prominent in more deprived areas of Norfolk, with the months of life lost to alcohol in the more deprived areas being three times that of the least deprived areas.
- Obesity is a continuing health problem for many people in Norfolk, with two out of every ten adults classified as obese.
- There has been little reduction in the levels of smoking across Norfolk over the past few years. Smoking accounts for around 2,000 deaths per year in Norfolk.

4.6 Summary

Norfolk faces a number of demographic, social and health-related challenges making the population and the local community sensitive to the effects of developments that could in turn have an impact on health. Norfolk's ageing population and high incidences of some serious illnesses continue to be a concern for policy makers. In addition, the health profiles for the three Norfolk districts included within the study area differ and Broadland performs better than Norwich and South Norfolk in a number of key indicators, with both performing poorly in comparison to both the county and national average.

5 Potential health effects

5.1 Introduction

This chapter sets out the potential health effects associated with NDR and identifies the populations most likely to experience these effects. The chapter is organised according to the construction and operation phases of the scheme and considers potential direct effects (on individuals) and indirect effects (on wider environmental health determinants).

The remainder of this chapter is organised as follows:

- air quality;
- noise;
- road safety;
- access to healthcare facilities;
- access to employment; and
- access to recreation facilities.

5.2 Air Quality

Health risks resulting from poor air quality have the potential to affect the population as a whole, however older people, children and disabled people are more vulnerable due to their traditionally higher susceptibility to respiratory illnesses. People with existing lung or heart conditions could also be more susceptible to negative effects as a result of increased pollutants around construction areas which could cause increased irritation and inflammation of the airways. Chronic and/or long term exposure to dust and emissions could contribute to the risk of developing respiratory and cardiovascular health problems, or the worsening of existing health problems such as asthma, bronchitis, CVD or lung cancer.

In assessing the impact of changes to air quality as a result of the proposed NDR scheme, air quality modelling has been undertaken at various points (receptor locations) across the study area in order to identify the change in concentrations of the pollutants nitrogen dioxide (NO2) and Particulate Matter (PM10 and PM2.5). The outputs of this analysis are reported in the Environmental Statement (ES) volumes I and II.

5.2.1 Construction Effects

During the construction phase, the proposed scheme would introduce new emission sources in the form of traffic and plant at some locations, and involve potentially dust generating activities. There is therefore the potential for the NDR to result in air quality effects as a result of the construction process, in particular through changes to key pollutants, including NO2 and Particulate Matter.

The Air Quality section of the NDR Environmental Statement (See Chapter 4) assesses various sites along the route for their sensitivity to dust effects (including: soiling effects, ecological effects and increases in particulate matter, specifically PM10) as a result of construction activity. The overall significance of effects of dust nuisance from the construction phase is described within the Air Quality chapter as ‘slight adverse’

and therefore is not significant. The table below presents a summary of the significance of effects for each dust source and each type of effect.

Table 5.1: Summary of significance where mitigation has been applied

Source	Dust Soiling Effects	Ecological Effects	PM10 Effects
Demolition	-	-	-
Earthworks	Slight Adverse	Slight Adverse	Negligible
Construction	Slight Adverse	Slight Adverse	Negligible
Trackout	Slight Adverse	Slight Adverse	Negligible
Overall Significance		Slight Adverse	

Source: NDR Environmental Statement Volume I Air Quality Chapter

Mitigation measures have been identified for incorporation within the Construction Environmental Management Plan (CEMP) commensurate with the risk of dust effects identified and in line with best practice.

There is not predicted to be any significant change in air quality during the construction phase. Changes in health effects are therefore not predicted as a result of changes to air quality.

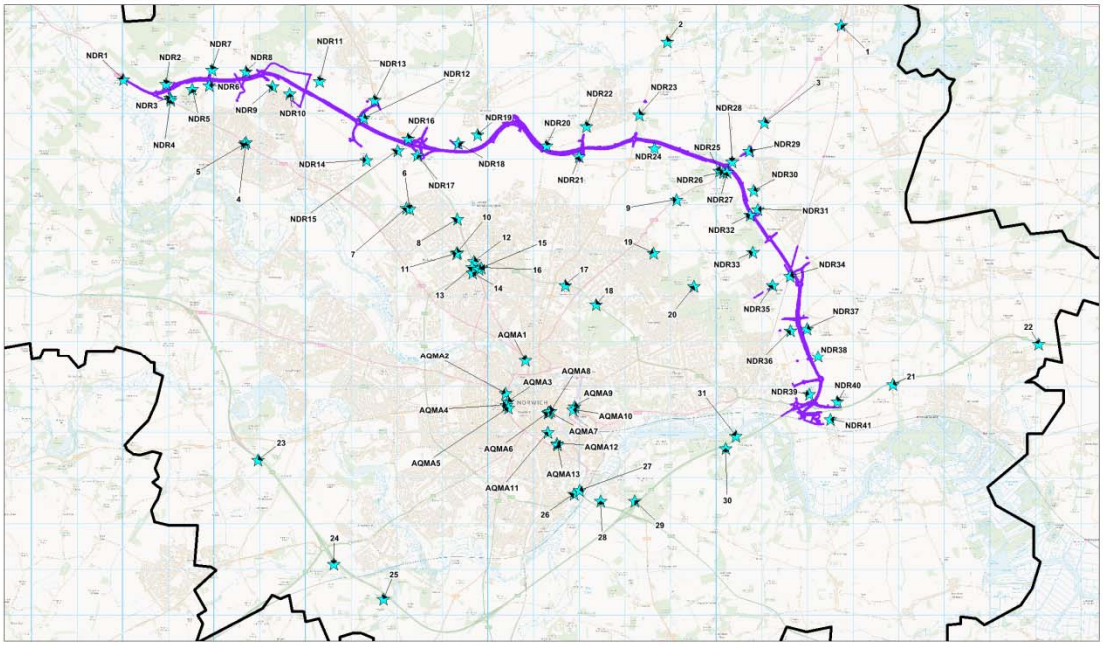
5.2.2 Operational Effects

The proposed scheme has the potential to cause air quality effects as a result of the operation of the scheme – vehicles using the new road - in particular through changes to key pollutants, including NO2 and Particulate Matter.

During operation the proposed scheme would result in changes to traffic flows and could therefore impact the location and amount of emissions in the air and, subsequently, affect ambient air quality with an associated impact on health.

Operation phase effects have been assessed (again as part of the Air Quality assessment within the ES, See: Chapter 4). Concentrations of key traffic related pollutants have been predicted at sensitive human health receptors and the change as a result of the scheme has been quantified. Existing concentrations of NO2 are of concern in Norwich, particularly in the city centre where an 'Air Quality Management Area' (AQMA) has been declared. The receptors analysed are shown on the map below:

Figure 5.1: Location of receptors along NDR route and in wider air quality study area



Contains Ordnance Survey data (c) Crown copyright and database right 2013

Source: Norfolk NDR Environmental Statement Chapter 4: Air quality

In order to provide an analysis of the number of properties affected by air quality effects overall, the tables below present firstly the number of properties within 25 metres of modelled roads that experience any improvement or deterioration in annual mean NO2 concentrations as a result of the proposed scheme, and secondly changes in annual mean NO2 of greater than 1 µg/m^3 only.

Table 5.2: Number of properties experiencing an improvement or deterioration in annual mean NO2 concentrations

Direction of change	Number of Properties
Properties with an improvement in air quality	1194
Properties with a deterioration in air quality	726

Source: NDR Environmental Statement Volume I Air Quality Chapter

Table 5.3: Number of properties experiencing an improvement or deterioration in annual mean NO2 concentrations greater than 1 µg/m^3

Direction of change	Number of Properties
Properties with an improvement in air quality >1 µg/m3	79
Properties with a deterioration in air quality >1 µg/m3	21

Source: NDR Environmental Statement Volume I Air Quality Chapter

Of the 1920 receptors examined as part of the study:

- 38% will see a deterioration in air quality, while only 21% will see a deterioration in air quality greater than 1 µg/m3
- 62% will see an improvement in air quality, while 79% will see an improvement in air quality greater than 1 µg/m3

Overall, there is an improvement in air quality in Norwich city centre - where most of the population of the study area live. There will be a decrease in air quality in the areas around NDR and around the junctions with NDR. These areas are less densely populated and the decreases are below accepted air quality limits and are therefore do not result in significant air quality effects.

- The proposed Scheme does not conflict with NCC's AQAP; the overall improvement in NO2 is consistent with the aims of the Plan.
- No specific incorporated air quality mitigation measures are included for the operational phase of NDR. However, the NDR route means that increases in traffic flows (and therefore emissions) generally occur in areas where existing pollutant concentrations are lower and therefore any increases remain below applicable limits.
- Operational phase air quality effects are concluded to be not significant. The data upon which this assessment is made can be found in the Air Quality chapter of Volumes I and II of the ES. Changes in health effects are therefore not predicted as a result of changes to air quality.

5.3 Noise and Vibration

Excessive or disruptive noise has the potential to cause a variety of short term and long term health effects, and can negatively interfere with people's day-to-day activities, causing unwanted disruption. Noise pollution has become a leading environmental nuisance within Europe, with around 40% of the population in EU countries experiencing noise levels above 55 db(A).

Although the experience of increased noise levels (either temporarily or permanent) can affect general community health and well-being, is not linked to mortality or morbidity rates. Potential health effects include annoyance, low levels of concentration and performance, and increased stress levels which can increase the risk of developing long term conditions such as high blood pressure, hypertension or cardio vascular disease. In addition, disturbance through extended periods of noise pollution can also lead to (or exacerbate) hearing impairments and mental health problems in more profound cases. Therefore population groups such as working people (particularly those who work on night shifts, children, people with mental health conditions and older people are more susceptible to changes in the noise environment.

The outputs of noise modelling analysis are reported in the ES (Chapter 10). The construction and operation of the NDR has the potential to give rise to both temporary and permanent noise and vibration effects at sensitive receptors in the vicinity of NDR extents and affected road links.

5.3.1 Construction Effects

Within the Noise and Vibration chapter of the ES (Chapter 10), the potential for significant construction noise effects has been identified at a number of receptor locations along the route where the predicted noise levels from construction of earthworks and drainage exceed 65 dB(A) (defined in the baseline as the acceptable level of noise) during normal construction hours (07:00 – 19:00) and the predicted increase of the overall noise level with construction is 5 dB or more above the measured baseline noise.

In these cases, as the basis of incorporated mitigation, the contractor will be required to seek prior consent under Section 61 of the Control of Pollution Act 1974 in advance of commencing works, which will require 'best practicable means' to prevent excessive noise. Measures may include erection of temporary noise barriers, selection of quieter plant options, alternative methods of working or avoiding times when works would be most disruptive to the receptor.

Further mitigation measures incorporated into the scheme include a thin surface course for the proposed NDR, three lengths of acoustic barrier and extensive bunding and false cuttings. Temporary barriers will be required during construction at some location.

No significant noise impacts or effects are predicted from carriageway paving or structural bridge construction.

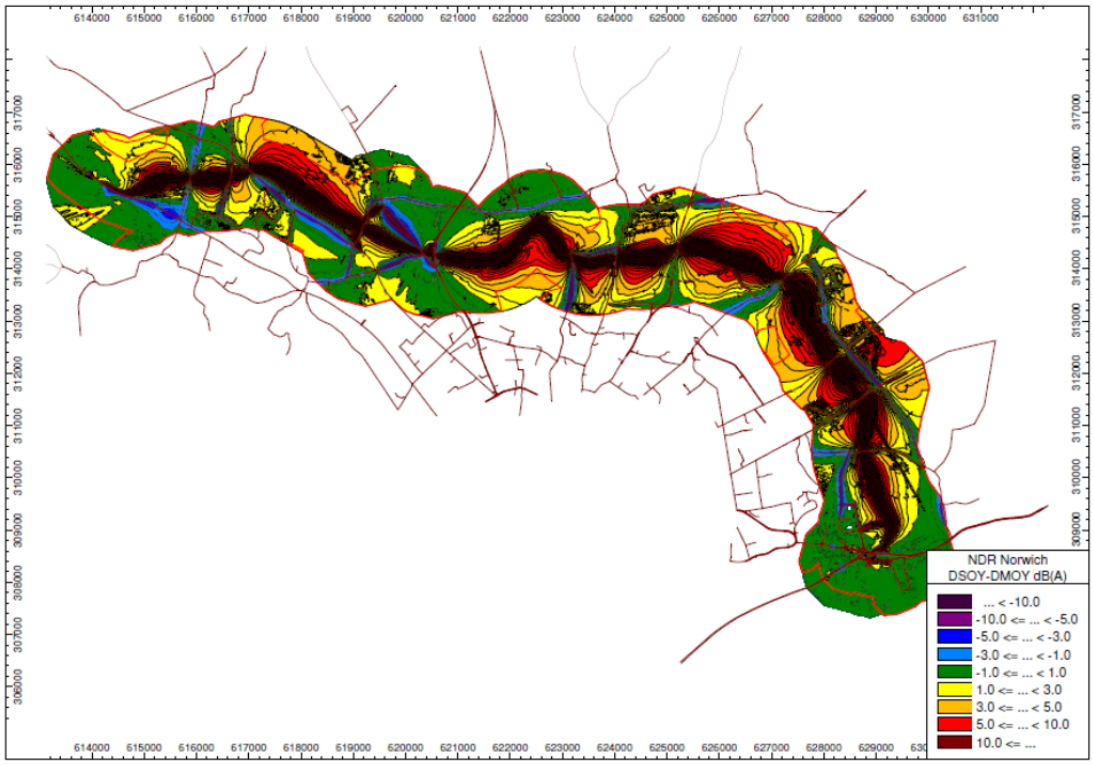
No significant vibration impacts are anticipated from construction works. Changes in health effects are therefore not predicted as a result of changes in the noise environment.

5.3.2 Operation Effects

The NDR is intended to reduce the volume of through traffic in and around Norwich city centre. At the same time it is recognised that this means introducing traffic into a relatively quiet rural corridor to the north and east of the city. This would result in positive noise impacts in the former area but negative impacts in the latter.

The figure below illustrates the change in noise within the first year of operation of the NDR scheme.

Figure 5.2: Short term noise change along proposed NDR route (dB(A))



Source: Norfolk NDR Environmental Statement Chapter 10: Noise and Vibration

A noise change of 3dB(A) or more in the short term at any noise sensitive receptor is considered significant. As such, significant noise impacts are likely within the immediate vicinity of the route in the short term including:

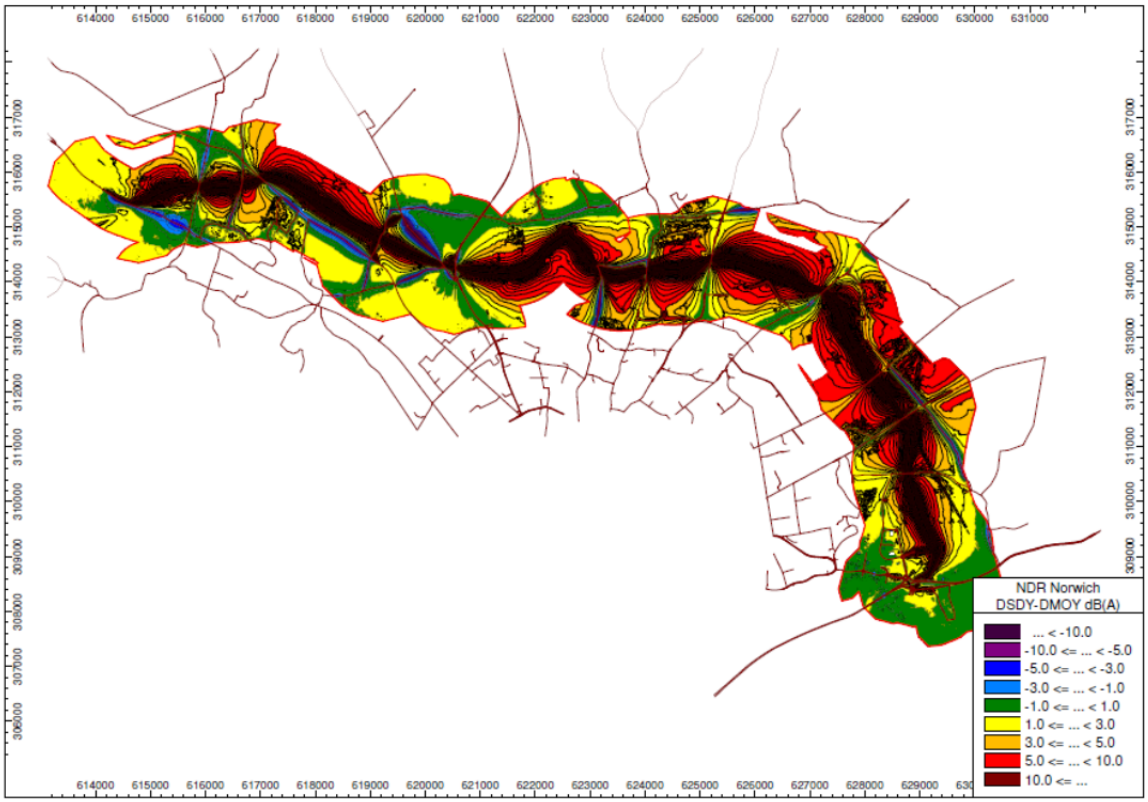
- At the western end at the junction with the A1067;
- At the junctions with Holt Road and Cromer Road to the north of the Airport and Park and Ride;
- Near Wroxham Road;
- At the junction with Salhouse Road; and
- At the eastern edge of route, near the Postwick Hub, Broadland Business Park, where substantial development is proposed.

There will be significant reductions in noise on several of the surrounding routes that intersect the NDR. These include:

- Along sections of the A1067, where traffic will be redirected onto the NDR; and
- Along sections of Wroxham Road, Salhouse Road and other routes leading into the city centre used as rat-runs at present.

The figure below illustrate the potential change in noise with the implementation of NDR in the long term:

Figure 5.3: Long term noise changes with NDR (dB(A))



Source: Norfolk NDR Environmental Statement Chapter 10: Noise and Vibration

A noise change of 5dB(A) or more in the Long Term at any noise sensitive receptor is considered significant.

While there will be only minimal long term changes (of an increase or decrease in 1 dB) in noise levels without the development of NDR (as no changes will be made in the area if the scheme does not proceed), there will long term increases in many areas of more than 5 dB, considered significant within the Noise and Vibration chapter of the ES.

In particular these will be focussed around the eastern end of the route, which includes several of the proposed new development areas for Norwich, including Rackheath Eco town.

The tables below summarise the overall effects at residential dwellings and non-residential receptors. These figures include those dwellings outside the 1m study area, adjacent to the existing road network. At these locations, changes in noise levels are primarily determined by changes in traffic flows and speed.

Table 5.4: Significance of effects at residential dwellings

	Adverse	Beneficial
Opening year with scheme		
Slight	5,529	5,084
Significant	2,393	382
Design year with scheme		
Slight	7,155	4,418
Significant	1,936	959
Do minimum		
Slight	12,895	1,145
Significant	146	54

Table 5.5: Significance of effects at non-residential receptors

	Adverse	Beneficial
Opening year with scheme		
Slight	54	16
Significant	17	1
Design year with scheme		
Slight	65	9
Significant	14	1
Do minimum		
Slight	243	0
Significant	1	0

From the tables it can be observed that significant adverse effects reduce with time, between opening and design year, and significant beneficial effects increase over the same time. This is likely to be a consequence of the adjustment in significance threshold between long term and short term effects to take into account different perceptions of noise change.

Therefore, the noise effects reduce with time and this would be expected to be the case for health effects too. Balancing adverse and beneficial changes in noise, around 2,000 residential dwellings experience significant noise effects in the short term and around 1,000 residential dwellings experience significant noise effects in the longer term. This is predicted to result in negative health effects for those residents exposed to a change in noise environment.

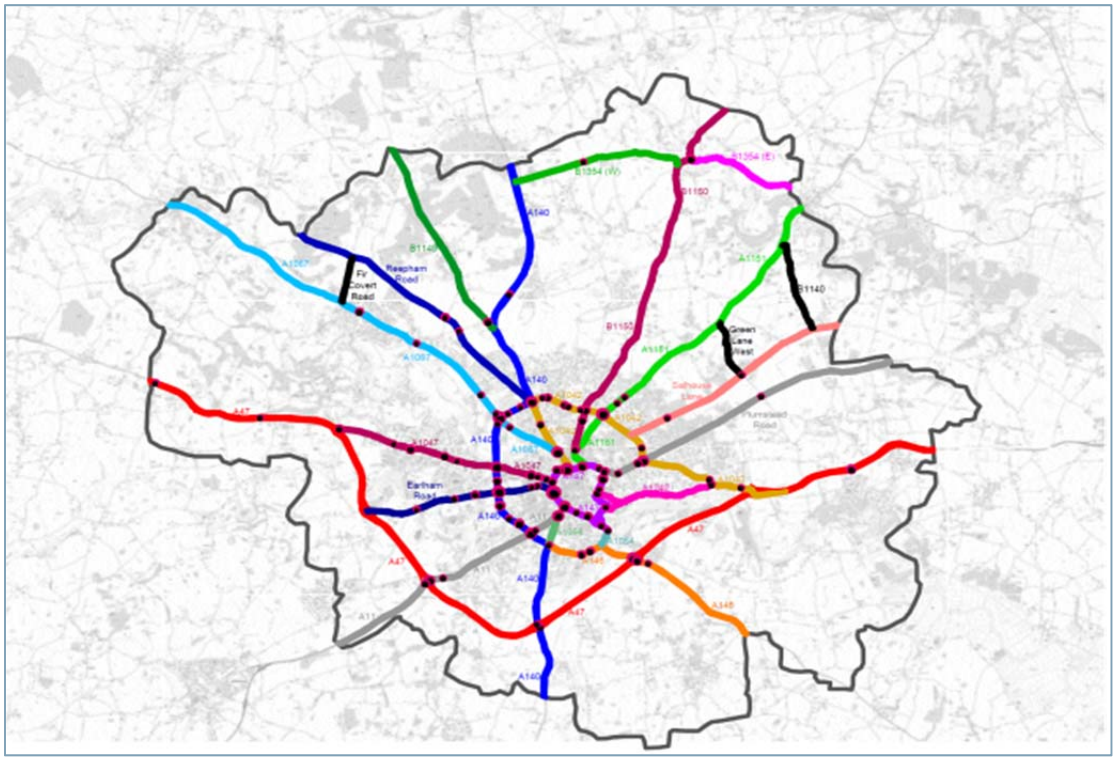
5.4 Road Safety

Transport safety is presented most commonly in terms of road traffic accidents. Death and injury from traffic accidents has a direct impact on mortality (death) and mortality (illness and serious injuries). It is estimated that, each day, approximately five people die and sixty-three people are seriously injured on roads in the UK.

Whilst the impact of traffic accidents on death and serious injury has fallen in the UK in recent years, cyclists remain the one road user group where rates have continued to rise. In 2012, 107 cyclists died as a result of traffic accidents – a rise of 10% and 3,222 were injured, a 4% increase.

Personal Injury Accident (PIA) data for the area along the proposed NDR route has been provided by Norfolk County Council for the period between July 2007 and June 2013. This included a study of the principal routes within the NDR scheme area as shown in figure 5.1. In total 89 cluster accident spots have been identified within the NDR principal route area.

Figure 5.4: Map of Principal routes within the NDR scheme area



Within the principal route area for the NDR scheme, there were in total 1,833 accidents. Of these, 26 PIAs (1%) have been classified as Fatal, 214 (12%) as Serious and 1593 (87%) as Slight.

Table 5.6: PIA along NGT route network

	2008	2009	2010	2011	2012	TOTAL
Fatal						
Total	9	4	3	7	3	26
Serious						
Total	45	39	44	46	40	214
Slight						
Total	339	331	305	318	300	1593
TOTAL	393	374	352	371	343	1833

Source: Norfolk County Council

This remains in-line with the national average.

Table 5.7: Severity Breakdown statistics for all roads in Great Britain and the NDR study area

	ALL GB ROADS 2012		STUDY AREA ROADS	
ACCIDENT SEVERITY	NUMBER	%	NUMBER	%
Fatal	1,637	1	26	1
Serious	20,901	14	214	12
Slight	123,033	85	1,593	87
Total	145,571	100	1,833	100

Source: DfT (2013)

5.4.1 Construction Effects

The construction period of NDR will result in a number of impacts on highway travel leading to potential effects on road safety. Access roads to the construction site will use radial routes to the north and east of Norwich, with 75 deliveries per day scheduled during peak construction activities. The routes, whilst presently carry heavy goods vehicles (HGVs), run through built up areas of Norwich and through some of the villages to the north and east of Norwich, involving 20 tonne eight wheeled wagons as well as staff vehicles.

At present, however the impact of this construction traffic on road safety in Norwich and the surrounding areas remains unclear and cannot be determined. The construction methodology does not as yet provide any details about the routes that the delivery traffic will use to get to/ from the access roads, nor whether delivery traffic will be evenly spread across the working day. In addition, the impact on named access roads also needs to be further considered, once more detailed information about construction traffic is available, in order to demonstrate the suitability of all the access roads and to ensure that any construction impacts are minimised.

5.4.2 Operational Effects

Once the scheme is operational, there is potential for both positive and negative impacts on road safety. Road safety implications are explicitly considered in WebTAG and DMRB appraisal methods and design and mitigation management to minimise the potential for road accidents will be employed. Further consideration of the health impacts only needs to be considered if traffic modelling shows a significant increase in predicted road accidents.

Given the extensive nature of the study area, the accident analysis within the transport analysis as part of the NDR ES was necessarily a high level assessment. It looked at trends and potential for change following construction of the NDR rather being a detailed accident remediation study.

The PIC data for the principal route network study area was analysed and cluster site identification was undertaken. In total 89 cluster sites were identified in the five year study period 01/07/2008 to 30/06/2013, which was the latest data available at the time of writing.

The severity breakdown resulting from the analysis is broadly in line with UK national average statistics across all roads in 2012 (Calculated from Reported Road Casualties Great Britain: 2012 Annual Report, DfT 2013).

A flow comparison was carried out at the 89 cluster sites.

Table 5.8: Number of cluster sites where flows change by following percentages

	Number of sites:	2017	2032
Reduction	25% or more	4	4
	24.9% to 10%	18	17
	9.9% to 5%	10	16
	4.9% to 2.5%	12	11
	2.49% to 0%	21	14
Increase	0% to 2.49%	14	10
	2.5% to 4.9%	6	9
	5% to 10%	2	5
	10% to 24.9%	1	2
	More than 25%	1	1
	Clusters	89	89

The impact of NDR as presented in the Traffic Assessment of the scheme:

- 62 sites (out of 89) are predicted to experience lower flows due to NDR. It can therefore be concluded that this may lead to a reduction in the occurrence of PICs.
- 24 sites (2017) and 27 sites (2032) are predicted to experience higher flows due to NDR but with a small number of exceptions, the increases in traffic flows are below the more stringent 10% threshold of significance given in published guidance on the environmental assessment of traffic impacts.

- In the worst case analysed, the accident record of the junction is good and considered unlikely to change significantly as a consequence of the increase in traffic predicted.
- Further investigation of the detailed accident records at high priority cluster sites will be conducted as part of regular quarterly monitoring by Norfolk County Council. This will determine whether the road environment was a factor and whether any measures could be implemented to improve road safety at these locations.

Overall it can be concluded that the NDR is likely to have a beneficial impact at nearly 70% of all existing cluster sites (62 out of 89). There is, therefore, not predicted to be a significant increase in road accidents as a result of the NDR. Whilst the increase in flows provides an indication of likely road safety issues, the monitoring measures and statutory responsibilities of Norfolk County Council will continue to address areas of risk of road traffic accidents.

5.5 Access to Healthcare Facilities

Providing improved access to appropriate healthcare facilities can be a key health and wellbeing benefit of local and sub-national transport schemes. Table 5.9 below shows the strategic health infrastructure in Greater Norwich, including hospitals:

Table 5.9: Hospitals within Greater Norwich

	Hospital
Norwich	The Huntercombe Hospital
	Colman Hospital
	Hellesdon Hospital
	Julian Hospital
	Norfolk and Norwich University Hospital
	Norwich Community Hospital
Broadland	St Michaels Hospital
South Norfolk	Ogden Court Community Hospital
	Partnerships in Care Burston House
	Partnerships in Care Richmond House
	Partnerships in Care St John's House

With high concentrations of older people, disabled people and children (all of whom are more likely to require access to healthcare that other sections of the general population) in the north of Norwich and the urban fringe to the south of Broadband. Any benefits of improved access to healthcare as a result of the NDR is likely to fall disproportionately on these to these groups.

5.5.1 Construction Effects

Changes in accessibility are not considered as part of the assessment of construction effects of the scheme.

5.5.2 Operational Effects

NDR has the potential to have positive effects in terms of improving access to key local health services, which is likely to be beneficial for a wide range of people in the wider impact area in particular. These benefits would accrue for young people (children), older people, and those from more deprived communities in particular who are likely to access health services more regularly than the population as a whole. In addition, further benefits would be felt by older people whereby access to services would be easier and more convenient.

Journey time changes to hospital access were analysed within the Greater Norwich area, with three locations selected to represent points where journeys might begin: Norwich City Centre, Taverham in Broadland and Wymondham in South Norfolk. Key hospitals within Greater Norwich (both within the LAI and WAI) were selected as destinations. The journey times between these three 'origin' points, and the selected health 'destinations' were assessed for one scenario (2017). The methodology for this process is contained within Appendix C of this document, and the underlying modelling is detailed in the Community and Private Assets chapter of the ES (Chapter 13).

The impact of the NDR scheme on access to hospitals varies across Greater Norwich.

Of the eleven strategic health sites analysed (using the three origin points) resulting in 33 journey time changes:

- 13 (40%) journey times will decrease
- 15 (45%) journey times will increase
- 5 (15%) journey times will not change
- 30 (91%) journey times will see change (either increase or decrease) of two minutes or less; therefore the majority of the journey time changes are relatively small.

For travellers beginning their journey in Norwich, travel times for all hospitals and care facilities studied are predicted to increase. However, it should be noted that in some cases increases are of 10 minutes or more. These are the result of a shift of travellers onto the Norwich Park and Ride system within the way that traffic movements are modelled and should be considered as such.

In contrast, journey times to hospitals from Taverham (Broadland) predominantly decrease as a result of the NDR scheme, positively increasing access to health services. For inhabitants of Wymondham, the overall impact is mixed, with mostly no change on travel time journeys to key hospitals within the area.

As a result of NDR, therefore, there will be improved access to healthcare services for residents of Taverham, with little or no change in Wymondham and a possible increase in journey times for residents of Norwich. Any benefits would accrue for young people (children), older people, and those from more deprived communities in particular who are likely to access health services more regularly than the population as a whole. In addition, further benefits would be felt by older people whereby access to services by public transport would be easier and more frequent.

5.6 Access to Employment

Employment plays a significant part in our overall levels of health and wellbeing. Having a job gives people a purpose, promotes independence, facilitates social participation and helps to prevent physical and mental health problems. Mental health problems such as depression and anxiety are becoming more common amongst people who are unemployed; this is often caused due to a lack of disposable income and/or reduced standards of living, loss of self-esteem and loss of social contacts.

Having the means to access employment opportunities is therefore a positive element in the promotion of health and wellbeing, in particular where access to jobs is facilitated through transport options such as the availability of public transport. This is significant for NDR as the route will provide quicker and easier access to key employment sites

5.6.1 Construction Effects

Changes in accessibility are not considered as part of the assessment of construction effects of the scheme. However, there are some employment-related benefits associated with construction.

The development of NDR would create temporary employment over the entire construction period. The ES reports that approximately 217 staff and operatives would be employed at the peak of construction activity. The majority of Birse Civils staff (the appointed contractor) will be existing employees, however it is anticipated that some agency staff from within Greater Norwich area will also be employed.

It is anticipated that a large proportion of staff will be based in Greater Norwich and that general labour and potentially some sub-contractors would be sourced from companies based in East Anglia. At this stage, it is not possible to accurately assess the total number of people to be employed during construction as this will only be known once all contracting for the work has been undertaken.

5.6.2 Operational Effects

The NDR will improve road access to a number of existing strategically-important employment sites and to other key economic drivers such as nearby business parks and Norwich Airport.

26 current employment sites were identified from the Joint Core Strategy and the journey times to these sites from three origin points were analysed with and without the implementation of the NDR scheme. The methodology for this process is described in Appendix C.

Of the 26 employment sites analysed (using three origin points) resulting in 78 journey time changes:

- 58 (64%) journey times will decrease
- 13 (17%) journey times will increase
- 7 (9%) journey times will not change
- 58 (64%) journey times will see change (either increase or decrease) of two minutes or less

The vast majority of journey times will be reduced as a result of the NDR. In particular journey times from Taverham to Meridian Business Park, Great Plumstead/Thorpe End, Rackheath Industrial Estate, Broadland Business Park, and St Andrews Business Park will all reduce by more than 10 minutes.

Journey times from Wymondham to Meridian Business Park, Broadland Business Park, and St Andrews Business Park will see the largest increases in journey time, of more than two minutes. Other journey time increases, where they exist, are of less than one minute.

NDR will also provide access to a number of future employment sites identified in the JCS. These are detailed in the table in Appendix C, applying the same methodology.

Six future employment sites were identified from the JCS and the journey times to these sites from three origin points were analysed with and without the implementation of the NDR scheme.Of the six employment sites analysed (using the three origin points) resulting in 18 journey time changes:

- 13 (72 per cent) journey times will decrease
- 3 (17 per cent) journey times will increase
- 2 (11 per cent) journey times will not change
- 11 (61 per cent) journey times will see change (either increase or decrease) of two minutes or less

The vast majority of journey times to proposed employment sites will be reduced. The biggest reductions are to Broadland Gate Business Park, Norwich Aeropark, Beyond Green Land and Rackheath Eco-town. All will see reduction of more than five minutes for at least one (and generally more than one) of the origin points identified in the table.

There will be some increases in journey times from Norwich (namely to Hethel Technology Park, Norwich Aeropark and Rackheath Eco-town) but these are expected to be very minor (around 30 seconds or less).

The greatest journey time savings are for those accessing the sites from outside of Norwich centre. The improvement in access to employment sites is likely to have a positive contribution to the health and well-being of the working age population.

5.7 Physical Fitness and Access to Recreation Facilities

Regular physical activity can reduce the risk of developing chronic illnesses later in life such as heart disease, stroke, type two diabetes and some cancers. In addition, those who are physically active and have access to (and make use of) leisure facilities and or open space are less likely to develop stress, anxiety, depression, dementia and Alzheimer's disease.

The table below illustrates the key leisure facilities along the NDR route.

Table 5.10: Leisure resources in Greater Norfolk

District	Facility
Norwich	The Norman Centre

District	Facility
	Riverside Leisure Centre
	Eaton Park
	Sportspark
	Whitlingham Outdoor Education Centre
	The Garage
	Wensum Lodge Sports Hall
Broadland	Acle War Memorial Recreation Centre
	Aylsham Community Gym
	Aylsham High School
	Bob Carter Centre
	Broadland High School
	Carrow Park (Community Sports Foundation)
	Hellesdon High School
	Oasis
	Sprowston High School
	Sprowston Manor
	Thorpe St Andrew High
South Norfolk	Diss Swim & Fitness Centre
	Long Stratton Leisure Centre
	Wymondham Leisure Centre
	Framingham Earl Community Sports Centre

5.8 Construction Effects

Changes in accessibility are not considered as part of the assessment of construction effects of the scheme.

5.9 Operational Effects

The NDR will improve road access to a number of key leisure facilities within Greater Norwich including leisure centres and sports facilities.

Twenty two leisure facilities were identified from local authority websites and the journey times to these sites from the same three origin points were analysed with and without the implementation of the NDR scheme. The methodology for this process is outlined in Appendix C.

Of the 22 leisure and recreation sites analysed (using three origin points) resulting in 66 journey time changes, less than ten of these journeys will experience a change in journey time of more than two minutes.

Those starting their journey in Norwich city centre and wishing to access Diss Swim and Fitness Centre and Long Stratton Leisure Centre are predicted to have large increases in journey times, although this could be as a result of the way these journeys have been modelled (as set out above – the assumption of switching to park and ride). Journey times to Sprowston Manor are predicted to improve from all destinations.

Overall, the change around two thirds of the modelled journeys are expected to result in journey times that are reduced or stay the same. Therefore, there is a slight positive health benefit, but the changes are very small.

6 Conclusions and Recommendations

6.1 Conclusions

The analysis of potential health effects of the construction and operation of the NDR has considered the main areas where a relationship between the proposed development and health outcomes are likely to be strongest.

There are not predicted to be any adverse air quality effects as a result of the construction phase. Neither are there predicted to be any significant health effects associated with a change in air quality from the operational phase as the levels of change in emissions are below the applicable limits.

There are not predicted to be any significant effects from construction noise. Across the length of the route residential dwellings and other receptors are predicted to experience significant increases in noise levels in both the short term and the long term. This is a direct product of the scheme, and these changes are expected to result in negative health impacts.

The risks to health associated with road safety are a common factor with new road schemes. The changes in traffic flows as a result of the scheme have the potential to lead to changes in accident levels which need to be explored through further study. This, in turn, provides a focus for accident prevention measures as the scheme develops.

NDR is considered to provide benefits to health by improving access to strategic healthcare facilities, employment sites and leisure facilities. Although accessibility is primarily improved by private transport, the ambition of the scheme extends to improving journey times throughout Norwich, supporting an improved public transport offer also.

6.2 Recommendations

The following recommendations seek to mitigate potential negative impacts and optimise positive impacts:

- use the opportunity created by NDR to promote modal shift within Norwich (for example through pricing and promotion) to active and sustainable modes of transport within the city centre, to encourage people away from cars to walking, cycling and buses in order to further reduce traffic and congestion in the city centre;
- consider the need for additional noise mitigation measures for those residents expected to experience the largest increases in noise; and
- commit to an on-going programme of maintenance of the route ensure that noise and vibration impacts from vehicles are controlled;
- encourage contractors to source local labour for the construction phase;
- consider how cycles could be accommodated on or along the route safely (with the ambition of complementing NATS and LTP ambitions);
- ongoing analysis and monitoring of potential road safety issues associated with the creation of a new road, using best-practice safety measures through detailed design and operation;
- consider the needs of the visually impaired with regard to road safety, particularly around junctions and crossings;

- in the restitution of open space following the construction period, identify opportunities to improve amenity to encourage use for recreation and physical activity; and
- promote open and recreational spaces accessible from NDR and encourage greater emphasis on healthy leisure pursuits.

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Appendices

Appendix A. Health Profile Indictors 2012

Figure A.1: Health profile for Norwich 2012

Domain	Indicator	Local No. Per Year	Local Value	Eng Avg	Eng Worst	England Range	Eng Best
Our communities	1 Deprivation	38349	28.0	19.8	83.0		0.0
	2 Proportion of children in poverty ‡	6640	31.3	21.9	50.9		6.4
	3 Statutory homelessness ‡	108	1.7	2.0	10.4		0.0
	4 GCSE achieved (5A*-C inc. Eng & Maths)	500	50.0	58.4	40.1		79.9
	5 Violent crime	2864	20.4	14.8	35.1		4.5
	6 Long term unemployment	834	8.1	5.7	18.8		0.9
Children's and young people's health	7 Smoking in pregnancy ‡	258	14.7	13.7	32.7		3.1
	8 Breast feeding initiation ‡	1323	75.8	74.5	39.0		94.7
	9 Obese Children (Year 6) ‡	165	18.5	19.0	26.5		9.8
	10 Alcohol-specific hospital stays (under 18)	12	53.3	61.8	154.9		12.5
	11 Teenage pregnancy (under 18) ‡	101	51.9	38.1	64.9		11.1
Adults' health and lifestyle	12 Adults smoking ‡	n/a	23.6	20.7	33.5		8.9
	13 Increasing and higher risk drinking	n/a	23.5	22.3	25.1		15.7
	14 Healthy eating adults	n/a	27.7	28.7	19.3		47.8
	15 Physically active adults ‡	n/a	11.7	11.2	5.7		18.2
	16 Obese adults ‡	n/a	21.7	24.2	30.7		13.9
Disease and poor health	17 Incidence of malignant melanoma	12	9.9	13.6	26.8		2.7
	18 Hospital stays for self-harm ‡	439	310.2	212.0	509.8		49.6
	19 Hospital stays for alcohol related harm ‡	2660	1806	1895	3276		910
	20 Drug misuse	1609	15.9	8.9	30.2		1.3
	21 People diagnosed with diabetes ‡	5470	4.2	5.5	8.1		3.3
	22 New cases of tuberculosis	11	7.8	15.3	124.4		0.0
	23 Acute sexually transmitted infections	1518	1058	775	2276		152
	24 Hip fracture in 65s and over ‡	120	400	452	655		324
Life expectancy and causes of death	25 Excess winter deaths ‡	72	20.8	18.7	35.0		4.4
	26 Life expectancy – male	n/a	77.8	78.6	73.6		85.1
	27 Life expectancy – female	n/a	83.5	82.6	79.1		89.8
	28 Infant deaths ‡	9	5.1	4.6	9.3		1.2
	29 Smoking related deaths	197	227	211	372		125
	30 Early deaths: heart disease and stroke ‡	88	75.1	67.3	123.2		35.5
	31 Early deaths: cancer ‡	144	122.2	110.1	159.1		77.9
	32 Road injuries and deaths ‡	40	28.8	44.3	128.8		14.1

Source: Public Health England – Health Profile for Norwich 2012

Figure A.2: Health Profile for Broadland 2012

Domain	Indicator	Local No. Per Year	Local Value	Eng Avg	Eng Worst	England Range	Eng Best
Our communities	1 Deprivation	0	0.0	19.8	83.0		0.0
	2 Proportion of children in poverty ‡	2265	10.9	21.9	50.9		6.4
	3 Statutory homelessness ‡	153	2.9	2.0	10.4		0.0
	4 GCSE achieved (5A*-C inc. Eng & Maths)	1004	65.7	58.4	40.1		79.9
	5 Violent crime	651	5.3	14.8	35.1		4.5
	6 Long term unemployment	202	2.7	5.7	18.8		0.9
Children's and young people's health	7 Smoking in pregnancy ‡	159	14.7	13.7	32.7		3.1
	8 Breast feeding initiation ‡	812	75.8	74.5	39.0		94.7
	9 Obese Children (Year 6) ‡	186	15.6	19.0	26.5		9.8
	10 Alcohol-specific hospital stays (under 18)	3	12.5	61.8	154.9		12.5
	11 Teenage pregnancy (under 18) ‡	46	22.1	38.1	64.9		11.1
Adults' health and lifestyle	12 Adults smoking ‡	n/a	18.6	20.7	33.5		8.9
	13 Increasing and higher risk drinking	n/a	23.6	22.3	25.1		15.7
	14 Healthy eating adults	n/a	31.1	28.7	19.3		47.8
	15 Physically active adults ‡	n/a	10.9	11.2	5.7		18.2
	16 Obese adults ‡	n/a	25.1	24.2	30.7		13.9
Disease and poor health	17 Incidence of malignant melanoma	22	14.4	13.6	26.8		2.7
	18 Hospital stays for self-harm ‡	173	155.3	212.0	509.8		49.6
	19 Hospital stays for alcohol related harm ‡	2346	1292	1895	3276		910
	20 Drug misuse	349	4.5	8.9	30.2		1.3
	21 People diagnosed with diabetes ‡	4619	5.1	5.5	8.1		3.3
	22 New cases of tuberculosis	2	1.6	15.3	124.4		0.0
	23 Acute sexually transmitted infections	658	532	775	2276		152
	24 Hip fracture in 65s and over ‡	166	454	452	655		324
Life expectancy and causes of death	25 Excess winter deaths ‡	70	16.4	18.7	35.0		4.4
	26 Life expectancy – male	n/a	80.3	78.6	73.6		85.1
	27 Life expectancy – female	n/a	83.2	82.6	79.1		89.8
	28 Infant deaths ‡	2	1.5	4.6	9.3		1.2
	29 Smoking related deaths	200	157	211	372		125
	30 Early deaths: heart disease and stroke ‡	77	44.1	67.3	123.2		35.5
	31 Early deaths: cancer ‡	164	97.9	110.1	159.1		77.9
	32 Road injuries and deaths ‡	53	43.1	44.3	128.8		14.1

Source: Public Health England – Health Profile for Broadland 2012

Figure A.3: Health Profile for South Norfolk 2012

Domain	Indicator	Local No. Per Year	Local Value	Eng Avg	Eng Worst	England Range	Eng Best
Our communities	1 Deprivation	38349	28.0	19.8	83.0		0.0
	2 Proportion of children in poverty ‡	6640	31.3	21.9	50.9		6.4
	3 Statutory homelessness ‡	108	1.7	2.0	10.4		0.0
	4 GCSE achieved (5A*-C inc. Eng & Maths)	500	50.0	58.4	40.1		79.9
	5 Violent crime	2864	20.4	14.8	35.1		4.5
	6 Long term unemployment	834	8.1	5.7	18.8		0.9
Children's and young people's health	7 Smoking in pregnancy ‡	258	14.7	13.7	32.7		3.1
	8 Breast feeding initiation ‡	1323	75.8	74.5	39.0		94.7
	9 Obese Children (Year 6) ‡	165	18.5	19.0	26.5		9.8
	10 Alcohol-specific hospital stays (under 18)	12	53.3	61.8	154.9		12.5
	11 Teenage pregnancy (under 18) ‡	101	51.9	38.1	64.9		11.1
Adults' health and lifestyle	12 Adults smoking ‡	n/a	23.6	20.7	33.5		8.9
	13 Increasing and higher risk drinking	n/a	23.5	22.3	25.1		15.7
	14 Healthy eating adults	n/a	27.7	28.7	19.3		47.8
	15 Physically active adults ‡	n/a	11.7	11.2	5.7		18.2
	16 Obese adults ‡	n/a	21.7	24.2	30.7		13.9
Disease and poor health	17 Incidence of malignant melanoma	12	9.9	13.6	26.8		2.7
	18 Hospital stays for self-harm ‡	439	310.2	212.0	509.8		49.6
	19 Hospital stays for alcohol related harm ‡	2660	1806	1895	3276		910
	20 Drug misuse	1609	15.9	8.9	30.2		1.3
	21 People diagnosed with diabetes ‡	5470	4.2	5.5	8.1		3.3
	22 New cases of tuberculosis	11	7.8	15.3	124.4		0.0
	23 Acute sexually transmitted infections	1518	1058	775	2276		152
	24 Hip fracture in 65s and over ‡	120	400	452	655		324
Life expectancy and causes of death	25 Excess winter deaths ‡	72	20.8	18.7	35.0		4.4
	26 Life expectancy – male	n/a	77.8	78.6	73.6		85.1
	27 Life expectancy – female	n/a	83.5	82.6	79.1		89.8
	28 Infant deaths ‡	9	5.1	4.6	9.3		1.2
	29 Smoking related deaths	197	227	211	372		125
	30 Early deaths: heart disease and stroke ‡	88	75.1	67.3	123.2		35.5
	31 Early deaths: cancer ‡	144	122.2	110.1	159.1		77.9
	32 Road injuries and deaths ‡	40	28.8	44.3	128.8		14.1

Source: Public Health Observatory, Health Profile for South Norfolk 2102

Appendix B. Community Profile

B.1 Introduction

This chapter provides an overview and analysis of the population that could potentially be affected by the NDR scheme. It identifies any groups particularly vulnerable to negative health impacts, as well as any groups whose health may benefit from the scheme.

B.2 Study Area

The spatial scope of this HIA covers the area of 'Greater Norwich' and includes the districts of Norwich, Broadland and South Norfolk, although the geographic scope varies for each of the topics being considered.

B.3 Population Profile

Demographic information on the community has been collated, consistent with the approach taken for the Equality Impact Assessment (EqIA). In defining the community and identifying potential groups that may be exposed to potential health impacts, the community datasets relevant to the HIA are:

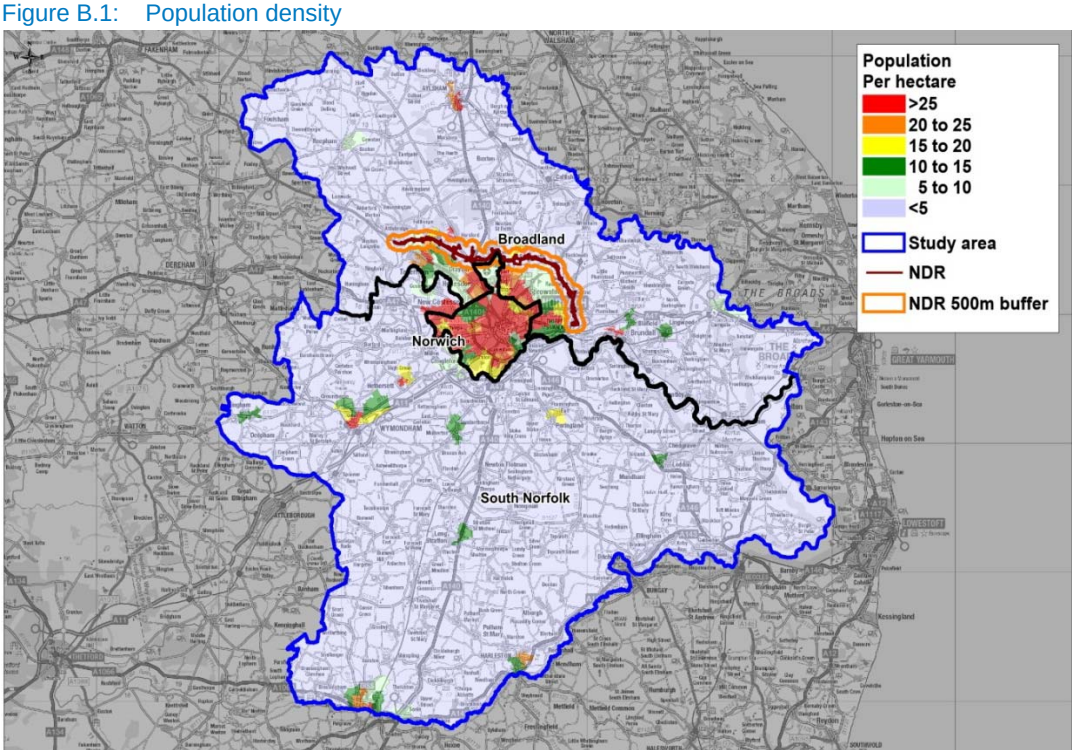
- population density;
- children (aged 0 – 5 years);
- older people (women over 60 and men over 65);
- BAME communities;
- disabled people (including people with physical, sensory or mental health issues); and
- people from deprived communities.

B.3.1 General population profile and density

The population within the Greater Norwich area has been increasing steadily over recent years. In all three districts (Norwich, Broadland and South Norfolk), the population has continued to increase with nearly 30,000 more people living in the area now compared to 10 years ago. According to Census data, the total population in the Greater Norwich area was around 381,170 in 2011, an increase of 29,100 since mid-2001.

Although Greater Norwich contains large areas with a low population density, Norwich and southern areas of Broadland are densely populated. The area to the south of the NDR route which contains both is the most densely populated part of the study area. The map below illustrates the population density in the three districts of Greater Norwich and the population density around the NDR route:

Figure B.1: Population density



Source: Census, 2011

B.3.2 Age

B.3.2.1 Children (aged under 5 years)

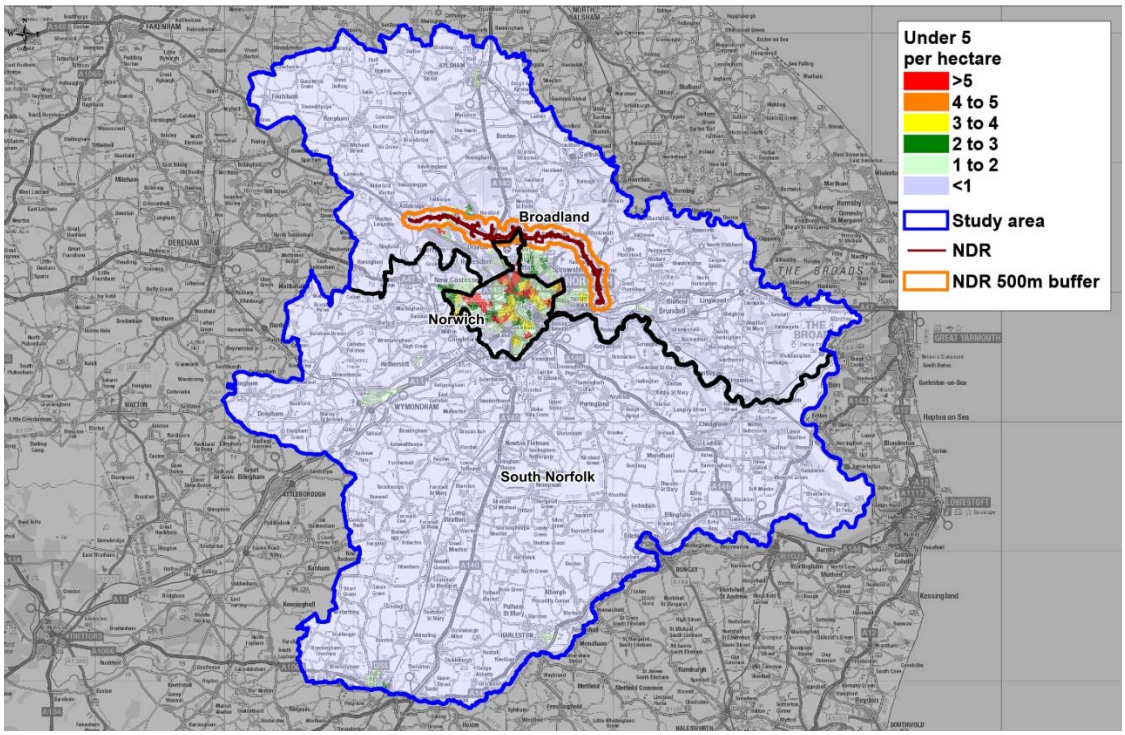
There are 21,300 children under 5 in the study area, accounting for 6 per cent of the total population. This proportion is similar across all three districts and is in line with the proportion of children under 5 in Norfolk, LEP Anglia and England.

Table B.1: Population of children under 5

Area	Total population	Under 5	Under 5%
LIA 500m Buffer	5,329	321	6
Norwich	132,512	8,425	6
Broadland	124,646	6,053	5
South Norfolk	124,012	6,816	5
Study Area	381,170	21,294	6
WIA Norfolk	857,888	46,531	5
LEP New Anglia	1,586,051	88,757	6
England	53,012,456	3,318,449	6

As the below map shows, large areas of the Greater Norwich districts have very low densities of children aged under 5, in particularly South Norfolk and Broadland. Norwich, in contrast, experiences the highest density of this age group in the Greater Norwich area, with some pockets of medium densities of children under 5 also found in the southern, urban areas of Broadland.

Figure B.2: Density of children under 5 years



Source: Census, 2011

The area that surrounds the NDR route consists mostly of areas with low densities of children, with some pockets of medium densities at the north of the route near Thorpe St Andrew, the middle of the route near Old Catton and towards the end of route near Taverhsam. In contrast, to the south of the route in northern areas of Norwich, lie the highest densities of children under 5, reflecting the wider population trends for the Greater Norwich area.

B.3.2.2 Older People (aged 65 and over)

In the districts of Greater Norwich, the older population (aged 65 and over) account for 19 per cent of the total population, lower than the proportion for both Norfolk and the New Anglia LEP area but much higher than the overall proportion for England (16 per cent). The highest proportions of older people are found in the districts of Broadland (22 per cent) and South Norfolk (21 per cent), with the lowest proportions of older people found in Norwich (15 per cent), where the proportion of older people remains comparable to that of England.

Table B.2: Population of older people aged 65 and over

Area	Total population	Over 65	Over 65%
LIA 500m Buffer	5,329	816	15
Norwich	132,512	19,345	15
Broadland	124,646	27,816	22
South Norfolk	124,012	26,523	21
Study Area	381,170	73,684	19
WIA Norfolk	857,888	185,231	22
LEP New Anglia	1,586,051	330,270	21
England	53,012,456	8,660,529	16

The highest densities of older people lie in the middle of the study area, specifically in Norwich and the southern areas of Broadland. The surrounding and outlying areas characteristic of South Norfolk and the remainder of Broadland, in contrast is broadly a low density area, with some sporadic pockets of medium to high densities of older people.

B.3.2.3 Black, Asian and Minority Ethnic groups

There are almost 31,400 people from BAME groups in the districts of Greater Norwich, accounting for 8 per cent of the total population, much lower than the BAME population in England (20 per cent). The highest proportion of BAME groups within the study area is found in Norwich, where BAME groups account for 15 per cent of the total population. In comparison, the proportion of BAME groups in Broadland and South Norfolk is much lower (4 percent and 5 percent), falling under the BAME proportion for both Norfolk and the LEP New Anglia area (both 8 percent).

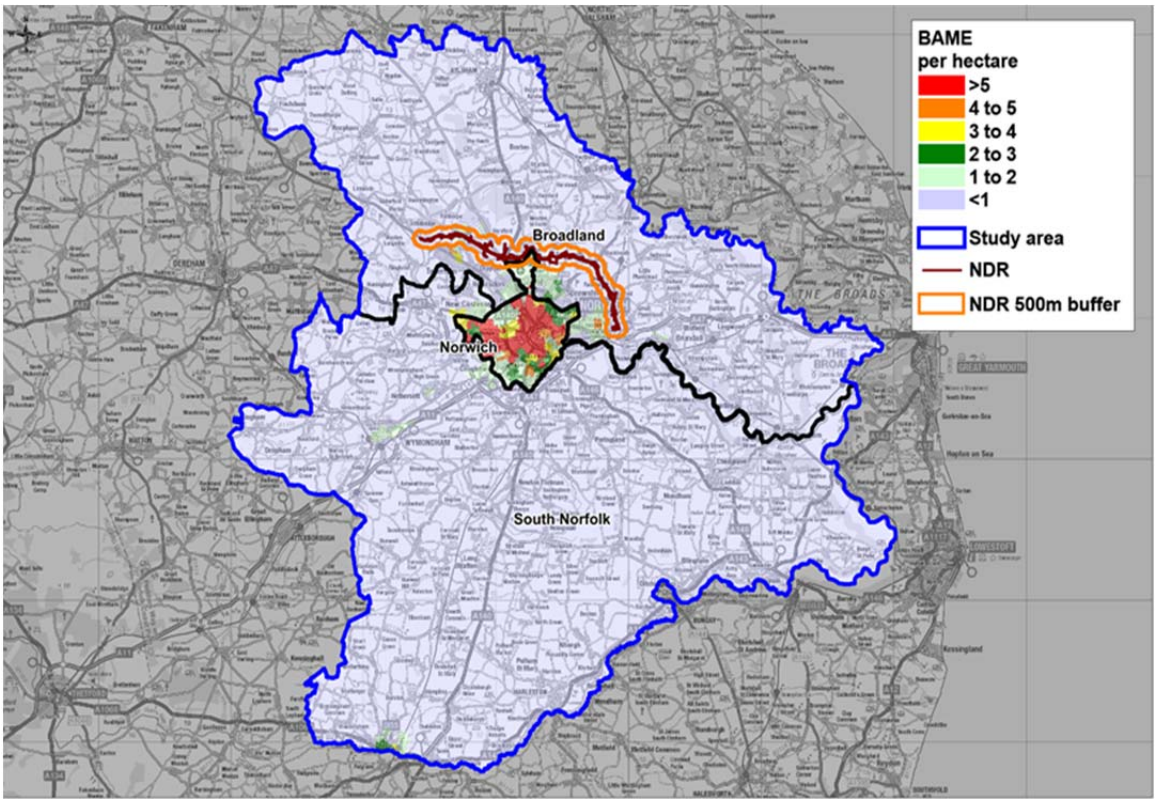
Table B.3: BAME population

Area	Total population	BAME	BAME %
LIA 500m Buffer	5,329	173	3
Norwich	132,512	20,275	15
Broadland	124,646	5,064	4
South Norfolk	124,012	6,014	5
Study Area	381,170	31,353	8
WIA Norfolk	857,888	64,802	8
LEP New Anglia	1,586,051	131,507	8
England	53,012,456	10,733,220	20

The highest densities of BAME communities are found in the middle of the study area in Norwich, with surrounding and outlying areas of Broadland and South Norfolk, broadly characterised by very low proportions of BAME groups. The exception being the pockets of low to medium BAME densities found in southern and eastern areas of Broadland and within South Norfolk.

Along the NDR route, the highest densities of BAME groups are found to the south of the route in Norwich specifically, but also including areas near Andrew St Thorpe and Taverham where there are medium to high densities of BAME groups. In addition, there are low to medium densities of BAME groups also found to the south of the route in areas of south Broadland.

Figure B.3: BAME population density



Source: Census, 2011

B.3.2.4 Disabled people

The proportion of DLA claimants in Greater Norwich accounts for 5 per cent of the total population. Whilst there is a slightly higher proportion of claimants within Norwich (6 per cent), overall the proportion of DLA claimants does not differ greatly between the three districts and is similar to trends for Norfolk, LEP New Anglia and England as the table below illustrates:

Table B.4: Population of disabled people

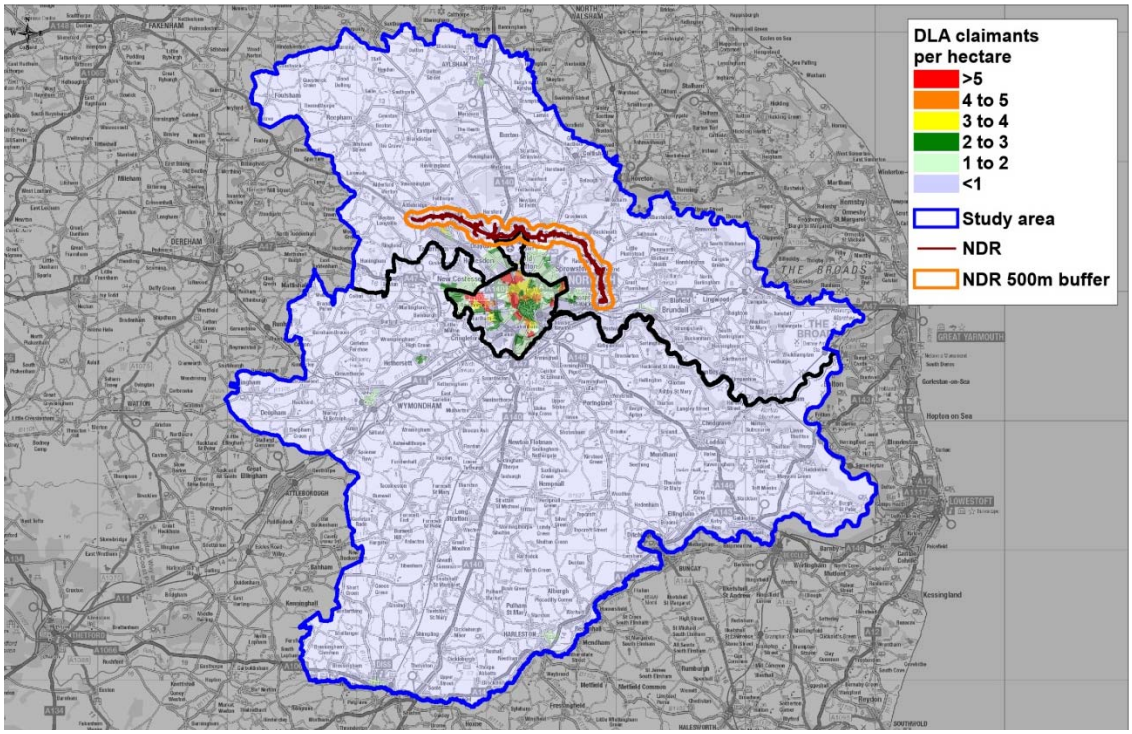
Area	Total population	DLA	DLA %
LIA 500m Buffer	5,329	203	4
Norwich	132,512	7,610	6
Broadland	124,646	5,050	4
South Norfolk	124,012	4,720	4

Area	Total population	DLA	DLA %
Study Area	381,170	17,380	5
WIA Norfolk	857,888	43,510	5
LEP New Anglia	1,586,051	75,860	5
England	53,012,456	2,708,310	5

As, the map below illustrates, there are only a few patches of high densities of DLA claimants, occurring predominantly within Norwich. Overall, the study area is characterised by very low densities of people claiming DLA with some areas of low to medium densities of DLA claimants located in Norwich and southern areas of Broadland and western areas of South Norfolk.

Following this trend, areas to the north of the NDR route in Broadland, also have very low densities of DLA claimants. In contrast, areas to the south of route include pockets of low to medium densities mainly in south eastern areas of Broadland and patches of medium to high densities near Taverham towards the end of the route and within northern areas of Norwich.

Figure B.4: Disabled people density



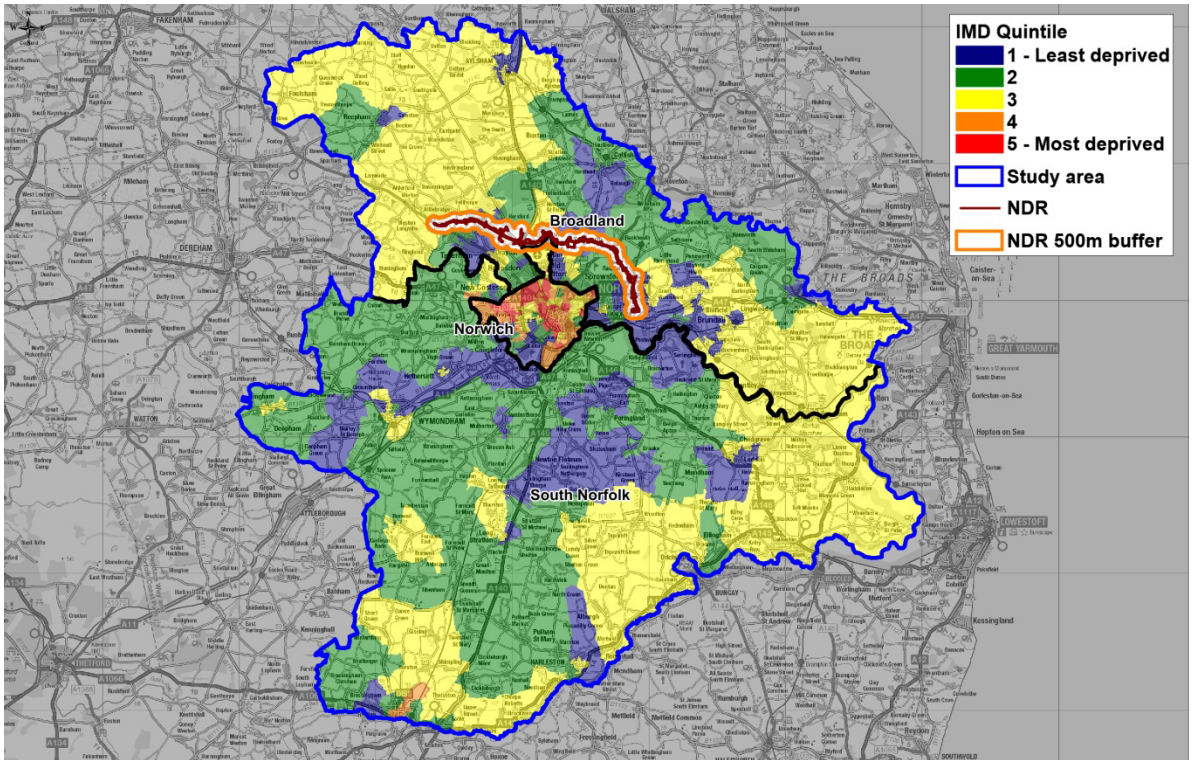
Source: nomis

Deprivation within Greater Norwich is particularly acute in the city of Norwich, with the majority of areas identified as experiencing medium to high levels of deprivation. This is in stark contrast to both Broadland and South Norfolk where deprivation ranges from low to medium.

In terms of the NDR, the majority of the areas surrounding the route are within the least deprived IMD quintiles (rating 1-3), the exception being areas falling to the south of the route within northern Norwich.

The map below illustrates the breakdown of deprivation across the Greater Norwich districts of Norwich, Broadland and South Norfolk.

Figure B.5: Deprivation by IMD quintile



Source: Department for Communities and Local Government

B.4 Healthcare Resources

The following table shows the community resources that are important for health along the NDR route, it contains a small number of sports and leisure resources, as no healthcare resources have been identified within a 500m radius of the route. The community resources identified include two sports clubs and one outdoor sports facility and park:

Table B.5: Sports and leisure resources

Facility	Name	Postcode
Outdoor sports facility	Manor Park	NA10 3AQ
Sports Club Sports Centre	Norwich County Football Association	NR7 0TA
	Norwich Rugby Football Club	NR12 7BW

Appendix C. Journey time data

C.1 Methodology

The changes in journey times to existing key strategic employment locations, economic centres and business districts throughout Greater Norwich are outlined in the tables below (including existing and proposed sites).

- For each identified site three locations have been selected to provide indicative journey origin points. For these origin points the 'centre' for the largest settlements in each of the three districts that make up the study area have been chosen – Norwich (County Hall), Taverham (in Broadland) and Wymondham (in South Norfolk). Clearly, not all journeys originate from these locations; they are intended to be indicative of potential changes and journey time savings as a result of the implementation of the NDR.
- The times indicated are for private transport during the AM peak for the year 2017.
- The table provides journey times for two scenarios: one for 'do nothing', representing the network in its current form; and one for the 'NDR' in its current JCS configuration (which includes the Postwick Hub). The change in journey time between the two is illustrated in the far right column where decreases in journey time are marked in green and increases marked in red. No change in journey time is coloured orange.
- Using the traffic model to calculate journey times for the purposes of analysis in the HIA means that certain journey times in the 'Do Something Scenario' include Park and Ride interchanges, where this occurs there is scope for an additional artificial increase to the journey time included.

C.2 Strategic Healthcare Facilities

Change
Increase
Decrease
No change

Table C.1: Journey Times to Hospitals within Greater Norwich (2017)

		Journey times		
Hospitals	Origin Point	Do nothing	NDR	Change
Colman Hospital	Norwich	05:16	06:13	00 minutes 57 seconds
	Taverham	18:03	17:38	-00 minutes 25 seconds
	Wymondham	12:48	12:46	-00 minutes 2 seconds
Hellesdon Hospital, Norwich	Norwich	13:40	13:46	00 minutes 6 seconds
	Taverham	09:42	09:32	-00 minutes 10 seconds
	Wymondham	21:07	21:05	-00 minutes 1 second
Julian Hospital, Norwich	Norwich	07:14	08:12	00 minutes 58 seconds
	Taverham	14:59	14:34	-00 minutes 26 seconds
	Wymondham	15:46	15:43	-00 minutes 3 seconds
Norfolk and Norwich University Hospital, Norwich	Norwich	12:10	13:01	00 minutes 51 seconds
	Taverham	16:48	16:09	-00 minutes 39 seconds
	Wymondham	09:05	09:05	00 minutes 00 seconds

		Journey times		
Norwich Community Hospital, Norwich	Norwich	07:14	08:12	00 minutes 58 seconds
	Taverham	14:59	14:34	-00 minutes 26 seconds
	Wymondham	15:46	15:43	-00 minutes 3 seconds
Ogden Court Community Hospital, Wymondham	Norwich	16:04	16:58	00 minutes 54 seconds
	Taverham	20:50	20:11	-00 minutes 39 seconds
	Wymondham	00:00	00:00	00 minutes 00 seconds
Partnerships in Care Burston House, Diss	Norwich	30:05	41:25	11 minutes 20 seconds
	Taverham	36:52	36:13	-00 minutes 39 seconds
	Wymondham	23:26	23:26	00 minutes 00 seconds
Partnerships in Care Richmond House, Harleston	Norwich	30:05	41:25	11 minutes 20 seconds
	Taverham	36:52	36:13	00 minutes 39 seconds
	Wymondham	23:26	23:26	00 minutes 00 seconds
Partnerships in Care St John's House, Diss	Norwich	05:56	17:17	11 minutes 20 seconds
	Taverham	12:43	12:05	00 minutes 39 seconds
	Wymondham	59:17	59:17	00 minutes 00 seconds
St Michaels Hospital, Aylsham	Norwich	25:15	25:44	00 minutes 29 seconds
	Taverham	17:41	17:36	-00 minutes 5 seconds
	Wymondham	32:49	34:43	1 minute 54 minutes
The Huntercombe Hospital - Norwich	Norwich	22:15	22:44	00 minutes 29 seconds
	Taverham	14:41	14:36	-00 minutes 5 seconds
	Wymondham	29:49	31:43	1 minute 54 minutes

C.3 Existing Employment Sites

Table C.2: Impact on journey times to existing strategic employment locations within Greater Norwich

		Journey times		
Business District	Origin Point	Do nothing	NDR	Change
Aylsham estate	Norwich	06 min 43 sec	06 min 36 sec	-00 min 07 sec
	Taverham	20 min 49 sec	17 min 16 sec	-03 min 33 sec
	Wymondham	21 min 10 sec	20 min 40 sec	-00 min 31 sec
Ayton Road, Wymondham	Norwich	18 min 26 sec	18 min 21 sec	-00 min 05 sec
	Taverham	25 min 58 sec	24 min 08 sec	-01 min 50 sec
	Wymondham	00 min 00 sec	00 min 00 sec	00 min 00 sec
Border Valley Industrial Estate, Harleston	Norwich	32 min 34 sec	32 min 41 sec	00 min 07 sec
	Taverham	42 min 28 sec	40 min 36 sec	-01 min 53 sec
	Wymondham	23 min 26 sec	23 min 26 sec	00 min 00 sec
Bowthorpe	Norwich	15 min 53 sec	15 min 43 sec	-00 min 10 sec

		Journey times		
Employment Area	Taverham	12 min 12 sec	11 min 56 sec	-00 min 15 sec
	Wymondham	13 min 53 sec	13 min 44 sec	-00 min 08 sec
Broadhill Industrial Estate and Tharston Industrial Estate, Long Stratton	Norwich	30 min 58 sec	31 min 05 sec	00 min 07 sec
	Taverham	40 min 52 sec	39 min 00 sec	-01 min 53 sec
	Wymondham	21 min 50 sec	21 min 50 sec	00 min 00 sec
Broadland Business Park	Norwich	14 min 39 sec	14 min 31 sec	-00 min 07 sec
	Taverham	32 min 40 sec	18 min 58 sec	-13 min 43 sec
	Wymondham	14 min 53 sec	16 min 59 sec	02 min 06 sec
City Trading Estate	Norwich	06 min 43 sec	06 min 36 sec	-00 min 07 sec
	Taverham	20 min 49 sec	17 min 16 sec	-03 min 33 sec
	Wymondham	21 min 10 sec	20 min 40 sec	-00 min 31 sec
Gateway 11 Business Park, Wymondham	Norwich	18 min 26 sec	18 min 21 sec	-00 min 05 sec
	Taverham	25 min 58 sec	24 min 08 sec	-01 min 50 sec
	Wymondham	00 min 00 sec	00 min 00 sec	00 min 00 sec
Great Plumstead/ Thorpe End	Norwich	15 min 52 sec	15 min 44 sec	-00 min 08 sec
	Taverham	31 min 33 sec	17 min 46 sec	-13 min 48 sec
	Wymondham	21 min 17 sec	19 min 12 sec	-02 min 04 sec
Hall Road	Norwich	11 min 59 sec	12 min 6 sec	00 min 06 sec
	Taverham	27 min 18 sec	3 min 7 sec	-00 min 11 sec
	Wymondham	12 min 51 sec	12 min 49 sec	-00 min 02 sec
Hethel (Lotus)	Norwich	18 min 33 sec	18 min 41 sec	00 min 07 sec
	Taverham	32 min 55 sec	7 min 6 sec	-01 min 49 sec
	Wymondham	11 min 54 sec	11 min 54 sec	00 min 00 sec
Horsford (general area)	Norwich	19 min 17 sec	19 min 59 sec	00 min 42 sec
	Taverham	11 min 58 sec	9 min 29 sec	-02 min 29 sec
	Wymondham	2 min 43 sec	2 min 29 sec	-00 min 14 sec
Loddon Industrial Estate	Norwich	0 min 53 sec	0 min 59 sec	00 min 06 sec
	Taverham	14 min 56 sec	12 min 53 sec	-02 min 03 sec
	Wymondham	1 min 1 sec	0 min 49 sec	-00 min 13 sec
Longwater Park	Norwich	19 min 13 sec	19 min 14 sec	00 min 01 sec
	Taverham	17 min 43 sec	15 min 55 sec	-01 min 49 sec
	Wymondham	10 min 34 sec	10 min 33 sec	-00 min 01 sec
Mason Road/Mile Cross Area	Norwich	12 min 55 sec	12 min 41 sec	-00 min 15 sec
	Taverham	18 min 15 sec	14 min 44 sec	-03 min 30 sec
	Wymondham	1 min 14 sec	0 min 36 sec	-00 min 38 sec
Meridian Business Park	Norwich	14 min 57 sec	14 min 49 sec	-00 min 08 sec
	Taverham	8 min 58 sec	18 min 56 sec	-14 min 01 sec
	Wymondham	14 min 51 sec	16 min 58 sec	02 min 06 sec
Norwich Airport	Norwich	16 min 28 sec	15 min 34 sec	-00 min 54 sec

		Journey times		
Industrial Estate	Taverham	16 min 23 sec	13 min 15 sec	-03 min 09 sec
	Wymondham	4 min 49 sec	3 min 46 sec	-01 min 04 sec
Norwich City Centre	Norwich1	7 min 53 sec	7 min 36 sec	-00 min 17 sec
	Taverham	20 min 26 sec	16 min 48 sec	-03 min 37 sec
	Wymondham	23 min 45 sec	23 min 4 sec	-00 min 41 sec
Norwich International Airport	Norwich	16 min 28 sec	15 min 34 sec	-00 min 54 sec
	Taverham	16 min 23 sec	13 min 15 sec	-03 min 09 sec
	Wymondham	4 min 49 sec	3 min 46 sec	-01 min 04 sec
Rackheath Industrial Estate	Norwich	18 min 16 sec	18 min 35 sec	00 min 18 sec
	Taverham	4 min 11 sec	14 min 28 sec	-13 min 43 sec
	Wymondham	22 min 8 sec	19 min 14 sec	-02 min 54 sec
St Andrews Business Park	Norwich	14 min 36 sec	14 min 29 sec	-00 min 07 sec
	Taverham	8 min 38 sec	20 min 16 sec	-12 min 22 sec
	Wymondham	16 min 12 sec	18 min 16 sec	02 min 04 sec
Taverham	Norwich	21 min 3 sec	20 min 7 sec	-00 min 56 sec
	Taverham	0 min 0 sec	0 min 0 sec	00 min 00 sec
	Wymondham	20 min 7 sec	20 min 4 sec	-00 min 04 sec
University of East Anglia/ Norwich Research Park (NRP)	Norwich	15 min 13 sec	15 min 8 sec	-00 min 05 sec
	Taverham	21 min 7 sec	19 min 57 sec	-01 min 10 sec
	Wymondham	11 min 41 sec	11 min 42 sec	00 min 01 sec
Vinces Road Industrial Estate, Diss	Norwich	8 min 34 sec	8 min 41 sec	00 min 07 sec
	Taverham	18 min 28 sec	16 min 36 sec	-01 min 53 sec
	Wymondham	23 min 26 sec	23 min 26 sec	00 min 00 sec
Vulcan Road Industrial Estate	Norwich	13 min 44 sec	13 min 33 sec	-00 min 11 sec
	Taverham	17 min 35 sec	14 min 51 sec	-02 min 45 sec
	Wymondham	2 min 21 sec	1 min 40 sec	-00 min 41 sec
Whiffler Road	Norwich	10 min 50 sec	10 min 6 sec	-00 min 44 sec
	Taverham	16 min 3 sec	12 min 34 sec	-03 min 29 sec
	Wymondham	23 min 3 sec	22 min 29 sec	-00 min 34 sec

C.4 Future Employment Sites

Table C.3: Impact on journey times to proposed future employment locations within Greater Norwich

		Journey times		
Business District	Origin Point	Do nothing	NDR	Change
Beyond Green Land	Norwich	17 min 22 sec	16 min 57 sec	-00 min 24 sec
	Taverham	24 min 08 sec	15 min 19 sec	-08 min 49 sec

		Journey times		
	Wymondham	33 min 12 sec	23 min 36 sec	-09 min 37 sec
Broadland Gate Business Park	Norwich	15 min 58 sec	14 min 55 sec	-01 min 03 sec
	Taverham	33 min 27 sec	17 min 03 sec	-16 min 24 sec
	Wymondham	15 min 13 sec	15 min 01 sec	-00 min 12 sec
Hethel technology park	Norwich	18 min 33 sec	18 min 41 sec	00 min 07 sec
	Taverham	32 min 55 sec	7 min 6 sec	-01 min 49 sec
	Wymondham	11 min 54 sec	11 min 54 sec	00 min 00 sec
Norwich Aeropark	Norwich	19 min 13 sec	19 min 21 sec	00 min 08 sec
	Taverham	20 min 7 sec	12 min 55 sec	-07 min 12 sec
	Wymondham	11 min 1 sec	21 min 40 sec	-13 min 21 sec
Rackheath Eco-town	Norwich	23 min 42 sec	0 min 13 sec	00 min 32 sec
	Taverham	9 min 54 sec	21 min 32 sec	-12 min 23 sec
	Wymondham	23 min 58 sec	23 min 56 sec	-00 min 02 sec
Wymondham Employment Estate	Norwich	18 min 26 sec	18 min 21 sec	-00 min 05 sec
	Taverham	1 min 58 sec	0 min 8 sec	-01 min 50 sec
	Wymondham	0 min 0 sec	0 min 0 sec	00 min 00 sec

C.5 Physical Fitness and Recreational Facilities

Table C.4: Impact on journey times to existing strategic leisure facilities within Greater Norwich

Business District	Origin Point	Do nothing	NDR	Change
Acle war memorial recreation centre	Norwich	20:56	23:39	02 minutes:42 seconds
	Taverham	30:16	25:34	-04 minutes:42 seconds
	Wymondham	21:13	21:20	00 minutes:07 seconds
Aylsham community gym	Norwich	25:15	25:44	00 minutes:29 seconds
	Taverham	17:41	17:36	-00 minutes:05 seconds
	Wymondham	32:49	34:43	01 minutes:54 seconds
Aylsham high school	Norwich	25:15	25:44	00 minutes:29 seconds
	Taverham	17:41	17:36	-00 minutes:05 seconds
	Wymondham	32:49	34:43	01 minutes:54 seconds
Bob carter centre	Norwich	17:00	17:14	00 minutes:14 seconds
	Taverham	04:39	04:31	-00 minutes:08 seconds
	Wymondham	19:45	19:30	-00 minutes:15 seconds
Broadland high school	Norwich	22:50	23:34	00 minutes:44 seconds
	Taverham	22:44	20:18	-02 minutes:27 seconds
	Wymondham	27:45	24:51	-02 minutes:54 seconds
Carrow park (community sports foundation)	Norwich	08:00	08:13	00 minutes:12 seconds
	Taverham	22:40	22:15	-00 minutes:25 seconds
	Wymondham	15:16	15:21	00 minutes:05 seconds

Business District	Origin Point	Do nothing	NDR	Change
Diss Swim & Fitness Centre	Norwich	30:05	41:25	11 minutes:20 seconds
	Taverham	36:52	36:13	-00 minutes:39 seconds
	Wymondham	23:26	23:26	00 minutes:00 seconds
Eaton Park	Norwich	07:21	08:17	00 minutes:57 seconds
	Taverham	19:14	18:48	-00 minutes:26 seconds
	Wymondham	09:18	09:19	00 minutes:01 seconds
Framingham Earl Community Sports Centre	Norwich	18:38	19:36	00 minutes:58 seconds
	Taverham	28:07	27:27	-00 minutes:39 seconds
	Wymondham	19:08	19:08	00 minutes:00 seconds
Hellesdon high school	Norwich	15:19	14:45	-00 minutes:34 seconds
	Taverham	10:54	10:32	-00 minutes:22 seconds
	Wymondham	22:40	21:56	-00 minutes:44 seconds
Long Stratton Leisure Centre	Norwich	28:29	39:49	11 minutes:20 seconds
	Taverham	35:16	34:37	-00 minutes:39 seconds
	Wymondham	21:50	21:50	00 minutes:00 seconds
Oasis	Norwich	16:38	16:37	-00 minutes:02 seconds
	Taverham	26:55	21:24	-05 minutes:31 seconds
	Wymondham	19:18	21:05	01 minutes:46 seconds
Riverside Leisure Centre	Norwich	24:51	24:51	00 minutes:00 seconds
	Taverham	22:20	21:55	-00 minutes:25 seconds
	Wymondham	16:50	16:57	00 minutes:06 seconds
Sportspark	Norwich	12:16	13:01	00 minutes:46 seconds
	Taverham	19:12	18:59	-00 minutes:14 seconds
	Wymondham	13:47	13:47	00 minutes:00 seconds
Sprowston high school	Norwich	12:44	12:38	-00 minutes:06 seconds
	Taverham	19:03	18:29	-00 minutes:35 seconds
	Wymondham	25:24	25:09	-00 minutes:15 seconds
Sprowston manor	Norwich	16:00	15:45	-00 minutes:15 seconds
	Taverham	22:19	17:39	-04 minutes:40 seconds
	Wymondham	28:39	21:06	-07 minutes:34 seconds
The Garage	Norwich	00:00	00:00	00 minutes:00 seconds
	Taverham	19:39	19:09	-00 minutes:29 seconds
	Wymondham	15:38	15:36	-00 minutes:02 seconds
The Norman Centre	Norwich	08:47	08:52	00 minutes:05 seconds
	Taverham	11:39	11:15	-00 minutes:23 seconds
	Wymondham	19:48	19:50	00 minutes:02 seconds
Thorpe St Andrew high	Norwich	13:19	13:16	-00 minutes:03 seconds
	Taverham	23:47	23:02	-00 minutes:45 seconds
	Wymondham	19:31	21:15	01 minutes:44 seconds

Business District	Origin Point	Do nothing	NDR	Change
Wensum Lodge Sports Hall	Norwich	30:41	30:41	00 minutes:00 seconds
	Taverham	23:09	22:59	-00 minutes:09 seconds
	Wymondham	17:18	17:12	-00 minutes:06 seconds
Whitlingham Outdoor Education Centre	Norwich	11:29	12:32	01 minutes:03 seconds
	Taverham	28:02	27:28	-00 minutes:33 seconds
	Wymondham	16:50	16:57	00 minutes:08 seconds
Wymondham Leisure Centre	Norwich	16:04	16:58	00 minutes:54 seconds
	Taverham	20:50	20:11	-00 minutes:39 seconds
	Wymondham	00:00	00:00	00 minutes:00 seconds