

Welsh Government

**A40 Llanddewi Velfrey to Penblewin
Improvements**

Environmental Statement Chapter 17:
Population and Human Health

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17 Population and Human Health

17.1 Introduction

17.1.1 This assessment documents the findings of an assessment of how the Scheme may influence public health and well-being in the areas surrounding the Scheme, through environmental and socioeconomic pathways. The assessment also considers, where possible, the distribution of impacts within different social groups, and the potential equalities impacts of the Scheme. The Scheme has been assessed both during construction and operation.

17.1.2 Health assessments are multidisciplinary and cut across the traditional boundaries of health, public health, social sciences and environmental sciences. The most commonly used definition of a health assessment is taken from the World Health Organisation (WHO) Gothenburg Consensus Paper:

'.....a combination of procedures, methods and tools by which a policy, programme or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population'¹

17.1.3 The broader understanding of health is captured by the WHO definition:

'Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'².

17.1.4 With this in mind, the objectives of this assessment are to:

- a) identify any negative or positive population and health impacts of the Scheme during construction and operation;
- b) develop mitigation and enhancement measures that can be applied to the Scheme (to be applied following planning consent) in order to minimise the negative and enhance the positive health and wellbeing impacts; and
- c) identify possible indicators for monitoring and evaluating the actual health impacts during construction and operation.

17.1.5 The following sections set out how the assessment has been carried out,

¹ WHO European Centre for Health Policy (1999). Health impact assessment: main concepts and suggested approach. Gothenburg consensus paper. WHO Regional Office for Europe.

² World Health Organisation (WHO) (2007). Constitution of the World Health Organisation, Geneva, 1946.

the results of the assessment and recommendations for improving the health and wellbeing effects of the Scheme.

17.2 Legislative context

17.2.1 The requirement for health and equalities to be assessed are covered by the following legalisation:

- a) **The Environmental Impact Assessment (Miscellaneous Amendments relating to Harbours, Highways and Transport) Regulations 2017** requires the consideration of effects of a project on human health.
- b) **The Equality Act 2010**, states in Section 149 of the Act, that public bodies are subject to the Public Sector Equality Duty ('the Duty'), which requires that, in the exercise of their functions, they have due regard to the need to:
 - i. Eliminate discrimination, harassment, victimisation, and any other conduct that is prohibited by or under this Act;
 - ii. Advance equality of opportunity between persons who share a protected characteristic and persons who do not share it; and
 - iii. Foster good relations between persons who share a relevant protected characteristic and persons who do not share it.

There are eight protected characteristics covered by the Public Sector Equality Duty including age, disability, gender reassignment, pregnancy and maternity, race, religion or belief, sex and sexual orientation.

- c) **The Well-being of Future Generations (Wales) Act 2015** which places a duty on public bodies in Wales and those listed in the Act to work to improve the economic, social, environmental and cultural well-being of Wales. It puts in place seven well-being goals, as shown in Figure 17.1.



Figure 17.1 Well-being goals

- d) **The Public Health (Wales) Act 2017** requires Welsh Ministers to make regulations to require public bodies to carry out health impact assessments (HIA)³ in certain circumstances. These circumstances are yet to be defined, and the Act is specific to public bodies; however, the Act is currently serving as a driver for HIA to be undertaken, aligning with the EIA Regulations.

17.2.2 As a result of the need to meet the legislative requirement for an assessment of both health and equalities, this population and health assessment considers both.

17.3 Relevant guidance

17.3.1 The approach and methodology for the assessment is primarily driven through the specific requirements within the Welsh Transport Planning and Appraisal Guidance (WelTAG) (Welsh Government, 2017)⁴ and the assessment approach outlined in Section 2 Methodology.

17.3.2 Guidance provided through the Wales HIA Support Unit (WHIASU) has also been used to identify vulnerable groups within the local population. This was augmented by consideration of people within the communities who have protected characteristics and which therefore need to be considered under the Equality Act, 2010.

³ HIA reports can, in some circumstances be prepared and submitted as separate assessment reports. They are fundamentally the same as an assessment of population and health.

⁴ https://consultations.gov.wales/sites/default/files/consultation_doc_files/161208-weltag-consultation-en.pdf

17.4 Assessment Methodology

- 17.4.1 The assessment of population and health is a multidisciplinary process designed to identify and assess the potential health outcomes (both adverse and beneficial) of a proposed project, plan or programme and to deliver evidence-based recommendations that optimise health gains and reduce or remove potential negative impacts or inequalities on people with protected characteristics.
- 17.4.2 This section sets out the scope of this assessment and the specific methodology that was followed including the study area, the study population, information and data sources that were consulted, assessment criteria and assessment outcomes.
- 17.4.3 The assessment approach was qualitative except where informed by quantitative findings from the EIA. The population and health assessment has been informed by and builds on the analysis of the EIA (air quality, noise, etc).

Geographical scope

- 17.4.4 The study area includes the wards of Lampeter Velfrey, Narberth Rural, Narberth and Whitland that sit within the wider area of the County of Pembrokeshire. Where possible, data is provided at the level of the study area (i.e. the three wards listed above), however the majority of data is only available at the County level (i.e. for Pembrokeshire).

Baseline data gathering - Community Profile

- 17.4.5 Baseline data has been collated from a range of sources to provide an overview of the existing population, existing health profile, socioeconomic conditions in the local community and the physical environment in the locale.
- 17.4.6 This gathering of baseline data has been coordinated with other workstreams within the EIA such as socioeconomic assessment and the air and noise assessments.
- 17.4.7 The data reviewed has included, but has not been limited to:
- a) Public Health Wales publications such as Welsh Health Survey lifestyle trends (2015);

- b) Health Board Maps, Demography (2016); and
- c) Office for National Statistics, Census 2011 data

Determinants of health

17.4.8 Environmental, social, economic and fixed factors, which are collectively known as ‘health determinants’ influence health and well-being. The key determinants of health can be characterised as:

- a) Pre-determined factors such as age, genetic make-up and gender are fixed and strongly influence a person’s health status;
- b) Social and economic circumstances such as poverty, unemployment and other forms of social exclusion strongly influence health, and improving them can significantly improve health;
- c) How the environment in which people live, work and play is managed - its air quality, built environment, water quality – can damage health, or provide opportunities for health improvement;
- d) Lifestyle factors such as physical activity, smoking, diet, alcohol consumption and sexual behaviour, can have significant impacts on health;
- e) Accessibility of services such as the National Health Service (NHS), education, social services, transport (especially public transport) and leisure facilities influence the health of the population.

17.4.9 Of these, only the pre-determined factors are unlikely to be influenced by a development proposal. This population and health assessment therefore considers all relevant health determinants other than the pre-determined factors.

17.4.10 Guidance from WHIASU has been adapted to identify a list of potential health determinants that may be relevant to a given project. This in turn allows for the identification of any likely significant effects that would need to be assessed further within the EIA.

17.4.11 Health determinants which have been identified as being relevant to the Scheme include:

- a) Access to open space and nature;
- b) Noise;
- c) Air quality;
- d) Flood risk;

- e) Access to work and training;
- f) Accessibility and active travel;
- g) Access to services and social infrastructure (including education)

17.4.12 Each of these health determinants is discussed further in the assessment section (Section 17.6).

Local community

17.4.13 The health assessment has considered health and well-being status and current health problems of all people within the local community. However, vulnerable and/or disadvantaged groups can often experience health impacts more acutely than other groups within communities resulting in health inequalities.

17.4.14 Vulnerable and/or disadvantaged groups within the local community have been identified using the Wales Health Impact Assessment Support Unit (WHIASU) Practical Guide to HIA vulnerable group checklist. Groups with protected characteristics (as defined by the Equality Act 2010) are also included for consideration in the assessment.

17.4.15 Table 17.2 identifies which groups are considered to have high relevance to the Scheme and which are therefore considered in more detail in the assessment. The selection has been based on the local community profile.

17.4.16 The WHIASU vulnerable group checklist systematically considers inequalities and the impacts on a range of vulnerable groups (including those with protected characteristics) within the population and assesses the extent and distribution of them. These groups can, for example, include older people, children and young people, those who suffer from chronic conditions, or those who are geographically isolated.

Table 17.1 Vulnerable and disadvantaged groups and their relevance to the assessment

Vulnerable and disadvantaged groups	Protected characteristic represented	Relevance to assessment (high/medium/low)
Age related groups:		
Children and young people	Age	High
Older people	Age	High
Income related groups:		
People on low income	Potentially all	Medium
Economically inactive	Potentially all	Medium
Unemployed/workless	Potentially all	Medium
People who are unable to work due to ill health.	Disability	Low
Groups who suffer discrimination or other social disadvantage:		
People with physical or learning disabilities /difficulties	Disability	Low
Refugee groups	Potentially all	Low
People seeking asylum	Potentially all	Low
Travellers	Race	Low
Single parent families	Potentially all	Low
Lesbian and gay and transgender people	Sex	Low
Black and minority ethnic groups	Race	Low
Religious groups.	Religion	Low
Geographical groups:		
People living in areas known to exhibit poor economic and/or health indicators	Potentially all	High
People living in isolated areas	Potentially all	High

Equalities

17.4.17 When considering whether a proposed project has equalities impacts it is necessary to determine whether impacts identified are likely to have a differential or disproportionate effect on people with protected characteristics:

- a) Differential effects arise where people with protected characteristics could be affected differently from the rest of the population, due to a particular need or sensitivity;
- b) Disproportionate effects arise when an impact has a proportionately greater effect on people with protected characteristics than the rest of the population.

17.4.18 The assessment considers all protected characteristics and whether there is likely to be a differential or disproportionate impact on any of these groups.

Literature review – Linking health determinants to health impacts

17.4.19 Several types of literature have been used to inform the health assessment including research reports from organisations such as the World Health Organization, as well as literature reviews, and primary research studies. Using available literature, including previous health studies and recent research, an evidence base has been collated to identify links between the selected determinants and health impacts. Key reference material has included:

- a) Government health policies, programmes and strategies;
- b) Previous health assessments for masterplans;
- c) Public health reports and research papers from a range of sources, including:
 - i. Public Health Wales;
 - ii. WHO;
 - iii. National Institute for Health and Care Excellence (NICE);
 - iv. Health Development Agency (HDA).

17.4.20 All reference material is acknowledged and referenced within the assessment text in Section 17.6.

Assessing population and health effects

17.4.21 There is no established or widely accepted framework for assessing the ‘significant’ health effects of a development proposal. The health significance of an environmental impact is typically a function of the ‘magnitude’ and ‘duration’ of the change to health determinants and the extent of the population exposed to this change. When considering the extent of the population, consideration also need be given to whether

there are populations within the study area that are particularly vulnerable to health effects.

17.4.22 The criteria that have been used to define significance of effects are set out in Table 17.2 which also considers whether the effect is direct or indirect, positive or negative and permanent or temporary.

Table 17.2 Impact Significance Matrix

Significance level	Criteria
Major +++/-- (positive or negative)	<p>Health effects are categorised as a major positive if they prevent deaths/prolong lives, reduce/prevent the occurrence of acute or chronic diseases or significantly enhance mental wellbeing would be a major positive.</p> <p>Health effects are categorised as a major negative if they could lead directly to deaths, acute or chronic diseases or mental ill health.</p> <p>The exposures tend to be of high intensity and/or long duration and/or over a wide geographical area and/or likely to affect a large number of people (e.g. over 500) and/or sensitive groups e.g. children/older people.</p> <p>They can affect either or both physical and mental health and either directly or through the wider determinants of health and wellbeing.</p> <p>They can be temporary or permanent in nature.</p> <p>These effects can be important local, district, regional and national considerations.</p> <p>Mitigation measures and detailed design work can reduce the level of negative effect though residual effects are likely to remain.</p>
Moderate ++/-- (positive or negative)	<p>Health effects are categorised as a moderate positive if they enhance mental wellbeing significantly and/or reduce exacerbations to existing illness and reduce the occurrence of acute or chronic diseases.</p> <p>Health effects are categorised as a moderate negative if the effects are long-term nuisance impacts, such smell and noise, or may lead to exacerbations of existing illness. The negative impacts may be nuisance/quality of life impacts which may affect physical and mental health either directly or through the wider determinants of health.</p> <p>The exposures tend to be of moderate intensity and/or over a relatively localised area and/or of intermittent duration and/or likely to affect a moderate-large number of people e.g. between 100-500 or so and/or sensitive groups.</p> <p>The cumulative effect of a set of moderate effects can lead to a major effect.</p> <p>These effects can be important local, district and regional considerations.</p> <p>Mitigation measures and detailed design work can reduce and in some/many cases remove the negative and enhance the positive effects though residual effects are likely to remain.</p>
Minor +/- (positive or negative)	<p>Health effects are categorised as minor either, positive or negative, if they are generally lower level quality of life or wellbeing impacts.</p> <p>Increases or reductions in noise, odour, visual amenity, etc. are examples of such effects.</p> <p>The exposures tend to be of low intensity and/or short/intermittent duration and/or over a small area and/or affect a small number of people e.g. less than 100 or so.</p> <p>They can be permanent or temporary in nature.</p> <p>These effects can be important local considerations.</p> <p>Mitigation measures and detailed design work can reduce the negative and enhance the positive effects such that there are only some residual effects remaining.</p>

Significance level	Criteria
Neutral/No Effect ~	No health effect or effects within the bounds of normal/accepted variation.

Limitations and assumptions

- 17.4.23 Literature and baseline data used in the study has been limited to readily available public and published sources. The information contained within the ES and other project documents has been used to characterise the study area and identify impacts on health determinants.
- 17.4.24 The approach to the assessment of health impacts is generally qualitative, identifying likely positive and negative impacts based on the relationships between determinants and health outcomes identified within the literature reviewed.

17.5 Community health and well-being profile

- 17.5.1 This section sets out the summary of the community and health profiles within the study area likely to be directly or indirectly affected during the construction and operation of the Scheme. A focus has been made on demographic factors which are of particular relevance to health determinants of the health assessment. The full baseline data is included within Appendix 17.1 which includes all references for the quoted data.

Community profile

- 17.5.2 The Scheme is located in a rural area with low population density, and lower than average rates of ethnic and religious diversity. Pembrokeshire has an older population than the Welsh average, with higher proportions of residents in groups aged 50 and over, and smaller proportions of residents in younger age groups. This is reflected in a higher than average proportion of residents who are retired.
- 17.5.3 Unemployment is low, and the workforce is relatively highly skilled, particularly in the local study area where the proportion of working-age residents with a degree-level qualification is above the national average. The largest sector for employment is public administration, education and health, and the agriculture and tourism sectors provide a higher proportion of employment than the Welsh average. Deprivation in the local study area is low. Across Pembrokeshire, there are pockets of higher deprivation in urban areas including Pembroke, Pembroke Dock,

Milford Haven and Haverfordwest.

Health profile

- 17.5.4 Health deprivation is also low across the study area, with some pockets of higher deprivation. Life expectancy is above the average for Wales, and mortality rates – including from cancer, respiratory and cardiovascular diseases – are lower than average. There are higher than average levels of alcohol consumption and smoking, but lower than average mortality rates attributable to alcohol and tobacco. The proportion of adults who are overweight or obese is slightly higher than average, although a higher than average proportion of adults meet the recommended level of physical activity. Crime is generally low, with the exception of antisocial behaviour and drugs offences where there are higher rates than the figures for England and Wales.

17.6 Assessment of health effects

- 17.6.1 The assessment of effects considers each of the determinants of health, identified in paragraph 17.4.11. Findings from the literature review are firstly set out, followed by an assessment of how, as a result of the Scheme, the determinants of health are likely to affect any of the identified vulnerable and disadvantaged groups of people within the population (see Table 17.2) in addition to the population in general.
- 17.6.2 The assessment matrixes below (Table 17.3 and Table 17.4 respectively) are an overall summary of this assessment which is elaborated on more within each health determinant assessment section. Consideration has been given to both the construction and operational phases.

Table 17.3 Summary of construction stage health effects

People/Groups considered	Determinant of health	Access to open space and nature	Noise	Air quality	Flood risk	Access to work and training	Accessibility and active travel	Access to services and other social infrastructure (including education)	Community safety	Use of natural resources
Children and young people		-	-	-	~	+	-	~	-	~
Older people		-	-	-	~	~	-	~	-	~
People on low incomes		-	-	~	~	~	-	~	~	~
Economically inactive		-	-	~	~	~	~	~	~	~
Unemployed/workless		-	--	~	~	+	-	~	~	~
Long term sick		-	--	-	~	~	-	~	~	~
People with physical/learning difficulties		-	--	~	~	~	-	~	-	~
People with [other] protected characteristics ⁵		-	-	~	~	+	~	~	~	~
People in areas of poor economic/health status		-	-	~	~	+	~	~	~	~
People living in isolated areas		-	-	~	~	~	~	~	-	~

Key: + or - = minor effect | ++ or -- = moderate effect | +++ or --- = major effect | ~ = neutral effect

Red = adverse effect | Amber = mixed effect | Green = positive effect

⁵ This includes gender, pregnancy and maternity, race, religion, sex & sexual orientation, marriage & civil partnership. Age and disability are covered separately.

Table 17.4 Summary of operational health effects

People/Groups considered	Determinant of health	Access to open space and nature	Noise	Air quality	Flood risk	Access to work and training	Accessibility and active travel	Access to services and other social infrastructure (including education)	Community safety	Use of natural resources
Children and young people		+	++/--	~	~	+	+	~	~	~
Older people		+	++/--	~	~	~	+	~	~	~
People on low incomes		+	++/--	~	~	+	+	~	~	~
Economically inactive		+	++/--	~	~	+	+	~	~	~
Unemployed/workless		+	++/--	~	~	+	+	~	~	~
Long term sick		+	++/--	~	~	~	+	~	~	~
People with physical/learning difficulties		+	++/--	~	~	~	+	~	~	~
People with [other] protected characteristics ⁶		+	++/--	~	~	~	~	~	~	~
People in areas of poor economic/health status		+	++/--	~	~	~	+	~	~	~
People living in isolated areas		+	++/--	~	~	+	+	~	~	~

Key: + or - = minor effect | ++ or -- = moderate effect | +++ or --- = major effect | ~ = neutral effect

Red = adverse effect | **Amber** = mixed effect | **Green** = positive effect

⁶ This includes gender, pregnancy and maternity, race, religion, sex & sexual orientation, marriage & civil partnership. Age and disability are covered separately.

Access to open space and nature

Literature review

- 17.6.3 Access to open space, green space and nature has health benefits, in relation to increasing physical activity⁷, as well as for mental wellbeing^{8, 9}.
- 17.6.4 A Forestry Commission¹⁰ review identified the key health benefits of green space as:
- a) Long and short term physical benefits associated with obesity, life expectancy, heart rate and blood pressure;
 - b) Attention and cognitive benefits associated with restoration, mood and self-esteem;
 - c) Physical activity benefits associated with the use of greenspace;
 - d) Self-reported benefits in terms of health and life satisfaction; and
 - e) Community cohesion benefits through social contact fostered by greenspace⁷.
- 17.6.5 Studies have found that the amount of green space and the walkability, connectivity and accessibility of the neighbourhood influence adult and children's mental health and physical health^{11, 12}. The attractiveness or quality of green space is also an important determinant of use of green space¹³.
- 17.6.6 Contact with nature has positive health benefits through its positive effects on blood pressure, cholesterol and stress reduction, with particular relevance to mental health and cardiovascular disease¹⁴. Green space can also provide spaces to promote social interaction and cohesion¹⁵, and reduce social annoyances and crime, all of which can

⁷ Scrivens, K. S. (2013). *Four interpretations of social capital: an agenda for measurement. Working Paper no. 55.* OCDC.

⁸ Gong Y, P. S. (1996). A systematic review of the relationship between objective measurements of the urban environment and psychological distress. *Environment International* , 48-57.

⁹ Lee, A. (2010). The health benefits of urban green space: a review of the evidence. *Journal of Public Health* , 33 (2), 212-222.

¹⁰ O'Brien, L., Williams, K., Stewart, A.,(2010), Urban health and health inequalities and the role of urban forestry in Britain: A review, The Research Agency of the Forest Commission.

¹¹ Lee, A. (2010). The health benefits of urban green space: a review of the evidence. *Journal of Public Health* , 33 (2), 212-222.

¹² Ward, J. S. (2016). Ward et al, 2016. The impact of children's exposure to greenspace on physical activity, cognitive development, emotional wellbeing, and ability to appraise risk. *Health and Place* , 40, 44-50.

¹³ Croucher, K. M. (2007). *The links between greenspace and health: a critical literature review.* Greenspace Scotland.

¹⁴ Maller, C. T. (2005). Healthy Nature Healthy People. *Health Promotion International* , 21 (10).

¹⁵ Lee, A. (2010). The health benefits of urban green space: a review of the evidence. *Journal of Public Health* , 33 (2), 212-222.

contribute to the mental health of individuals¹⁶.

- 17.6.7 Often the poorest or most vulnerable people experience poorer quality outdoor environments and suffer disproportionately from a lack of equitable access to ecology and green spaces. Recent research has suggested that there is a positive association between the percentage of green space in a person's residential area and their perceived general health and that this relationship is strongest for lower socio-economic groups¹⁷.
- 17.6.8 Evidence demonstrates that 'an inactive lifestyle has a substantial, negative impact on both individual and public health – specifically, physical inactivity is a primary contributor to a broad range of chronic diseases such as coronary heart disease, stroke, diabetes and some cancers'¹⁸. Even relatively small increases in physical activity are associated with some protection against chronic diseases and an improved quality of life.

Construction phase effects

- 17.6.9 During construction, there are a number of footpaths which would be temporarily closed or diverted. These include: as shown on Volume 2 Figure 15.1: SP19/31/3; SP19/37/1; SP19/30/1; SP19/38/1; SP19/38/2; SP19/1/1; SP19/2/2; SP19/3/2; SP19/4/5; SP19/4/7; and SP19/17/1. There are no bridleways that would be directly affected although there are two within close proximity to the Scheme (Bridleway SP19/34/4 and Bridleway SP19/29/3). See ES Chapter 15 All Travellers for further details on which routes would be affected.
- 17.6.10 The closure and/or diversions of the footpaths and the general disturbance that would occur during construction would potentially affect use of these areas for recreation as people are generally disinclined to use such resources where there are chances of disruption and noise. This would subsequently potentially impact on physical fitness, particularly for people within the local residential areas who would become 'cut off' from footpaths either south or north of the A40 during the construction period.
- 17.6.11 For example, residents in Llanddewi Velfrey would have access on

¹⁶ Maas, J. (2006). Green space, urbanity and health: how strong is the relation? *Journal of Epidemiology and Community Health*, 60 (7), 587-592.

¹⁷ Maas, J. (2006). Green space, urbanity and health: how strong is the relation? *Journal of Epidemiology and Community Health*, 60 (7), 587-592.

¹⁸http://www.dchs.nhs.uk/your_health_useful_info/cyph/cyph_resources_and_support_materials/active_lifestyles

footpath SP19/1/1 disrupted which would reduce access by foot to areas of open space north of the new alignment. However, the results of the PRoW survey, which was carried out in May 2017¹⁹, revealed that none of the routes around the Scheme were well used. This suggests that they are not important assets in relation to health and wellbeing of the local communities. Notwithstanding this usage evidence, the disruption to these rights of way during construction will reduce accessibility options to open space for the local communities and psychologically may lead to residents feeling restricted. Overall, it is considered that the effect on health would be short term, and minor.

Operation phase effects

- 17.6.12 There will be one new public bridleway and two new public footpaths created as part of the Scheme. One of the bridleways will be created to run from the public highway leading to Trefangor Burial Ground, east along the highway boundary to Ffynnon Chapel, where it intersects with footpath 19/30/1. At this location, the new northern bridleway will pass beneath the Scheme in a new underpass.
- 17.6.13 In addition, a new combined equestrian, cycling and pedestrian link will be provided along the southern highway boundary of the A40, running east from just south of Henllan Lodge to meet the detrunked A40 at Llanddewi Velfrey Western Junction. This route will link to the proposed bridleway described in the previous paragraph.
- 17.6.14 Whilst access to and use of some existing pathways will continue during the operation of the A40, the Scheme does present an opportunity to support physical activity and social connectivity improvements at the local level. Proposals also exist to address existing environmental and behavioural barriers limiting levels of physical activity, including:
- a) improving the quality of green transport networks (influencing the desire to walk/cycle over alternative options);
 - b) improving pedestrian safety and addressing perceptions of poor safety e.g. through the improvement of junctions, signage and lighting (enabling people of all ages and levels of mobility to safely utilise routes); and
 - c) raising awareness regarding the convenience, economic and social, mental and physical health benefits of active lifestyles.
- 17.6.15 From a health perspective these changes and improvements to access

¹⁹ WCHR Assessment Report at Volume 3 Appendix 15.1.

are likely to result in a long term, **positive, minor effect**, especially for members of the community who currently may be more restricted in access options.

Noise

Literature review

- 17.6.16 Evidence for health impacts from environmental noise has also been established, including sleep disturbance, cognitive impairment in children, hypertension and stroke, and cardiovascular disease, particularly ischaemic heart disease²⁰. Sleep disturbance in turn is associated with obesity, diabetes, cardiovascular disease and all-cause mortality, and is "usually considered the most severe non-auditory effect of environmental noise exposure"²¹²²²³, a view re-emphasised in almost the same terms in a recent 2014 summary of noise effects on health (Basner, et al., 2014).
- 17.6.17 Sufficient evidence of heart disease risk is available to allow quantification of heart disease risk from road noise exposure^{24,25}. Other potential health outcomes in susceptible groups (children and older people), such as birth weight, cognitive performance, diabetes and cancer, are the subject of the 'QUIET' research programme in Europe, using data from the population of Denmark. The QUIET programme which ended in 2017 found that certain diseases, including diabetes, were higher when traffic noise exposure was increased (Sørensen, et al., 2017)²⁶.
- 17.6.18 Separating the effects of noise and air pollution exposure is difficult, as both tend to be linked to road traffic in urban areas, but recent research on populations in two Danish cities (as part of the QUIET project) suggests that stroke risk is increased by combined exposure to noise and air pollutants from road traffic, possibly with the stress effect of noise exposure creating stroke risk at a relatively low level of air pollution exposure (Sørensen, et al., 2017)³⁵. A recent study of mortality and hospital disease outcomes in London found increased risks associated

²⁰ Fritschi, L. et al., 2011. Burden of disease from environmental noise, Copenhagen: WHO Regional Office for Europe.

²¹ Fritschi, L. et al., 2011. Burden of disease from environmental noise, Copenhagen: WHO Regional Office for Europe.

²² Muzet, A., 2007. Environmental noise, sleep and health. *Sleep Medicine Review*, Volume 11, pp. 135-142.

²³ Hume, K., Brink, M. & Basner, M., 2012. Effects of environmental noise on sleep. *Noise and Health*, 14(61), pp. 297-302.

²⁴ Fritschi, L. et al., 2011. Burden of disease from environmental noise, Copenhagen: WHO Regional Office for Europe.

²⁵ Babisch, W., 2008. Road traffic noise and cardiovascular risk. *Noise Health*, Volume 10, pp. 27-33.

²⁶ Sorensen, et al, 2017. Health consequences of noise exposure from road traffic. European Research Council. [Accessed January 2019] <https://cordis.europa.eu/project/rcn/102535/reporting/en>

with noise exposure after adjustment for PM_{2.5} exposure among other potential confounding factors.²⁷

17.6.19 Noise as discussed here is environmental noise (i.e. unwanted or harmful outdoor sound, as defined in the Environmental Noise Directive (Directive 2002/49/EC of the European Parliament and of the Council relating to the assessment and management of environmental noise., 2002), as opposed to workplace noise, and likewise the health impacts discussed are those other than direct auditory damage (as environmental noise is below the threshold for such damage).

17.6.20 The non-auditory effects of noise, as summarised above, can include annoyance or sleep disturbance, in turn with potential to cause stress and health risk factors such as increased blood pressure, resulting in health outcomes such as cardiovascular disease. Figure 17.2 “Summary of Noise Health Effects” and Figure 17.3 “Noise Health Pathways” illustrate these pathways, albeit noting that the 'direct' pathway (hearing loss) is not relevant in this case. This also illustrates the fact that adverse health outcomes (disease or mortality) would affect only a small proportion of those experiencing noise.

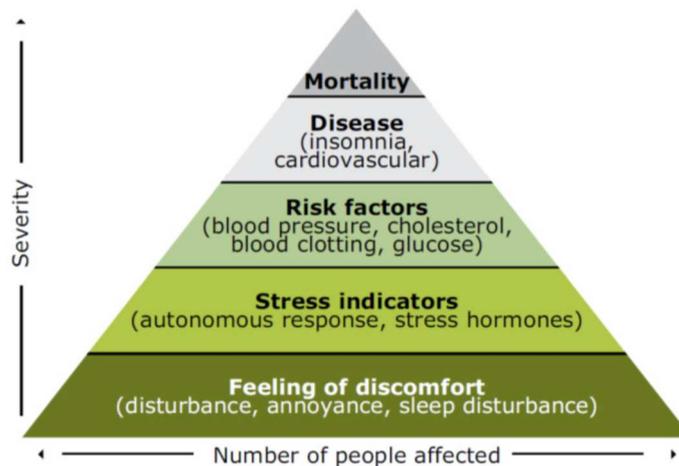


Figure 17.2 Summary of Noise Health Effects

²⁷ Halonen, J. et al., 2015. Road traffic noise is associated with increased cardiovascular morbidity and mortality and all-cause mortality in London. *European Heart Journal*, Volume 36, pp. 2653-2661.

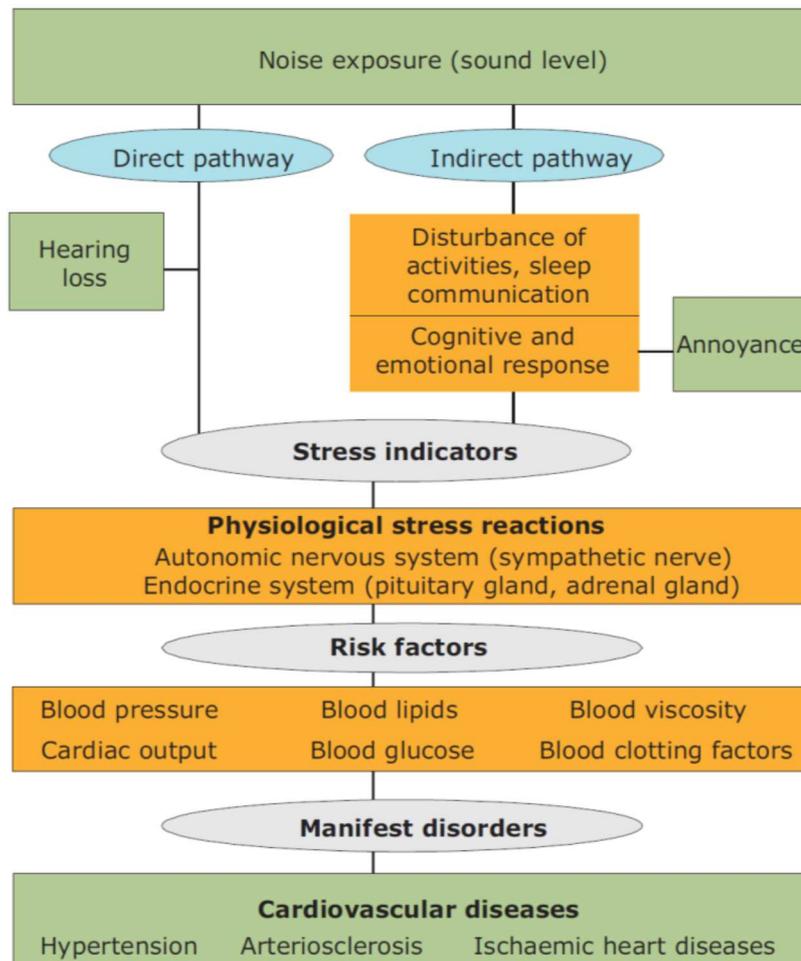


Figure 17.3 Noise Health Pathways Source: (Expert Panel on Noise 2010)²⁸

17.6.21 The WHO suggests that some people may be less able to cope with the impacts of noise exposure and be at greater risk for harmful effects, including older people, the physically ill, those with existing mental illness, people with hearing impairment, and young children. Families with lower income tend to have lower mobility but greater exposure to adverse environmental conditions related to noise pollution²⁹.

Construction phase effects

17.6.22 A noise survey was undertaken to establish baseline noise levels in the vicinity of the Scheme, as recommended as part of the HD 213/11 detailed assessment procedure. The survey locations were selected to represent the nearest residential receptors. Noise loggers were used in selected locations to capture baseline noise over a period of more than

²⁸ Babisch, W., 2002. The noise/stress concept, risk assessment and research needs. *Noise Health*, 4(16), pp. 1-11

²⁹ World Health Organization. (2011). *Burden of Disease from Environmental Noise*. Geneva, Switzerland: World Health Organization Europe.

24 hours.

- 17.6.23 Detailed results and the survey method are reported in Volume 3 Appendix 14.2 of ES Chapter 14 Noise and Vibration, along with a plan of the survey locations. However, as would be expected, the dominant noise source at the attended measurements was road traffic on the A40. Other notable noise sources were distant farm vehicles and aircraft.
- 17.6.24 Chapter 14 Noise and Vibration concludes that the construction of the Scheme has the potential to give rise to temporary short-term increases in noise and vibration at sensitive receptors which include residential properties, community facilities, educational facilities and commercial premises which are sensitive to noise and vibration.
- 17.6.25 Noise threshold levels (BS 5228-1 ABC thresholds) are predicted to be exceeded at receptors R1 Penblewin Farm, R3 Henllan Lodge, R4 Penrhiw Cottage, R5 Maes-y-ffynnon and R8 Bethel Cottage. However, the noise assessment concludes that if natural screening from landform and vegetation is taken into consideration, along with purpose-built noise barriers, level of noise can be effectively mitigated by approximately 5-10dB. It is however, predicted that some properties will still experience significant increases in noise during construction which can be mitigated by providing individual sound insulation at these affected properties (i.e. insulated glazing). Due to these mitigation measures, the assessment in Chapter 14 concludes that there will be no significant effects as a result of noise and vibration during construction.
- 17.6.26 From a population health perspective, the increases in noise is potentially likely to result in annoyance and, for the residents whose property is affected, increased stress and a reduced capacity to enjoy outside space or have open windows during the construction period. However, due to the low number of people affected, noise during construction is predicted to have a **short term, minor, adverse health effect**.

Operational phase effects

- 17.6.27 Chapter 14 Noise and Vibration sets out the full assessment for noise and vibration in relation to the Scheme. Significant permanent direct beneficial effects have been identified for the community of Llanddewi Velfrey as a result of the Scheme in the short and long term. Receptors to the south of the existing A40 in and around the village of Llanddewi

Velfrey are predicted to experience major beneficial noise impacts reducing to moderate and minor beneficial impacts with distance from the existing A40 in the baseline year with the Scheme in operation.

- 17.6.28 Short term significant increases in noise levels across the scheme area of more than $3\text{dB}_{\text{LA}10, 18\text{h}}$ dB will be experienced by 7 dwellings, whilst an equivalent significant decrease in noise will be experienced by 63 dwellings.
- 17.6.29 Long term significant increases in noise levels across the scheme area of more than $3\text{dB}_{\text{LA}10, 18\text{h}}$ dB will be experienced by 8 dwellings (with one experiencing an increase of $10+\text{dB}_{\text{LA}10, 18\text{h}}$), whilst an equivalent significant decrease in noise will be experienced by 54 dwellings.
- 17.6.30 There are three properties along the bypass section of the Scheme which would experience major noise increases. These include properties to the north of the new A40 bypass around Llanddewi Velfrey at Valley View and Castell; properties at the northern extent of Glan Preseli (Brynwyfla and Llanddewi Village Hall) and Maes-y-ffynnon situated to the east of the new junction, equidistant at around 50m from the new bypass and the existing A40 through Llanddewi Velfrey.
- 17.6.31 For those properties which would experience noise reductions, it is considered that the health effects would be moderately beneficial. For properties that would experience significant increases in noise, health effects are likely to be moderately adverse. It is not known who lives in these properties and therefore no assessment can be made on whether the residents would be particularly vulnerable to changes in noise levels. Whilst at the individual level, these reductions and increases in noise could lead to positive and adverse health impacts respectively, at a population level, the changes in noise are considered likely to result in an overall health effect that is **neutral**.

Air Quality

Literature review

- 17.6.32 Ambient outdoor air pollution to which populations are exposed on a day-to-day basis is associated both with long-term burdens of disease across the whole population, and with short-term changes in mortality due to acute exposure in vulnerable populations such as elderly people or those already suffering from cardiovascular or respiratory disease.

This is an area of active scientific research (see, for example, recent reviews of cardiovascular disease and air pollutant exposure evidence,^{30,31}) but given the strong link to public policy, is also characterised by frequent reviews of the evidence base, including summaries published by health protection bodies that are designed to bring the evidence base together for use by those applying research to policy formulation or decisions, as in the case of this study.

17.6.33 Evidence on the links between road traffic emissions and respiratory health is well established, based on numerous research studies. Epidemiological studies have shown that long-term exposure to air pollution (over years or a lifetime) reduces life expectancy, due to cardiovascular and respiratory diseases and lung cancer. Short-term exposure (over hours or days) to increased levels of air pollution can also have a range of health effects, including effects on lung function, asthma, as well as increases in respiratory and cardiovascular hospital admissions, and mortality.³²

17.6.34 Populations thought particularly vulnerable to the effects of PM10 are those with pre-existing lung or heart disease, the elderly and children³³,
34.

Construction phase effects

17.6.35 The Scheme has the potential to generate dust during the construction phase. Dust-generating activities would occur along the length of the Scheme and include: demolition of Trefangor Cottage, earthworks to create attenuation ponds, embankments and cuttings and construction of the proposed new section of road, proposed roundabouts at either end of the Scheme and Llanfallteg Road bridge.

17.6.36 Chapter 13 Air quality identifies five residential properties within 20m of the site boundary, and which have a medium sensitivity for dust soiling as a result of earthworks and construction.

17.6.37 The dust emitting activities can be greatly reduced or eliminated by

³⁰ Shah, A. et al., 2013. Global association of air pollution and heart failure: a systematic review and meta-analysis. *Lancet*, Volume 382, pp. 1039-48.

³¹ Lee, B.-J., Kim, B. & Lee, K., 2014. Air Pollution Exposure and Cardiovascular Disease. *Toxicological Research*, 30(2), pp. 71-75.

³² Public Health England 2018. Guidance: Health Matters: Air pollution

<https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution>

³³ World Health Organization . (2013). Health effects of particulate matter. Denmark: World Health Organization Europe.

³⁴ Defra, Netcen, Department for Communities and Local Government, National Statistics. (2006). *Air Quality and Social Deprivation in the UK: an environmental inequalities analysis (AEAT/ENV/R.2170)*. London: Defra.

applying the site-specific mitigation measures for medium risk sites according to the guidance published by the Institute of Air Quality Management (IAQM)³⁵ and reported in the Scheme specific pre-construction CEMP (ES Appendix 2.2).

- 17.6.38 Overall, the construction effects were assessed using the qualitative approach described in the latest IAQM guidance and it was concluded in the Air quality ES chapter (Chapter 13) that with mitigation measures appropriate for a medium risk site in place, there is likely to be no significant effect from the dust-generating activities on site. **No health effects** in relation to air quality during construction are therefore predicted for the majority of the population. However, it is likely that children, older people and those who have long term health effects may be more susceptible to even small changes in air quality and therefore a **short term, minor adverse** effect is predicted for these groups.

Operational phase effects

- 17.6.39 No exceedances of the air quality objectives were predicted with or without the Scheme in place in any of the scenarios assessed.
- 17.6.40 The key criteria for evaluating significance are set out and results for each summarised in Table 17.5. The answers to these questions show that the Scheme is not predicted to have a significant effect on local air quality. The use of the IAN 174/13 methodology for assessing significance does not allow a significant beneficial effect to be determined unless there is removal of an exceedance of a relevant air quality objective. Whilst the Scheme does not result in a significant beneficial effect overall, the Scheme would deliver improvements in air quality at the majority of receptors in the study area.

³⁵ IAQM (2014), Guidance on the assessment of dust from demolition and construction, Version 1.1.

Table 17.5 Evaluation of Significance

Key Criteria Questions	Yes/No	Reasoning
Is there a risk that environmental standards will be breached?	No	No exceedances of air quality objectives are predicted as a result of the Scheme
Will there be a large change in environmental conditions?	Yes	The Scheme does result in a large beneficial change ($>4\mu\text{g}/\text{m}^3$) in annual mean NO_2 concentrations at some receptor locations on the existing A40 corridor.
Will the effect continue for a long time?	Yes	The effect of the Scheme would be permanent, however the effect of the Scheme on local air quality whilst beneficial is not considered to be significant.
Will many people be affected?	No	There are few receptors given the rural location of the Scheme. At the majority of receptors, the Scheme would have a beneficial impact.
Is there a risk that designated sites, areas, or features will be affected?	No	There are no designated sites present within the study area.
Will it be difficult to avoid, or reduce or repair or compensate for the effect?	No	No adverse effects have been identified which would require mitigation.
On balance is the overall effect significant?	No	

17.6.41 Potential impacts during the operational phase of the Scheme have been assessed to be not significant as modelled pollutant concentrations are already well below the air quality objectives. However, many receptors would experience a beneficial impact as a result of the Scheme.

17.6.42 **No health effects** are predicted as a result of local air quality during operation of the Scheme. Vulnerable groups within the local population such as children, older people and those with long term health issues may experience health benefits from the minor improvements in air quality predicted as they are more sensitive to any changes.

Flood Risk

Literature review

17.6.43 The damaging consequences of flooding are not only limited to property and possessions but can also have lasting impacts on health

and well-being. Physical and mental health may be affected during and after flooding and studies have shown that stress may continue for a long time after the water has receded. It is important to be aware that the impact on health is often not immediately obvious.

17.6.44 Injuries and illness, the anxiety caused through being involved in a flood, disruption to healthcare services and the effect of being displaced from homes and local area can all take their toll on people's well-being and can affect anyone.

17.6.45 Flooding can affect people of all ages and while most go on to recover with the support of their families, friends and local community, for others the longer-term, indirect effects on their health, relationships and welfare can be far reaching. Symptoms can include insomnia, anxiety disorders, phobias, depression and post-traumatic stress disorder³⁶.

Construction phase effects

17.6.46 All areas of the Scheme route are designated as Zone A on Welsh Government's TAN15 mapping. Areas designated as Zone A are considered to be at little or no risk of fluvial or coastal/tidal flooding.

17.6.47 Where works take place in the vicinity of watercourses, material and plant would be stored beyond the areas potentially susceptible to flooding in order to mitigate any adverse effects. The health effect during construction associated with flooding is **neutral**.

Operational phase effects

17.6.48 In addition to the Scheme continuing to be within Zone A, i.e. at little or no risk of fluvial or coastal/tidal flooding during operation, the Scheme is also not expected to cause any detriment to fluvial, surface or groundwater flood risk.

17.6.49 The health effect is therefore considered to **neutral**.

Access to work and training

Literature review

17.6.50 Employment and income are among the most significant determinants of long-term health, influencing a range of factors including the quality

³⁶ http://www.floodlinescotland.org.uk/media/1881/health-effects-of-flooding_swish_bottom.pdf

of housing, education, diet, lifestyle, coping skills, access to services and social networks. Consequently, poor economic circumstances can influence health throughout life, where communities subject to socio-economic deprivation are more likely to suffer from morbidity, injury, mental anxiety, and depression, and tend to suffer from higher rates of premature death than those less deprived³⁷.

- 17.6.51 The Marmot Review (2010)³⁸ looked at the differences in health and well-being between social groups. The Review identified the importance of work for health: 'being in good employment is protective of health. Conversely, unemployment contributes to poor health.' The documented linkages between access to work and health are often related to the negative impacts of unemployment, rather than the positive impacts of employment. However, it follows that employment is generally expected to be positive in health terms.
- 17.6.52 Employment is also related to social and psychological well-being; a study commissioned by the Department of Work and Pensions³⁹ found that '*work meets important psychosocial needs in societies where employment is the norm*' and that '*work is central to individual identity, social roles and social status*'.
- 17.6.53 The evidence suggests, therefore, that projects that have the potential to support regeneration, reduce unemployment and improve socio-economic circumstance, would contribute to improving the health and well-being of socio-economically deprived communities. It is important to note, however, that increasing employment and income opportunities alone would not maximise health benefits. Increased support, training and community involvement is required in order to link and develop skills to employment and reduce the risk of inequality.

Construction phase effects

- 17.6.54 The creation of new job opportunities during the construction phase of the proposed development would have a positive effect on health and wellbeing for those that secure jobs. This assessment is based on the known links between employment and mental health, and the positive health effects of increased wealth on access to services, food and other

³⁷ Beland, F., Birch, S. and Stoddart, G. (2002), Unemployment and health: contextual level influences on the production of health in populations. *Social Science and Medicine*, Volume 55, pp. 2033-2052; Stafford, M., Marjkainen, P., Lahelma, E., and Marmot, M. (2005) Neighbourhoods and self-rated health: a comparison of public sector employees in London and Helsinki. *Journal of Epidemiology and Community Health*, Volume 58, pp. 772-778.

³⁸ Marmot M. (2010) Fair Society, Healthy Lives: A Strategic Review of Inequalities in England. London: University College London

³⁹ Waddell, G and Burton, A.K. (2006) Is work good for health and wellbeing?, Department for Work and Pensions

health determinants.

- 17.6.55 The community profile (Appendix 17.1) shows that the Scheme is located in an area of relatively low multiple socio-economic deprivation, with lower than average rates of unemployment and a relatively highly skilled workforce. It is expected that the construction of the Scheme will create new employment opportunities, and there may be the potential for local people, and young people in particular, to benefit from these jobs and from any training opportunities that may be provided. Any investment in skills and training would have the potential for long-term positive impacts on employment and skills in the local economy (and consequently benefits to health and well being), although due to the low unemployment levels, benefits are likely to be diluted over a wider area.
- 17.6.56 People within the community who are most likely to benefit from securing jobs would be those that are currently unemployed or economically inactive and wish to find work. Those that already have employment would benefit if it led to better paid, or more skilled work (either through training opportunities or organic promotion). Overall, it is considered that the health effects from this would be **long-term, minor beneficial**.

Operational phase effects

- 17.6.57 The Economic Appraisal Report (EAR) provides an assessment of the direct and wider economic costs and benefits accrued over a 60-year period for the Scheme. Benefits relating to the 'economic efficiency' of transport schemes are derived from journey time savings, vehicle operating cost savings, user charges (tolls) and additional costs to travellers due to construction/maintenance works. Costs to implement the Scheme are measured in terms of 'public accounts' and include revenue, operating costs, investment costs, developer and other contributions (not applicable), grant/subsidy payments (not applicable), and indirect tax revenues to Central Government through, for example, fuel duty⁴⁰.
- 17.6.58 The EAR concludes that the Scheme would have a Benefit-Cost Ratio (BCR) of 0.13 under the central case, which indicates that the costs of the Scheme outweigh the quantifiable benefits. However, the economic appraisal is only a partial assessment of value for money which does

⁴⁰ Welsh Government (2017), A40 Llanddewi Velfrey to Penblewin Improvements: Economic Assessment Report.

not capture all of the expected benefits of the Scheme. There are a range of other impacts and considerations that the Welsh Government will take into account in its decision-making process, such as the Scheme objectives. These set out the Welsh Government's intention to deliver benefits in relation to enhanced network resilience, improved prosperity and reduced community severance. These are only partially reflected in the quantified economic analysis set out in the EAR.

- 17.6.59 In terms of wider economic benefits, an 'Economic Activity and Location Impact' study undertaken by Peter Brett Associates on behalf of the Welsh Government in 2015 identified a number of mechanisms through which improvements to the A40 could deliver economic benefits⁴¹. This included widening the labour market, inward investment, improved business performance, enhanced prospects for the Enterprise Zone, increased residential development, increased trade and improved strategic rail access.
- 17.6.60 Each of these economic benefits suggests that there is a likelihood of increasing job and training opportunities long term through indirect benefits of the Scheme, which would result in a **long term, minor beneficial** health effect for the local population.

Accessibility and active travel

Literature review

Accessibility

- 17.6.61 Research indicates that public transit improvements and more transit-oriented development can provide large but often overlooked health benefits. People who live or work in communities with high quality public transportation tend to drive significantly less and rely more on alternative modes (walking, cycling and public transit) than they would in more automobile-oriented areas. This reduces traffic crashes and pollution emissions and increases physical fitness and mental health. These impacts are significant in magnitude compared with other planning objectives but are often overlooked or undervalued in conventional transport planning⁴².

⁴¹ Peter Brett Associates (2015), A40 St Clears to Haverfordwest Economic Activity & Location Impacts (EALI) Study.

⁴² Litman, T (2010), Evaluating public transportation health benefits. Victoria Transport Policy Institute.

Active travel

- 17.6.62 Active travel applies to modes of transport that require physical activity (i.e. cycling and walking), in contrast to modes that require little physical effort such as motor vehicles. It is therefore the physical activity associated with active travel that brings about health effects.
- 17.6.63 Active travel in areas with low pollution levels has been associated with increased physical activity among older adults. Where there is a perception that there is air pollution this appears to constitute a barrier to participating in outdoor physical activity and active transport⁴³.
- 17.6.64 The positive effects of physical activity on physical health was summarised in the Department of Health's 2011 report⁴⁴ which suggests that:
- 17.6.65 'Regular physical activity can reduce the risk of many chronic conditions including coronary heart disease, stroke, type 2 diabetes, cancer, obesity, mental health problems and musculoskeletal conditions. Even relatively small increases in physical activity are associated with some protection against chronic diseases and an improved quality of life.'
- 17.6.66 An ever-growing body of research also provides consistent evidence of a relationship between physical activity and mental capacity, especially in older and elderly people. Longitudinal studies show not only that physical activity is associated with a reduced risk of age-related cognitive decline, but also that regular physical activity is linked to a lower risk of Alzheimer's disease (AD) and other forms of dementia⁴⁵. Age UK's guidelines also outlines examples of practical ways to promote older people to become more active, including Nordic walking, Tai-Chi sessions aimed at older people, walking groups, and an 'easy rider' scheme (using a fixed-wheel bike, tricycles and tandems to aid balance)⁴⁶.

⁴³ Annear, M., Keeling, S., Wilkinson, T., Cushman, G., Gidlow, B., & Hopkins, H. (2014). Environmental influences on healthy and active ageing: A systematic review. *Ageing & Society*, 34 (4), 590-622

⁴⁴ CMO (2011) Start Active, Stay Active: A report on physical activity from the four home countries' Chief Medical Officers, Department of Health, Physical Activity, Health Improvement and Protection.

⁴⁵ Government Office for Science. (2008). *Mental Capital and Wellbeing: Making the most of ourselves in the 21st century*. State-of-Science Review: SR-E24, p.2.

⁴⁶ Age UK. (2010). *Promoting Mental Health and Well-being in Later Life: A Guide for Commissioners of Older People's Services*

Construction phase effects

- 17.6.67 No changes to the existing bus service provision are anticipated during the construction phase.
- 17.6.68 There are a variety of links available for Walking, Cycling and Horse Riders (WCHR) within the study area. The density of routes is greatest to the north and south of the existing A40. Overall there are very few bridleways and restricted byways, which limits opportunities for equestrian and cycle users. Although National Cycle Routes 4 and 47 do not directly interface with the proposed A40 Scheme, many WCHR may cross the A40 study area to access these routes. No WCHR routes are explicitly identified for east-west movement along the Scheme and the existing A40 is the only attractive route currently.
- 17.6.69 Along the length of the existing A40 through Llanddewi Velfrey, there is a substandard footpath adjacent to the westbound lane. There is no adjacent provision for the eastbound lane. Therefore, there are no crossing points along the route. These will not be affected during construction.
- 17.6.70 There is no WCHR facility west of Llanddewi Velfrey along the existing A40.
- 17.6.71 On both sides of the existing A40, the density of Public Rights of Way (PRoWs) for the exclusive use of WCHR is relatively sparse and spread out over the landscape. This probably reflects that most routes have followed the land boundaries for landowners in the area. The connections provided tend to connect places of residence with places of work. As discussed in the assessment on effects to access to open space (Section 17.6.9) there are several PRoW that will be affected during construction through temporary closure or diversion.
- 17.6.72 These PRoWs include: as shown on Volume 2 Figure 15.1: SP19/31/3; SP19/37/1; SP19/30/1; SP19/38/1; SP19/38/2; SP19/1/1; SP19/2/2; SP19/3/2; SP19/4/5; SP19/4/7; and SP19/17/1. There are no bridleways that would be directly affected although there are two within close proximity to the Scheme (Bridleway SP19/34/4 and Bridleway SP19/29/3). See ES Chapter 15 All Travellers for further details on which routes would be affected.
- 17.6.73 During construction, the existing A40, together with most local roads

crossing the Scheme or linking to it, would remain open under traffic management, where required, except for some overnight weekend road and lane closures during works such as utility diversions and tie-in works.

- 17.6.74 Llanfallteg Road would be temporarily stopped up during construction with a temporary diversion put in place to allow for the construction of a new overbridge. This, together with the temporary impacts on PRoWs used by pedestrians, would result in a construction effect on community severance and accessibility i.e. some residents may be dissuaded from making trips and some trips would be made longer or less attractive, particularly for children and older people or people who may have restricted mobility. It is also likely that active travel would be less attractive for local communities during construction who are therefore less likely to participate in this form of travel.
- 17.6.75 Health effects during construction as a results of impacts on accessibility and active travel options is considered to be **short term, minor adverse**.

Operational phase effects

- 17.6.76 The only public transport that currently operates in the vicinity of the Scheme is a bus service. The bus stops are currently located on the existing road that would be detrunked as part of the Scheme. During operation of the Scheme the bus services would need to leave the proposed A40 and travel through the village using the proposed junctions. It is envisaged that the bus services will continue to function as they do presently and therefore there would be no potential for equality effects arising from the operation of the proposed new section of trunk road.
- 17.6.77 Following the completion of the construction works, the connectivity of the PRoW network would be maintained. Those routes that were partly or fully stopped up on a permanent basis (see section 17.6.1 for details of which ones) will have been diverted, with the exception of one public footpath (SP19/4/5). However, the proposed network provides alternative, equally advantageous routes that do not result in longer routes. Those that were partly or fully stopped up temporarily during the construction phase will have been reinstated along their original alignment or their permanent diversion alignment.

- 17.6.78 In addition, one new public bridleway and two new public footpaths created as part of the Scheme would be operational. These include:
- a) A new public footpath would be created along the fence line of the proposed new section of trunk road, running from the unnamed road that leads to Trefangor Burial Ground, eastwards to meet footpath SP19/37/1;
 - b) A new bridleway would be created, linking the unnamed road that leads to Trefangor Burial Ground to the north of the proposed A40 with the unnamed road that leads to Henllan Farm to the south of the proposed A40. The bridleway would pass under the proposed A40 in an underpass in the area of Fynnon; and
 - c) A new public footpath would be created at the east Llanddewi Velfrey Junction. The footpath would cross the proposed A40 carriageway at the proposed roundabout, at an at-grade crossing. This provides connectivity between the village of Llanddewi Velfrey and Bethel Chapel and the properties to the north of the A40.
- 17.6.79 There are several new crossing points that will be delivered as part of the proposed new trunk road to maintain connectivity of the local highway and PRoW networks:
- a) A new underpass, which a new bridleway will pass through, providing north/south connectivity between SP19/30/1 and SP19/37/1.
 - b) A new pedestrian underpass will be provided for diverted footpath SP19/38/1. This underpass will also provide farm access to severed land.
 - c) A new overbridge to carry the public road that leads from Llanddewi Velfrey to Llanfallteg.
 - d) A new pedestrian underpass to carry a new footpath that is the diversion for several stopped-up footpaths (SP19/1/1, SP19/2/2 & SP19/3/2).
- 17.6.80 These improvements to PRoW are likely to encourage more use of the currently underused network which will lead to improvements in both active travel and accessibility to the network. It is possible that the improvements will increase active travel participation by people who may otherwise be unwilling to use the network due to perceived or real shortcomings, e.g. older people, families with young children or people with mobility challenges.
- 17.6.81 The provision of an improved A40 will result in improved accessibility due to reduced congestion and improved travel conditions. This would

lead to less stress related to travel which would bring minor beneficial health effects.

- 17.6.82 Overall it is considered that there would be a **long term, minor beneficial health effect** on accessibility and active travel during operation.

Access to services and social infrastructure

Literature review

- 17.6.83 Services and social infrastructure such as healthcare, education, social networks and social interaction can impact on people's physical and mental health⁴⁷. 5% of adults in Great Britain have reported feeling a sense of isolation due to difficulties accessing local shops and services⁴⁸. Furthermore, over a fifth of adults reported knowing someone who felt a sense of isolation due to these difficulties.
- 17.6.84 Access to healthcare is important for communities as healthcare offers information, screening, prevention and treatments. Restricted access to healthcare prevents patients gaining necessary treatments and information. Access to healthcare services is affected by transport modes, availability of financial support for those on low incomes and the location of healthcare services. Groups impacted by disability and older people are more dependent on health and social care services⁴⁹ therefore these groups are more vulnerable if access to health and social care services becomes restricted.
- 17.6.85 Access to social infrastructure including leisure and cultural facilities is a determinant of health and well-being. According to research, 'leisure activities can have a positive effect on people's physical, social, emotional and cognitive health through prevention, coping (adjustment, remediation, diversion), and transcendence'⁵⁰. People participate in cultural activities for a number of reasons including personal growth and development, to learn new skills, enjoyment and entertainment and as a 'means of creative expression', or 'to meet new people' and to 'pass

⁴⁷ Global Research Network on Urban Health Equity (2010) Improving urban health equity through action on the social and environmental determinants of health

⁴⁸ Randall, C., 2012, Measuring National Well-being - Where we Live – 2012, Office for National Statistics

⁴⁹ Hamer, L., 2004, Improving patient access to health services: a national review and case studies of current approaches, Health Development Agency

⁵⁰ Caldwell, L.L. (2005) Leisure and health: Why is leisure therapeutic?

on cultural traditions'⁵¹.

Construction phase effects

- 17.6.86 During the construction phase, access to existing social infrastructure will not change from the existing baseline because there are no significant journey time increases to services or direct loss of services. Therefore, **no effect** is expected.

Operational phase effects

- 17.6.87 During operation the improved road and the access it provides to services will continue long term. However, it is considered that the health effects associated with this would be neutral and therefore **no effect** expected.

Road safety

Literature review

- 17.6.88 According to Department of Transport (2016)⁵², in the UK, road traffic accidents in 2015 included a total of 186,209 casualties of all severities. The number of people seriously injured decreased by 3% to 22,137 compared with 2014, although traffic volumes rose by 1.6% compared with 2014. There is no single underlying factor that drives road casualties; instead there are a number of influences which include:

- a) The distance people travel;
- b) The mix of transport modes used;
- c) Behaviour of drivers, riders and pedestrians;
- d) Mix of groups of people using the road e.g. changes in the number of newly qualified or older drivers; and
- e) External effects such as the weather which can influence behaviour for instance, encouraging/discouraging travel, or closing roads or change the risk on roads e.g. by making the road surface more slippery.

- 17.6.89 Children are subject to higher risk from road traffic accident and injury than adults, and other groups including women and older people may

⁵¹ New Zealand Government, 2007, Social Report: Leisure and Recreation, Ministry of Social Development, New Zealand Government

⁵² Department for Transport (2016), Reported road casualties in Great Britain, main results: 2015

be more likely to report feeling nervous about driving⁵³.

Construction phase effects

- 17.6.90 During the construction phase, there would be temporary increased HGV movements and a change in road layout. The temporary increased HGV movements and change in road layout could increase risk of accidents. However, when work is required online, a series of traffic management measures and speed restrictions would be implemented in work areas for the safety of road users and the construction workforce. These restrictions would only be introduced when the works commence and would remain until a specific section was complete.
- 17.6.91 It is considered that there would be no changes to any crime rates during construction.
- 17.6.92 Health effects related to community safety during construction are considered to be **short term, minor, adverse**. This is based on consideration of how vulnerable groups such as young people, older people and those with reduced mobility may perceive their safety during construction.

Operational phase effects

- 17.6.93 The Scheme will aim to improve transport safety and reduce the number and severity of collisions. There may be the potential for this to result in a positive effect for people sharing certain protected characteristics, including women and older people, who may be more likely to report feeling nervous about driving⁵⁴. In addition, one of the environmental design principles of the Scheme involves *'using design of the carriageway, structures, earthworks and landscape to incorporate the connectivity requirements of indigenous native species. Where necessary to provide barriers to movement, or to reinstate safe routes across the new road so that natural patterns of movement are not unduly interrupted and casualties from collisions with vehicles are minimised'*. See ES Chapter 2 The Project for further information.
- 17.6.94 The Walking Cycling Horse Riding Assessment (WCHRA) Report indicates that all facilities directly provided by the Scheme would, within reason be: accessible, attractive for use, coherent, comfortable,

⁵³ DfT (2011) Road Safety Research Report No.122: Attitudes to Road Safety: analysis of Driver Behaviour Module, 2010 NatCen Omnibus Survey.

⁵⁴ Ibid.

convenient, direct, and safe for users to use. If the WCHR Objectives set out in the WCHRA Report are met - which should be secured through the further stages of WCHR Reviews that would be undertaken during detailed design - it is anticipated that there would be no health impacts due to road safety risk for WCHR. Conversely, conditions for WCHR predicted to improve.

- 17.6.95 Overall it is considered that there would be a **long term, minor beneficial** health effect in relation to community safety.

17.7 Mitigation Measures

- 17.7.1 Adverse health impacts have only been identified to arise during the construction phase. These are only likely to persist for the duration of construction and are therefore only temporary. To mitigate these adverse effects, measures outlined in the CEMP will be followed and it is recommended that effective community liaison is established early. This should take into account the needs of the local communities such as older people and those with Welsh language skills.

- 17.7.2 Where health benefits have been identified during operation, these predominantly relate to improved access to open space, improved accessibility and opportunities for active travel. During the design of these improved features, such as new PRoWs and overbridges, consideration should be given to the needs of the local communities such as clear wayfinding (including distances to next location on signs).

17.8 Monitoring

- 17.8.1 There are no specific monitoring requirements for population and health.

17.9 Summary

- 17.9.1 Temporary adverse health effects have predominantly been identified for the construction phase including the following:
- a) Minor adverse health effects as a result of changes to access to open space and nature. This may occur due to changes in PRoWs during the construction period. This would affect all of the community with vulnerable groups unlikely to be affected disproportionately or differentially.

- b) Minor adverse health effects as a result of construction noise. People who are likely to spend more time in one place, and therefore have a longer exposure to construction noise, including older people, unemployed and long-term sick are likely to experience noise increases as a moderate adverse health effect.
- c) Minor adverse health effects in relation to air quality for vulnerable groups such as children, older people and long-term sick who may be more sensitive to small adverse changes in air quality.
- d) Minor adverse health effects as a result of changes to provisions for active travel during the construction stage, which may discourage more vulnerable groups such as children, older people and people with physical disabilities from using active travel options during construction. Accessibility is not considered to be affected.
- e) Minor adverse health effects as a result of vulnerable groups such as young people, older people and those with reduced mobility having the perception of reduced safety during construction.

17.9.2 During operation the only adverse health effect identified relates to an increase in noise for some properties. More properties would experience a health benefit due to reduced traffic noise as the Scheme takes traffic further away from their properties.

17.9.3 Beneficial health effects associated with operation include:

- a) Minor beneficial health effects from improved access to open space and nature. This is likely as a result of improved PRow provision;
- b) Minor beneficial health effects from improved access to work and training as a result of an improved road network and the corresponding reduced congestion.
- c) Minor beneficial health effects from improved participation in active travel. As with improved access to open space and nature, this is also related to improved PRow provision that would provide more opportunities and easier access.

17.9.4 An equalities assessment considers whether the scheme would have any disproportionate or differential effects on people with protected characteristics. Table 17.6 below summarises potential effects for each protected characteristic group.

Table 17.6 Summary of equality effects

Protected characteristic	Likely disproportionate or differential effect	
	Construction	Operation
Age	Children and older people who engage in active travel may be more likely to be discouraged from doing so during construction and would therefore be disproportionately adversely affected. It is not considered that this would be significant.	Children and older people may become more engaged with active travel as provision is improved and safety is improved. They would therefore be disproportionately beneficially affected. It is not considered that this would be significant.
Disability	As above	As above
Gender	None	None
Pregnancy and maternity	None	None
Race	None	None
Religion or belief	None	None
Sex or sexual orientation	None	None
Marriage & civil partnership	None	None